KENDRIYA VIDYALAYA SANGATHAN

CHENNAI REGION

STUDENT SUPPORT MATERIAL

CLASS X

SCIENCE

Session 2022-23

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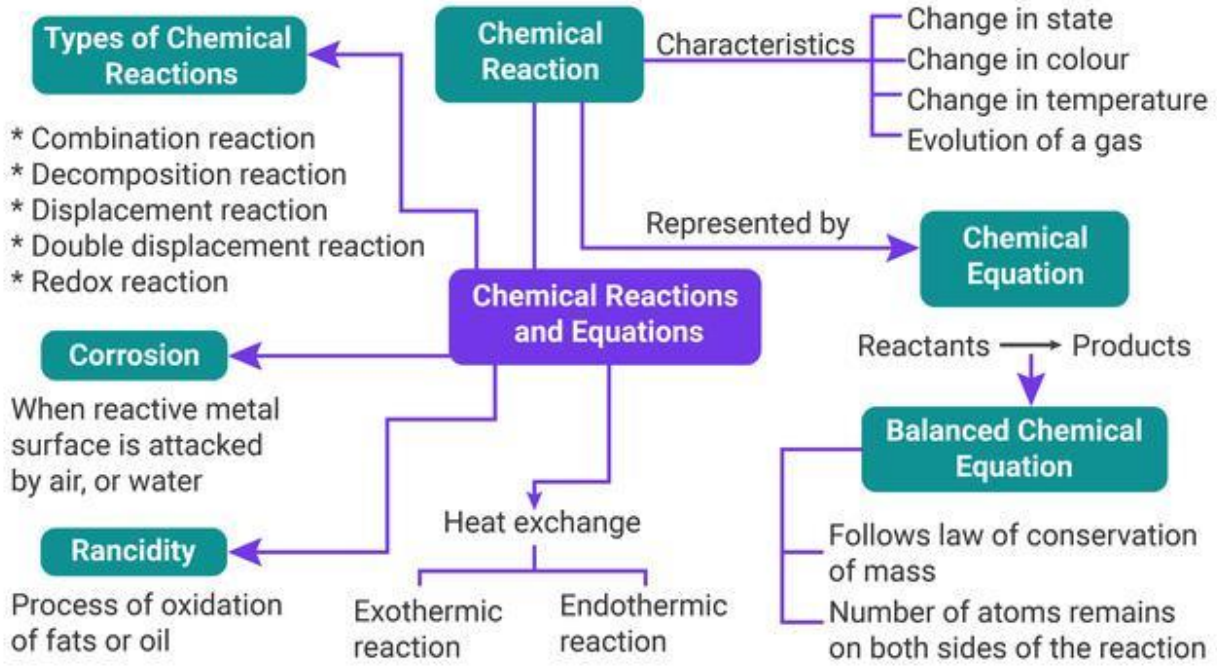
CHAPTER -1
CHEMICAL REACTION AND EQUATIONS



Chemical Reaction: In a chemical reaction, a new substance is formed which is completely different in properties from the original substance, so in a chemical reaction, a chemical change takes place.

Characteristics of Chemical Reactions:

Evolution of gas
Change in Colour
Change in state of substance
Change in temperature
Formation of precipitate

Balanced Chemical Equation: A balanced chemical equation has the number of atoms of each element equal on both sides.

Example: $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

Types of Chemical Reactions:

Chemical reactions can be classified into the following types:

Combination Reaction: Reactions in which two or more reactants combine to form one product are called Combination Reactions.

Example: When magnesium is burnt in the air (oxygen), magnesium oxide is formed. In this reaction, magnesium combines with oxygen.

$Mg(s) + O_2(g) \rightarrow 2MgO(s)$

Magnesium + Oxygen → Magnesium Oxide

Decomposition Reaction: Reactions in which one compound decomposes in two or more compounds or elements are known as Decomposition Reaction. A decomposition reaction is just the opposite of combination reaction.

Example: When calcium carbonate is heated, it decomposes into calcium oxide and carbon dioxide.

$CaCO_3(s) \xrightarrow{Heat} CaO(s) + CO_2(g)$

Calcium carbonate → Calcium oxide + Carbon dioxide

Thermal Decomposition: The decomposition of a substance on heating is known as Thermal Decomposition.

Example: $2Pb(NO_3)_2(s) \xrightarrow{Heat} 2PbO(s) + 4NO_2(g) + O_2(g)$

Electrolytic Decomposition: Reactions in which compounds decompose into simpler compounds because of passing of electricity, are known as Electrolytic Decomposition. This is also known as Electrolysis.

Example: When electricity is passed in water, it decomposes into hydrogen and oxygen.

$2H_2O(l) \rightarrow 2H_2(g) + O_2(g)$

Photolysis or Photo Decomposition Reaction: Reactions in which a compound decomposes because of sunlight are known as Photolysis or Photo Decomposition Reaction.

Example: When silver chloride is put in sunlight, it decomposes into silver metal and chlorine gas.

$2AgCl(s)\ (white) \xrightarrow{Sunlight} 2Ag(s)\ (grey) + Cl_2(g)$

Displacement Reaction: The chemical reaction in which a more reactive element displaces a less reactive element from a compound is known as Displacement Reactions.

Displacement reactions are also known as Substitution Reaction or Single Displacement/ replacement reactions.

Example: Iron displaces copper from copper sulphate solution.

$Fe(s) + CuSO_4(aq) \rightarrow FeSO_4(aq) + Cu(s)$

Double Displacement Reaction: Reactions in which ions are exchanged between two reactants forming new compounds are called Double Displacement Reactions.

Example: When the solution of barium chloride reacts with the solution of sodium sulphate, white precipitate of barium sulphate is formed along with sodium chloride.

$Na_2SO_4(aq) + BaCl_2(aq) \rightarrow BaSO_4(s)\ (Precipitate) + 2NaCl(aq)$

Precipitation Reaction: The reaction in which a precipitate is formed by the mixing of the aqueous solution of two soluble salts is called Precipitation Reaction.

Oxidation and Reduction Reactions:

Oxidation: Addition of oxygen to an element or compound is known as Oxidation.

Elements or compounds in which oxygen is added are called to be oxidized.

Reduction: Removal of oxygen from a compound is called Reduction. The compound or element which goes under reduction in called to be reduced. Oxidation and Reduction take place together.

Oxidizing agent: • The substance which gives oxygen for oxidation is called an Oxidizing agent.

Reducing agent: • The substance which removes oxygen is also called a Reducing agent.

REDOX REACTIONS: The reaction in which oxidation and reduction both take place simultaneously is called Redox reaction.

When copper oxide is heated with hydrogen, then copper metal and hydrogen are formed.

$CuO + H_2 \rightarrow Cu + H_2O$

In this reaction, CuO is changing into Cu.

Oxygen is being removed from copper oxide. Removal of oxygen from a substance is called Reduction, so copper oxide is being reduced to copper.

In this reaction, H_2 is changing to H_2O. Oxygen is being added to hydrogen. Addition of oxygen to a substance is called Oxidation, so hydrogen is being oxidized to water.

Effects of Oxidation Reactions in Everyday life: Corrosion and Rancidity.

Corrosion: The process of slow conversion of metals into their undesirable compounds due to their reaction with oxygen, water, acids, gases etc. present in the atmosphere is called Corrosion.

Rancidity: The taste and odour of food materials containing fat and oil change when they are left exposed to air for a long time. This is called Rancidity. It is caused due to the oxidation of fat and oil present in food materials.

Methods to prevent rancidity:

By adding anti-oxidant.

Vacuum packing.

Replacing air by nitrogen.

Question Bank

LEVEL-1

MULTIPLE CHOICE QUESTIONS

1. Burning of candle is a _____ change.
(a) physical
(b) chemical
(c) both (a) and (b)
(d) none of these
Ans. (c) both (a) and (b)
2. The reaction in which decomposition takes place after supply of heat is called _____.
(a) Thermal decomposition
(b) Combination reaction
(c) Redox reaction
(d) Displacement reaction
Ans. (a) Thermal decomposition
3. What is the colour of the ash formed when a magnesium ribbon is burnt in the air?
(a) White
(b) Black
(c) Yellow
(d) Pink
Ans. (a) White
4. Which law should be kept in mind while we balance chemical equations?
(a) Conservation of momentum
(b) Conservation of mass
(c) Conservation of energy
(d) Conservation of frequency
Ans. (b) Conservation of mass
5. Heating of ferrous sulphate is a type of :
(a) Decomposition reaction
(b) Combination Reaction
(c) Displacement reaction
(d) All of the above
Ans:-(a) Decomposition reaction
6. Rancidity can be prevented by:
(a) adding antioxidants
(b) storing food away from light
(c) keeping food in refrigerator
(d) all of the above
Ans. (a) adding antioxidants
7. Oxidation is a process which involves
(i) addition of oxygen
(ii) addition of hydrogen
(iii) removal of oxygen
(iv) removal of hydrogen
a) (i) and (ii)
(b) (ii) and (iii)
(c) (i) and (iv)
(d) (ii) and (iv)
Ans. c

8. Which of the following statements is correct with regard to physical changes?
(a) In physical change, new substance is formed.
(b) In physical change, no new substance is formed.
(c) In physical change, chemical composition of substance is changed.
(d) None of these
Ans. (b) In physical change, no new substance is formed.
9. Which of the following is not a chemical reaction?
(a) Souring of milk
(b) Dissolution of sugar in water
(c) Rusting of iron
(d) Digestion of food in the body
Ans. (b) Dissolution of sugar in water
10. When white silver chloride is left exposed to sunlight, it colours becomes:
(a) Grey
(b) Yellow
(c) Green
(d) Red
Ans. (a) Grey
11. In which of the following, the identity of initial substance remains unchanged ?
(a) Curdling of milk
(b) Formation of crystals by process of crystallisation
(c) Fermentation of grapes
(d) Digestion of food
Ans. (b) Formation of crystals by process of crystallisation

Assertion-Reason Type Questions:
Following questions consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.
1. **Assertion**: Chemical reaction changes the physical and chemical state of a substance.
Reason: When electric current is passed through water (liquid), it decomposes to produce hydrogen and oxygen gases.
Ans. (b) Both A and R are true but R is not the correct explanation of A.

2. **Assertion**: Chemical equations should be balanced.
Reason: As per the law of conservation of mass, mass can neither be created nor be destroyed.
Ans. (a) Both assertion and reason are correct and reason is the correct explanation of assertion.

3**. Assertion**: Colour of copper sulphate solution changes when an iron nail is kept immersed in it.
Reason: The colour of copper sulphate solution changes when iron nail is kept immersed in it due to the decomposition reaction taking place between iron and copper leading to formation of iron sulphate.
Ans. (c) Assertion is true, but reason is false.

4. **Assertion:** Photosynthesis is considered as an exothermic reaction.
Reason: Photosynthesis is an endothermic reaction because sunlight energy is absorbed by green plants during this process.
Ans. (d) Assertion is false, but reason is true.

5. **Assertion**: Silver bromide is kept in dark coloured bottles.
Reason: It is because it decomposes in presence of light.
Ans. (a) Both assertion and reason are correct and reason is the correct explanation of assertion.

6. **Assertion**: Paint is applied on iron articles.
Reason: To protect them from rain.
Ans. (c) Assertion is true, but reason is false.

7. **Assertion** - Calcium Carbonate when heated gives calcium oxide and water
Reason – On heating $CaCO_3$, decomposition reaction takes place.
Ans: 1. d) A is false but R is true

VSA Type Questions (One Mark):

1. Name and state the law which is kept in mind while we balance a chemical equation.

Answer. Law of conservation of mass. Mass can neither be created nor be destroyed during a chemical reaction

2. What is meant by a chemical reaction?

Answer: The reaction representing a chemical change is called a chemical reaction.

3. Why is respiration considered an exothermic reaction? Explain.

Answer: In human beings, energy is obtained from the food that we eat. Glucose combines with oxygen in the cells and provides energy. The special name of this combustion reaction is respiration. Since energy is released in the whole process, it is an exothermic process.

4. Why do we store silver chloride in dark coloured bottles?

Answer: Silver chloride on exposure to sunlight may decompose as per the following reaction.
$2AgCl \rightarrow 2Ag + Cl_2$
Therefore, it is stored in dark colored bottles.

5. What happens when an iron nail is put inside the copper sulphate solution? Write a reaction with observation.

Answer: Iron nail turns brown, blue color of $CuSO_4$ changes to colorless. (or light green) $Fe(s)+CuSO_4(aq) \rightarrow FeSO_4(aq)-+Cu(s)$

SA Type Questions (Two Marks):

1. List four observations that help us to determine whether a chemical reaction has taken place.

Answer: The observations that help us to determine whether a chemical reaction has taken place are:
1. Evolution of a gas
2. Change in temperature
3. Formation of precipitate
4. Change in colour

2. Translate the following statements into chemical equations and balance them.

(i) Hydrogen sulphide reacts with sulphur dioxide to form sulphur and water.
(ii) Methane on burning combines with oxygen to produce carbon dioxide and water.

Answer:
(i) $2H_2S + SO_2 \rightarrow 3S + 2H_2O$
(ii) $CH_4+2O_2 \rightarrow CO_2+2H_2O$

3. What is a combination reaction? State one example giving balanced chemical equation for the reaction.
Answer: A combination reaction is said to have occurred when two or more than two substances combine to form a single substance.
$CaO + H_2O \rightarrow Ca(OH)_2 + Heat$

4. What do you mean by a precipitation reaction? Give an example.
Answer: A reaction in which an insoluble solid (called precipitate) is formed is called a precipitation reaction. For example :
$Na_2CO_3(s) + CaCl_2(s) \rightarrow CaCO_3\ (s)\downarrow + 2NaCl\ (aq)$
Sodium carbonate + Calcium chloride →Calcium Carbonate + Sodium chloride
In this reaction, calcium carbonate is obtained as a precipitate. Hence, it is a precipitation reaction.

5. What does one mean by exothermic and endothermic reactions? Give examples.
Answer: Chemical reactions that release energy in the form of heat are called exothermic reactions.
Example: Sodium oxide dissolves in water to form sodium hydroxide and releases large amount of energy.
$Na_2O + H_2O \rightarrow 2NaOH + Energy$
Reactions that absorb energy or require energy in order to proceed are called endothermic reactions.
Example: Combination of nitrogen and oxygen to form nitric oxide.
$N_2 + O_2 + Heat \rightarrow 2NO$

6. Identify the type of reaction(s) in the following equations.
(i) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
(ii) $Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + 2KNO_3$
(iii) $CaO + H_2O \rightarrow Ca(OH)_2$
(iv) $CuSO_4 + Zn \rightarrow ZnSO_4 + Cu$
Answer:
(i)Combustion reaction and oxidation reaction.
(ii)Double displacement reaction and precipitation reaction.
(iii)Combination reaction.
(iv)Displacement reaction.

7. When Hydrogen gas is passed over heated copper (II) oxide, copper and steam are formed. Write the balanced chemical equation with physical states for this reaction. State what kind of chemical reaction is this?
Answer:
$$CuO(s) + H_2(g) \xrightarrow{Heat} Cu(s) + H_2O(g)$$
This is a Redox reaction.

SA Type Questions (Three Marks):
1. Define the term decomposition reaction. Give one example of each of thermal decomposition and electrolytic decomposition.
Answer:
In a decomposition reaction, a compound is broken into smaller chemical species. These are the reaction in which one reactant gives two or more products after a reaction. These reactions are just opposite of chemical combination reactions.
i. Thermal Decomposition: Decomposition takes place by heat.
$2\ FeSO_4\ (s) \xrightarrow{Heat} Fe_2O_3(s) + SO_2(g) + SO_3(g)$

ii. Electrolytic decomposition or electrolysis: Decomposition takes place by electricity. Example, electrolysis of aluminium oxide

$2Al_2O_3 \rightarrow 4Al + 3O_2$

2. Explain the following in terms of gain or loss of oxygen with two examples each.

(i) Oxidation

(ii) Reduction

Answer:

(i) $4Na(s) + O_2(g) \rightarrow 2Na_2O(s)$

$2Cu + O_2 \rightarrow 2CuO$

Oxidation is the gain of oxygen. In the above examples, both Na and Cu gains oxygen and get oxidised.

(ii)Reduction is loss of oxygen.

$CO_2 + H_2 \rightarrow CO + H_2O$

$CuO\ (s) + H_2(g) \rightarrow Cu(s) + H_2O\ (l)$

In the above reactions, carbon dioxide and CuO lose oxygen.

3. State the type of chemical reactions and chemical equations that take place in the following: (i) Magnesium wire is burnt in air.

(ii) Electric current is passed through water. (iii) Ammonia and hydrogen chloride gases are mixed.

Answer: (i) It is combination reaction.

$2Mg(s) + O_2(g) \rightarrow 2MgO\ (s)$

(ii) It is an electrolytic decomposition reaction.

$2H_2O(l)\ 2H_2(g) + O_2(g)$

(iii) It is a combination reaction.

$NH_3(g) + HCl\ (g) \rightarrow NH_4Cl(s)$

4. What is observed when carbon dioxide gas is passed through lime water.

(i) For a short duration

(ii) For a long duration

Ans.

(i) When carbon dioxide gas is passed through lime water for a short duration, lime water turns milky. The milkiness is due to the formation of white precipitate of calcium carbonate which is insoluble in water. The reaction can be given as:

$Ca(OH)_2\ (aq) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(l)$

(ii) When carbon dioxide gas is passed through lime water for a long duration, a clear solution is obtained. It is due to the fact that when carbon dioxide is passed for long duration, the insoluble calcium carbonate formed initially is converted into water soluble calcium bicarbonate.

$CaCO_3(s) + H_2O(l) + CO_2(g)(\text{ excess}) \rightarrow Ca(HCO_3)_2(aq)$

5. Identify the type of each of the following reactions. Also write the balanced chemical equation involved.

(i) The reaction mixture becomes warm.

(ii) An insoluble substance is formed.

Answer: (i) It is an exothermic reaction. In exothermic reaction, energy is released due to which reaction mixture becomes warm. Example:

$CaO + H_2O \rightarrow Ca(OH)_2 + \text{Heat.}$

(ii) In a precipitation reaction, an insoluble substance called precipitate is formed. For example, on mixing aqueous solutions of silver nitrate and sodium chloride, a white curdy precipitate of silver chloride is formed.

$AgNO_3(aq) + NaCl(aq) \rightarrow AgCl(s) + NaNO_3(aq)$

LA Type Questions (Five Marks):

1. Answer the following questions:

(i) Define corrosion.

(ii) What is corrosion of iron called?

(iii) How will you recognise the corrosion of silver?

(iv) Why corrosion of iron is a serious problem?

(v) How can we prevent corrosion of iron?

Ans.

(i) The gradual destruction of pure metals by the action of air, moisture or a chemical (such as an acid) on their surface is called corrosion.

(ii) Corrosion of iron is called rusting.

(iii) The corrosion of silver can be recognised by black layer on the surface of silver articles.

(iv) Corrosion of iron is serious problem because it causes a large damage to iron and money.

(v) The corrosion of iron can be prevented by painting or oiling, galvanizing and electroplating.

2. Identify the type of chemical reaction in the following statements and define each of them.

(i) Digestion of food in the body.

(ii) Rusting of iron.

(iii) Heating of manganese dioxide with aluminium powder.

(iv) Blue colour of copper sulphate solution disappears when iron filings are added to it.

(v) Dilute hydrochloric acid is added to sodium hydroxide solution to form sodium chloride and water.

Ans: (i) Digestion of food is an example of decomposition reaction because the food that we eat mainly contains carbohydrates, proteins, fats. These are decomposed into smaller units such as glucose, amino acids and fatty acids in the presence of enzymes in the body.

(ii)Rusting of iron is an example of oxidation reaction. In this process, iron react with oxygen and moisture present in atmosphere and forms brown layer of iron oxide called rust.

(iii)Heating of manganese dioxide with aluminium powder is an example of displacement reaction, as more reactive metal Al displaces Mn from its solution.

(iv)Blue colour of copper sulphate solution disappears when iron filings are added to it. It is also a displacement reaction. In this reaction, Fe displaces copper from copper sulphate solution as iron is more reactive than copper.

(v)Dilute hydrochloric acid is added to sodium hydroxide solution to form sodium chloride and water. It is an example of neutralization reaction (double displacement reaction). In this reaction, an acid and a base react to form salt and water.

LEVEL-2

MULTIPLE CHOICE QUESTIONS

1. In a double displacement reaction such as the reaction between sodium sulphate solution and barium chloride solution:

(i) exchange of atoms takes place.

(ii) exchange of ions takes place.

(iii) a precipitate is produced.

(iv) an insoluble salt is produced.

The correct option is :

(a) (ii) and (iv)

(b) (i) and (iii)

(c) only (ii)
(d) (ii), (iii) and (iv)
Ans. (d) (ii), (iii) and (iv)

2. Electrolysis of water is a decomposition reaction. The mole ratio of hydrogen and oxygen gases liberated during electrolysis of water is _____.
(a) 1 : 1
(b) 2 : 1
(c) 4 : 1
(d) 1 : 2
Ans. (b) 2 : 1

3. Which one of the following precipitates are formed when carbon dioxide gas is passed through lime water?
(a) $Ca(OH)_2$
(b) $Ca(OH)_4$
(c) $CaCO_3$
(d) $CaCO_2$
Ans. (c) $CaCO_3$

VSA Type Questions (One Mark):

1. Why do we apply paint on iron articles?
Ans. Iron articles are painted to prevent them from rusting. When iron articles are painted, the contact of iron articles from moisture and air is cut off. Therefore, rusting is prevented.

2. State one basic difference between a physical change and a chemical change.
Ans. The basic difference between a physical change and chemical change is that in a physical change, no new substance(s) formed, whereas in a chemical change, new substance(s) is formed.

3. What happens when magnesium ribbon burns in air?
Ans. When magnesium ribbon burns in air, it combines with the oxygen to form magnesium oxide.
$2Mg(s) + O_2(g) \rightarrow 2MgO(s)$

SA Type Questions (Two Marks):

1. When a solution of potassium iodide is added to a solution of lead nitrate in a test tube, a reaction takes place.
(i) What type of reaction is this?
(ii) Write a balanced chemical equation to represent the above reaction.
Ans. (i) It is a double displacement as well as a precipitation reaction.
(ii) $Pb(NO_3)_2\,(aq) + 2KI\,(aq) \rightarrow PbI_2(s)\downarrow + 2KNO_3(aq)$ Yellow ppt.

2. Why do silver articles becomes black after sometimes when exposed to air?
Ans. Silver reacts with sulphur present in the air and forms a layer of silver sulphide which is black in colour. Therefore, silver article gets tarnished or becomes black when exposed to air.

3. Explain why, food products containing fats and oils (like potato chips) are packaged with nitrogen.
Ans. Oil and fat containing food items are flushed with nitrogen because it is an inert gas and does not easily react with these substances. On the other hand, oxygen reacts with food substances and makes them rancid. Thus, bags used in packing food items are flushed with nitrogen gas to remove oxygen inside the pack. When oxygen is not present inside the pack, rancidity of oil and fat containing food items is avoided.

4. On heating blue coloured powder of copper (II) nitrate in a boiling tube, black copper oxide, O_2 and a brown gas X is formed.
(i) Identify the type of reaction and the gas X.

(ii) Write balanced chemical equation of the reaction.
Ans. (i) Decomposition reaction The gas X is Nitrogen dioxide (NO_2)
(iii) $2Cu(NO_3)_2 \cdot 3H_2O \rightarrow 2CuO + 4NO_2 \uparrow + O_2 \uparrow + 6H_2O$

SA Type Questions (Three Marks):
1. 2 g of ferrous sulphate crystals are heated in a dry boiling tube.
(i) List any two observations.
(ii) Name the type of chemical reaction taking place.
(iii) Write the chemical equation for the reaction.
Ans. (i) The two observations are:
1. Green colour of $FeSO_4$ disappears and reddish-brown solid is formed.
2. Smell of burning sulphur.
(ii) It is an example of decomposition reaction.
(iii) $2FeSO_4(s) \rightarrow Fe_2O_3(s) + SO_2(g) + SO_3(g)$

2. Answer the following questions:
(i) Name two metals which do not corrode easily.
(ii) Corrosion of some metals is an advantage, given an example to support that.
(iii) Corrosion of metal is a serious problem, give an example to support that.
Ans. (i) Gold and platinum do not corrode easily.
(ii) Aluminium forms a layer of aluminium oxide on its surface due to corrosion which makes the metal passive and protects it from further corrosion.
(iii) Corrosion of iron is a serious problem, every year a lot of iron is being wasted and damaged due to corrosion and a lot of money is spent to repair that the damaged iron and steel structures.

LA Type Questions (Five Marks):
1. Identify the type of chemical reaction taking place when:
(a) Barium chloride solution is mixed with copper sulphate solution and a white precipitate is observed.
(b) On heating, copper powder in air in a china dish, the surface of copper powder becomes black.
(c) On heating green ferrous sulphate crystals, reddish brown solid is left and a gas having smell of burning sulphur is noticed.
(d) Iron nails when left dipped in blue copper sulphate solution become brownish in colour and blue colour of copper sulphate solution fades away.
(e) Quick lime reacts vigorously with water releasing a large amount of heat.
Answer:
a) The reaction is double displacement in nature.
$BaCl_2(aq) + CuSO_4(aq) \rightarrow BaSO_4(s) + CuCl_2(aq)$
(White ppt.)
b) It is an example of combination reaction.
$2Cu(s) + O_2(g) \rightarrow 2CuO(s)$
(in air) Copper(II)oxide
(Black)
c) The green crystals of ferrous sulphate have the chemical formula $FeSO_4.7H_2O$. Upon heating, they lose molecules of water of crystallisation.
While heating,

$FeSO_4.7H_2O \rightarrow FeSO_4 + 7H_2O$
(Green)
Upon further heating, ferrous sulphate undergoes decomposition reaction as follows:

$2FeSO_4(s) \rightarrow Fe_2O_3(s) + SO_2(g) + SO_3(g)$

Ferric oxide(Reddish brown)

Both the gases evolved have the smell of burning sulphur.

d) This happens because of displacement reaction. Iron displaces copper from copper sulphate solution. Brownish coating of copper gets deposited on the iron nails. As the concentration of copper sulphate in the solution decreases, the blue colour of the solution slowly fades.

$Fe(s) + CuSO_4(aq) \rightarrow FeSO_4(aq) + Cu(s)$

(Brownish)

e) Calcium hydroxide is formed as a result of combination reaction. It is highly exothermic. A large amount of heat is evolved accompanied by hissing sound.

$CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(s) + heat$

2. A silvery white metal X is in the form of ribbons. Upon ignition, it burns with a dazzling white flame to form white powder Y. When water is added to the powder Y, it partially dissolves to form a substance Z which is used as an antacid.

(a) What is metal X?

(b) Name the white powder Y.

(c) What is the substance Z?

(d) Write the chemical reactions that are taking place.

Answer:

(a) The metal X is Mg.

(b) The white powder Y is MgO.

(c) White powder Y dissolves partially in water to form substance Z. It is Mg (OH), and is used as an antacid.

(d) The chemical reactions that are taking place are :

$2Mg(s) + O_2(g) \xrightarrow{\text{(Ignition)}} 2MgO(s)$

(X) (Y)

$MgO(s) + H_2O(s) \longrightarrow Mg(OH)_2$

(Y) (Z)

LEVEL-3
MULTIPLE CHOICE QUESTIONS

1) A student notices that a new hammer made of iron is shiny while an old one kept in the toolbox for long has a reddish-brown powder deposit over it. What does the change in colour of the hammer indicate?

(a) effect of moisture on metals

(b) iron hammer turns brown after some time

(c) effects of kept in a box for a longer duration

(d) iron changes colour when kept with other tools

Answer: Option (a)

2) A student learns that food companies fill bags of chips with nitrogen gas. What is the purpose packing it with nitrogen?

(a) it prevents rancidity of chips

(b) it keeps the mosquitoes away from chips

(c) it keeps the chips dry if the pack falls in water

(d) prevents chips from spilling out when the pack is opened

Answer: Option (a)

3) A student adds lead and silver to two different test tubes containing an equal amount of copper sulphate solution. The student observes that the color of the solution in the test tube with lead changes. What explains the change in the colour of the solution?
(a) A displacement reaction takes place as lead replaces copper from the solution.
(b) A combination reaction takes place as lead combines with sulphate in the solution.
(c) decomposition reaction takes place as copper dissociates from sulphate in the solution.
(d) A double displacement reaction takes place as copper dissociates from sulphate and lead combines with sulphate in the solution.
Answer: Option (a)

Assertion-Reason Type Questions:
Following questions consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.
1. Assertion: Copper vessels get covered with green coating in rainy season.
Reason: It is because of the formation of copper carbonate.
Ans. (a) Both assertion and reason are correct and reason is the correct explanation of assertion.
2.Assertion: Gold and silver do not corrode in moist air.
Reason: It is because they have low reactivity.
Ans. (a) Both assertion and reason are correct and reason is the correct explanation of assertion.

VSA Type Questions (One Mark):
1. Ferrous sulphate decomposes with the evolution of a gas having a characteristic odour of burning sulphur. Write the chemical reaction involved and identify the type of reaction.
Ans. It is a thermal decomposition reaction:
$2FeSO_4(s) \rightarrow Fe_2O_3(s) + SO_2(g) + SO_3(g)$
2. State the following:
(i) The type of reaction used in photography?
(ii) An example of endothermic reaction?
Answer: (i) Photo-decomposition of silver chloride is used in photography.
(iii) Photosynthesis is an example of endothermic reaction.

SA Type Questions (Two Marks):
1. A white salt on heating decomposes to give brown fumes and a residue is left behind. (i) Name the salt.
(ii) Write the equation for the decomposition reaction.
Ans. (i) The white salt is lead Nitrate.
(ii)Lead nitrate decomposes as:
$2Pb(NO_3)_2(s) \rightarrow 2PbO(s) + 4NO_2(g) + O_2(g)$
Brown fumes are of nitrogen dioxide gas.
2. When the powder of a common metal is heated in an open China dish, its colour turns black. However, when hydrogen is passed over the hot black substance so formed, it regains its original colour. Based on the above information, answer the following questions.
(i) What type of chemical reaction takes place in each of the two given steps?
(ii) Name the metal initially taken in the powder form. Write balanced chemical equations for both reactions.
Ans.

(i) In first step, oxidation takes place whereas in second step, redox reaction takes place.
(ii) Metal initially taken in the powder form is copper.

$2Cu(s) + O_2(g) \rightarrow 2CuO(s)$

$CuO + H_2(g) \rightarrow Cu(s) + H_2O(g)$

3. The following diagram displays a chemical reaction. Observe carefully and answer the following questions:

(i) Identify the type of chemical reaction that will take place and define it. How will the colour of the salt change?
(ii) Write the chemical equation of the reaction that takes place.
Ans. (i) Photochemical decomposition reaction is taking place. The reactions in which a compound breaks down into simple substances in presence of light are called photochemical decomposition reaction. The colour of salt will change from white to grey.
(ii) $2AgCl(s) \rightarrow 2Ag(s) + Cl_2(g)$

4. Identify the type of reactions taking place in each of the following cases and write the balanced chemical equation for the reactions.
(i) Zinc reacts with silver nitrate to produce zinc nitrate and silver.
(ii) Potassium iodide reacts with lead nitrate to produce potassium nitrate and lead iodide.
Ans.
(i) The given reaction is a displacement reaction.

$Zn + 2AgNO_3 \rightarrow Zn(NO_3)_2 + 2Ag\ (s)$

(ii) The given reaction is a double displacement reaction.

$2KI + Pb(NO_3)_2 \rightarrow 2KNO_3 + PbI_2$

SA Type Questions (Three Marks):

1. Why eatables are preferably packed in aluminium foils?
Answer: Aluminium foils do not corrode in atmosphere even if kept for a long time. Actually, a protective coating of aluminium oxide (Al_2O_3) is formed on the surface of the metal. It stops any further reaction of the metal with air (oxygen) and water. The eatables do not get spoiled.

2. Write one equation each for decomposition reactions where energy is supplied in the form of heat, light or electricity.
Ans. i. Thermal decomposition: Energy in the form of heat.

$2FeSO_4(s) \rightarrow Fe_2O_3(s) + SO_2(s) + SO_3(s)$

Ferrous sulphate Ferric oxide Sulphur dioxide Sulphur trioxide
ii.Decomposition by light: It is known as photolysis.

$2AgCl(s) \rightarrow 2Ag(s) + Cl_2(s)$

Silver chloride Silver Chlorine
iii.Decomposition by electricity: It is also known as electrolysis. Electrolysis of lead bromide:

$PbBr_2 \rightarrow Pb + Br_2$

LA Type Questions (Five Marks):

1. (i)Account for the following:
(a) White silver chloride turns grey in sunlight.
(b) Brown coloured copper powder on heating in air turns into black coloured substance.

(ii) What do you mean by (a) Displacement reaction (b) Reduction reaction (c) Combination reaction? Write balanced chemical equation in support for all.

Answer:

i) a)White coloured silver chloride undergoes decomposition in the presence of sunlight and forms silver(grey in colour) and chlorine.

In presence of Sunlight

$2AgCl(s) \rightarrow 2Ag(s) + Cl_2(g)$

(White) (Grey)

b)Brown coloured copper powder on heating in air gets oxidised to copper oxide which is black in colour.

When heated

$2Cu(s) + O_2(g) \rightarrow 2CuO(s)$

(Brown) (Black)

ii) For the different types of reactions,

a) In a displacement reaction, one element takes the place of another in a compound dissolved in a solution. For example,

$Fe(s) + CuSO_4(aq) \rightarrow FeSO_4(aq) + Cu(s)$

b) Reduction is a process which involves the addition of hydrogen or any electropositive element or the removal of oxygen or any electronegative element.

Removal of oxygen

$ZnO + C \rightarrow Zn + CO$ (reduction of zinc oxide)

c) Combination reaction may be defined as the reaction in which two or more substances combine under suitable conditions to form a new substance. For example,

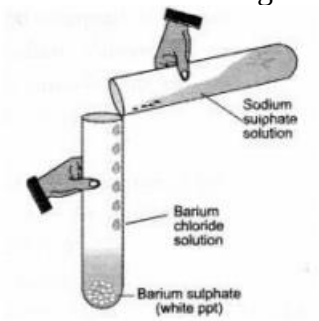
In Heat

$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$

In Sunlight

$H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$

2. Observe the given figure and answer the following questions.



(a) Write the complete balanced reaction for the reaction that takes place.

(b) Type of reaction involved.

(c) Is there any precipitate formed?

(d) If any precipitate formed, write the color of the precipitate.

Answer:

(a) $BaCl_2(aq) + Na_2SO_4(aq) \longrightarrow BaSO_4(s) + 2NaCl(aq)$ (White ppt.)

(b) It is a double displacement reaction

(c) Yes, a precipitate of barium sulphate is formed.

(d) The precipitate is white in colour.

CASE STUDY QUESTIONS

1. **Read the passage carefully and answer the following questions from (i) to (iv).**

The substance which we use for white-washing our houses is calcium oxide. We put calcium oxide in a drum and add water to it slowly. Calcium oxide reacts with water vigorously to form a white solid called slaked lime with the evolution of heat. More water is then added to get slaked lime solution. This slaked lime solution is then applied to the walls of the house with the brush. Since, this process gives a white, shiny appearance to the walls of a house, it is called white-washing and gives a shiny finish to the walls.

(i)What is the chemical formula of slaked lime?
(ii) Name the chemical reaction resulting to form slaked lime.
(iii)Give the chemical equation for the formation of slaked lime.
(iv) What is the reason behind shining appearance of walls after white washing?
Ans. (i) The Chemical formula of slaked lime is $Ca(OH)_2$.
(ii)The reaction is named as combination reaction.
(iii)$CaO(s) + H_2O(l) \rightarrow Ca(OH)_2$ Slaked lime
(iv) When white washing is done, slaked lime (calcium hydroxide) slowly reacts with carbon dioxide in air to form a thin layer of calcium carbonate on walls that gives a shiny appearance on walls.

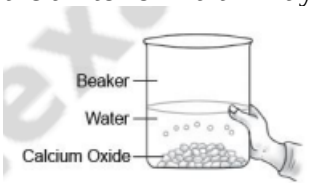
2. **Read the passage carefully and answer the following questions from (i) to (iv).**

When two or more substances react and form some new substance, it is called a chemical reaction. As we know, all chemical reaction obeys law of chemical combination. Therefore, chemical reactions need to be balanced. It is done by hit and trial method. The chemical reactions can be classified into different types such as combination reaction, decomposition reaction, displacement reaction, double displacement reaction. The reactions take place in solution is precipitation reactions and neutralization reactions.

(i) Define a chemical reaction.
(ii) Which law is followed by all chemical reactions?
(iii) Name four types of chemical reactions.
(iv) Give example of precipitation reactions.
Ans. (i) A chemical reaction is defined as the reaction in which two or more substances react to form a new substance.
(ii)The law of chemical combination is followed by all chemical reactions.
(iii) Combination reactions, displacement reactions, double displacement reactions and decomposition reactions are four types of chemical reactions.

(iv) The reaction between silver nitrate and sodium chloride that forms precipitate of silver chloride and sodium nitrate is an example of precipitation reactions.
$AgNO_3$ (aq) + NaCl (aq) → AgCl (s) + $NaNO_3$ (aq)
Silver chloride (ppt.)

3. **Read the passage carefully and answer the following questions from (i) to (v).** When two or more reactants combine to form a single product, the reaction is named a combination reaction. For example, calcium oxide reacts vigorously with water to form calcium hydroxide. The reaction is highly exothermic in nature. Lot of heat is produced during the reaction.
$CaO + H_2O \rightarrow Ca(OH)_2$ + Heat
Solution of calcium hydroxide is used to white-wash walls. It reacts slowly with carbon dioxide present in the air to form a thin layer of carbonate which gives a shiny appearance.



(i) The chemical name of quick lime is:
(a) Calcium oxide
(b) Calcium carbonate
(c) Calcium hydroxide
(d) Carbon dioxide
Ans. (a) Calcium oxide

(ii) On passing carbon dioxide through lime water:
(a) Calcium hydroxide is formed
(b) A white precipitate of CaO is formed
(c) Lime water turns milky
(d) Colour of lime water turns green
Ans. (c) Lime water turns milky

(iii) Following observations were recorded when calcium oxide reacts vigorously with water. Identify the incorrect observations:
I. It is an endothermic reaction
II. slaked lime is produced
III. Quick lime is produced
IV. It is an exothermic reaction
(a) I and II
(b) III and IV
(c) I and III
(d) II and IV
Ans. (c) I and III
(iv) Quick lime combines vigorously with water to form Y which reacts slowly with carbon dioxide in the air to form Z. [Y] [Z]
(a) Calcium carbonate calcium hydroxide
(b) Calcium hydroxide calcium carbonate
(c) Calcium calcium bicarbonate
(d) Calcium bicarbonate calcium metal
Ans. (b) [Y] [Z] Calcium hydroxide calcium carbonate

(v) Which of the following is an endothermic reaction?
(a) Combination of carbon and oxygen to form carbon monoxide
(b) Combination of nitrogen and oxygen to form nitrogen monoxide
(c) Combination of glucose and oxygen to form carbon dioxide and water
(d) Combination of zinc and hydrochloric acid to form zinc chloride and hydrogen Ans. (b) Combination of nitrogen and oxygen to form nitrogen monoxide

CHAPTER - 2
ACIDS, BASES AND SALTS

NOTES

* **Acids** – produce H^+ ions in the presence of water and Turns Blue litmus Red e.g. lemon juice, HCl
* **Base** – produce OH^- ions in the presence of water and Turns Red litmus Blue e.g. NaOH, Soap, Detergents
* Some Naturally occurring acids

Vinegar – Acetic Acid
Orange – Citric Acid
Lemon – Citric Acid
Tamarind – Tartaric Acid
Tomato – Oxalic Acid
Sour milk (Curd) – Lactic Acid
Ant and Nettle sting – Methanoic Acid

*** Acid – Base Indicators** – Indicate the presence of an acid or base in a solution.

Colour Indicators

S. No.	Name of the Indicator	Colour Change with Acid	Colour Change with Base
A.	Blue litmus solution	To red	No change
B.	Red litmus solution	No change	To blue
C.	Turmeric	No change	To red
D.	Methyl orange	To red	To yellow
E.	Phenolphthalein (colourless)	No change	To pink

Litmus solution – It is a natural indicator. It is a purple dye extracted from Lichens.
Other examples are Red Cabbage and coloured petals of Petunia and turmeric.

Olfactory indicators – Show odour changes in acidic or basic media. eg. onion and clove.

* Dilute Acid : Contains only a small amounts of acid and a large amount of water.
* Concentrated Acid : A concentrated acid contains a large amount of acid and a small amount of water.
* Dilution of an acid is a highly exothermic process.
* **Chemical properties of Acids and Bases**

Acid + Metal → Salt + Hydrogen gas
Metal Carbonate + Acid → Salt + Carbondioxide + Water
Metal Bicarbonate + Acid → Salt + Carbondioxide + Water
Metal Oxide + Acid → Salt + Water
Base + Acid → Salt + Water
Non metallic oxide + Base → Salt + Water
Base + Metal → Salt + Hydrogen
$NaOH + Zn \rightarrow Na_2ZnO_2 + H_2$

* **Pop test** : When a burning candle is brought near a test tube containing hydrogen gas it burns with a 'Pop' sound. This test is conducted for examining the presence of hydrogen gas.
* **Lime Water Test** : On passing the CO_2 gas evolved through lime water,

$Ca(OH)_2(aq) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(l)$
On passing excess CO_2 the following reaction takes place
$CaCO_3(s) + H_2O(l) + CO_2(g) \rightarrow Ca(HCO_3)_2$

*** Importance of pH in everyday life**

Importance of pH in our digestive system – Stomach HCl – excess secretion – irritates and gives pain - To get relief from this pain antacids are used which neutralizes the excess acid.

pH of Acid Rain : When pH of rain water is less than 5.6 it is called Acid Rain.

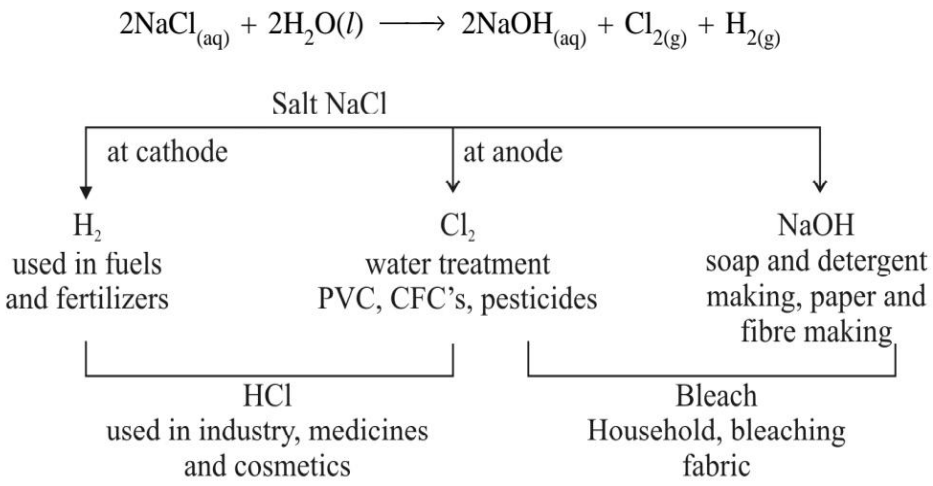
pH of Soil : Plants require a specific range of pH for their healthy growth. If pH of soil of any particular place is less or more than normal than the farmers add suitable fertilizers to it.

Our body functions between the range of 7.0 to 7.8 living organisms can survive only in the narrow range of pH change.

Tooth decay and pH : Bacteria present in the mouth produce acids by degradation of sugar and food particles remaining in the mouth. Using toothpaste which is generally basic can neutralize the excess acid and prevent tooth decay.

* **Chlor-Alkali Process, Products and their uses**

$2NaCl(aq) + 2H_2O(l) \rightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$



1. Sodium Hydroxide

Preparation : Prepared by the method called chlor-alkali process

$2NaCl(aq) + 2H_2O(l) \rightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$

Uses – soap, detergents, paper and linen making

2. Bleaching Power

Preparation

$Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$

Uses – textile factories and laundry, used as disinfectant

3. Baking Soda/ Sodium Hydrogencarbonate

Preparation

$NaCl + H_2O + CO_2 + NH_3 \rightarrow NH_4Cl + NaHCO_3$

On heating $NaHCO_3$produces :

$NaHCO_3 + Heat \rightarrow Na_2CO_3 + H_2O + CO_2$

CO_2 produced causes dough to rise and make cakes, pastries spongy.

Uses - In household, ingredients of antacid, In making baking power

On heating baking powder produces

$NaHCO_3 + H^+ \rightarrow CO_2 + H_2O$ + Sodium Salt of acid

4. Washing Soda

Preparation : Recrystallisation of sodium carbonate

$Na_2CO_3 + 10H_2O + Heat \rightarrow Na_2CO_3.10H_2O$

Uses – Used in glass, soap and paper industry, Cleaning agent for domestic purposes, Removal of hardness of water, Manufacture of borax

5. H_2 gas

Preparation – Chlor alkali process

Uses – Fertilizer, fuel

* **Water of crystallization**

Fixed number of water molecules present in one formula unit of a salt.

Example – $CuSO_4. 5H_2O$.

Gypsum $CaSO_4.2H_2O$

* **Plaster of Paris**

$CaSO_4.½ H_2O + 1½ H_2O \rightarrow CaSO_4.2H_2O$

Uses of plaster of Paris : Making toys, decorative material and smooth surfaces.

Question Bank

L1 Questions

MCQ

1. Sodium carbonate is a basic salt because it is a salt of

A. Strong acid and strong base B. Weak acid and weak base

C. Strong acid and weak base D. Weak acid and strong base

Answer. D. Weak acid and strong base

2. Common salt besides being used in kitchen can also be used as the raw material for making

(i) Washing soda (ii) bleaching soda (iii) Baking soda (iv) slaked lime

A. (i) and (ii) B. (i), (ii) and (iv)

C. (i), (ii) and (iii) D. (i), (iii) and (iv)

Answer. C. (i), (ii) and (iii)

3. One of the constituents of baking powder is sodium hydrogen carbonate, the other constituent is

A. Hydrochloric acid

B. Tartaric acid

C. Acetic acid

D. Sulphuric acid

Answer. B. Tartaric acid

4. To protect tooth decay we are advised to brush our teeth regularly. The nature of toothpaste commonly used is

A. Acidic

B. Neutral

C. Basic

D. Corrosive

Answer. C. Basic

5. Which of the following statements is correct about an aqueous solution of an acid and a base?

(i) Higher the pH, stronger the acid

(ii) Higher the pH, weaker the acid

(iii) Lower the pH, stronger the base

(iv) Lower the pH, weaker the base

A. (i) and (iii)

B. (ii) and (iii)

C. (i) and (iv)

D. (ii) and (iv)

Answer. D. (ii) and (iv)

6. Which of the following is acidic in nature?
A. Lime juice
B. Human blood
C. Baking soda
D. Antacid
Answer. A. Lime juice
7. Which of the following is used for dissolution of gold?
A. Hydrochloride acid
B. Sulphuric acid
C. Nitric acid
D. Aqua- regia
Answer. D. Aqua- regia
8. Which of the following is not a mineral acid?
A. Hydrochloride acid
B. Citric acid
C. Sulphuric acid
D. Nitric acid
Answer. B. Citric acid
9. Which among the following is not a base?
A. NaOH
B. KOH
C. NH_4OH
D. C_2H_5OH
Answer. D. C_2H_5OH
10. Which of the following statements is true for acids?
A. Bitter and change red litmus to blue
B. Sour and change red litmus to blue
C. Sour and change blue litmus to red
D. Bitter and change blue litmus to red
Answer. C. Sour and change blue litmus to red

Very Short Answer Type Questions

1. What is the chemical name of bleaching powder?
Answer. Calcium Oxychloride/ Calcium hypochlorite $CaOCl_2$
2. What is the use of common salt in soap industry?
Answer. To produce NaOH by the electrolysis of brine.
3. Write the formula of washing powder.
Answer. Na_2CO_3

Short Answer Type Questions

1. Write two physical properties of an acids.
Answer. They taste sour, corrosive in nature, turn blue litmus red, etc
2. Why metallic oxides are called as basic oxides and non-metallic oxides are called as acidic oxides?
Answer. Metallic oxides can neutralize acids, and vice versa.
3. What is acid rain? How does it affect the aquatic life?
Answer. When pH of rain water is less than 5.6 it is called Acid Rain. It disturbs the balance of aquatic life as it changes the narrow range of pH they're adjusted to.
4. When zinc metal is treated with a dilute solution of a strong acid, a gas is evolved, which is utilised in the hydrogenation of oil. Name the gas evolved.
Answer. Hydrogen gas

ASSERTIONS AND REASONS

For the following questions numbers, two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

1. Assertion - Lemon juice is sour in taste.
Reason - Lemon juice is acidic in nature.
Answer. A

2. Assertion - Sodium hydrogen carbonate is used in fire extinguisher.
Reason - Sodium hydrogen carbonate is a mild base.
Answer. B

3. Assertion - HCl produces hydronium ions and chloride ions in aqueous solution.
Reason - In presence of water, base gives H+ ions.
Answer. C

Long Answer Type Questions

1. (a) Write down five products formed with the help of common salt on industrial level.
(b) Write down the chemical name of these compounds and one use of each of them.
Answer. 1. Bleaching Power
Synthesis - $Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$
Uses in textile, factories and laundry, used as disinfectant
2. Baking Soda $NaHCO_3$ Sodium Hydrogen Carbonate,
Uses - causes dough to rise and make cakes, pastries spongy, In household, ingredients of antacid
3. Washing Soda $Na_2CO_3. 10H_2O$,
Uses - Used in glass, soap and paper industry, Cleaning agent for domestic purposes, Removal of hardness of water, Manufacture of borax.
4. Sodium hydroxide NaOH
Uses – soap, detergents, paper and linen making
5. Hydrogen gas
Uses – fertilizer, fuel

Case Based Questions

Ram was suffering from a stomach pain for a number of days. He consulted a doctor who advised him to take two antacid tablets after each meal for about a week and avoid spicy food. Ram followed the advice strictly and was cured.

1. What was the problem faced by Ram ?

A. Anaemia B. Acidity C. Anxiety D. Asthma
Answer. B. Acidity
2. True or false. The antacid tablets contain base like or Magnesium hydroxide which neutralise the effect of HCl released in the stomach.
Answer. TRUE

L2 Questions

MCQ

1. What happens when a solution of an acid is mixed with a solution of a base in a test tube?
(i) The temperature of the solution increases.
(ii) The temperature of the solution decreases.
(iii) The temperature of the solution remains the same.
(iv) Salt formation takes place.
A. Only (i) B. (i) and (ii) C. (ii) and (iii) D. (i) and (iv)
Answer. D. (i) and (iv)
2. During the preparations of hydrogen chloride gas on a humid day, the gas is usually passed through the guard tube containing calcium chloride. The role of the calcium chloride taken in the guard tube is to
A. absorb the evolved gas B. moisten the gas
C. absorb moisture from the gas D. absorb Cl- ions from the evolved gas
Answer. C. absorb moisture from the gas
3. Which of the following salts does not contain water of crystallization?
A. Blue vitriol B. Baking soda C. Washing soda D. Gypsum
Answer. C. Baking soda
4. The pH of the gastric juices released during digestion is
A. less than 7
B. more than 7
C. equal to 7
D. equal to 0
Answer. A. less than 7
5. Which of the following phenomena occur when a small amount of acid is added to water?
(i) Ionisation (ii) Neutralisation
(iii) Dilution (iv) Formation
A. (i) and (ii)
B. (i) and (iii)
C. (ii) and (iii)
D. (i) and (iv)
Answer. B. (i) and (iii)
6. Which one of the following can be used as an acid-base indicator by a visually impaired student?
A. Litmus
B. Turmeric
C. Vanilla essence
D. Petunia leaves
Answer. C. Vanilla essence
7. Which of the following substances will not give carbon dioxide on treatment with dilute acid?
A. Marble
B. Limestone
C. Baking soda
D. Lime
Answer. D. Lime

Very Short Answer Type Questions

1. Why should sour substances not be kept in brass and copper vessel?
Answer. Acids in sour substances react with metals to produce harmful substances.
2. Name the gas evolved when dil. sulphuric acid acts on sodium carbonate.
Answer. Carbodioxide
3. What do you observe when a burning candle is brought near the test tube containing hydrogen gas?
Answer. Candle extinguishes with a pop sound.

Short Answer Type Questions

1. Identify the type of reaction
H X + M OH → MX + HOH
Answer. Acid reacts with metal hydroxide/ Neutralization reaction/ Displacement reaction
2. Complete the reaction Calcium oxide with water. Name the products formed and list Its uses.
Answer. Slaked lime/ lime water, used for white washing
3. What happens when nitric acid is added to egg shell?
Answer. Egg shells are rich in calcium carbonate (CaCO3). When nitric acid reacts with calcium carbonates, calcium nitrate, water and CO2 gas is formed. Formation of CO2 gas causes brisk effervescence.
4. In one of the industrial process for manufacture of sodium hydroxide, a gas X is formed as by-product. The gas X reacts with lime water to give a compound Y which is used as a bleaching agent in chemical industry. Identify X and Y.
Answer. X – Cl_2 gas, Y – $CaOCl_2$

ASSERTIONS AND REASONS

For the following questions numbers, two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.
1. Assertion - Sodium carbonate is an acidic salt.
Reason - Sodium carbonate is salt of weak acid and strong base.
Answer. D
2. Assertion - Phenolphthalein gives pink colour in basic solution.
Reason - Phenolphthalein is a natural indicator.
Answer. C
3. Assertion - If the pH inside the mouth decreases below 5.5, the decay of tooth enamel begins.
Reason - The bacteria present in mouth degrades the sugar and the leftover food particles and produce acids that remains in the mouth after eating.
Answer. A

Long Answer Type Questions

A metal carbonate X on reacting with an acid gives a gas which when passed through a solution Y gives the carbonate back. On the other hand, a gas G that is obtained at anode during electrolysis of brine is passed on dry Y, it gives a compound Z, used for disinfecting drinking water. Identify X, Y, G, and Z.
Answer. X – CaCO3, Y – Lime water and dry slaked lime, G – Chlorine gas, Z – Bleaching powder

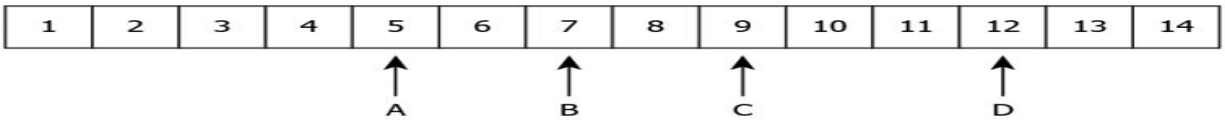
Case Based Questions

Care must be taken while mixing concentrated nitric acid or sulphuric acid with water. The acid must always be added slowly to water with constant stirring. If water is added to a concentrated acid, the heat generated may cause the mixture to splash out and cause burns. The glass container may also break due to excessive local heating.
Such a process is called dilution and the acid or the base is said to be diluted.

1. When acid is added to beaker containing water which of the following statements is(are) true about temperature of beaker?
A. Temperature decreases B. Temperature increases C. No change in temperature D. No observable change occur
Answer. B. Temperature increases
2. The process of adding acid to water an exothermic or endothermic process?
Answer. Exothermic
3. What happens to concentration of ions per unit volume when water is added to acid or base?
A. Concentration of ions decreases B. Concentration of ions increases C. No change in the concentration of ions D. No observable change occur
A. A. Concentration of ions decreases

L3 Questions
MCQ
1. An aqueous solution turns red litmus solution blue. Excess addition of which of the following solution would reverse the change?
A. Baking Powder B. Lime C. Ammonium hydroxide solution D. Hydrochloric acid
Answer. D. Hydrochloric acid
2. A sample of soil is mixed with water and allowed to settle. The clear supernatant solution turns the pH paper yellowish-orange. Which of the following would change the colour of this pH paper to greenish-blue?
A. Lemon Juice B. Vinegar C. Common salt D. An antacid
Answer. D. An antacid
3. Sodium hydrogen carbonate, when added to acetic acid, evolves a gas. Which of the following statements are true about the gas evolved?
(i) It turns lime water milky.
(ii) It extinguishes a burning splinter.
(iii) It dissolves in a solution of sodium hydroxide.
(iv) It has a pungent odour.
A. (i) and (ii) B. (i), (ii) and (iii) C. (ii), (iii) and (iv) D. (i) and (iv)
Answer. B. (i), (ii) and (iii)
4. If water is added to a basic solution, then pH will
(a) increase (b)decrease (c)=7 (d) unchanged
Answer. (b)decrease
5. A metal carbonate reacts with a solution X which forms a salt, water, and a gas Y. What are X and Y?
a) X: hydrochloric acid; Y: hydrogen
b) X: sodium hydroxide; Y: hydrogen
c) X: hydrochloric acid; Y: carbondioxide
d) X: sodium hydroxide; Y: carbondioxide
Answer. (c)

6. The image shows the pH values of four solutions on a pH scale. Which solutions are alkaline in nature?



a) A and B
b) B and C
c) C and D
d) A and D
Answer. (c)C and D
7. Baking soda is a mixture of
(a) sodium carbonate and acetic acid
(b) sodium carbonate and tartaric acid
(c) sodium hydrogen carbonate and tartaric acid
(d) sodium hydrogen carbonate and acetic acid
Answer. (c) sodium hydrogen carbonate and tartaric acid

Very Short Answer Type Questions

1. Two solution have pH number 4 and 9 respectively which solution has more H+ ion concentration?
Answer. Solution with pH 4
2. Explain why plaster of Paris should be stored in a moisture proof container?
Answer. As POP reacts with moisture and hardens
3. Name the indicator used to measure pH values over the whole range.
Answer. Universal indicator

Short Answer Type Questions

1. A test tube contains solution of NaOH and Phenolphthalein. Why the colour of the solution changes when HCl in added to it.
Answer. Pink to colourless
2. In a beaker a solution of HCl is poured and an electric circuit containing bulb is placed systematically. What happens to the bulb and why? What will happen if HCl is replaced by NaOH?
Answer. Bulb glows as electricity is conducted by ions. The same happens with NaOH also.
3. Why all bases are not alkalis but all alkalis are bases?
Answer. Alkalis are only those bases which dissolve in water.
4. Salt A commonly used in bakery products on heating gets converted into another salt B which itself is used for removal of hardness of water and a gas C is evolved. The gas C when passed through lime water, turns it milky. Identify A, B and C.
Answer. A – $NaHCO_3$, B – Na_2CO_3, C - CO_2

ASSERTIONS AND REASONS

For the following questions numbers, two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.
1. Assertion: Baking powder is used in making cake instead of using baking soda.
Reason: Baking powder contains tartaric acid which reacts with sodium carbonate and removes bitter taste.
Answer. A

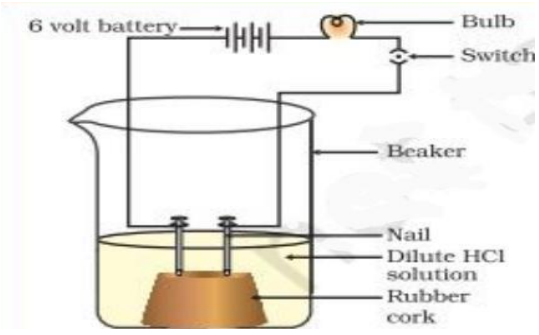
2. Assertion: Pure water is neither acidic nor basic.
Reason: The pH of a solution is inversely proportional to the concentration of hydrogen ions in it.
Answer. B
3. Assertion: The aqueous solution of glucose and alcohol does not show acidic character.
Reason: Aqueous solutions of glucose and alcohol do not produce hydrogen ions
Answer. A

Long Answer Type Questions

For making cake, baking powder is taken. If at your home mother uses baking soda instead of baking powder in cake.
(a) How will it affect the taste of the cake and why?
(b) How can baking soda be converted into baking powder?
(c) What is the role of tartaric acid added to baking soda?
Answer. While making cake if baking soda is used instead of baking powder the cake will taste bitter. Baking soda ($NaHCO_3$) is a base and we know that bases are bitter. In case of baking powder, tartaric acid neutralizes the bitter taste of baking soda.
On heating baking powder produces sodium carbonate, carbon dioxide and water. Sodium carbonate makes the cake taste bitter.
$2NaHCO_3 + Heat \Rightarrow Na_2CO_3 + CO_2 + H_2O$
(b) Baking soda can be converted into baking powder by adding tartaric acid and starch.
(c) Tartaric acid produces hydrogen ions when it reacts with water. Hydrogen ions produced by tartaric acid reacts with sodium bicarbonate and gives carbon dioxide which makes the dough soft and fluffy. Tartaric acid also neutralizes sodium carbonate (formed as a result of heating baking soda) to form sodium tartarate that has pleasant smell and good taste.
$2NaHCO_3 + C_4H_6O_6 \Rightarrow 2CO_2 + 2H_2O + Na_2C_4H_4O_6$

Case Based Questions

Refer to the above Figure, a student took solutions of glucose, alcohol, diluted sodium hydroxide, hydrochloric acid, sulphuric acid, etc. He fixed two nails on a cork, and placed the cork in a 100 mL beaker. He connected the nails to the two terminals of a 6 volt battery through a bulb and a switch, as shown. He then poured some dilute HCl in the beaker and switched on the current.



1. Does the bulb glow in case of alcohol and diluted sodium hydroxide?
A. Yes B. No C. Maybe D. None of the above
Answer. B. No
2. Does the bulb glow in case of hydrochloric acid and sulphuric acid?
A. Yes B. No C. Maybe D. None of the above
Answer. A. Yes
3. The bulb glows in case of acids. The electric current is carried through the acidic solution by
A. Filament B. Glass C. Ions D. Particles
C. Ions

Chapter - 3
Metals and Non- Metals
3.1) Physical Properties of Metals (MSDSHLC)

M – Malleability
S - Sonorous
D – Ductility
S – State
H – Hardness
L – Lustrous
C – Conductivity

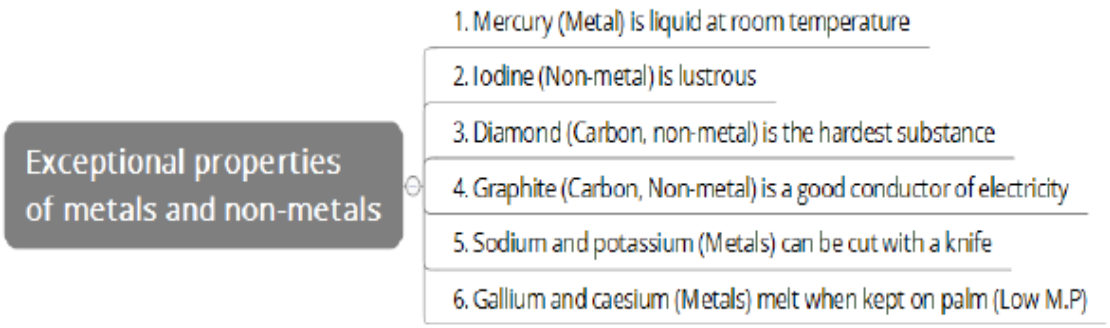
Mnemonics….Let's Learn!

Physical Properties:

MahendraSingh
Dhoni'SHeLiCopter shot

Differences Between Metals And Non-metals On The Basis Of Physical Properties

S.No.	Property	Metals	Non-metals
1	Physical state	Solid except mercury	Solid, liquid and gas
2	Appearance	Lustrous	Non-lustrous except iodine
3	Density	High except Li, Na & K	Low
4	Malleability	Malleable	Non-malleable
5	Ductility	Ductile	Non-ductile
6	Conduction of Heat	Good conductor	Poor conductor
7	Conduction of Electricity	Good conductor	Poor conductor except graphite
8	Melting point	Generally High except Hg, Ga, Cs, Li, Na, K	Generally Low except diamond
9	Sonorous	Some metals are sonorous	Not sonorous
10	Hardness	Generally hard except Li, Na & K	Generally soft except diamond



3.3) Chemical properties of Metals

1) Burning in Air (O_2):

Metals reacts with Oxygen (when burned) produced metal oxides.

Metals + Oxygen $\xrightarrow{\Delta}$ Metal Oxide

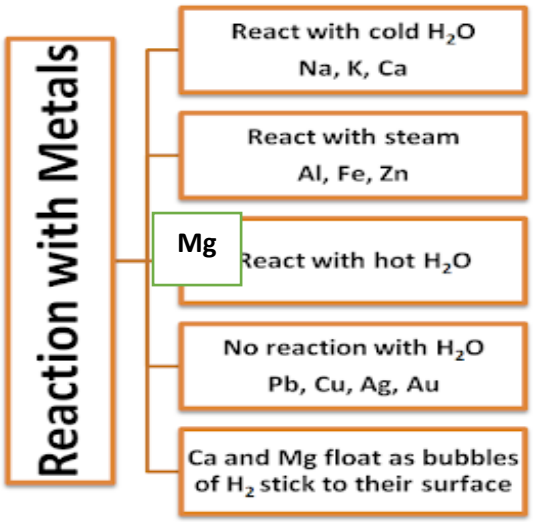
For Example:

$4Na + O_2 \longrightarrow 2Na_2O$

A few metal oxides such as aluminium oxide and zinc oxide react with both acids and bases as these metal oxides show both acidic as well as basic property these are called **amphoteric oxides**.

2) Reaction of metals with water

Metals react with water to produce metal oxides and hydrogen gas. Metal oxides that are soluble in water produce metal hydroxide.



3. Reaction with acids

The reaction of metal and acid is generally displacement reaction.

Metal + Acid $\longrightarrow$ Salt + Hydrogen

For example,

$2\ Na + 2\ HCl \longrightarrow 2\ NaCl + H_2$

3) Reaction of metals with solution of other metal salts

Reactive metals can displace a comparatively less reactive metal from its compounds in aqueous salt solution or in molten form.

Metal A + Salt solution of B $\longrightarrow$ Salt solution of A + Metal B

For example: $Cu(s) + 2AgNO_3(aq) \longrightarrow Cu(NO_3)_2\,(aq) + 2Ag\ (s)$

This type of reaction is called **displacement reaction.**

3.4) The Reactivity Series

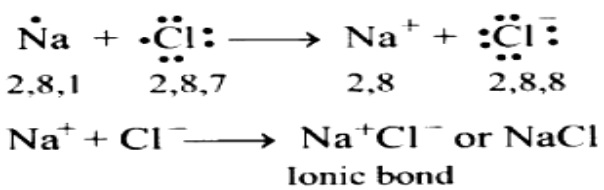
The reactivity series is a list of metals arranged in the order of their decreasing activities.

Mnemonics….Let's Learn!

Mnemonics	Element	
Please	**P**otassium	MOST REACTIVE
Stop	**S**odium	
Calling	**Cal**cium	
Me	**M**agnesium	
AAluminium	Reactivity dec ses	
Careless	(**Car**bon)	downward
Zebra	**Z**inc	
Instead	**I**ron	
Try	**T**in	
Learning	**L**ead	
How	(**H**ydrogen)	
Copper Copper		
Saves	**S**ilver	
Gold	**Gold**LEAST REACTIVE	

3.5) Reaction between Metals and Non-metals (Ionic bond formation)

Each element wants to have a completely filled valence shell, i.e., it wants to have either 2 or 8 electrons in their outermost shell. Metals have a tendency to loose electrons and non-metals have a tendency to gain electrons. For example: If sodium and chlorine react with each other then electron lost by sodium (Na^+) is gained by chlorine (Cl^-). Na^+ and Cl^- being oppositely charged, attract each other and held by strong electrostatic forces of attraction to exist as NaCl. Thus an ionic bond is formed between them.



- A chemical bond formed by the complete transfer of electrons from one atom to another is called **ionic bond**. The compounds formed in this manner are called ionic **compounds or electrovalent compounds**.

3.6) Properties of Ionic compounds

- Ionic compounds are solid. Ionic bond has a greater force of attraction because of which ions attract each other strongly. This makes ionic compounds solid.
- Ionic compounds have high melting and boiling points because force of attraction between ions of ionic compounds is very strong.
- Ionic compounds generally dissolve in water. Ionic compounds are generally insoluble in organic solvents; like kerosene, petrol, etc.
- Ionic compounds do not conduct electricity in the solid state but conduct electricity in the molten state.

3.7) Occurrence of metals

Mineral: The elements or compounds, which occur naturally in the earth crust, are known as minerals

Ores:Minerals which contain a very high percentage of a particular metal and the metal can be profitably extracted from it. These minerals are called ores.

Gangue: - Ores mined from the earth are usually contaminated with large amounts of impurities such as soil, sand, etc., collectively these impurities are called gangue

Metallurgy:-The process or technique used for the extraction of metals from their ores and then refining them for use is known as metallurgy.

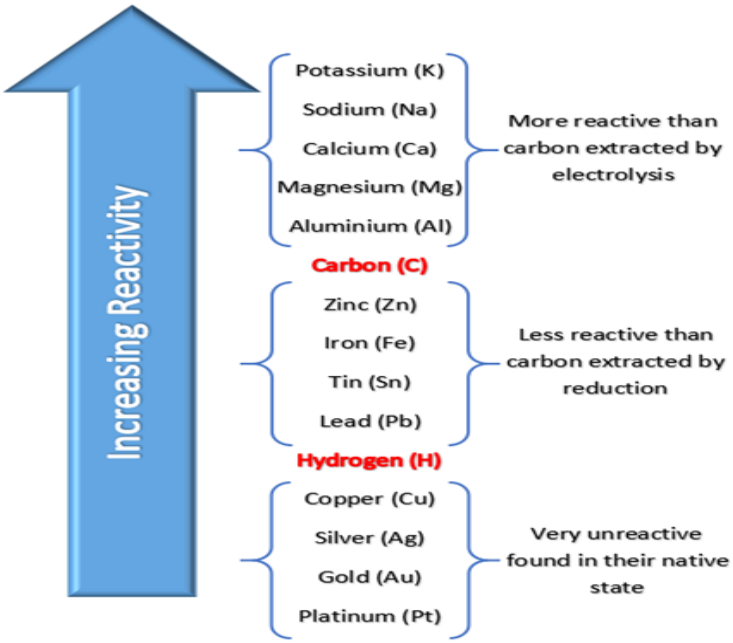
Table 3.2 Important metals and their ores

Metal	Ores	Chemical Formula
Sodium	Chile saltpeter	$NaNO_3$
	Borax	$Na_2B_4O_7.10H_2O$
Aluminium	Bauxite	$Al_2O_3.2H_2O$
Magnesium	Magnesite	$MgCO_3$
Calcium	Calcite	$CaCO_3$
	Gypsum	$CaSO_4.2H_2O$
Copper	Cuprite	Cu_2O
	Copper glance	Cu_2S
Zinc	Zinc Blende	ZnS
Mercury	Cinnabar	HgS
Lead	Galena	PbS
Iron	Haemetite	Fe_2O_3
	Magnetite	Fe_3O_4

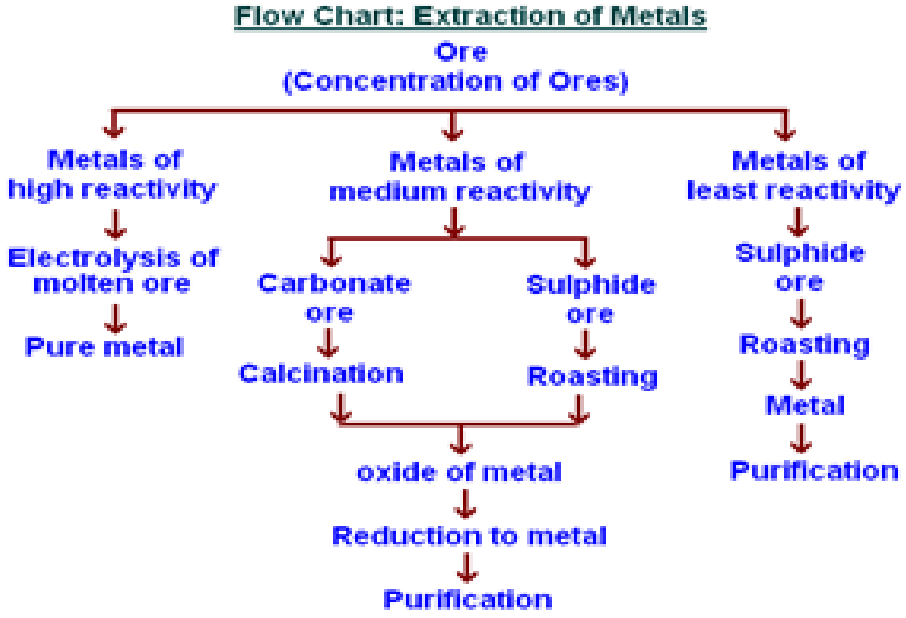
Some metals are found in the earth's crust in the free state. Some are found in the form of their compounds. On the basis of reactivity, we can group the metals into the following three categories–

i) Metals of low reactivity;
ii) Metals of medium reactivity;
iii) Metals of high reactivity.

Different techniques are to be used for obtaining the metals falling in each category:



Several steps are involved in the extraction of pure metal from ores. A summary of these steps is given:



Steps involved in Extraction of a Metal from its ore

Three major steps:-

1. Concentration or Enrichment of ore
2. Reduction of the ore to get the metal
3. Refining of Metals.

STEP 1. ENRICHMENT OF ORES:-

The process of removal of gangue from an ore to increase the percentage of metal in ore is called enrichment of ore or concentration of ore.

STEP 2. REDUCTION OF THE ORE TO GET THE METAL

Extracting Metals Low in the Activity Series

Metals low in the activity series are very unreactive. The oxides of these metals can be reduced to metals by heating alone.

For example, cinnabar (HgS) is an ore of mercury. When it is heated in air, it is first converted into mercuric oxide (HgO). Mercuric oxide is then reduced to mercury on further heating. This is called auto-reduction.

Extracting Metals in the Middle of the Activity Series

Roasting:-The sulphide ores are converted into oxides by heating strongly in the presence of excess air. This process is known as roasting.

Calcination: - The carbonate ores are changed into oxides by heating strongly in limited air. This process is known as calcination.

The metal oxides are then reduced to the corresponding metals by using suitable reducing agents.

Extracting Metals towards the Top of the Activity Series

Highly reactive metals are obtained by **electrolytic reduction** fromtheir ores**.**

In electrolytic reduction, the metals are obtained by the electrolysis of their molten chlorides or oxides.For example, sodium, magnesium and calcium are obtained by the electrolysis of their **molten chlorides.** The metals are deposited at the cathode (the negatively charged electrode), whereas, chlorine is liberated at the anode (the positively charged electrode).

The reactions are – At cathode: $Na^+ + e^- \longrightarrow Na$

At anode: $2Cl^- \longrightarrow Cl_2 + 2e^-$

Similarly, aluminium is obtained by the electrolytic reduction of aluminium oxide.

STEP 3. REFINING OF METALS

Many metals, such as copper, zinc, tin, nickel, silver, gold, etc., are refined electrolytically. The impure metal is used as anode and a thin strip of pure metal is used as cathode. A solution of the metal salt is used as an electrolyte.

3.8) Corrosion

It is the slow process of eating away of metals by the reaction of atmospheric air and moisture, e.g., rusting of iron, tarnishing of silver, formation of green coating over copper etc.

Prevention of Corrosion: The rusting of iron can be prevented by painting, oiling, greasing, chrome plating , anodizing, galvanising or making alloys.

- **Galvanisation** :- coating of iron and steel objects with a thin layer of Zn.
- An **alloy** is a homogeneous mixture of two or more metals, or a metal and a nonmetal.

Question Bank

Level 1

1) Expand PVC.

Answer: Polyvinyl chloride.

2) Name the element which shows non-metallic properties, but is also present in the activity series of metal.

Answer: Hydrogen.

3) Name two metals which melt when you keep them on your palm.

Answer: Gallium and caesium have so low melting points that they melt even on keeping them on palm.

4) What is meant by corrosion? Name any two methods used for the prevention of corrosion.

Answer: It is the slow process of eating away of metals by the reaction of atmospheric air and moisture, e.g., rusting of iron, tarnishing of silver, formation of green coating over copper etc.

- Galvanisation is a process to prevent corrosion of iron and steel.
- Electroplating is also used to prevent corrosion.

5) Why is sodium kept immersed in kerosene oil?

Answer: Sodium metal being highly reactive reacts vigorously with oxygen that it catches fire if kept in open air. Therefore to protect it from accidental fires, sodium is kept immersed in kerosene oil.

6) Write the electron-dot structures for sodium and oxygen.

Answer: (i) Sodium:

(ii) Oxygen:

7) Why do ionic compounds have high melting points?

Answer: Ionic compounds are the ones which has both positive and negative charges. Hence there will be strong force of attraction between them. This make expenditure of lot of heat to break this force of attraction hence ionic compounds have high melting points.

8) You must have seen tarnished copper vessels being cleaned with lemon or tamarind juice. Explain why these sour substances are effective in cleaning the vessels.

Answer: Tarnished copper vessels being cleaned with lemon or tamarind because this sour substance contains acids which dissolve the coating of copper oxide or basic copper carbonate present on the surface or tarnished copper vessels. This makes them shining red-brown again. Hence they are very effective in cleaning tarnished copper vessels.

9) A non-metal X exists in two different forms Y and Z. Y is the hardest natural substance, whereas Z is a good conductor of electricity. Identify X, Y and Z.

Answer: Non-metal 'X' must be carbon. It exist in two forms, diamond and graphite. Diamond is hardest natural substance. Hence, 'Y' is diamond. Graphite is a good conductor of electricity. Hence, 'Z' is graphite.

10) Give reason for the following:

i) School bells are made up of metals.

ii) Electrical wires are made up of copper.

Answer: i) Metals are sonorous (produce sound on being hit), so school bells are made up of metals.

ii) Copper is a very good conductor of electricity. So, it is used for making electrical wires.

Level 2

1) Name two metals which do not react with oxygen even at high temperature.

Answer: Gold and silver.

2) What is meant by amphoteric oxides? Choose the amphoteric oxides from the following :

Na_2O, ZnO, CO_2, Al_2O_3, H_2O

Answer : Amphoteric oxides are those which show acidic as well as basic character, i.e., they react with bases as well as acids. ZnO and Al_2O_3 are amphoteric oxides.

3) Write the chemical name of the coating that forms on silver and copper articles when these are left exposed to moist air.

Answer: Ag_2S (silver sulphide) is formed on silver, basic copper carbonate $CuCO_3.Cu(OH)_2$ is formed on copper.

4) Write the chemical formulae of the main ores of iron and aluminium.

Answer: The main ore of iron is haematite (Fe_2CO_3) while that of aluminium is bauxite ($Al_2O_3.2H_2O$).

5) Name an alloy of

a) Aluminium used in construction of air crafts.

b) Lead in joining metals for electric welding.

c) Copper used in household vessels.

Answer: i) The alloy is duralumin: A1 (93%), Cu (4%), Mg (0.5%), Mn (0.5%).

ii) The alloy is solder: Pb (50%), Sn (50%)

iii) The alloy is brass: Cu (80%), Zn (20%)

6) In nature, metal A is found in the free state, while metal B is found in the form of its compounds. Which of these two will be nearer to the top of the activity series of metals?

Answer: Metal B will be nearer to the top because it is more reactive as it is clear from the fact that it exists in the form of its compounds.

7) An element forms an oxide A_2O_3 which is acidic in nature. Identify A as a metal or non-metal.

Answer: Oxides of non-metals are acidic in nature while those of metals are basic in nature. Hence, A must be a non-metal.

8) Every ore is a mineral but not every mineral is an ore. Explain.

Answer: Every mineral is not suitable for the extraction of the metal. The mineral from which the metal is economically and conveniently extracted is called an ore.

9) State reasons for the following:

(i) Electric wires are covered with rubber-like material.

(ii) From dilute hydrochloric acid, zinc can liberate hydrogen gas but copper cannot.

Answer:

(i) It is because rubber is an insulator and does not allow current to flow through it.

(ii) Zinc is placed above hydrogen in the reactivity series of metals while copper is placed below it. Metals placed above hydrogen can displace hydrogen from water and acids while those below it cannot. Therefore, zinc can displace hydrogen from dilute HCl whereas copper cannot.

10) Give reason for the following:

(i) Iron grills are frequently painted.

(ii) Gold ornaments retain their lustre even after several years of use.

Answer:

(i) Iron metal easily gets rusted by air containing moisture and oxygen. Therefore, iron grills are frequently painted with rust proof paints.

(ii) Gold is a noble metal and is not affected by chemicals or by air. Therefore, gold ornaments retain their lustre even after several years.

Level 3

1) Metal A can displace metal B from BO, the oxide of metal B. Metal B can displace C from solution of CSO4, the sulphate of metal C. Arrange metal A, B and C in the order of increasing reactivity.

Answer: C < B < A.

2) You are provided with three metals: Sodium, magnesium and copper. Using only water as the reactant, how will you identify them?

Answer:The metal which reacts violently with cold water and catches fire is sodium.

The metal which evolves hydrogen gas upon heating with water is magnesium. The metal which does not react with water even on strong heating is copper.

3) A non-metal A is an important constituent of our food and forms two oxides B and C. Oxide B is toxic whereas C causes global warming. Identify A, B and C.

Answer: The non-metal A is carbon. It is an important constituent of our food in different forms. For example, glucose (C6H12O6) contains carbon. In fact, all food materials are organic compounds and these contain carbon as an essential constituent. The two oxides of carbon are, carbon monoxide (B) and carbon dioxide (C). Carbon dioxide causes global warming.

Hence, A = Carbon (C); B = Carbon monoxide (CO); C = Carbon dioxide (CO_2)

4) An element A burns with a golden yellow flame in air. It reacts with another element B, atomic number 17 to give a product C. An aqueous solution of product C on electrolysis gives a compound D and liberates hydrogen. Identify A, B, C and D. Also write down the equations for the reactions involved.

Answer: A = Sodium which burns with golden flame in air. It reacts with chlorine (Z = 17) to form sodium chloride.

$2Na\ (s) + Cl_2\ (g) \rightarrow 2NaCl\ (s)$

Hence, B = chlorine and C = sodium chloride

$$2Na^+ + Cl^-(aq) + 2H_2O(l) \xrightarrow{\text{Electrolysis}} \underset{\text{Sodium hydroxide}}{2NaOH(aq)} + Cl_2(g) + H_2(g)$$

Hence, D = Sodium hydroxide.

5) A student has been collecting silver coins and copper coins. One day, she observed a black coating on silver coins and a green coating on copper coins. Which chemical phenomenon is responsible for these coatings? Write the chemical name of black and green coatings.
Answer: The name of the phenomenon is corrosion. The chemical name of black coating is silver sulphide (Ag_2S) formed due to attack of H_2S gas present in the atmosphere on silver and that of green coating is basic copper carbonate formed due to attack of moist air (CO_2, O_2 and H_2O vapours) on copper.

$$\underset{\text{Silver}}{2Ag(s)} + \underset{\text{Hydrogen sulphide (from air)}}{H_2S(g)} \longrightarrow \underset{\text{Silver sulphide (Black)}}{Ag_2S(s)} + \underset{\text{Hydrogen}}{H_2(g)}$$

$$\underset{\text{Copper}}{2Cu(s)} + \underbrace{CO_2(g) + O_2(g) + H_2O(l)}_{\text{From moist air}} \longrightarrow \underset{\text{Basic copper carbonate (Green)}}{CuCO_3.Cu(OH)_2}$$

6) Explain the following:
(a) Reactivity of Al decreases if it is dipped in HNO_3.
(b) Carbon cannot reduce the oxides of Na or Mg.
(c) NaCl is not a conductor of electricity in solid state whereas it does conduct electricity in aqueous solution as well as in molten state.
(d) Iron articles are galvanised.
(e) Metals like Na, K, Ca and Mg are never found in their free state in nature.
Answer:
(a) On dipping in HNO_3, the surface of Al is oxidised to form an oxide layer of Al_2O_3, which is hard and impervious. It acts as a protective layer for Al underneath. Hence, reactivity of Al decreases.

(b) Na or Mg are highly reactive metals. They have greater affinity for oxygen than for carbon. Hence, their oxides are stable. To reduce them with carbon, very high temperature is required. At this temperature, these metals react with carbon to form corresponding carbides.

(c) The conduction of electricity is due to movement of ions. In the solid state, Na^+ and Cl^- are fixed and not free to move. Hence, it does not conduct electricity. In the aqueous solution or in the molten state, Na^+ and Cl^- ions are free to move about and hence conduct electricity.

(d) Galvanisation means coating of iron articles with a layer of zinc. Zinc is more reactive than iron. Hence, it undergoes oxidation more readily than iron. As a result, iron articles remain protected.

(e) These metals are highly reactive and react with the gases present in the air. Hence, they are found as compounds in the ores and not in the free state in nature.
7) A non-metal A which is the largest constituent of air, when heated with H_2 in 1: 3 ratio in the presence of catalyst (Fe) gives a gas B. On heating with O_2 it gives an oxide C. If this oxide is passed into water in the presence of air it gives an acid D which acts as a strong oxidising agent. Identify A, B, C and D.
Answer: Non-metal which is the largest constituent of air is nitrogen (N_2). Hence, A = N_2.
When heated with H_2 in presence of Fe as catalyst, it forms ammonia (NH_3).

$$N_2(g) + 3H_2(g) \xrightarrow[Fe]{\text{Heat}} 2NH_3(g)$$

Hence, B = NH_3.
When heated with O_2, it forms nitric oxide (NO).

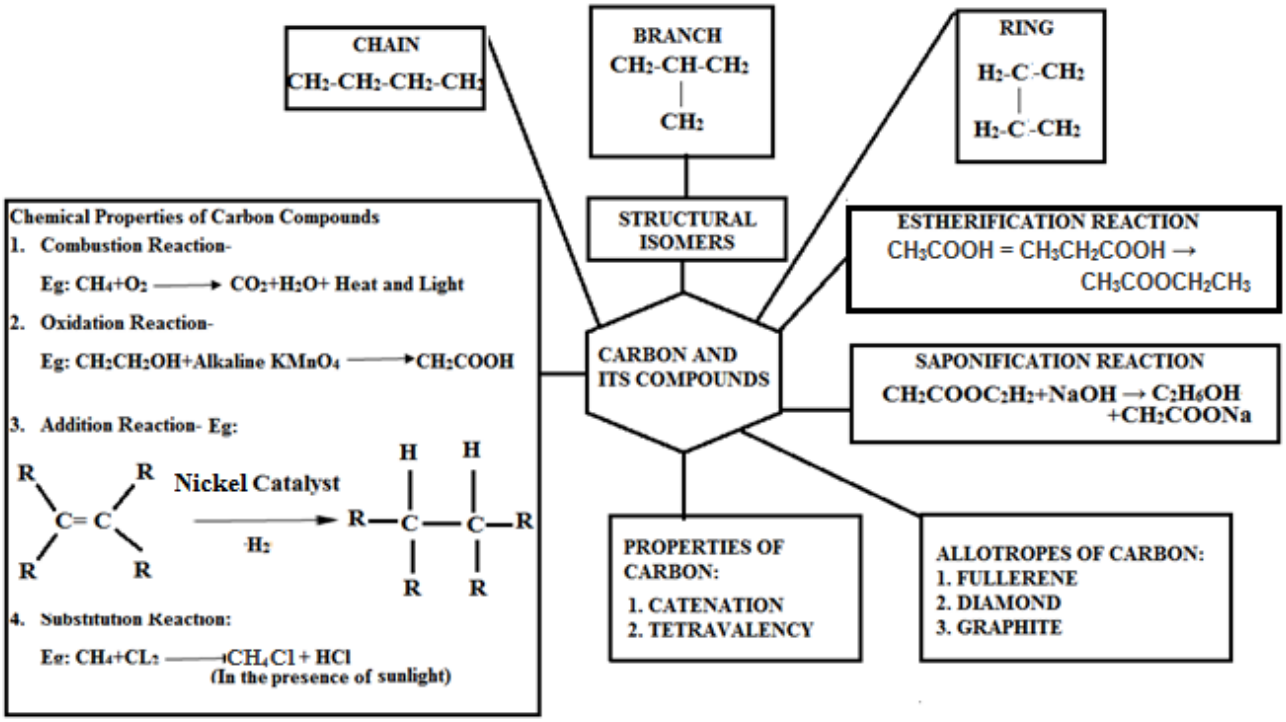
$$4NH_3(g) + 5O_2(g) \xrightarrow[\text{Catalyst (Pt)}]{\text{Heat (750–900°C)}} 4NO(g) + 6H_2O(g)$$

NO further gets oxidised to NO_2 by O_2 of the air.
$2NO(g) + O_2(g) \rightarrow 2NO_2(g)$
Hence, C = NO_2.

On passing this oxide into water in presence of air (O_2), it gives nitric acid (HNO_3) which is a strong oxidising agent.
$4NO_2(g) + H_2O(l) + O_2(g) \rightarrow 4HNO_3(aq)$
Hence, D = HNO_3.
8) Anil and his neighbour Sunil had got their garden fenced with iron rods. Next day Anil saw that Sunil was painting the iron fence. Sunil suggested Anil to do the same to increase the longevity of the iron rods by preventing corrosion. Anil argued that it is a waste of time and his iron rods were strong enough. After reading the above passage, answer the following questions.
(i) Whose opinion was correct? Justify.
(ii) Mention two methods (other than painting) to prevent iron from corrosion.
(iii) What is the chemical formula of rust?
(iv) Mention the values exhibited by Sunil.
Answer:
(i) Sunil's opinion is correct, it helps to protect iron rods from rusting/corrosion.
(ii) (a) Galvanisation
(b) Cathodic protection
(iii) $Fe_2O_3.XH_2O$
(iv) Friendship/use of knowledge of Chemistry

CHAPTER 4
CARBON AND ITS COMPOUNDS

Introduction: The non-metallic element carbon can be found in many different forms. It typically has a muted, grey colour. Diamond is a unique variety of carbon, the world's hardest substance. When used in optical design, diamond can appear fairly dazzling.
Mind Map: Carbon and its compounds:



Properties of carbon:

1. Physical properties of carbon

- Carbon has a number of allotropes which have different physical as well as chemical properties.
- poor conductor of electricity(exception:-Carbon can conduct electricity in the form of graphite).
- low boiling and melting point

2. Chemical properties of carbon

- **Catenation**: The self linking property of an element mainly carbon atom through covalent bonds to form long straight, branched and rings of different sizes is called Catenation.
- Carbon has the highest tendency to catenate due to its small size and tetravalency.
- **Tetravalent:** There are four electrons in the outermost shell of a carbon **atom**. This enables the C atom to form a variety of bonds with **hydrogen**, oxygen, nitrogen, halogens and many other elements.

Bonding in Carbon:
Covalent Bond:
The bond formed by mutual sharing of electron pairs

Types of Covalent Bond:

Single Covalent Bond: When a single pair of electrons isshared between two atoms in a molecule. For example; F_2, Cl_2, H_2, etc.

Double Covalent Bond: When two pairs of electrons areshared between two atoms in a molecule. For example; O_2, CO_2, etc.

Triple Covalent Bond: When three pairs of electrons are shared between two atoms in a molecule. For example N_2, etc.

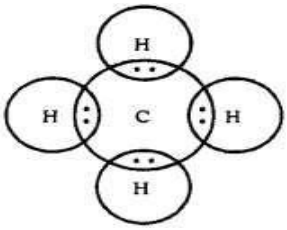
Electron Dot Structure: The electron dot structure provides a picture of bonding in molecules in terms of the shared pairs of electrons and octet rule.

Formation of Hydrogen Molecule

Atomic number of Hydrogen = 1Numberofvalence electrons= 1

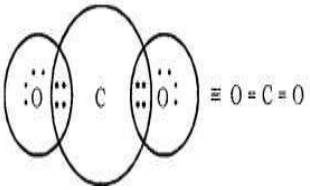
Formation of CH_4 Molecule

Atomic number of Carbon = 6 [2, 4]
Number of valence electrons = 4
Atomic number of Hydrogen = 1
Number of valence electrons=1



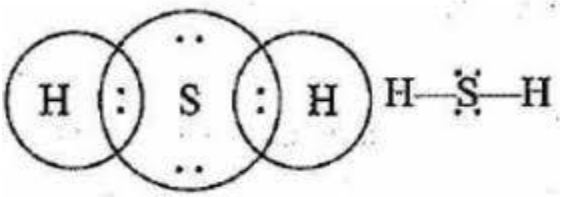
Formation of CO_2 Molecule

Atomic number of Carbon = 6 [2, 4]
Number of valence electrons = 4
Atomic number of Oxygen=8[2, 6]
Number of valence electrons=6

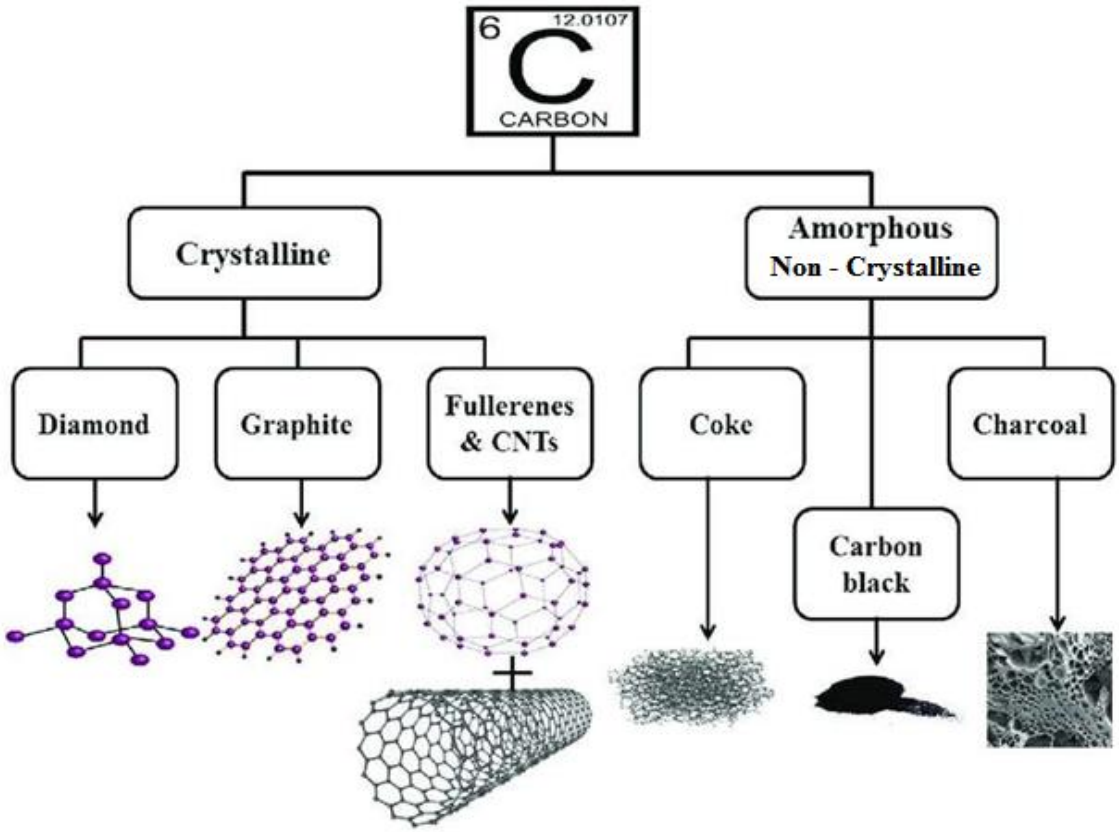


Formation of H_2S Molecule

Atomic number of Sulphur = 16 [2, 8, 6]
Number of valence electrons= 6

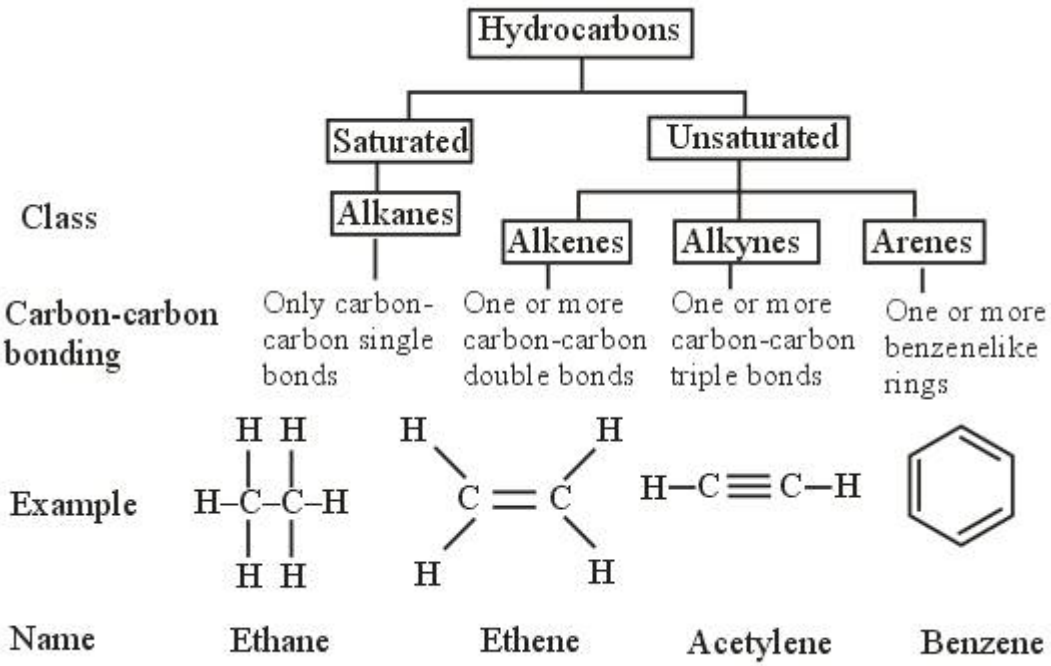


Allotropic forms of carbon:



Hydrocarbons:

The compounds of carbon with hydrogen are called hydrocarbons.



S. No	Number of Carbon Atoms	Word Root (-)	Single bon (Alkane)
1.	One	Meth	+ane
2.	Two	Eth	+ane
3.	Three	Prop	+ane
4.	Four	But	+ane
5.	Five	Pent	+ane
6.	Six	Hex	+ane

Functional groups:

When one or more hydrogen atom is in an organic compound (Carbon chain) is replaced by other atoms satisfying its valency then these atoms are called hetero atoms.

An atom or group of atoms present in an organic compound which largely determines its chemical properties js called Functional Group.

Functional Group	Formula of Functional Group
1. Halo- Chloro- Bromo-	—Cl —Br
2. Alcohol	—OH
3. Aldehyde	—CHO or —C(=O)—H
4. Ketone	—CO— or —C(=O)—
5. Carboxylic acid	—COOH or —CO_2H or —C(=O)—O—H

Homologous Series:

Series of organic compounds having the same functional group and chemical properties and successive members differ by a CH_2 unit or 14 mass units is known as Homologous series.

Homologous series of Alkanes, Alkenes and Alkynes

Alkanes-CnH_2n+_2	Alkenes-CnH_2n	Alkynes-CnH_2n-_2
Methane –CH_4	Ethene-C_2H_4	Ethyne-C_2H_2
Ethane-C_2H_6	Propene-C_3H_6	Propyne-C_3H_4
Propane-C_3H_8	Butene-C_4H_8	Butyne-C_4H_6

Characteristics of Homologous Series

- The successive members in homologous series differ by CH_2 unit or14 mass unit.
- Members of given homologous series have the same chemical properties.

Isomers: Compounds having the same molecular formula but different but different structural formula and properties are known as Isomers and this phenomenon is known as Isomerism.

Chemical properties of carbon compounds:

1. Combustion (Burning of Carbon Compound in Air)

Carbon and its compounds burn in the presence of oxygen or air to give carbon dioxide, water vapour, and energy. This process of burning carbon compounds in excess of oxygen to give heat and light is called a combustion reaction.

Example:-

1) $C + O_2$---------> CO_2 + Energy
2) $C_2H_5OH + 3O_2$ ----------> $CO_2 + 3H_2O$ + Energy
3) $CH_4 + O_2$ ----------> $CO_2 + H_2O$ + Energy

2. Oxidation: Oxidation of ethanol in presence of oxidizing agents gives ethanoic acid.

$$CH_3CH_2—OH \xrightarrow[\text{or Acidified } K_2Cr_2O_7 + \text{Heat}]{\text{Alkaline } KMnO_4 + \text{Heat}} CH_3COOH$$

Ethanol — Ethanoic acid

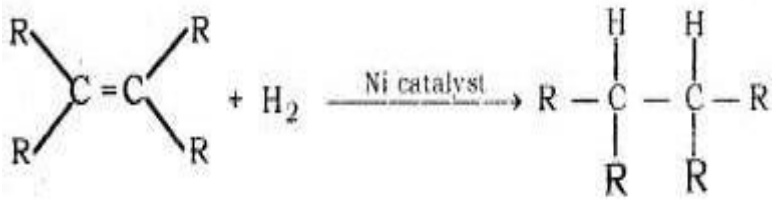
Oxidizing Agent: Some substances capable of adding oxygen to others are known as oxidizing agents. Example: Alkaline $KMnO_4$ (or $KMnO_4$—KOH) Acidified $K_2Cr_2O_7$ (or $K_2Cr_2O_7$—H_2SO_4)

$KMnO_4$–Potassium permanganate

$K_2Cr_2O_7$–Potassium dichromate

Catalyst: Substances that cause a reaction to occur or proceeds to different rate without consuming in it are called a catalyst. For example, Ni, Pt, Pd, etc.

3. Addition Reaction: Addition of hydrogen with unsaturated hydrocarbon in the presence of catalysts such as nickel, platinum or palladium are known as Hydrogenation.



$$CH_2 = CH_2 + H_2 \xrightarrow{\text{Ni catalyst}} CH_3 — CH_3$$

Ethene — Ethane

Hydrogenation:

Process of converting vegetable oil into solid fat (vegetable ghee) is called Hydrogenation of Oil.

Vegetable oil + H_2 ⟶ Vegetable ghee

Vegetable fats are saturated fats which are harmful for health.

4. **Substitution Reaction :** Replacement of one or more hydrogen atom of an organic molecule by another atom or group of the atom is known as Substitution Reaction.

$$CH_4(g) + Cl_2(g) \xrightarrow{\text{Sunlight}} CH_3Cl(g) + HCl(g)$$

Methane — Chloromethane

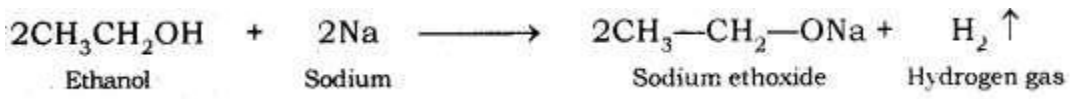
Some Important Carbon Compounds :

Ethanol (CH_3CH_2—OH): Commonly known as Ethyl Alcohol.Physical Properties

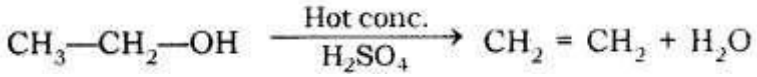
a. It is colourless, inflammable liquid.
b. It is miscible with water in all proportions.
c. It has no effect on the litmus paper.

Chemical Properties

a. Reaction with sodium



b. Reaction with concentrated H_2SO_4 (Dehydration Reaction)

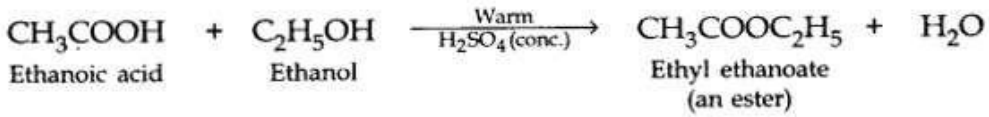


Dehydrating agent:

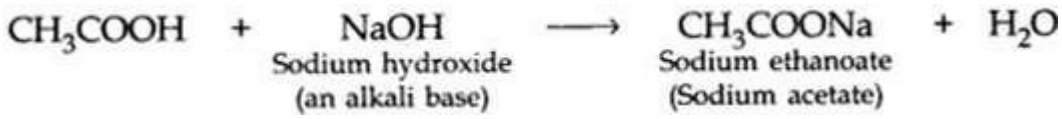
Substances which removes water from ethanol (alcohols) is known as Dehydrating agent. For example, Cone. H_2SO_4.
Uses: As solvent, as antiseptic (tincture iodine), as anti-freeze in automobiles.

Ethanoic Acid (CH_3COOH): Commonly known as Acetic acid. 5-8% of ethanoic acid in water is called Vinegar. The melting point of pure ethanoic acid is 290K and hence, it often freezes in cold climate so named as glacial acetic acid.
Physical Properties:
a. It is a colourless, pungent-smelling liquid.
b. Miscible with water in all proportions.
c. Turns blue litmus to red.

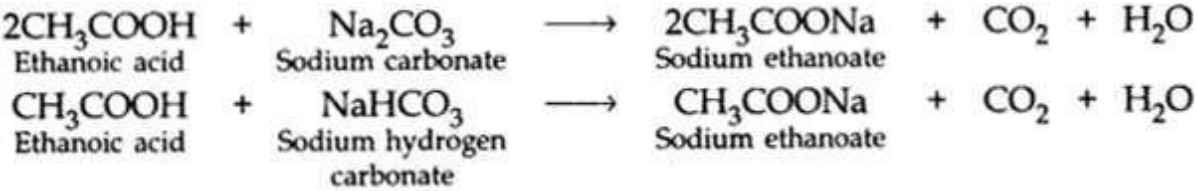
The harmful effects of drinking alcohol:
Intoxication, dehydration, loss of balance, clumsiness, poor reflex actions, ambiguous speech, etc. are its immediate effects of ethanol.
But prolonged alcohol consumption leads to liver ailments and brain disorders. Alcohol consumption increases cancer risk and women become more prone to breast cancer
Chemical properties of Ethanoic acid:
- Ethanoic acid commonly called acetic acid (CH_3COOH) is a colourless liquid. The functional group present in it is carboxylic acid –COOH.
- Its melting point is 290K and the boiling point is 391K.
- Being an acid, it turns blue litmus red.
- It is sour in taste.
- Ethanoic acid reacts with alcohols in the presence of cone. H_2SO_4 acid to form sweet smelling compounds called esters.



- Ethanoic acid reacts with bases to form its salt and water.



- It reacts with carbonate and hydrogen-carbonate compounds of metals to form its salt (sodium ethanoate commonly called sodium acetate) and release CO_2 gas.



Esterification Reaction : Reaction of ethanoic acid with an alcohol in the presence of a few drops

of conc. H_2SO_4 as catalyst gives a sweet-smelling substance known as Esters, called Esterification reaction.
Esters are used in making perfumes and flavouring agents.

$$\underset{\text{Ethanoic acid}}{CH_3COOH(aq)} + \underset{\text{Ethanol}}{CH_3CH_2OH(aq)} \xrightarrow{\text{conc.}H_2SO_4} \underset{\text{Ethyl ethanoate (Fster)}}{CH_3COOC_2H_5(aq)} + H_2O(l)$$

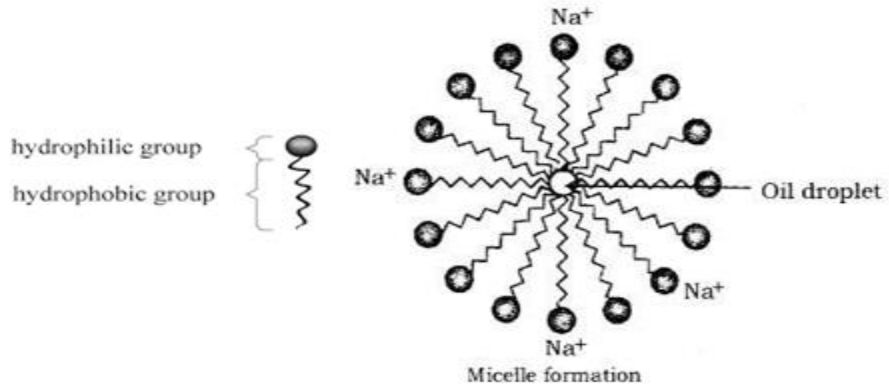
Saponification Reaction: Reaction of esters with sodium hydroxide, gives alcohol and sodium salt of carboxylic acid(soap).This reaction is known as Saponification Reaction.

$$\underset{\text{Ethyl ethanoate}}{CH_3COOC_2H_5} + \underset{\text{Sodium hydroxide}}{NaOH} \xrightarrow{H_2SO_4} \underset{\text{Ethanol}}{C_2H_5OH} + \underset{\text{Sodium ethanoate (soap)}}{CH_3COONa}$$

Soaps and Detergents:

Soap: Sodium or potassium salts of long chain fatty acids is called Soap.
General formula: $RCOO^-Na^+$
Detergent: Ammonium and sulphonate salts of long chain fatty acids are called Detergent.
Example: $CH_3—(CH_2)_{11}—C_6H_4—SO_3Na$.
Hard and Soft Water: Water that does not produce lather with soap readily is called Hard water and which produces lather with soap is called Soft Water.
Hardness of water is due to the presence of bicarbonates, chlorides and salt of calcium and magnesium sulphate
Cleansing Action of Soaps and Detergents: Both soaps and detergents contains two parts. A long hydrocarbon part which is hydrophobic (water repelling) in nature and a short ionic part which is hydrophilic (water attracting) in nature.
The hydrocarbon part of the soap molecule links itself to the oily (dirt) drop and ionic end orients itself towards water and forms a spherical structure called micelles. The soap micelles helps in dissolving the dirt in water and wash our clothes.

Soaps	**Detergents**
(i) These are sodium or potassium salts of lor chain fatty acids.	(i) These are ammonium and sulphonate salts of lor chain fatty acids.
(ii) Ionic part of the soap is —COO^-Na^+	(ii)Ionic part of detergent is—$OSO_3^-Na^+$.
(iii)Their efficiency decreases in hardwater	(iii)Their efficiency is unaffected in hardwater.
(iv)Soaps are biodegradable.	(iv) Detergents are non- biodegradable.



QUESTION BANK
LEVEL I
MULTIPLE CHOICE QUESTIONS

1. The bond formed by sharing of one electron each
(a) single covalent bond (b) double covalent bond
(c) triple covalent bond (d)none of the above
Answer: (a) single covalent bond

2. Carbon has atomic number
(a) 4 (b) 6
(c) 7 (d) 8
Answer: (b) 6

3. A pleasant fruit smelling compound
(a) methane (b) propane
(c) butane (d) ester
Answer: (d) ester

4. The hardest crystalline form of carbon
(a) graphite (b) Diamond
(c) coke (d) coal
Answer: (b) Diamond

5. Substance used as preservatives in pickles
(a) Hydrochloric (b) acetic acid
(c) tartaric acid (d) oxalic acid
Answer: (b) acetic acid

6. Ethane (C_2H_6) has ------ covalent bonds
(a) 6 (b) 7
(c) 8 (d) 9
Answer: (b) 7

7 The general formula of alkynes is ……
(a) C_nH_{2n-2} (b) C_nH_{2n+2}
(c) C_nH_{3n-2} (d) C_nH_{4n-2}
Answer: (a) C_nH_{2n-2}

8 A soap molecule has a
(a) hydrophobic head and hydrophobic tail
(b) hydrophobic head and hydrophilic tail
(c) hydrophilic head and hydrophilic tail
(d) hydrophilic head and hydrophobic tail
Answer: (d) hydrophilic head and hydrophobic tail

9. Which of the following belongs to homologous series of alkynes?
C_6H_6, C_4H_6, C_2H_4, C_3H_4.
(a) C_6H_6 (b) C_2H_4
(c) C_4H_6 (d) C_3H_4

Answer: (c) C_4H_6

10. Butanone is a four carbon compound with the functional group

(a) Carboxylic acid (b) Aldehyde

(c) ketone (d) Alcohol

Answer: (c) ketone

Assertion Reason Questions

The questions given below consist of an assertion and the reason. Use following key to choose the appropriate answer.

(a) Both the Assertion and the Reason are correct and the Reason is the correct explanation of the Assertion.

(b) The Assertion and the Reason are correct but the Reason is not the correct explanation of the Assertion.

(c) Assertion is true but the Reason is false.

(d) The statement of the Assertion is false but the Reason is true.

11. Assertion: Carbon forms a large number of organic compounds.

Reason: Carbon is tetravalent

Answer: (b) The Assertion and the Reason are correct but the Reason is not the correct explanation of the Assertion

12 Assertion: Vegetable oils are unsaturated, react with hydrogen in presence of nickel to form vegetable ghee.

Reason: This reaction takes place in the presence of catalyst.

Answer: (b) The Assertion and the Reason are correct but the Reason is not the correct explanation of the Assertion.

13. Write the name and the structure of a saturated compound in which carbon atoms are arranged in a ring. How many double bonds are present in this compound?

Answer: Benzene (C_6H_6) three double bonds

THREE MARKS QUESTIONS

1. List two characteristic features of carbon. Why is carbon considered to be the most important element?

Answer: Catenation and tetra valency of carbon

Carbon is the main element in organic compounds, so carbon is essential to life on Earth. Without carbon, life as we know it could not exist.

2. What is an hetero atom? Which hetero atoms are present in haloalkanes and alcohol ?

Answer: An element or group of elements that replace *one or more hydrogen (H) atoms* from hydrocarbon,

The hetero atom present in haloalkane is *halogen atom*. Examples: Cl, F, Br, and I .The heteroatom present in alcohol is oxygen atom.

3. The primary reason behind the formation of the toxic foam is high phosphate content in the wastewater because of detergents used in dyeing industries, dhobi ghat and households. Yamuna's pollution level is so bad that parts of it have been labelled 'dead' as there is no oxygen in it for aquatic life to survive

(a) Predict the pH value of the water of river Yamuna if the reason for froth is high content of detergents dissolved in it.

a) 10-11 b) 5-7 c) 2-5 d) 7 - 14

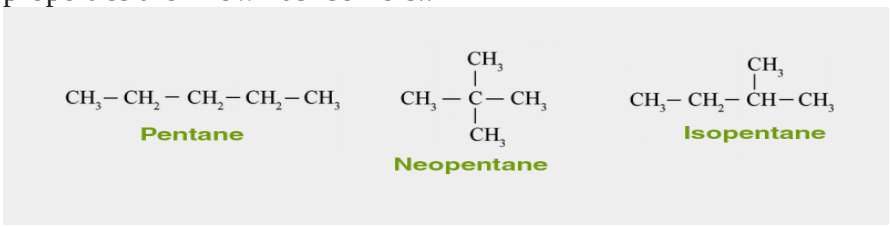
(b) Name the salts present in detergents.

(c) What is the nature of soap? Is it acidic or basic ?

Answer: (a) between 7-14. (b) These are ammonium and sulphonate salts of long chain fatty acids (c) basic

FIVE MARKS QUESTION

1. Atom of an element contains five electrons in its valence shell. This element is the major component of the air. It exists as a diatomic molecule,
(a) Identify the element.
(b)Show the bond formed between the two atoms of this element elements.
(c)Write the nature of the bond between the two atoms.
(d) What is the compound formed when it combines with oxygen?
(e)What are diatomic molecules?
Answer: a) Nitrogen b) N≡N c) Covalent bond (d) NO
A diatomic molecule consists of two atoms of the same element, such as hydrogen (H_2) or oxygen (O_2), then it is said to be diatomic
2. What are isomers? Draw two structures of isomers of Pentane.
Answer: Compounds having the same molecular formula but different structural formula and properties are known as Isomers..



LEVEL 2

MULTIPLE CHOICE QUESTION:

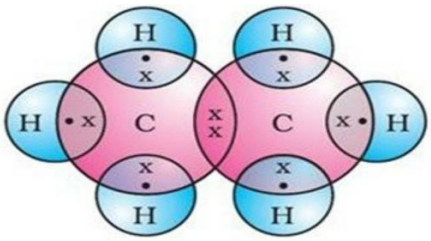
1. Ethanol on complete oxidation gives
(a) ethanol (b) acetic acid/ ethanoic acid
(c) CO_2 and water (d) acetic acid and water
Answer : (c) CO_2 and water
2. C_3H_8 belongs to the homologous series of
(a)Cyclo alkanes (b) Alkynes
(c) Alkanes (d) Alkenes
Answer: (c) Alkanes
3. Which of the following will give a pleasant smell of ester when heated with ethanol and a small quantity of sulphuric acid?
(a) CH_3COOH (b)CH_3OH (c)CH_3CH_2OH (d)CH_3CHO
Answer: (a) CH_3COOH
4When ethanoic acid is treated with $NaHCO_3$the gas evolved is
(a)CH_4 (b) CO
(c)CO_2 (d)H_2
Answer:(c)CO_2
5. Name the functional group present in CH_3COCH_3.
(a) Alcohol(b) Carboxylic acid
(c) Ketone(d) Aldehyde
Answers: (c) Ketone
4. A functional group mainly determines the
(a) physical properties(b) chemical properties
(c) both(d) none of these
Answers: (b) chemical properties
5. Solubility of alcohol in water is due to
(a) low density of alcohol(b) volatile nature of alcohol
(c) ionisation(d) hydrogen bonding
Answer: (d) hydrogen bonding
6. Which form of carbon is found in Golkonda mines of Karnataka?
(a) Diamond(b) Graphite
(c) Coal(d) Coke
Answer: (a) Diamond

7. A few drops of ethanoic acid were added to solid sodium carbonate. The observation made was that
(a) a hissing sound was produced(b) brown fumes evolved
(c) brisk effervescence occurred(d) a pungent smelling gas evolved
Answer: (c) brisk effervescence occurred
8. The correct formula of butanoic acid is
(a) $C_4H_8O_2$ (b) $C_3H_8O_2$ (c) $C_4H_60_2$ (d) $C_3H_3O_2$
Answer (a)

TWO MARKS QUESTIONS
REASON AND ASSERTIONS:
11. Assertion (A): Carbon is the only element that can form large number of Compounds
Reason (R): Carbon is tetravalent and shows the property of catenation.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.
Answer: A is false but R is true.
2. **Assertion**: Graphite is slippery to touch.
Reason : The various layers of carbon atoms in graphite are held together by weak forces of attractions.
Answer: (b) Both A and R are true but R is not the correct explanation of A
Answer the Following:
13. What is saponification? Write the equation.
Answer: Saponification can be defined as a "hydration reaction where free hydroxide breaks the ester bond between the fatty acid and glycerol triglyceride, resulting in free fatty acid and glycerol," which are soluble in acqueous solution.

$$CH_3COOC_2H_5 + NaOH \rightarrow CH_3COONa + C_2H_5OH$$

14. Draw the structure of Ethene.
Answer:



15. What are the properties of ethanoic acid?
Answer: Ethanoic acid is a colourless liquid with a pungent vinegar odour and sour taste.
THREE MARKS QUESTIONS
16: ***Read the following passage and answer any three questions***
Food, clothes, medicines, books, or many of the things are all based on this versatile element carbon. In addition, all living structures are carbon based. The earth's crust has only 0.02% carbon in the form of minerals. The element carbon occurs in different forms in nature with widely varying physical properties. Carbon has the unique ability to form bonds with other atoms of carbon, giving rise to large molecules. This property is called catenation.
(i)What is catenation?
Answer: Carbon has the unique ability to form bonds with other atoms of carbon, giving rise to large molecules. This property is called catenation.
(ii**) Why methyl alcohol and acetic acid. Possess different physical and chemical properties?**
Answer: Due to presence of different functional groups methyl alcohol and acetic acid. Possess different physical and chemical properties.

17. Name the following compounds:
(a) $CH_3 – CH_2 – OH$

Answer:
(a) $CH_3 – CH_2 – OH$: Ethanol

18 Could you be able to check if water is hard by using a detergent? Why ?
Answer:
No, because detergents can lather well even in hard water. They do not form insoluble calcium or magnesium salts (scum). On reacting with the calcium ions and magnesium ions present in the hard water.

19. Why is the conversion of ethanol to Ethanoic acid is an oxidation reaction?
Answer:
The conversion of ethanol into ethanoic acid is called an oxidation reaction because oxygen is added to it during this conversion.

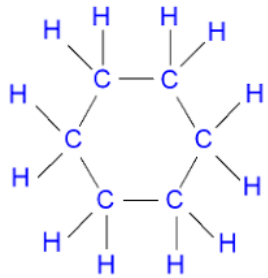
20. Covalent compounds have low melting and boiling point. Why?
Answer:
Covalent compounds have low melting and boiling points because the forces of attraction between molecules of covalent compounds are very weak. On applying a small amount of heat these molecular forces break.

FIVE MARK QUESTION

21. Explain the cleansing action of soap.

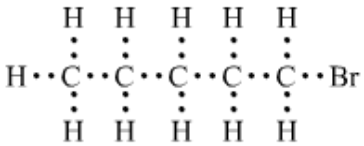
Answer: When a dirty cloth is put in water containing dissolved soap, then the hydrocarbon end of the soap molecules in micelle attach to the oil or grease particles present on the surface of dirty cloth. In this way the soap micelle entraps the oily or greasy particles by using its hydrocarbon ends. The ionic ends of the soap molecules in the micelles, however, remain attached to water. When the dirty cloth is agitated in soap solution, the oily and greasy particles present on its surface and entrapped by soap micelles get dispersed in water due to which the soap water becomes dirty but the cloth gets cleaned. The cloth is cleaned thoroughly by rinsing in clean water a number of times.

22. (a) What will be the formula and electron dot structure of Cyclopentane?
Answer: C_6H_{12}



(b) How many structural isomers can you draw for pentane?
Answer: We can draw 3 structural isomers for pentane.

(c) Draw the structures for the compound Bromopentane
Answer:



LEVEL 3
MULITIPLE CHOICE QUESTIONS -ONE MARK QUESTIONS(10)

1. Which of the following serves as the main source of carbon for plants?
(a) Fossil fuels (b) Atmospheric carbon dioxide
(c) Both (a) and (b) (d) None of the above
Answer (b) Atmospheric carbon dioxide.
2. Carbon is a poor conductor of electricity (a)Yes (b) No
Answer(a) Yes
3. One of the most important carbon compounds are _____.
(a) Charcoal (b) Diamond
(c) Graphite (d) Amorphous carbon
Answer (a) Charcoal.
4. What kind of bonds are present in diamond?
(a) Covalent bond only (b) Ionic bond only
(c) Mix of covalent and ionic bond (d) Metallic bonds
Answer: a) Covalent bond only
5. Which of the following can conduct electricity?
(a) Coke (b) Carbon
(c) Graphite (d) Diamond
Answer: (c) Graphite
6. C_3H_8 belongs to the homologous series of
(a) Alkynes (b) Alkenes(c) Alkanes (d) Cyclo alkanes
Answer: (c) Alkanes
7. Name the functional group present in CH_3COCH_3.
(a) Alcohol (b) Carboxylic acid
(c) Ketone (d) Aldehyde
Answer: c) Ketone
8. Addition reactions are undergone by
(a) saturated hydrocarbons (alkanes) (b) only alkenes
(c) only alkynes (d) both alkenes and alkynes
Answer: (d) both alkenes and alkynes
9.Which of the following can be used for lubrication?
(a) Graphite (b) Diamond
(c) Brass (d) Bronze
Answer: a) Graphite
10.The chemical composition of Buckminster Fullerene?
(a) C_{60} (b) C_{50}
(c) C_{55} (d) C_{45}
Answer: a)C_{60}
TWO MARK QUESTIONS

Assertion Reason Questions

The following questions consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

11. Assertion(A): Diamond is the hardest natural known substance.

Reason (R): Diamond is used for cutting marble, granite and glass.

Answer: (b) Both A and R are true but R is not the correct explanation of A.

12. Assertion (A): Alkanes give addition reaction.

Reason (R): Addition reactions are a characteristic property of unsaturated hydrocarbons.

Answer: (d) Assertion is false but reason is true

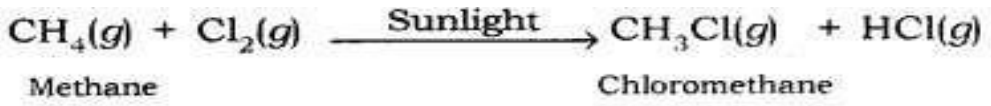
13.What is esterification reaction? Write its equation. [2]

Answer: The reaction between carboxylic acid and alcohol in the presence of a few drops of conc H_2SO_4 is called esterification.

$CH_3COOH + C_2H_5OH \rightarrow CH_3COOC_2H_5 + H_2O$

14. Define substitution reaction. Write the equation

Answer: A substitution reaction is a type of chemical reaction where an atom or functional group of a molecule is replaced by another atom or functional group.



THREE MARK QUESTIONS

16. The compounds which have the same molecular formula but differ from each other in physical or chemical properties are called isomers and the phenomenon is called isomerism. In these compounds, carbon atoms can be linked together in the form of straight chains, branched chains or even rings.

a) Define the term isomerism?

b) How carbon atoms are linked together?

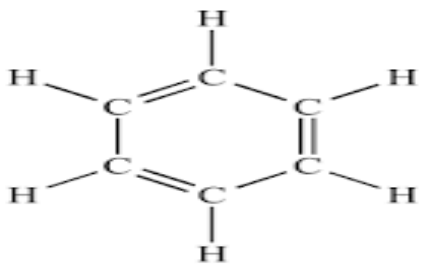
c) Draw the structure of benzene

Answer:

(a) The compounds which have the same molecular formula but differ from each other in physical or chemical properties are called isomers and the phenomenon is called isomerism

(b) carbon atoms can be linked together in the form of straight chains, branched chains or even rings.

(c)



17. Write the equations to show how ethanoic acid reacts with carbonates and hydrogen carbonates?

Answer: $2\ CH_3COOH + Na_2CO3 \rightarrow 2\ CH_3COONa + H_2O + CO_2$

$CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + H_2O + CO_2$

18. What are micelles and when does it form?

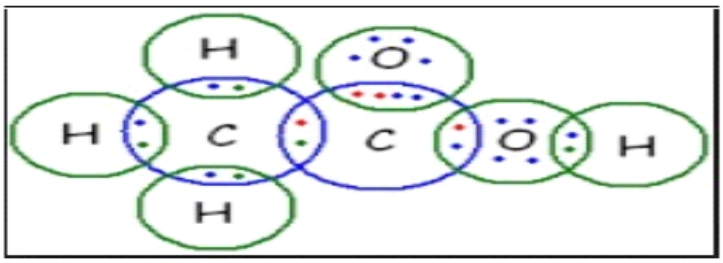
Answer: Micelles are formed by a cumulative formation of amphipathic molecules in an aqueous solution. In simple terms, it is formed when an array of solutions is added to water. The molecules can either be phospholipid or fatty acids.

19. What is a catalyst? Name three catalyst.
Answer: Catalyst**:** Substances that cause a reaction to occur or proceeds to different rate without consuming in it are called a catalyst. For example, Ni, Pt, Pd, etc.
20. What are the two properties of carbon which lead to the huge number of carbon compounds we see around us?
Answer: The two features of carbon that give rise to a large number of compounds are as follows:
(i) Catenation: It is the ability to form bonds with other atoms of carbon.
(ii) Tetravalency: With the valency of four, carbon is capable of bonding with four other atoms.

FIVE MARKS QUESTION-
21. Write the difference between soaps and detergents

Soaps	**Detergents**
(i) These are sodium or potassium salts of lor chain fatty acids.	(i) These are ammonium and sulphonate salts of lor chain fatty acids.
(ii) Ionic part of the soap is —$COO^{-}Na^{+}$	(ii)Ionicpartofdetergentis—$OSO^{3-}Na^{+}$.
(iii)Their efficiency decreases in hardwater	(iii)Their efficiency is unaffected in hardwater.
(iv)Soaps are biodegradable.	(iv) Detergents are non-biodegradable.

22. What are saturated and unsaturated hydrocarbons? B)Draw the electron dot structure for ethanoic acid.
Answer: Saturated Hydrocarbons — contain only carbon- carbon single bonds. Unsaturated Hydrocarbons — contain carbon- carbon double or triple bonds (more hydrogens can be added). In the carbon-carbon double bond, two pairs of electrons are being shared.



Chapter - 6

Life Processes

➢ **Life processes –** The processes that are necessary for an organism to stay alive. Eg. Nutrition,respiration, etc.

➢ **Criteria of life**- (i) Growth (ii) Movement

➢ **Nutrition**- The process in which an organism takes in food, utilizes it to get energy, for growth, repair and maintenance, etc. and excretes the waste materials from the body

Types of nutrition

1. Autotrophic nutrition (Auto =self: trophos = nourishment) E.g. Plants, Algae, blue green bacteria.

- **Process –** Photosynthesis (Photo=light; Synthesis= to combine)
- **Raw materials**- (i) Carbon dioxide (ii)Water

$$6CO_2 + 6H_2O \xrightarrow[\text{Chlorophyll}]{\text{sunlight}} C_6H_{12}O_6 + 6O_2$$

- **Equation-**
- Energy conversion- Light/Solar energy to Chemical energy
- Role off Chlorophyll- To trap the sun's energy for photosynthesis

o Factors for Autotrophic nutrition -

1. Carbon dioxide
2. Water
3. Light
4. Temperature

o **Events/ Steps of photosynthesis-**

1. Absorption of light energy by chlorophyll
2. Conversion of light energy to chemical energy & Splitting of water molecule into Hydrogen & oxygen
3. Reduction of Carbon dioxide to Carbohydrate

- **Gaseous exchange-**
  1. Gas used- Carbon dioxide
  2. By product - Oxygen
- **Source of raw materials-**
  1. Carbon dioxide –Land plants- Air, Aquatic plants- Water
  2. Water & Minerals – Soil

2. Heterotrophic nutrition (Hetero =others: trophos =nourishment) Eg. Animals, plants lacking chlorophyll like fungi.

a) **Saprophytic nutrition**: Organisms feeds on dead decaying plants or

animals material. E.g.Fungi, Bacteria

b) **Parasitic nutrition**: Organisms obtain food from the body of another living (host)

- **Endoparasite :** Parasite lives inside the body of the host e.g. tapeworm, roundworm.
- **Exoparasite :** Parasite lives on the body of the host. E.g. lice, leech.

Note- The parasite benefits while the host is usually harmed e.g. Cuscutta-plant parasite (amar bel), plasmodium (malarial parasite).

c) **Holozoic nutrition**: Organism (mostly animals) take in whole food and then digest it into smaller particles with enzyme. Eg.Amoeba, Paramoecium. Animals, human beings.

- **Steps in Holozoic nutrition**

i. Ingestion: taking in of food.

ii. Digestion: breaking down of complex food into simpler, absorbable form.

iii. Assimilation: Utilization of digested food from the body.

iv. Egestion: Removing undigested food from the body

- **Nutrition in human beings**

- Alimentary canal-
  Mouth Oesophagus Stomach Small intestine Large intestine
- Important gland/juices
  (Refer to figure 6.6 page no.97 of N.C.E.R.T Text book)

Organ	**Gland**	**Enzyme/Juice**	**Function**
Mouth	Salivary glands	Salivary Amylase	Converts starch into sugar
Stomach	Gastric glands	Gastric juice- (i) Hydrochloric acid	i. Kills harmful bacteria that enters with the food. ii. Makes the medium alkaline for the action of Pepsin
		(ii) Pepsin	Digests proteins
		(iii) Mucus	Protects the inner lining of the stomach from the corrosive action of Hydrochloric acid.
Small intestine	1) Liver	(i) Bile juice	i. Makes the medium acidic for the action of Pancreatic enzymes. ii. Breaks down large fat molecules into smaller globules so that enzymes can act upon them.
	2) Pancreas	(ii) Pancreatic Juice Amylase	Converts Carbohydrates to glucose
		Trypsin	Converts Proteins to Amino acids
		Lipase	Converts Fats into Fatty acids & Glycerol

Aerobic respiration	Anaerobic respiration
1. Takes place in presence of Oxygen. 2. End products- Carbon dioxide & Water 3. More energy is released. 4. Takes place in Cytoplasm & Mitochondria 5. Complete oxidation of glucose takes place. 6. It occurs in most organisms. 7. Equation- Glucose→ Pyruvate→ CO_2 + H_2O + Energy	1. Takes place in absence of Oxygen. 2. End products- Ethanol & Carbon dioxide 3. Less energy is released. 4. Takes place in only in Cytoplasm. 5. Incomplete oxidation of glucose takes place. 6. It occurs in certain bacteria, yeast & certain tissues of higher organisms. E.g. In humans during vigorous exercise, when the demand for Oxygen is more than the supply, muscle cells respire anaerobically for some time. 7. Equation- In Yeast- Glucose→ Pyruvate→ Ethanol + H_2O + Energy In muscle cells - Glucose→ Pyruvate→ Lactic acid + Energy

- **Some common features of Respiratory organs-**
  1. Large surface area- for greater rate of diffusion of respiratory gases.
  2. Thin permeable walls – to ensure easy diffusion & exchange of gases.
  3. Extensive blood supply- Respiratory organs are richly supplied with blood vessels for quick transport of gases.
- **Gaseous exchange in plants-**
  - Process – Diffusion
  - Direction of diffusion depends on-
  - Environmental conditions
  - Requirement of the plant.
    - Day time- Carbon dioxide given out during respiration is used for photosynthesis. Therefore only Oxygen is released, which is a major activity during the day.
    - Night time – Only respiration takes place. Therefore only Carbon dioxide is released, which is a major activity during the night.
  - **Gaseous exchange in animals-**
    - Terrestrial animals- take Oxygen from the atmosphere.
    - Aquatic animals- take Oxygen dissolved in water. (Oxygen content is low in water, therefore they breathe faster.
  - **Human Respiratory system-**
  - External nostrils → Nasal cavity → Trachea→ Bronchi → Bronchioles →Alveoli
    - Rings of cartilage present in the throat ensure that the trachea (air passage) does not collapse when there is less air in it.
    - Lungs –

- Present in the thoracic cavity.
- They are spongy, elastic bags consisting of Bronchi, Bronchioles and Alveoli

Refer to figure 6.9 page no. 104 of N.C.E.R.T Text book)

- **Respiration occurs in two phases-**
- (i) External-Breathing, which is a mechanical process.
- (ii) Internal - Cellular respiration
- **Mechanism of breathing – It includes :**
- Inhalation
- Exhalation

- **Exchange of gases-**

- Unicellular organisms- By Diffusion
- Animals-

a) As the body size is large, diffusion alone is not enough.

b) Respiratory pigments also required.

c) Respiratory pigment in human beings is Haemoglobin, which is present in red blood corpuscles.

d) It has very high affinity for Oxygen.

(Carbon dioxide is more soluble in water than Oxygen, so it Gets dissolves in blood and is thus transported.

- **Transportation**
- **Transportation in human beings-**

- **Blood-**

1. It is a fluid connective tissue.
2. Components-

(1) Fluid medium- Plasma (2) Red blood corpuscles (3) White blood corpuscles (4) Platelets suspended in plasma

3. Plasma transports food, Oxygen, Carbon dioxide, Nitrogenous wastes, etc.

- **Functions of blood-**

i. Transport of respiratory gases.

ii. Transport of nutrients.

iii. Transport of waste products.

iv. Defence against infection

- **Blood vessels-** (i) Arteries (ii) Veins (iii) Capillaries

Arteries	Veins
1. Thick walled.Deep seated. 2. Carry blood away from the heart. 3. Carry Oxygenated blood. 4. Valves absent.	1) Thin walled.Superficial. 2) Carry blood to the heart. 3) Carry Deoxygenated blood. 4) Valves present

- **Heart-**

(Refer to figure 6.10 page no. 106 of N.C.E.R.T Text book)

1. It is a muscular organ, which works as a pump in the circulatory system.
2. It is the size of our fist.
3. It has two sides, which are separated by a partition so that the oxygenated

and deoxygenated blood do not get mixed up.

It has four chambers - Two upper chambers called Atria.
Two lower chambers called Ventricle.

Working of heart- Left side-

1. Left atrium relaxes & the Oxygenated blood enters it from the lungs through the pulmonary vein.
2. Left atrium contracts & the blood enters the left ventricle through the valve.
3. Left Ventricle contracts and the blood is pumped into the largest artery **Aorta** and is carried to all parts of the body.

Working of heart- Right side-

1. Right atrium relaxes & the deoxygenated blood from the body enters it through superior and inferior Vena cava.
2. Right atrium contracts & the blood enters the right Ventricle through the valve.
3. Right Ventricle contracts and the blood is pumped into the Pulmonary artery and is carried to lungs.

- Valves- Unidirectional to prevent the backward flow of blood.
- Pulmonary vein is the only vein that carries Oxygenated blood.
- Aorta is the only artery that carries Deoxygenated blood.
- Double circulation in man- because the blood passes through the heart twice in one complete cycle of the circulation.

Capillaries

1. Form the connection between arteries & veins.
2. Walls are one cell thick only for easy exchange of blood.

- Platelets- Plug the leaks of arteries and veins by clotting the blood.
- Lymph- Extracellular fluid similar to plasma but colourless with lesser protein.
- Function of lymph-

1. Transportation of digested & absorbed fats from the small intestine.
2. Drains excess fluid from the intercellular spaces back in the blood.

- Higher animals- E.g., birds, mammals.

(i)Oxygenated blood & Deoxygenated blood are completely separate for efficient Oxygen supply. (ii)This is to fulfil higher energy needs and to maintain body temperature (warm blooded animals).

Amphibians & reptiles- have 3 chambered heat where little mixing of Oxygenated blood & Deoxygenated blood takes place. Therefore their body temperature varies with the temperature of the environment. (cold blooded animals)

- **Transportation in plants**-

Plants need less energy needs- because they do not move and therefore have a slow transport system

- **Transport of water**-

1. Takes place by xylem tissue present in roots, stem, leaves and is therefore interconnected.
2. Root cells take up ions from the soil, which creates a concentration difference between root and soil. Column of water therefore rises upwards.

- In very tall plants- transpiration creates a suction pressure, which pulls the water upwards.
- Importance of transpiration-

1. Helps in upward movement of water in plants.
2. It regulates the temperature in plants.

- **Transport of food-**

1. Takes place by phloem tissue.
2. Movement of prepared food in plants is called translocation.

➢ Excretion- The biological process of removal of harmful metabolic wastes in living organisms.

➢ Excretion in human beings-

(Refer to figure 6.13 page no. 110 of N.C.E.R.T Text book)

- **Organs of excretory system-**

1. kidneys
2. Ureters
3. Urinary bladder
4. Urethra

- **Kidneys-**

1. Two in number
2. Bean shaped
3. Present in abdomen on either side of the backbone
4. Basic unit is nephron.

1. **Glomerulus-** Group of capillaries (cluster) present in Bowman's capsule to receive blood from renal artery and filters it.
2. **Bowman's capsule-** Cup shaped structure, which contains glomerulus.
3. **Convoluted tubule-** is long and reabsorbs vital nutrients like glucose, amino acids, salts, urea and water.

Note-Vital functions of kidneys-

1. Filtration & removal of Nitrogenous wastes
2. Reabsorption of vital nutrients

- Ureters- Transport the urine formed in the kidneys to the urinary bladder.
- Urinary bladder- Muscular bag like structure to store urine.
- Urethra- Helps in removal of urine when the Urinary bladder is full.
- Artificial kidney- Principle: Dialysis

➢ **Excretion in plants-**

Gaseous wastes- CO_2 in respiration & O_2 in photosynthesis are removed by the process of diffusion.
Excess water- is removed by transpiration.

- Other wastes-

1. Stored in cellular vacuoles or in leaves, which fall off or as gums, resins, etc. in old xylem.
2. Excreted in soil.

➢ **Important diagrams-**

1. Open & close stomata
2. Steps of nutrition in Amoeba
3. Alimentary canal of human beings/ Digestive system of human beings
4. Respiratory system of human beings
5. Structure of heart.
6. Excretory system of human beings
7. Structure of nephron

➢ **Important activities-**

1. To prove that chlorophyll is necessary for photosynthesis.
2. To prove that Carbon dioxide is necessary for photosynthesis.
3. To prove that light is necessary for photosynthesis.
4. To prove that product of fermentation is Carbon dioxide.
5. To prove that leaves lose water by transpiration.
6. To study the action of salivary amylase on starch.
7. To demonstrate that Carbon dioxide is present in exhaled air.
8. To demonstrate the process of transpiration in plants.

Multiple Choice Questions

1. Which of the following statements about the autotrophs is incorrect? **1**

(a) They synthesis carbohydrates from carbon dioxide and water in the presence of sunlight and chlorophyll

(b) They store carbohydrates in the form of starch

(c) They convert carbon dioxide and water into carbohydrates in the absence of sunlight

(d) They constitute the first trophic level in food chains

Sol:(c)They convert carbon dioxide and water into carbohydrates in the absence of sunlight

Explanation:

They need sunlight to convert carbon dioxide and water into carbohydrates.

2. In which of the following groups of organisms, food material is broken down outside the body and absorbed? **1**

(a) Mushroom, green plants, Amoeba

(b) Yeast, mushroom, bread mould

(c) Paramecium, Amoeba, Cuscuta

(d) Cuscuta, lice, tapeworm

Ans (b) Yeast, mushroom, bread mould

Explanation:

Yeast , mushroom and bread mould are saprophytes and Saprophytes break the food material outside their body and absorbed.

3. Select the correct statement **1**

(a) Heterotrophs do not synthesise their own food

(b) Heterotrophs utilise solar energy for photosynthesis

(c) Heterotrophs synthesise their own food

(d) Heterotrophs are capable of converting carbon dioxide and water into carbohydrates

Answer is (a) Heterotrophs do not synthesise their own foodExplanation:
Heterotrophs either dependent on Phototrophs or other organisms for their food.

4. Which is the correct sequence of parts in human alimentary canal? **1**
(a) Mouth → stomach → small intestine → oesophagus → large intestine
(b) Mouth →oesophagus → stomach → large intestine → small intestine
(c) Mouth → stomach → oesophagus → small intestine → large intestine
(d) Mouth → oesophagus → stomach → small intestine → large intestine

Answer is (d) Mouth → oesophagus → stomach → small intestine → large intestine

5. If salivary amylase is lacking in the saliva, which of the following events in the mouth cavity will be affected? **1**
(a) Proteins breaking down into amino acids
(b) Starch breaking down into sugars
(c) Fats breaking down into fatty acids and glycerol
(d) Absorption of vitamins

Answer is (b) Starch breaking down into sugars
Explanation:
Salivary Amylase enzyme present in the saliva breaks down Starch into simpler sugar and helps in digestingthem. Hence the breakdown of starch will be affected if salivary amylase is lacking in the saliva.

6. The inner lining of stomach is protected by one of the following from hydrochloric Acid. Choose thecorrect one **1**
(a) Pepsin
(b) Mucus
(c) Salivary amylase
(d) Bile

Answer is (b) Mucus

7. Which part of alimentary canal receives bile from the liver? **1**
(a) Stomach
(b) Small intestine
(c) Large intestine
(d) Esophagus

Answer is (b) Small intestine
Explanation: Bile goes to small intestine from gall bladder through hepta pancreatic duct.

8. A few drops of iodine solution were added to rice water. The solution turned blue-black in 1 colour. Thisindicates that rice water contains
(a) complex proteins
(b) simple proteins
(c) fats
(d) starch

Answer is (d) starch

Explanation
Starch is made up of two components Amylose and Amylo pectin. When we add iodine to starch containing waterAmylose reacts with iodine to form a blue colour complex. Here solution gives blue-black colour on adding Iodine which confirms the presence of starch in the rice water.

9. In which part of the alimentary canal food is finally digested? 1
(a) Stomach
(b) Mouth cavity
(c) Large intestine
(d) Small intestine
Answer is (d) Small intestine
Explanation:
Although primary digestion process is conducted in mouth and stomach most of the digestion process occur insmall intestine and in large intestine digestion process will not take place.

10. Choose the function of the pancreatic juice from the following 1
(a) trypsin digests proteins and lipase carbohydrates
(b) trypsin digests emulsified fats and lipase proteins
(c) trypsin and lipase digest fats
(d) trypsin digests proteins and lipase emulsified fats
Answer is (d) trypsin digests proteins and lipase emulsified fats
Explanation:
Trypsin breaks down proteins into polypeptides and Lipase digest emulsified fat molecules into fatty acids andglycerol.

11. When air is blown from mouth into a test-tube containing lime water, the lime water 1 turned milky dueto the presence of
(a) oxygen
(b) carbon dioxide
(c) nitrogen
(d) water vapour
Answer is (b) carbon dioxide
Explanation:
Carbon dioxide reacts with lime water to convert it to milky.

12. The correct sequence of anaerobic reactions in yeast is 1

(a) Glucose $\xrightarrow{\text{cytoplasm}}$ Pyruvate $\xrightarrow{\text{mitochondria}}$ Ethanol + Carbondioxide

(b) Glucose $\xrightarrow{\text{cytoplasm}}$ Pyruvate $\xrightarrow{\text{cytoplasm}}$ Lactic acid

(c) Glucose $\xrightarrow{\text{cytoplasm}}$ Pyruvate $\xrightarrow{\text{mitochondria}}$ Lactic acid

(d) Glucose $\xrightarrow{\text{cytoplasm}}$ Pyruvate $\xrightarrow{\text{cytoplasm}}$ Ethanol + Carbondioxide

Soln:
Answer is d)
Explanation:
In Yeast cytoplasm Glucose is breakdown in anaerobic condition to produce Pyruvate which is

further breakdownto Ethanol and carbon-di-oxide

13. Which of the following is most appropriate for aerobic respiration? **1**

(a) Glucose $\xrightarrow{\text{mitochondria}}$ Pyruvate $\xrightarrow{\text{cytoplasm}}$ CO_2+H_2O+ Energy

(b) Glucose $\xrightarrow{\text{cytoplasm}}$ Pyruvate $\xrightarrow{\text{mitochondria}}$ CO_2+H_2O+ Energy

(c) Glucose $\xrightarrow{\text{cytoplasm}}$ Pyruvate + Energy $\xrightarrow{\text{mitochondria}}$ CO_2+H_2O

(d) Glucose $\xrightarrow{\text{cytoplasm}}$ Pyruvate + Energy $\xrightarrow{\text{mitochondria}}$ CO_2+H_2O+ Energy

Soln:

Answer is d) Glucose $\xrightarrow{\text{Cytoplasm}}$ Pyruvate +Energy $\xrightarrow{\text{Mitochondria}}$ CO_2+H_2O+ Energy

Explanation:

In aerobic respiration breakdown of pyruvate takes place in mitochondria. CO_2, H_2O and energy are released inthe reaction.

14. Which of the following statement(s) is (are) true about respiration? **1**

i. During inhalation, ribs move inward and diaphragm is raised
ii. In the alveoli, exchange of gases takes place i.e., oxygen from alveolar air diffuses into blood and carbondioxide from blood into alveolar air
iii. Haemoglobin has greater affinity for carbon dioxide than oxygen
iv. Alveoli increase surface area for exchange of gases

(a) (i) and (iv)
(b) (ii) and (iii)
(c) (i) and (iii)
(d) (ii) and (iv)

Soln:

Answer is (d) (ii) and (iv)

Explanation:

Statement i) is wrong because ribs move outward and diaphragm is lowered during inhalation. Similarly Option
iii) is wrong because Hemoglobin has greater affinity for Oxygen than CO_2.

15. Which is the correct sequence of air passage during inhalation? **1**

(a) Nostrils □ larynx □ pharynx □ trachea □ lungs
(b) Nasal passage □ trachea □ pharynx □ larynx □ alveoli
(c) larynx □ nostrils □ pharynx □ lungs
(d) Nostrils □ pharynx □ larynx □ trachea □ alveoli

Soln:

Answer is (d) Nostrils □ pharynx □ larynx □ trachea □ alveoli

Explanation:
Air enter respiratory system through nostrils through nostrils, passes to pharynx, larynx, trachea and then to alveoli. After inhalation diaphragm and intercoastal muscles contract along with expansion of thoracic muscleswhich creates enough space for the air to enter into the lungs.

16. During respiration exchange of gases take place in **1**
(a) trachea and larynx
(b) alveoli of lungs
(c) alveoli and throat
(d) throat and larynx
Soln:
Answer is (b) alveoli of lungs

Explanation:

Trachea, Larynx provide a passage for the movement of air. Gas exchange takes place in Alveoli of lungs. Fromalveoli oxygen diffuses into blood and Carbon-di-oxide exhaled out of blood.

17. Which of the following statement (s) is (are) true about heart? **1**
i. Left atrium receives oxygenated blood from different parts of body while right atrium receivesdeoxygenated blood from lungs
ii. Left ventricle pumps oxygenated blood to different body parts while right ventricle pumpsdeoxygenated blood to lungs
iii. Left atrium transfers oxygenated blood to right ventricle which sends it to different body parts
iv. Right atrium receives deoxygenated blood from different parts of the body while left ventricle pumpsoxygenated blood to different parts of the body
(a) (i)
(b) (ii)
(c) (ii) and (iv)
(d) (i) and (iii)
Soln:
Answer is (c) (ii) and (iv)
Explanation:
Oxygenated blood circulates through left part of the heart whereas deoxygenated blood circulates through rightpart of the heart. Atrium receives blood and ventricle pumps the blood out of the heart.

18. What prevents backflow of blood inside the heart during contraction? **1**
(a) Valves in heart
(b) Thick muscular walls of ventricles
(c) Thin walls of atria
(d) All of above
Soln:
Answer is (a) Valves in heart
Explanation:
Walls in the heart are responsible for only pumping of the blood and they are not responsible in blocking backflow of blood inside the heart during contraction.

19. Single circulation i.e., blood flows through the heart only once during one cycle of passage through thebody, is exhibited by **1**
(a) Labeo, Chameleon, Salamander

(b) Hippocampus, Exocoetus, Anabas
(c) Hyla, Rana, Draco
(d) Whale, Dolphin,Turtle

Soln:

Answer is (b) Hippocampus, Exocoetus, Anabas

Explanation:

In Option a) Chameleon is a reptile and Salamander is an amphibian which are having 3 chambered hearts andshow partial double circulation. In Option c) all are Amphibians and they show partial double circulation. In option d) Whale is a mammal but turtle is a reptile hence option d) is wrong.

20. In which of the following vertebrate group/groups, heart does not pump oxygenated blood to different parts of the body? **1**

(a) Pisces and amphibians
(b) Amphibians and reptiles
(c) Amphibians only
(d) Pisces only

Soln:

Answer is (d) Pisces only

Explanation:

This is because of single circulation where deoxygenated blood from all part of the body is pumped into heart. From heart it is pumped to gills where it gets oxygenated and gets transferred to all parts of the body. Hence it proves pisces will not receive oxygenated blood.

21. Choose the correct statement that describes arteries. **1**

(a) They have thick elastic walls, blood flows under high pressure; collect blood from different organs andbring it back to the heart
(b) They have thin walls with valves inside, blood flows under low pressure and carry blood away from theheart to various organs of the body
(c) They have thick elastic walls, blood flows under low pressure; carry blood from the heart to variousorgans of the body
(d) They have thick elastic walls without valves inside, blood flows under high pressure and carry bloodaway from the heart to different parts of the body.

Soln:

Answer is (d) They have thick elastic walls without valves inside, blood flows under high pressure and carryblood away from the heart to different parts of the body.

22. The filtration units of kidneys are called **1**

(a) ureter
(b) urethra
(c) neurons
(d) nephrons

Soln:

Answer is (d) nephrons

Explanation:

Nephron is called as the functional unit of kidney. It helps in removing the waste products and excess substancesfrom our body.

23. Oxygen liberated during photosynthesis comes from **1**

(a) water
(b) chlorophyll

(c) carbon dioxide
(d) glucose

Answer is (a) water

Explanation:

During photosynthesis water molecule splits to produce Oxygen and Hydrogen Ions. Oxygen is expelled out ofplants and Hydrogen is used to reduce Carbon-di-oxide to produce carbohydrates.

24. The blood leaving the tissues becomes richer in **1**

(a) carbon dioxide
(b) water
(c) heamoglobin
(d) oxygen

Soln:

Answer is (a) carbon dioxide

Explanation:

Because of respiration Carbon-di-oxide gets accumulated in tissues. Hence blood leaving the tissues becomesricher in Carbon-di-oxide.

25. Which of the following is an incorrect statement? **1**

(a) Organisms grow with time
(b) Organisms must repair and maintain their structure
(c) Movement of molecules does not take place among cells
(d) Energy is essential for life processes

Answer is (c) Movement of molecules does not take place among cells

Explanation:

Movement of molecule is a vital process. Movement of molecules in cells take place in active and passive modessuch as Diffusion, osmosis, facilitated diffusion etc.

26. The internal (cellular) energy reserve in autotrophs is **1**

(a) glycogen
(b) protein
(c) starch
(d) fats

Soln:

Answer is (c) starch

Explanation:

Glycogen is the stored energy in animals, Plants stores energy in the form of Starch.

27. Which of the following equations is the summary of photosynthesis **1**

(a) 6CO2 + 12H2O → C6H12O6 + 6O2 + 6H2O
(b) 6CO2 + H2O + Sunlight→ C6H12O6 + O2 + 6H2O
(c) 6CO2 + 12H2O + Chlorophyll + Sunlight→ C6H12O6 + 6O2 + 6H2O
(d) 6CO2 + 12H2O + Chlorophyll + Sunlight→ C6H12O6 + 6CO2 + 6H2O

Soln:

Answer is (c) $6CO_2 + 12H_2O$ + Chlorophyll + Sunlight→ $C_6H_{12}O_6 + 6O_2 + 6H_2O$

Explanation:
Option a does not show the factors responsible for photosynthesis . Option b) is not a balanced equation. Option
d) is wrong as it has CO_2 in the products.

28. Choose the event that does not occur in photosynthesis **1**
(a) Absorption of light energy by chlorophyll
(b) Reduction of carbon dioxide to carbohydrates
(c) Oxidation of carbon to carbon dioxide
(d) Conversion of light energy to chemical energy
Soln:
Answer is (c) Oxidation of carbon to carbon dioxide

29. The opening and closing of the stomatal pore depends upon **1**
(a) oxygen
(b) temperature
(c) water in guard cells
(d) concentration of CO_2 in stomata
Soln:
Answer is (c) water in guard cells
Explanation:
Opening of guard cells is facilitated by the entry of water inside guard cells. This make the guard cell become turgid. Closing of guard cells is facilitated by water coming out of guard cells. This will make the guard cells flaccid.

30. Choose the forms in which most plants absorb nitrogen **1**
(i) Proteins
(ii) Nitrates and Nitrites
(iii) Urea
(iv) Atmospheric nitrogen
(a) (i) and (ii)
(b) (ii) and (iii)
(c) (iii) and (iv)
(d) (i) and (iv)
Soln:
Answer is (b) (ii) and (iii)
Explanation:
Plants cannot absorb atmospheric Nitrogen. They can absorb the Nitrogen in the form of Nitrates, Nitrites andUrea present in the soil.

31. Which is the first enzyme to mix with food in the digestive tract? **1**
(a) Pepsin
(b) Cellulase
(c) Amylase
(d) Trypsin
Soln:
Answer is (c) Amylase
Explanation:
Amylase is secreted in mouth and acts on the starch to convert into simpler molecules. Hence Amylase is the firstenzyme to mix with food in the digestive tract.

32. Which of the following statement(s) is (are) correct? **1**

(i) Pyruvate can be converted into ethanol and carbon dioxide by yeast

(ii) Fermentation takes place in aerobic bacteria

(iii) Fermentation takes place in mitochondria

(iv) Fermentation is a form of anaerobic respiration

(a) (i) and (iii)

(b) (ii) and (iv)

(c) (i) and (iv)

(d) (ii) and (iii)

Soln:

Answer is (c) (i) and (iv)

Explanation:

Fermentation is carried out by anaerobes in the cytoplasm. Hence option ii) and iii) are wrong.

33. Lack of oxygen in muscles often leads to cramps among cricketers. This results due to **1**

(a) conversion of pyruvate to ethanol

(b) conversion of pyruvate to glucose

(c) non conversion of glucose to pyruvate

(d) conversion of pyruvate to lactic acid

Soln:

Answer is (d) conversion of pyruvate to lactic acid

Explanation:

Breakdown of Pyruvate in presence of oxygen takes place in mitochondria leading to the formation of Lactic acid. Due to workout oxygen is used for the production of energy leading to the lack of oxygen and production of lactic acid.

34. Choose the correct path of urine in our body **1**

(a) kidney → ureter → urethra → urinary bladder

(b) kidney → urinary bladder → urethra → ureter

(c) kidney → ureters → urinary bladder → urethra

(d) urinary bladder → kidney → ureter → urethra

Soln:

Answer is (c) kidney → ureters → urinary bladder → urethra

Explanation:

Urine from nephron is brought to the collecting duct of kidneys where the urine enters the ureters. There are 2ureters, each opening from one kidney into the urinary bladder. The urinary bladder stores urine and it size increases as the amount of urine collected increases. When the CNS gives a voluntary message the muscles ofbladder contract and the bladder sphincter relaxes thus excreting urine out through the urethra.

35. During deficiency of oxygen in tissues of human beings, pyruvic acid is converted into **1**

lactic acid in the

(a) cytoplasm

(b) chloroplast

(c) mitochondria

(d) golgi body

Soln:

Answer is (a) cytoplasm

Explanation:
When there is lack of oxygen Breakdown of Pyruvate takes place in cytoplasm of muscle cells leading to theformation of Lactic acid.

Short Answer Questions

36. Name the following **2**
(a) The process in plants that links light energy with chemical energy
(b) Organisms that can prepare their own food
(c) The cell organelle where photosynthesis occurs
(d) Cells that surround a stomatal pore
(e) Organisms that cannot prepare their own food
(f) An enzyme secreted from gastric glands in stomach that acts on proteins.

Soln:

a) Photosynthesis
b) Autotrophs
c) Chloroplasts
d) Guard cells
e) Heterotrophs
f) Pepsin

37. "All plants give out oxygen during day and carbon dioxide during night". Do you agree with this statement? Give reason. **2**

Soln:
The statement is wrong because plants respire every time and expel out Carbon-di-oxide every time but they giveout oxygen only in the day time as photosynthesis process can take place only in the presence of sunlight.

38. How do the guard cells regulate opening and closing of stomatal pores? **2**

Soln:
Opening of guard cells is facilitated by the entry of water inside guard cells. This make the guard cell become turgid. Closing of guard cells is facilitated by water coming out of guard cells. This will make the guard cells flaccid.
Entry of water inside guard cells will make the cell turgid leading to the opening of stomata. Similarly cellbecome flaccid when water come out of guard cells, this leads to closing of the stomata.

39. Two green plants are kept separately in oxygen free containers, one in the dark and the other in continuous light. Which one will live longer? Give reasons. **2**
Soln:
Plant kept in continuous light live longer because plats release CO_2 during respiration. In case of plant kept indark CO_2 resulting in lack of oxygen and the plant will die earlier.

40. If a plant is releasing carbon dioxide and taking in oxygen during the day, does it mean that there is no photosynthesis occurring? Justify your answer. **2**
Soln:
If a plant is releasing carbon dioxide and taking in oxygen during the day means plant is respiring; it

does not mean that there is no photosynthesis occurring in the plant. This is because Photosynthesis and respiration are twoindependent processes.

41. Why do fishes die when taken out of water? 2

Soln:

Fishes can respire only by using dissolved oxygen. When we take fish out of water it cannot respire due to lack ofdissolved oxygen and they die.

42. Differentiate between an autotroph and a heterotroph 2

Soln:

Autotrophs	Heterotrophs
They can make their own food	They cannot make their own food
Ex: Plants and certain bacteria	Ex: Animals, Fungi and protozoans

43. Is 'nutrition' a necessity for an organism? Discuss. 2

Soln:

Nutrition is an absolute necessity for the organisms because nutrition provides energy for carrying out metabolicactivities.

44. What would happen if green plants disappear from earth? 2

Soln:

Green plants are the sources of energy for all the heterotrophs on earth. Plants convert solar and chemical energyinto viable food sources. If plants gets disappeared from the earth it lead to imbalance in the ecosystem and heterotrophs may die without food.

45. Leaves of a healthy potted plant were coated with vaseline. Will this plant remain healthy for long? Give reasons for your answer. 2

Soln:

Coating Vaseline to the leaves of a healthy plants will clog its stomata pores and stops the respiration of plantsand the plants dies.

46. How does aerobic respiration differ from anaerobic respiration? 2

Soln:

Aerobic Respiration	Anaerobic respiration
Takes place in the presence of Oxygen	Takes place in the absence of Oxygen
Carbon-di-oxide and water are the end products	Carbon-di-oxide and Lactic acid/ethanol are the endproducts
More efficient in energy production	Less efficient in energy production
Takes Place in animals and plants	Takes place in unicellular organisms

47. Match the words of Column (A) with that of Column (B) 2

Column A	**Column B**
Phloem	**(i) Excretion**
Nephron	**(ii) Translocation of food**
Veins	**(iii) Clotting of blood**
Platelets	**(iv) Deoxygenated blood**

Soln:

Column A	Column B
Phloem	(ii) Translocation of food
Nephron	(i) Excretion
Veins	(iv) Deoxygenated blood
Platelets	(iii) Clotting of blood

48. Differentiate between an artery and a vein. **2**

Soln:

Artery has thick walls whereas Veins has thin walls.
Arteries carries blood away from the heart but veins carry blood to the heart.In arteries valves are absent and in veins they are present
In arteries blood flows under pressure but in veins there will be no pressure.

49. What are the adaptations of leaf for photosynthesis? **2**

Soln:

Adaptation of leaf for photosynthesis are as follows

a) Surface of leaf is flat to allow greater exposure of light.
b) Presence of chlorophyll to trap sunlight
c) Presence of stomata on the lower surface for easy transpiration

50. Why is small intestine in herbivores longer than in carnivores? **2**

Soln:

Food of herbivores contains mostly cellulose. To digest cellulose herbivores need help of certain bacteria. In orderto accommodate the microbes and to facilitate digestion of food herbivores has longer small intestine than carnivores.

51. What will happen if mucus is not secreted by the gastric glands? **2**

Soln:

Mucus prevent inner lining of stomach from HCl. Mucus prevents drying of inner lining of the stomach. Mucushelps in easy movement of food particles through digestive system. If mucus is not secreted food will not easily moved through digestive system. HCl will damage the stomach lining and the digestion process will not take place.

52. What is the significance of emulsification of fats? **2**

Soln:

Emulsification is a process of breakage of larger fats molecules into digestible fat globules. Emulsification aidsaction enzymes on fats by breaking larger fat molecules.

53. What causes movement of food inside the alimentary canal? **2**

Soln:

Peristalsis is the process that cause movement of food inside the alimentary canal.

54. Why does absorption of digested food occur mainly in the small intestine? 2

Soln:
Small intestine has specialized structures that facilitate absorption of digested food. Small intestine has number of folds that increase the area of absorption. Small intestine also has fingerlike projection called microvilli which are richly supplied by blood vessels.

55. Match Group (A) with Group (B) 2

Group A	**Group B**
(a) Autotrophic nutrition	**(i) Leech**
(b) Heterotrophic nutrition	**(ii) Paramecium**
(c) Parasitic nutrition	**(iii) Deer**
(d) Digestion in food vacuoles	**(iv) Green plant**

Soln:

Group A	Group B
(a) Autotrophic nutrition	(iv) Green plant
(b) Heterotrophic nutrition	(iii) Deer
(c) Parasitic nutrition	(i) Leech
(d) Digestion in food vacuoles	(ii) Paramecium

56. Why is the rate of breathing in aquatic organisms much faster than in terrestrial organisms? 2

Soln:
Rate of breathing in aquatic organisms much faster than in terrestrial organisms because availability of oxygen is less in water than on land, hence in order to obtain required oxygen aquatic organisms has to work hard.

57. Why is blood circulation in human heart called double circulation? 2

Soln:
In Humans blood flow in two direction simultaneously in one cardiac cycle. Oxygenated blood comes to heartfrom lungs and at the same time de-oxygenated blood goes from Heart towards lungs. Because of this double movement is blood circulation in human heart called double circulation.

58. What is the advantage of having four chambered heart? 2

Soln:
Four chambered heart has the following advantages

- Clear cut division of labors among different chambers
- Segregation of oxygenated and deoxygenated blood in the heart.
- Efficiency of the heart will increase.

59. Mention the major events during photosynthesis **2**

Soln:

Major events of Photosynthesis are

a) Absorption of light energy by chlorophyll
b) Conversion of light energy into chemical energy
c) Splitting of water molecules into Hydrogen and Oxygen
d) Reduction of CO2 to from carbohydrates.

60. In each of the following situations what happens to the rate of photosynthesis? **2**

(a) Cloudy days
(b) No rainfall in the area
(c) Good manuring in the area
(d) Stomata get blocked due to dust

Soln:

a) Rate of photosynthesis will reduce due to availability of sunlight.
b) Rainfall will not affect rate of Photosynthesis
c) Manuring will not affect rate of Photosynthesis
d) Blockage of stomata will reduce the rate of photosynthesis because blockage will affect availability pfCarbon-di-oxide.

Short Answer Question

61. Name the energy currency in the living organisms. When and where is it produced? **3**

Soln:

Adenosine tri-Phosphate (ATP) is the energy currency in the living organisms. It is produced in Mitochondriaduring respiration.

62. What is common for cuscuta, ticks and leeches? **3**

Soln:

These all are parasite. They live on or inside another body to obtain food from the host. In obtaining foodparasites always harm their host.

63. Explain the role of mouth in digestion of food. **3**

Soln:

Role of mouth in digestion of food.

a) Ingestion of food
b) Breakage of food by Mastication
c) Saliva aids easy swallowing of food
d) Salivary amylase breaks starch into simpler carbohydrates.

64. What are the functions of gastric glands present in the wall of the stomach? **3**

Soln:

Hydrochloric acid, pepsin and mucus are secreted by gastric gland present in the stomach. They have followingfunctions.

HCl Kills germs present in the food and it decreases pH of the stomach which is essential for the working ofdigestive enzymes.
Pepsin digests protein.
Mucus protects stomach's inner lining from HCl.

65. Match the terms in Column (A) with those in Column (B) 3

Column (A)	**Column (B)**
(a) Trypsin	**(i) Pancreas**
(b) Amylase	**(ii) Liver**
(c) Bile	**(iii) Gastric glands**
(d) Pepsin	**(iv) Saliva**

Soln:

Column (A)	Column (B)
(a) Trypsin	(i) Pancreas
(b) Amylase	(iv) Saliva
(c) Bile	(ii) Liver
(d) Pepsin	(iii) Gastric glands

66. Name the correct substrates for the following enzymes 3
(a) Trypsin
(b) Amylase
(c) Pepsin
(d) Lipase
Soln:

a) Protein
b) Starch
c) Protein
d) Lipid

67. Why do veins have thin walls as compared to arteries? 3

Soln:
Blood flow through veins does not exert pressure on walls of veins hence they have thin walls. Blood flow inarteries exerts high pressure on arterial walls hence they need thick walls.

68. What will happen if platelets were absent in the blood? 3

Soln:
Platelets are responsible for the clotting of the blood. If platelets are absent blood will not clot. In case of injuriesblood flow cannot be stopped without clotting and this may prove fatal for the person.

69. Plants have low energy needs as compared to animals. Explain. 3

Soln:
Most of the transport in plants occur through passive transport which does not require energy and plants stand stillat one place and they will not travel in search of food Hence Plants require low energy compared to animals.

70. Why and how does water enter continuously into the root xylem? 3

Soln:
Water should enter the root xylem continuously to assist the various process such as photosynthesis. Continuous flow of water into root xylem is due to transpiration pull.

71. Why is transpiration important for plants? **3**

Soln:

Transpiration is important for plants because of the following reasons.

(a) It creates transpiration pull to facilitate ascent of sap.

(b) Ascent of sap is necessary to make water available for photosynthesis.

(c) It helps a plant to get rid of excess water.

72. How do leaves of plants help in excretion? **3**

Soln:

Leaves plays an important role in excretion in plants because CO_2 is expelled out through pores of stomata present in the leaf. Plants shed leaves to get rid of excretory products deposited on them.

Long Answer Questions

73. Explain the process of nutrition in Amoeba. **5**

Soln:

Amoeba shows holozoic nutrition which is comprised of Ingestion, Digestion, Absorption, Assimilation and Egestion.

Ingestion:

Ameoba traps food particles through fingerlike projections called as pseudopodia. Pseudopodia present outside its body and helps in taking food along with water

Digestion:

Food vacuoles are made after ingesting the food. Enzymes are released in the food vacuole for digestion.

Absorption:

After digestion, nutrients enter the cytoplasm through osmosis.

Assimilation:

Nutrients are utilized by the cell for various purposes.

Egestion:

Food vacuole goes near the cell membrane to empty its contents outside the cell. This results in expulsion of waste materials from the cell.

74. Describe the alimentary canal of man. **5**

Soln:

Human Alimentary canal has the following parts

Buccal Cavity:

Generally called as mouth and it consists of tongue, teeth and salivary gland. It is the entry site for the food to digestive system. Food is breakdown into simpler molecules by mastication in buccal cavity and salivary amylase breaks Starch into simpler carbohydrates in the Buccal cavity.

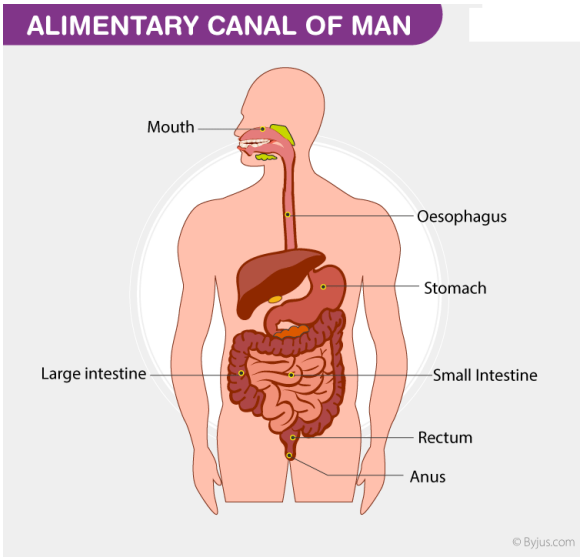
Oesophagus:

Buccal cavity is connected to long tube like structure called as Oesophagus. Oesophagus connects the buccal cavity to stomach and assists in flow of food towards stomach. Oesophagus has a valve to prevent backflow of food particles.

Stomach:

Stomach is a J Shaped organ which has gastric glands in it. Gastric glands secrets Hydrochloric acid, Pepsin and Mucus that helps in the digestion of food.

Small Intestine:
Small intestine is highly coiled long structure. Small intestine performs major of the food absorption. Small intestine has specialized structures that facilitate absorption of digested food. Small intestine has number of foldsthat increase the area of absorption. Small intestine also has fingerlike projection called microvilli which are richly supplied by blood vessels.
Large Intestine :
This is shorter than small intestine and its lumen is larger than that of Small intestine. The major function of the large intestine is to absorb water from the remaining indigestible food matter and transmit the useless wastematerial from the body.
Rectum:
Large Intestine open into rectum. Waste materials and undigested food are stored in rectum.
Anus:
It is the opening at the end of alimentary canal. Solid waste materials leave the body through Anus.



75. Explain the process of breathing in man **5**

Soln:
Breathing in Humans has two processes 1) Inhalation 2) ExhalationInhalation:
Inhalation is the process of taking oxygen. During this process, ribs come out and diaphragm moves down. Thisincreases the volume of the lungs and decreases the pressure. This will make the air move towards the lungs.
Exhalation:
Exhalation is a process of throwing out carbon-dioxide. During this process, ribs go down and diaphragm movesup. This decreases the volume of the lungs and increases the pressure. As a result air moves out of the lungs.

76. Explain the importance of soil for plant growth. **5**

Soln:
Soil is very important for the growth of the plant for the following reasons.

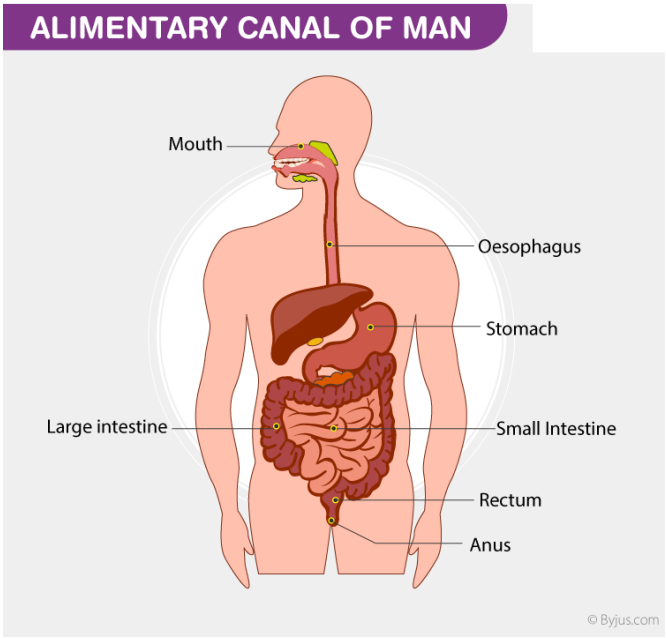
1) Soil provides the base for the growth of the plants and provides a platform for the penetration of roots.
2) It acts as a reservoir of the water.
3) Soil has

different
minerals essential for the growth of the plant. Soil is the only medium from which soil obtain nutrients.

4) Soil has organic materials essential for the growth of the plants.
5) Soil has microorganisms that has symbiotic relationship with the plant and these microbes assist plant intheir growth and life processes.

77. Draw the diagram of alimentary canal of man and label the following parts. 5
Mouth, Oesophagus, Stomach,Intestine

Soln:



78. How do carbohydrates, proteins and fats get digested in human beings? 5

Soln:
Carbohydrate Digestion
Digestion of cabohydrates starts with buccal cavity where salivary enzymes breaks down the starch into simplesugar molecules. Other sugar molecules are breakdown to glucose in small intestine.
Protein digestion
Proteins are partially digested by pepsin secreted by gastric glands present in the stomach. Then Pancreatic juicesecrets trypsin and chymotrypsin enzymes in small intestine where complete digestion of proteins takes place.
Fat Digestion
Fats are digested in small intestine. Bile juice present in the liver emulsifies the fat which breaks fats into smallglobules. These small fat globules are converted into glycerol and fatty acids by Lipase enzyme.

79. Explain the mechanism of photosynthesis 5
Soln:
Photosynthesis is a process by which plants produce their own food by utilizing sunlight, CO2 and water. CO@ and water are converted to carbohydrates with the evolution of oxygen. Photosynthesis reaction can be given by following reaction.

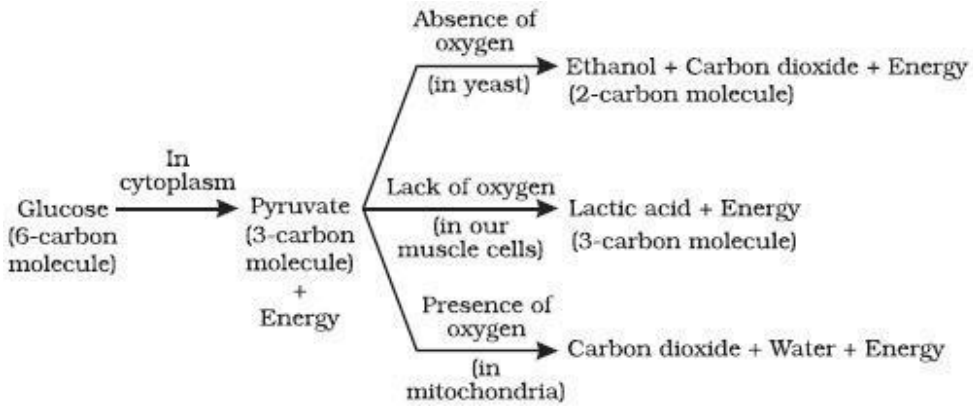
$6CO_2 + 6H_2O \xrightarrow{\text{Sunlight energy}} C_6H_{12}O_6 + 6O_2$

Process of Photosynthesis is divided into 4 processes

1. Absorption of light energy by chlorophyll
2. Conversion of light energy into chemical energy
3. Splitting of water molecules into Hydrogen and Oxygen
4. Reduction of CO_2 to produce carbohydrates

80. Explain the three pathways of breakdown in living organisms. 5

Soln:



Glucose is first broken down to 3 carbon molecule called as pyruvate. This process takes place in the cytoplasmof all organisms. Pyruvate is further broken down by the flowing steps.

In yeast:

Pyruvate is broken down in the absence of oxygen and the process is called as anaerobic respiration. In yeastspyruvate is broken down to produce CO_2 and ethanol.

In Muscle Cells:

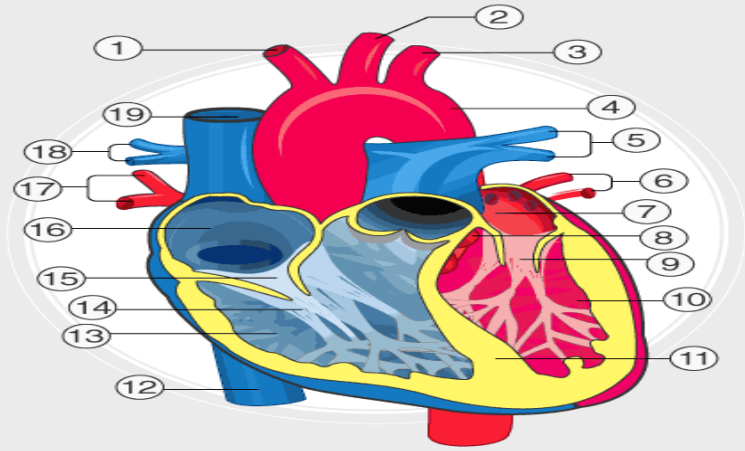
During rigorous physical activity energy demand of our muscles cells increases rapidly. This is compensated byanaerobic respiration in muscle cells. In muscle cells pyruvate is broken down into lactic acid.

In Mitochondria:

In case of aerobic respiration(in presence of oxygen) pyruvate is broken down in mitochondria. Here Pyruvate isbroken down to produce H_2O and CO_2. Aerobic respiration is most common in most of the organisms.

81. Describe the flow of blood through the heart of human beings 5

Soln:



1 Brachiocephalic Artery	2 Left Common Caroid Artery	3 Left Subclavian Artery	4 Aorta
5 Left Pulmonary Arteries	6 Left Pulmonary Veins	7 Left Atrium	8 Semilunar Valves
9 Atrioventricular Valve	10 Left Ventricle	11 Septum	12 Inferior Vena Cava
13 Right Ventricle	14 Chordae Tendineae	15 Atrioventricular	16 Right Atrium
17 Right Pulmonary Veins	18 Right Pulmonary Arteries	19 Superior Vena Cava	

Deoxygenated blood from different organs comes to the right atrium through the vena cava. From the right atrium, blood goes to the right ventricle. The tricuspid valve between the right atrium and rightventricle prevents the backflow of blood.
From the right ventricle, blood goes to the lungs through pulmonary artery. Inside the lungs, carbon dioxide isremoved from the blood and oxygen enters the blood.
From the lungs, blood goes to the left atrium through pulmonary vein.
From the left atrium, blood goes to the left ventricle.
From the left ventricle, blood is pumped into the aorta so that it can be supplied to different organs.

82. Describe the process of urine formation in kidneys **5**

Soln:

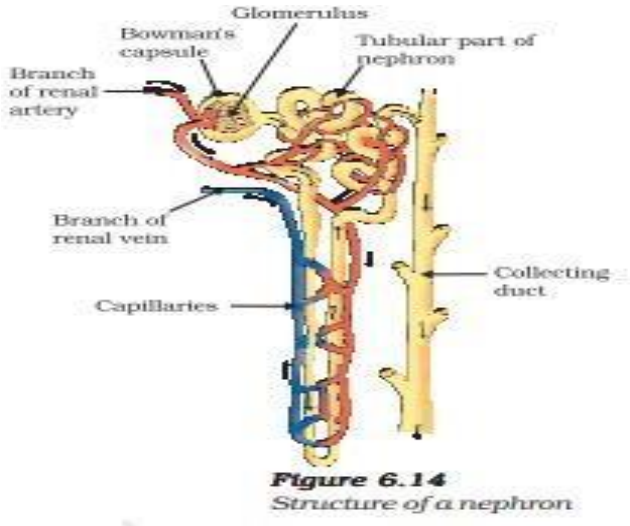


Figure 6.14
Structure of a nephron

The basic filtration unit in the kidneys is a cluster of very thin-walled blood capillaries. Each capillary cluster in the kidney is associated with the cup-shaped end of a coiled tube called Bowman's capsule that collects the filtrate(Fig. 6.14). Each kidney has large numbers of these filtration units called nephrons packed close together.
Some substances in the initial filtrate, such as glucose, amino acids, salts and a major amount of water, are selectively re-absorbed as the urine flows along the tube. The amount of water re-absorbed depends on how muchexcess water is there in the body, and on how much of dissolved waste there is to be excreted. The urine forming in each kidney eventually enters a long tube, the ureter, which connects the kidneys with the urinary bladder.

Urine is stored in the urinary bladder until the pressure of the expanded bladder leads to the urge to pass it outthrough the urethra. The bladder is muscular, so it is under nervous control.

(Assertion and Reasoning Questions)

Following questions consist of two statements – Assertion (A) and Reason (R).Answer these questions selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

Q.1. Assertion (A) : Plants lack excretory organs.

Reason (R) : Plants usually absorb essential nutrients.

Solution: (b)

Q.2. Assertion (A) : In anaerobic respiration, one of the end product is alcohol.

Reason (R) : There is an incomplete breakdown of glucose.

Solution: (a)

Q.3. Assertion (A) : In plants there is no need of specialised respiratory organs.

Reason (R) : Plants do not have great demands of gaseous exchange.

Solution: (a)

Q.4. Assertion (A) : Bile is essential for digestion of lipids.

Reason (R) : Bile juice contains enzymes.

Solution: (c)

Q.5. Assertion (A) : Carbohydrate digestion mainly takes place in small intestine.

Reason (R) : Pancreatic juice contains the enzyme lactase.

Solution: (c)

Q.6. Assertion (A) : Aerobic respiration requires less energy as compared to anaerobic respiration.

Reason (R) : Mitochondria is the powerhouse of the cell.

Solution: (d)

Q.7. Assertion (A): Arteries are thick-walled and elastic in nature.

Reason (R) : Arteries have to transport blood away from the heart.

Solution: (b)

Q.8. Assertion (A) : Human heart is four-chambered.

Reason (R) : Vena cava is the only artery that supplies deoxygenated blood to theheart.

Solution: (c)

Q.9. Assertion (A): Energy is required to carry out different life processes.

Reason (R) : Energy is obtained in the form of ATP in the mitochondria.

Solution: (a)

Q.10. Assertion (A): Rings of cartilage are present in the throat,

Reason (R) : These ensure that the air-passage does not collapse

Solution: (a)

Q.11. Assertion (A): Pyruvate is a six-carbon molecule

Reason (R) : It is prepared in the cytoplasm as the first step to cellular respiration

Solution: (d)

Q.12. Assertion (A): Molecular movements are needed for life.

Reason (R): Body structures made up of these molecules need continuous repair and maintenance

Solution: (a)

Q.13. Assertion (A): Diffusion does not meet high energy requirements of multi-cellular organisms

Reason (R) : Diffusion is a fast process but occurs at the surface of the body.

Solution: (c)

Q.14. Assertion (A): The opening and closing of the pore is a function of the guardcells.

Reason (R) : Stomatal pores are the site for exchange of gases by diffusion.

Solution: (b)

Q.15. Assertion (A): The purpose of making urine is to filter out undigested foodfrom intestine

Reason (R): Kidneys filter the waste and produce urine,

Solution: (d)

Competency Based/Case based/ Passage based Questions

Read the following and answer the questions.

1. Heterotrophic nutrition is a mode of nutrition in which organisms obtain readymade organic food from outside sources. The organisms that depend upon outside sources for obtaining organic nutrients are called heterotrophs. Heterotrophic nutrition is of three types: saprophytic, parasitic and holozoic nutrition. (4)

(i) In which of the following groups of organisms food material is broken outside the body and absorbed?
(a) Mushroom, green plants, Amoeba
(b) Yeast, mushroom, bread mould
(c) Paramecium, Amoeba, Cuscuta
(d) Cuscuta, lice, tapeworm

Answer (b)

(ii) Which of the following is a parasite?
(a) Yeast
(b) Taenia
(c) Amoeba
(d) Earthworm

Answer (b)

(iii) Which of the following is an example of saprotroph?
(a) Grass
(b) Mushroom
(c) Amoeba
(d) Paramecium
Answer (b)

(v) Heterotrophic nutrition involves
(a) production of simple sugar from inorganic compounds
(b) utilisation of chemical energy to prepare food
(c) utilisation of energy obtained by plants
(d) all of these.

Answer (c)

2. All living cells need nutrients, and other essential substances. Also, the waste and harmful substances need to be removed continuously for healthy functioning of cells. So, a well developed transport system is mandatory for living organisms. Complex organisms have special fluids within their bodies to transport such materials. Blood is the most commonly used body fluid by most of the higher organisms. Lymph also helps in the transport of certain substances. (4 marks)

(i) Which of the following does not exhibit phagocytic activity?
(a) Monocytes

(b) Neutrophils
(c) Basophil
(d) Macrophage

Answer: (c)

(ii) Amount of blood corpusles in changed in dengue fever. One of the common symptoms observed in people infected with dengue fever is
(a) significant decrease in RBC count
(b) significant decrease in WBC count
(c) significant decrease in platelets count
(d) significant increase in platelets count.

Answer: (c)

(iii) Why are WBCs called soldiers of the body?
(a) They are capable of squeezing out of blood capillaries.
(b) They are manufactured in bone marrow.
(c) They fight against disease causing germs.
(d) They have granular cytoplasm with lobed nucleus.

Answer: (c)

(iv) Which of the following is the correct feature of lymph?
(a) It is similar to the plasma of blood, but is colourless and contains less proteins.
(b) It is similar to the WBCs of blood, but is colourless and contain more proteins.
(c) It is similar to the RBCs of blood and red in colour.
(d) It contains more fats.

Answer: (a)

CHAPTER - 7
Control and Co-ordination

Control and Co-ordination in Animals: Nervous system and endocrine system. In animals, the nervous system and hormonal system are responsible for control and coordination.

Receptors: Receptors are the specialized tips of the nerve fibres that collect the information to be conducted by the nerves.

Nervous System: The nervous system is composed of specialized tissues, called nervous tissue. The nerve cell or neuron is the functional unit of the nervous system.

Functions of the nervous system

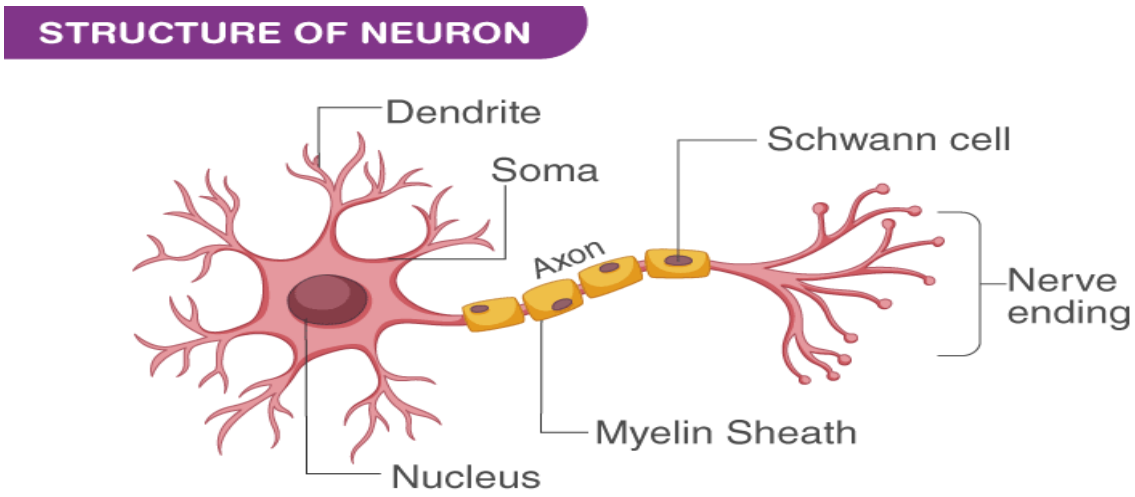
- Nervous system receives information from the environment.
- To receive the information from the various body.
- To act according to through muscles and glands.

Neuron: Neuron is a highly specialized cell which is responsible for the transmission of nerve impulses. The neuron consists of the following parts.

(i) **Cyton or cell body:** The cell body or cyton is somewhat star-shaped, with many hair like structures protruding out of the margin.

(ii) **Axon:** This is the tail of the neuron. It ends in several hair-like structures, called axon terminals.

(iii) **Myelin sheath:** There is an insulator cover around the axon. This is called myelin sheath.



Synapse: The point contact between the terminal branches of axon of one neuron with the dendrite of another neuron is called synapse.

Transmission of nerve impulse: Nerve impulses travel in the following manner from one neutron to the next :

Dendrites → cell body → axon → nerve endings at the tip of axon → synapse → dendrite of next neuron.

Human Nervous System: The nervous system in humans can be divided into three main parts

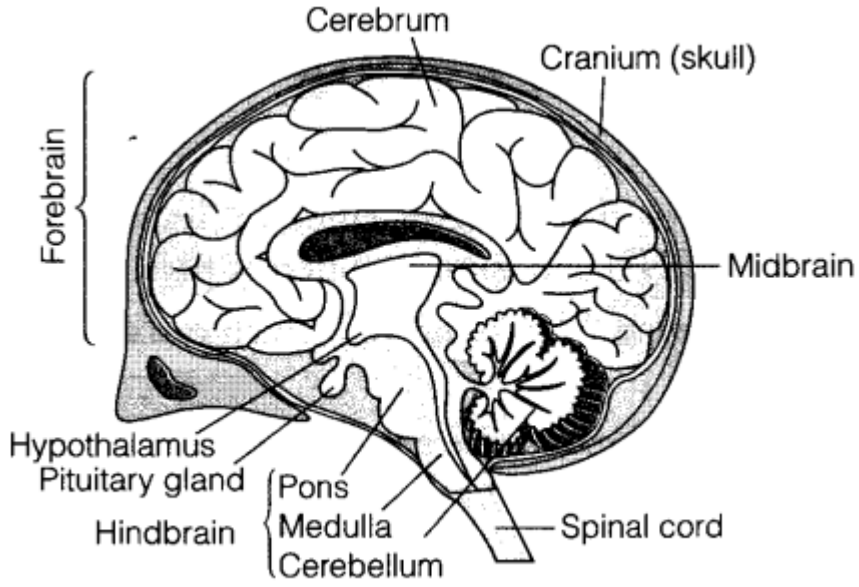
1. Central Nervous System: The central nervous system is composed of the brain and the spinal cord.

2. Peripheral Nervous System: The peripheral nervous system is composed of the cranial nerves and spinal nerves.

3. Autonomous Nervous System: The autonomous nervous system is composed of a chain of nerve ganglion which runs along the spinal cord.

- Sympathetic nervous system.
- Parasympathetic nervous system.

Human Brain: Human brain is a highly complex organ, which is mainly composed of nervous tissue. The tissues are highly folded to accommodate a large surface area in less space. The brain is covered by a three-layered system of membranes, called meninges. Cerebrospinal fluid is filled between the meninges.



Human brain

Parts of Human Brain:

- Fore-brain: It is composed of the cerebrum.
- Mid-brain: It is composed of the hypothalamus.
- Hind-brain: It is composed of the cerebellum, pons, medulla, oblongata.

Cerebrum: The cerebrum is the largest part in the human brains.

Functions of cerebrum

- The cerebrum controls voluntary motor actions.
- It is the seat of learning and memory.

Hypothalamus: The hypothalamus lies at the base of the cerebrum. It also controls the urges for eating and drinking.

Cerebellum: Cerebellum lies below the cerebrum, It controls posture and balance.

Medulla: Medulla forms the brain stem, along with the pons. It controls involuntary actions.

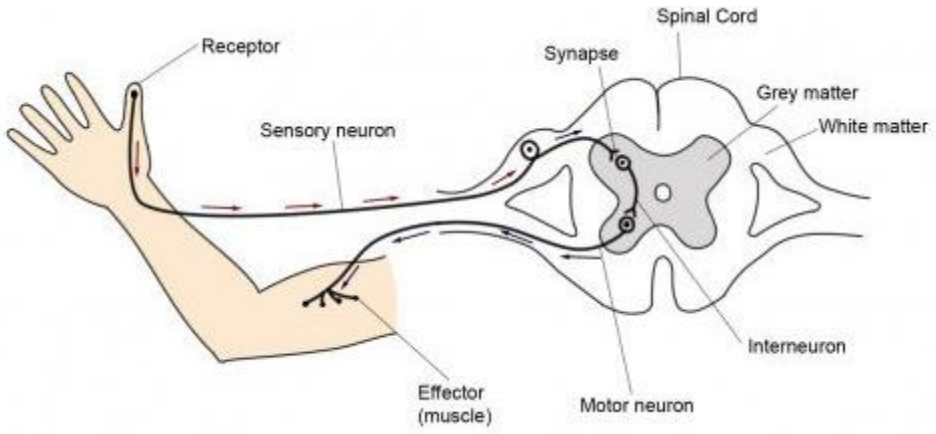
Pons: It regulates respiration.

Spinal cord: Spinal cord controls the reflex actions.

Reflex Action: Reflex action is a special case of involuntary movement involuntary organs.

Reflex Arc: The path through which nerves signals, involved in a reflex action, travel is called the reflex arc.

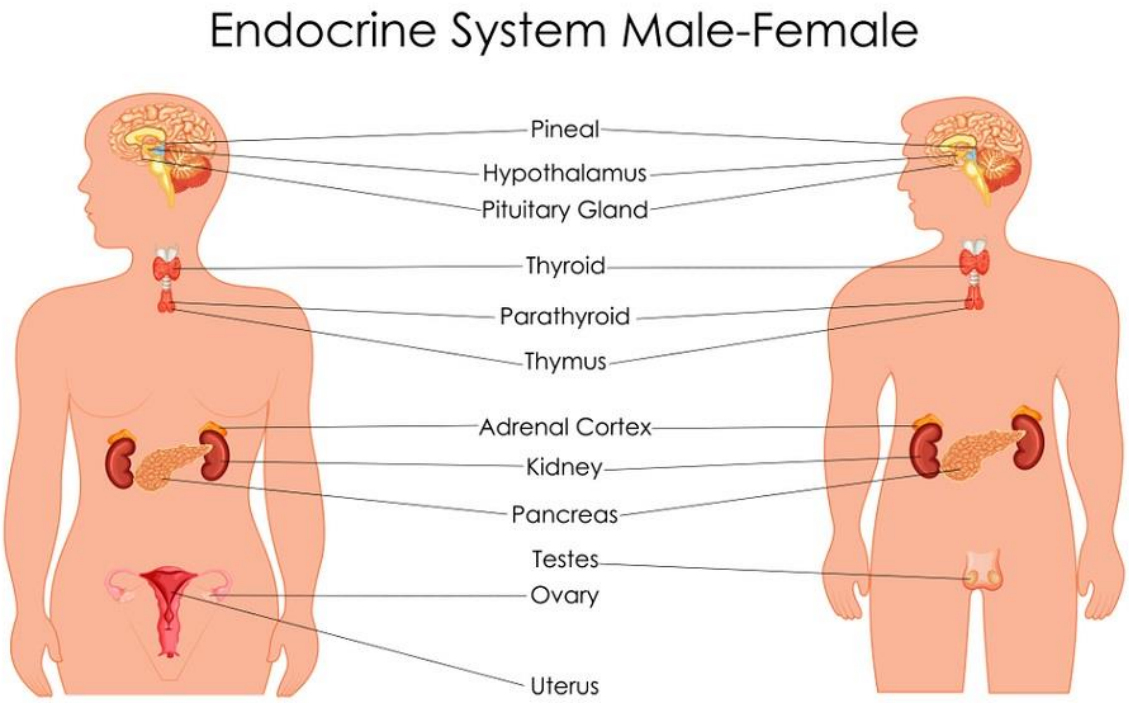
Receptor → Sensory neuron → Relay neuron → Motor neuron → Effector (muscle)



Endocrine System: The endocrine system is composed of several endocrine glands. A ductless gland is called endocrine gland. Endocrine gland secretes its product directly into the bloodstream.

Hormones: These are the chemical messengers secreted in very small amounts by specialised tissues called ductless glands.

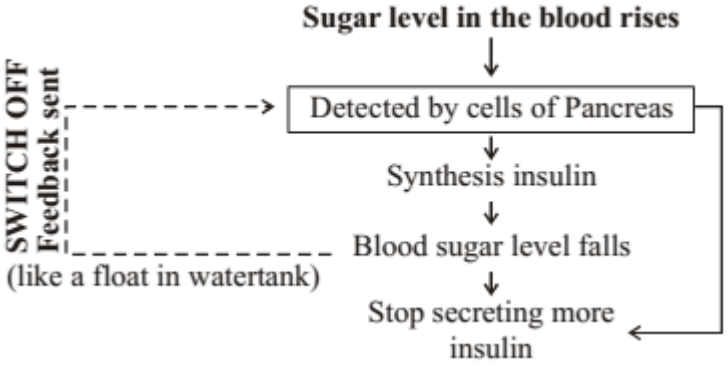
Endocrine Gland:



Endocrine Gland	**Location**	**Hormones Produced**	**Functions**
Pituitary gland (also known as the master gland)	At the base of the brain	Growth hormone (GH). Thyroid stimulating hormone (TSH). Follicle stimulating hormone (FSH)	GH stimulates growth. TSH stimulates the functioning of the thyroid gland. FSH stimulates the follicles during ovulation.
Thyroid Gland	Neck	Thyroxine	Controls general metabolism and growth in the body.
Adrenal gland	Above kidneys	Adrenalin	Prepares the body for emergency situations and hence is also called 'Fight and flight' hormone.
Pancreas	Near stomach	Insulin	Controls blood sugar level

Testis (male)	In Scrotum	Testosterone	Sperm production, development of secondary sexual characters during puberty.
Ovary (female)	Near uterus	Oestrogen	Egg production, development of secondary sexual characters during puberty.

Feedback mechanism: A type of self-regulating mechanism in which the level of one substance in body influences the level of another.



Control and Co-ordination in Plants: Movements in plants and plant harmones. Co-ordination in Plants: Unlike animals, plants do not have a nervous system. Plants use chemical means for control and co-ordination. Many plant hormones are responsible for various kinds of movements in plants. Movements in plants can be divided into two main types :

4) Tropic movement
5) Nastic movement

1. Tropic Movement: The movements which are in a particular direction in relation to the stimulus are called tropic movements. There are four types of tropic movements.

(i) Geotropic movement: The growth in a plant part in response to the gravity is called geotropic movement.

(ii) Phototropic Movement: The growth in a plant part in response to light is called phototropic movement. Stems usually show positive phototropic movement.

(iii) Hydrotropic Movement: When roots grow in the soil, they usually grow towards the nearest source of water. This shows a positive hydrotropic movement.

(iv) Thigmotropism Movement: The growth in a plant part in response to touch is called thigmotropism movement. Such movements are seen in tendrils of climbers.

2. Nastic Movement: The movement which do not depend on the direction from the stimulus acts are called nastic movement.

Plant hormones: Plant hormones are chemical which help to co-ordinate growth, development and responses to the environment.

Type of plant hormones: Main plant hormones are

- Auxin: (Synthesized at shoot tip).
  Function: Helps in growth.
  Phototropism: more growth of cells towards the light.
- Gibberellin: Helps in the growth of the stem.
- Cytokinins: Promotes cell division.
- Abscisic acid: Inhibits growth, cause wilting of leaves. (Stress hormone)

QUESTIONS :

1. What is the difference between a reflex action and walking?

Answer: Reflex action are the involuntary actions that occur in response to stimuli. They occur without involvement of conscious areas of brain. All the reflex actions are unconscious actions. Reflex action occurs brain and spinal cord of central nervous systems.

2. What happens at the synapse between two neurons?

Answer: Between the synapse between two neurons electric signals are converted into chemicals that can easily cross over the gap and pass on the chemical messenger to next neuron where it is converted back to electrical signal.

3. Which part of the brain maintains posture and equilibrium of the body?

Answer: Cerebellum which is a part of the brain is responsible for Controls the motor functioning hence it is the part reengaged in the maintenance of posture and equilibrium of the body.

4. How do we detect the smell of an agarbatti (incense stick)?

Answer: Smell of an agarbatti is detected by nose, olfactory receptors present in the nose sends electrical signal to the fore brain..

5. What is the role of the brain in reflex action?

Answer: Reflex action are generated in spinal cord and the information also reaches brain. This helps the brain to record this event and remember it for future use. Brain helps the person to get awareness of the stimulus and prevent himself from that situation again.

6. What are plant hormones?

Answer: Plant hormones are the organic substances produces at certain sites of the plant and are translocated to other parts based on the requirement. Ex: Auxin's Gibberlin's, cytokines, abscisic acid and ethylene.

7. How is the movement of leaves of the sensitive plant different from the movement of a shoot towards light?

Answer:

Sl. no	Movement of leaves of the sensitive plant	Movement of a shoot towards light
1	It does not depend on the direction of stimulus applied.	Depends on the direction of stimulus applied.
2	Called as Nastic movement	Called as tropic movement
3	Touch is the stimulus	Light is the stimulus
4	Caused by the sudden loss of water from the swellings at the base of leaves	Caused by the unequal growth on the two sides of the shoot.
5	Not a growth movement	Growth movement
6	Occurs very fast	Occurs slowly

8. Give an example of a plant hormone that promotes growth

Answer: Auxins and Gibberlins are the hormone responsible for the growth of plant.

9. How do auxins promote the growth of a tendril around a support?

Answer: Auxins are the plant hormones produces at the tip of a shoot and root. Auxins are present at the tip of tendrils. When tendrils are attached around any support their growth is slowed down as auxins are sensitive to touch.

10. How does chemical coordination take place in animals?

Answer: Chemical coordination takes place in animals with the help of chemical messengers called as hormones.

11. Why is the use of iodized salt advisable?

Answer: Usage of Iodized salt is advisable to avoid the deficiency of Iodine. If the intake of iodine is low, the release of thyroxine from the thyroid gland will be decreased.

12. How does our body respond when adrenaline is secreted into the blood?

Answer: Adrenaline is a hormone secreted when a person is frightened or mentally disturbed. When Adrenaline reaches heart, heartbeat will increase to increase blood supply to our muscles.

13. Why are some patients of diabetes treated by giving injections of insulin?

Answer: Diabetes is a condition where insulin hormone is produced less or stopped by pancreatic cells of a person. Insulin regulates blood glucose by converting extra glucose to glycogen. When insulin is not produced adequately person blood glucose level which leads to adverse effects. In order to maintain the insulin and blood glucose level diabetes patients are treated with injections of insulin.

14. Which of the following is a plant hormone?

(a) Insulin

(b) Thyroxin

(c) Oestrogen

(d) Cytokinin

Answer: d) cytokinin.

15. The gap between two neurons is called a

(a) Dendrite.

(b) Synapse.

(c) Axon.

(d) Impulse.

Answer: (b) Synapse

16. The brain is responsible for

(a) Thinking.

(b) Regulating the heartbeat.

(c) Balancing the body.

(d) all of the above.

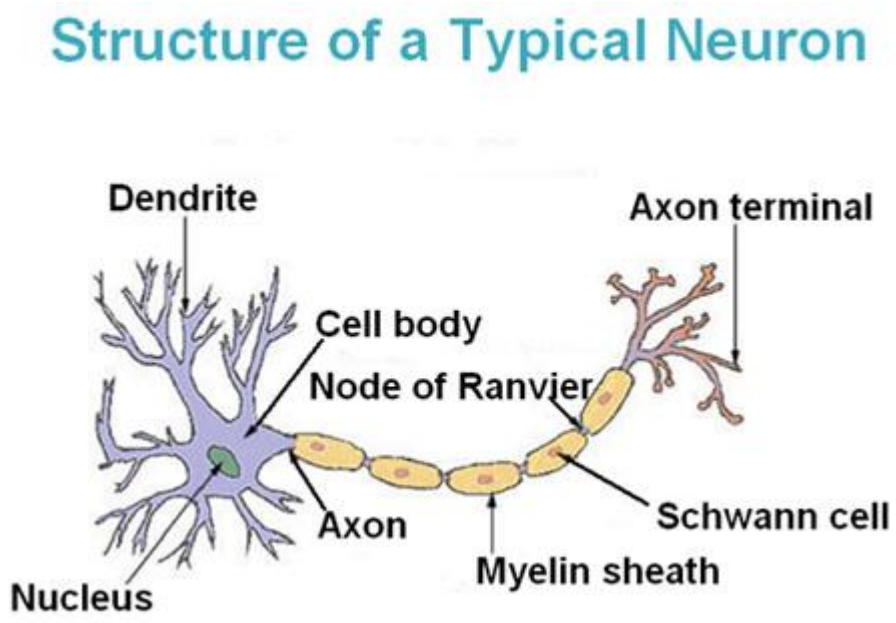
Answer: (d) all the above

17. What is the function of receptors in our body? Think of situations where receptors do not work properly. What problems are likely to arise?

Answer: Receptors are present throughout our body mainly sense organs. Receptors collect the information about changes that happen around us and send the signal to information to brain which render effector mechanism against the change.

18. Draw the structure of a neuron and explain its function.

Answer: Neurons are nerve cells which are functional units of the nervous system. Three main parts of neurons are Dendrites, Axons and cell body.



Dendrite: Detects information and sends it to cell body

Cell Body: Maintains growth of the cell

Axon: Conducts messages away from cell body and signal to next neuron.

19. How does phototropism occur in plants?

Answer: Directional movement and growth of plant in response to light is called as phototropism. Phototropism occurs due to increased auxin on the dark side and decreased auxin on the illuminated side.

20. Which signals will get disrupted in case of a spinal cord injury?

Answer: In case of a spinal cord injury, signals coming from the nerves as well as the signals coming to the receptors will be disrupted.

21. How does chemical coordination occur in plants?

Answer: Plant growth, development and responses to the environment is controlled and coordinated by a special class of chemical substances known as hormones. The five major types of phytohormone are auxins, gibberellins, cytokinins, abscisic acid, and ethylene. These phytohormones are either growth promoters (such as auxins, gibberellins, cytokinins, and ethylene) or growth inhibitors such as abscisic acid.

22. What is the need for a system of control and coordination in an organism?

Answer: There are various organs in an organism. These organs must be carefully controlled and coordinated for the survival of an organisms. In the body of an organism various fluids are secreted from the glands of the endocrine system. These hormones are responsible for the overall growth and development of an organism. All others daily decision that includes voluntary and involuntary action are controlled by central nervous system (CNS).

23. How are involuntary actions and reflex actions different from each other?

Answer:

Reflex actions	Involuntary actions
1. Rapid automatic responses to a stimulus without the conscious involvement of the brain	1. Occurs without the consciousness of an organism
2. Controlled by spinal cord	2. Controlled by mid brain or medulla oblongata
3. Very quick and instantaneous	3. Relatively slower
4. May involve any muscle or a gland	4. Involves only smooth muscles
5. Can be conditioned	5. Cannot be influenced by external conditioning
Examples: Blinking of eyes, salivation	Examples: Beating of heart, blood circulation

QUESTION BANK FOR L1

(1 Marks)

1- Which hormone helps in lowering the level of blood glucose in human beings?

Answer: Insulin

2- We suddenly withdraw our hand when a pin pricks. Name the type of response involved in this action?

Answer: Reflex action

3- Which hormone is responsible for the development of moustache and beard in man?

Answer: Testosterone

4- Name the largest cell present in human body?

Answer: Neuron

5- Name the gland which secretes growth hormone?

Answer: Pituitary gland.

(2 Marks)

1- Name two tissues that provide control and coordination in multicellular animals?

Answer: Nervous tissue and Endocrine tissue.

2- Name two hormones secreted by pancreas. Write one function of each hormone named?

Answer: Insulin and glucagon

Insulin helps the cells absorb glucose, reducing blood sugar . When blood sugar levels are too low,

Glucagon instructs the liver to release stored glucose, which causes blood sugar to rise.

3- Name the gland and hormone secreted by the gland which are associated with the following problems?

(i) A girl has grown extremely tall

(ii) A woman has swollen neck.

Answer: Pituitary, excessive secretion of growth hormone causing gigantism.

(ii) Thyroid, reduced secretion of thyroxine causing hypothyroidism or goitre.

4- If the cerebellum is not functioning properly, state the activities of our body that are affected?

Answer: Maintenance of posture or balance of body and coordination of body activities will be impaired.

5- Name the part of brain which controls Voluntary actions and Involuntary actions?

Answer: Voluntary Actions. Cerebellum. Involuntary Actions. Medulla oblongata. Fore brain has controls over many involuntary and voluntary actions.

(3 Marks)

1- Mention three major regions of brain. Write one function of each?

Answer: Brain is divided into three main regions forebrain, midbrain and hindbrain.

(i) Forebrain consists of cerebrum, olfactory lobes and diencephalon. Its main function is thinking and controlling various activities such as touch, smell, hearing, speech and sight.

(ii) Midbrain controls reflex movements of the head, neck and trunk in response to visual and auditory stimuli.

(iii) Hindbrain has three centres called pons, cerebellum and medulla. This part is responsible for regulating respiration, maintaining posture and balance of body.

2- Name the hormones secreted by the following endocrine glands and specify one function of each: (a) Thyroid (b) Pituitary (c) Pancreas?

Answer: (a) Thyroid gland secrete the hormone called thyroxine.

(b) Pituitary secretes following hormones :

Growth hormone (GH) or somatotropic hormone controls the overall development of body, muscles, bones and tissues.

Thyroid stimulating hormone (TSH) controls growth and functions of thyroid gland.

(c) Pancreas secretes following hormones :

(i) Insulin regulates the conversion of glucose to glycogen, i.e., it lowers the blood glucose level.

(ii) Glucagon is responsible for regulation of glycogen to glucose, i.e., increase blood glucose level.

3- An old man is advised by his doctor to take less sugar in his diet. Name the disease from which the man is suffering. Mention the hormone due to imbalance of which he is suffering from this disease. Which endocrine gland secretes this hormone?

Answer: Old man who is advised by his doctor to take less sugar in his diet is suffering from diabetes mellitus that occurs due to imbalance of insulin hormone. Endocrine part of islets of Langerhans in pancreas secrete insulin hormone.

4- Name the two main regions of our central nervous system. Which one of them plays a major role in sending command to muscles to act without involving thinking process ? Name the phenomenon involved?

Answer: Brain and spinal cord, Spinal cord plays a major role in mediating muscle action without involving thinking process, The phenomenon is called reflex action.

5- Name the hormone secreted by human testes. State its functions?

Answer: Hormone: Testosterone.

Functions: Development of male sex characteristics and secondary sex organs during puberty, Maintenance of male sex characteristics and male sex organs thereafter.

(5 Marks)

1- What are plant hormones? Write two important functions of gibberellin in plants?

Answer: Plant hormones can be defined as a chemical substance which is produced naturally in plants and are capable of translocation and regulating one or more physiological processes when present in low concentration.

Gibberellins are plant growth regulators that facilitate cell elongation, help the plants to grow taller. They also play major roles in germination, elongation of the stem, fruit ripening and flowering.

2- (a) Draw a neat diagram of a neuron and label (i) dendrite and (ii) axon.

(b) Which part of the human brain is:

(i) the main thinking part of the brain?

(ii) responsible for maintaining the posture and balance of the body?

Answer: (a) For Diagram refer the Topic Neuron.

(b) (i) Forebrain which includes cerebrum, olfactory lobes and diencephalon, is the main thinking part of the brain.

(ii) Cerebellum, part of hindbrain is responsible for maintaining the posture and balance of the body.

3- Why is chemical communication better than electrical impulses as a means of communication between cells in a multicellular organisms?

Answer: In animals, the message communicated in the form of nerve impulses, from receptors to central nervous system and from latter to effectors is very quick. But nerve impulses can reach only those animal cells which are connected by the nervous tissue. These cells after generation and transmission of nerve impulses, take sometime to reset their mechanism before a new impulse is generated and transmitted. It means, cells cannot continuously generate and transmit electrical impulses. This is the reason most multicellular organisms use another means of communication called chemical communication.

QUESTION BANK FOR L2

(1 Marks)

1- Which part of the brain controls posture and balance of the body?

Answer: Cerebellum

2- Name the plant hormone responsible for elongation of cells?

Answer: Auxin

3- Name the hormone secreted by an endocrine gland during emergency?

Answer: Hormone: Adrenaline.

4- Name the plant hormone that triggers the fall of mature leaves and fruits from plants?

Answer: Cytokinin

5- Name the part of hind brain which takes part in regulation of respiration?

Answer: Medulla oblongata

(2 Marks)

1- What is the need for a system of control and co – ordination in an organism?

Answer: a) It evokes an appropriate movement in response to any change in external environment

b) Multicellular organisms have complex body. So it, co – ordinates various organs of body of an organism work together in a proper manner to produce proper reaction to stimulus.

2- Define 'nerve impulse'. Which structure in a neuron helps to conduct a nerve impulse?

a) Towards the cell body?

b) Away from the cell body?

Answer: Nerve Impulse – It is the passing of information through neurons is in the form of electrical and chemical signals. This is called nerve impulse.

a) Dendrite

b) Axon

3- A man becomes unconscious due to head injury. A pin is pricked on his foot, he withdraws his foot. Why? Explain

Answer: It is reflex action. Stimulus is perceived by receptor (skin). Sensory nerve sends the sensation from receptor to the spinal cord. Then spinal cord sends the message through motor nerves to the effectors. Effectors i.e. muscles help in withdrawing his foot.

4- What are plant hormones? Write two important functions of auxin?

Answer: Plant hormones can be defined as a chemical substance which is produced naturally in plants and are capable of translocation and regulating one or more physiological processes when present in low concentration. Two important functions of auxin are that it promotes cell elongation, root formation, cell division, etc.

5-Write one example each of the following tropic movements:

(i) Positive phototropism

(ii) Negative phototropism

Answer: (i) Positive phototropism: shoots growing towards light.

(ii) Negative phototropism: roots growing away from light towards ground.

(3 Marks)

1- What is reflex arc ? Why have reflex arcs evolved in animals?

Answer: Reflex arc is the pathway taken by a stimulus to travel from the receptor organ to the effector organ through CNS without consulting the will of the individual. It produces a quick, immediate and involuntary response where delay can be harmful. Reflex arcs evolved in animals as a survival mechanism before the development of intelligence.

2- Define hormones. Name the hormone secreted by thyroid. Write its functions. Why is the use of iodised salt advised to us ?

Answer: Hormone of Thyroid. Thyroxine.

Functions of Thyroxine: It controls

Basal metabolic rate or BMR.

Metabolism of carbohydrates, fats and proteins.

Physical activity, Body temperature

Iodised Salt: Iodine is essential for formation of thyroxine. In its deficiency, thyroid undergoes overgrowth causing goitre. Common salt is iodised to prevent occurrence of goitre.

Hormones are chemical substances that act like messenger molecules in the body.

3- State how concentration of auxin stimulates the cells to grow longer on the side of the shoot which is away from light?

Answer: When light falls on the side of the shoot auxin diffuses towards the shady side of the shoot. This concentration of the auxin stimulates the cell to grow longer on the side of the shoot which is away from light. Thus plant appears to bend towards light.

4- What is synapse?

Answer:synapse is the gap between the two neurons. Here the axon terminal of one neuron is in close proximity to the dendrite of the second neuron.

5- Explain any three directional movements in plants?

Answer: Stimuli is responsible for the movement of the plant parts towards or away from it. This movement is called as Tropic Movement.

Phototropism: movement of plant towards or away from the light. Geotropism: movement of plant parts towards the earth or away from it. Hydrotropism: movement of plant parts towards or away from any source of water.

(5 Marks)

1- Trace the sequence of events through a reflex arc with occur when a bright light is focussed on your eyes?

Answer: Cerebral reflex: It functions as a relay centre for transferring impulse from sensory to motor neurons in several reflex actions called cerebral reflexes,

Reflex Arc: Reflex action requires a stimulus, a receptor organ, sensory neurons, a part of central nervous system, motor neurons and effector organ. The pathway taken by a stimulus to travel from receptor organ to effector organ is known as reflex arc. Its components are as follows

Receptor → Sensory neuron → Brain → Motor neuron → Eye → Eye muscle contracts.

2- Name the hormone synthesised at the shoot tips. How does it help the plant to respond to light?

Answer: Hormone Synthesised at shoot tip. Auxin. The shoot responds to unilateral light by bending towards it. This is caused by migration and synthesis of more auxin on the shaded side as compared to the illuminated side. Higher concentration of auxin on the shaded side causes more growth as compared to illuminated side. This bends the shoot towards the light.

3- Define hormones. Name the hormone secreted by thyroid. Write its functions. Why is the use of iodised salt advised to us?

Answer: Hormone of Thyroid. Thyroxine.

Functions of Thyroxine: It controls

Basal metabolic rate or BMR.

Metabolism of carbohydrates, fats and proteins.

Physical activity, Body temperature

Iodised Salt: Iodine is essential for formation of thyroxine. In its deficiency, thyroid undergoes overgrowth causing goitre. Common salt is iodised to prevent occurrence of goitre.

Hormones are chemical substances that act like messenger molecules in the body.

QUESTION BANK FOR L3

(1 Marks)

1- Name one plant hormone which inhibits growth?

Answer: Abscisic acid.

2- A female is suffering from an irregular menstrual cycle. The doctor prescribed her some hormonal tablets. Name hormone she lacks in her body from the endocrine gland?

Answer: Oestrogen

3- Which parts of the brain controls the blood pressure?

Answer: Pons, medulla, cerebellum

4- Rhythm of sleep in our body is controlled by which gland?

Answer: Pineal gland

5- Name the plant hormone that is involved in inhibiting growth and cause wilting of leaves?

Answer: Abscisic acid

(2 Marks)

1- State one example of chemotropism?

Answer: Growth of pollen tube towards the ovule due to chemical stimulus during the process of fertilisation in a flower is an example of chemotropism.

2- Define phototropism. Name the plant hormone which is responsible for phototropism?

Answer: Phototropism is the movement of a part of the plant in response to light.

The growth movement of the plant part (stem) is caused by the action of auxin hormone. Auxin causes cell elongation. Thus, causing growth of stem towards the light stimulus.

3- A squirrel is in a scary situation. Its body has to prepare for either fighting or running away. State the immediate changes that take place in its body so that the squirrel is able to either fight or run?

Answer: When squirrel is in a scary situation then its nervous system stimulates the adrenal glands to secrete more adrenaline hormone into blood.

4-Where are Pons and medulla oblongata located? Write their functions?

Answer: Pons and medulla Oblongata are located in hind brain.

Pons acts as bridge between brain and spinal cord.

Medulla oblongata –

a) It is the reflex centre to control activities like salivation, swallowing, vomiting, breathing, coughing, sneezing and heart beat

b) It also controls sleeps, consciousness and activities of cerebrum.

5- Differentiate between axon and dendrons?

Answer: Dendrons receive electrochemical impulses from other neurons, and carry them inwards and towards the soma, while axons carry the impulses away from the soma.

Dendrons are short and heavily branched in appearance, while axons are much longer.

Most neurons have a lot of dendrons and only have one axon.

Generally, dendrons receive neuron signals, and axons transmit them.

(3 Marks)

1- How brain and spinal cord are protected in human ?

(b) Name the master gland present in the brain?

Answer: Both the brain and the spinal cord are protected by bone: the brain by the bones of the skull and the spinal cord is protected by a set of ring-shaped bones called vertebrae. They are both cushioned by layers of membranes called meninges**.**

Pituitary gland present in the brain is known as the master gland.

2- Which organ secretes a hormone when blood sugar rises in our body? Name the hormone and name one enzyme released by this organ?

Answer: Pancreas secretes a hormone when blood sugar rises in our body. Insulin is the hormone released by this organ and the name of the enzyme is pancreatic juice.

3- Name the two main constituents of the Central Nervous System in human beings.

(b) What is the need for a system of control and coordination in human?

Answer: The two main constituents of the Central Nervous System in human beings are the brain and the spinal cord.

(b) A living being does not live in isolation. It has to constantly interact with its external environment and has to respond properly for its survival.

4- What is geotropism?

(b) Describe an experiment to demonstrate positive and negative geotropism?

Answer: Geotropism : It is directional growth movement of curvature which occurs in response to force of gravity. Main root shows positive geotropism while main stem shows negative geotropism.

(b) Experiment. Place a well watered potted plant on its side (horizontally) in sunlight. Keep watering the plant on alternate days. Observe after 3-4 days. The terminal part of the shoot bends upwardly. It shows negative geotropic response. The terminal part of the root bends downwardly. It shows positive geotropic response.

5- Draw a diagram of human brain and label cerebrum, cerebellum, medulla and fore brain on it?

Answer: Refer the Diagram of Brain and Label all its parts.

(5 Marks)

1- How does feed back mechanism regulate hormone secretion?

Answer: Feed back system is a regulatory mechanism in which presence of certain level of substance promotes or inhibits its further formation. Common control is through negative feed back. Here regulation is through opposite action. Positive feed is rare as during uterine contraction at child birth. Regulation of thyroxine production by its concentration in blood is an example of negative hormonal feed back system. Concentration of thyroxine in blood is detected by hypothalamus. If it is low, hypothalamus produces TSH-RH. The latter stimulates pituitary gland to produce TSH or thyroid stimulating hormone. TSH passes into circulatory z system and reaches thyroid. Thyroid begins to secrete more thyroxine.

2- Mention one function for each of these hormones?

i) Thyroxine ii) Insulin iii) Adrenaline

iv) Growth hormone v) Testosterone.

Answer: (i) Thyroxin – Control overall metabolic rate of the body (carbohydrate, protein and fat metabolism)

(ii) Insulin – Conversion of glucose to glycogen in liver and muscles, thus decreases blood glucose level.

(iii) Adrenalin – increases heart beat, blood pressure and blood glucose level.

(iv) Growth hormone – Body growth and development of bones.

(v) Testosterone – Development of male sex organ sand secondary sex.

3- (a) How is brain protected from injury and shock?

(b) Name two main parts of hind brain and state the functions of each.

Answer: Brain is covered by a three layered membrane called meninges. In between the layers of meninges and brain, cavity fluid named Cerebro Spinal Fluid (CSF) is filled. The hard skull covers the meninges. Thus Meninges, CSF and Skull protects our brain for a certain extent.

(b) Two main parts of hind-brain are — Medulla and Cerebellum. Their functions are:

Medulla: Involuntary actions such as blood pressure, salivation and vomiting.

Cerebellum: It is responsible for precision of voluntary actions and maintaining the posture and balance of the body.

CHAPTER – 8

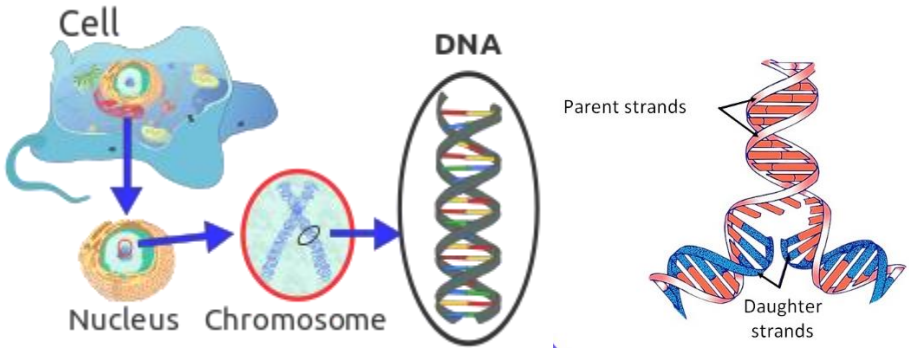
HOW DO ORGANISMS REPRODUCE?

Reproduction:- Re + Production

The process of producing own kind of organism is known as reproduction.

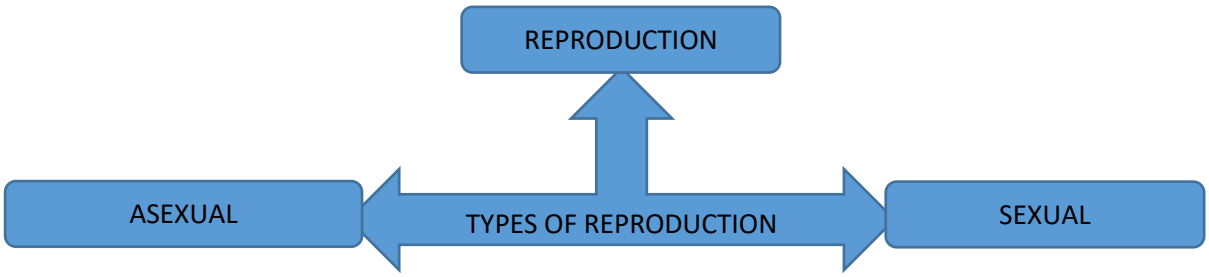
DNA copying

- The reproducing cells produce copy of their DNA (Deoxy ribo nucleic acid) through some chemical reactions.
- It takes place along with development of additional cellular structure.
- It passes genetic information from parents to offspring.
- The process of copying DNA have some variation each time, so copies will be similar but not identical.



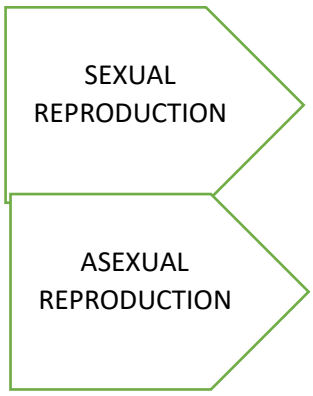
Importance of variation

- Due to variation strong offspring produced which have higher chance of survival in adverse climatic condition.
- Individuals without variation having less chance to survive.
- The surviving individuals may reproduce and develop a kind of population which is suited to the changed environment.

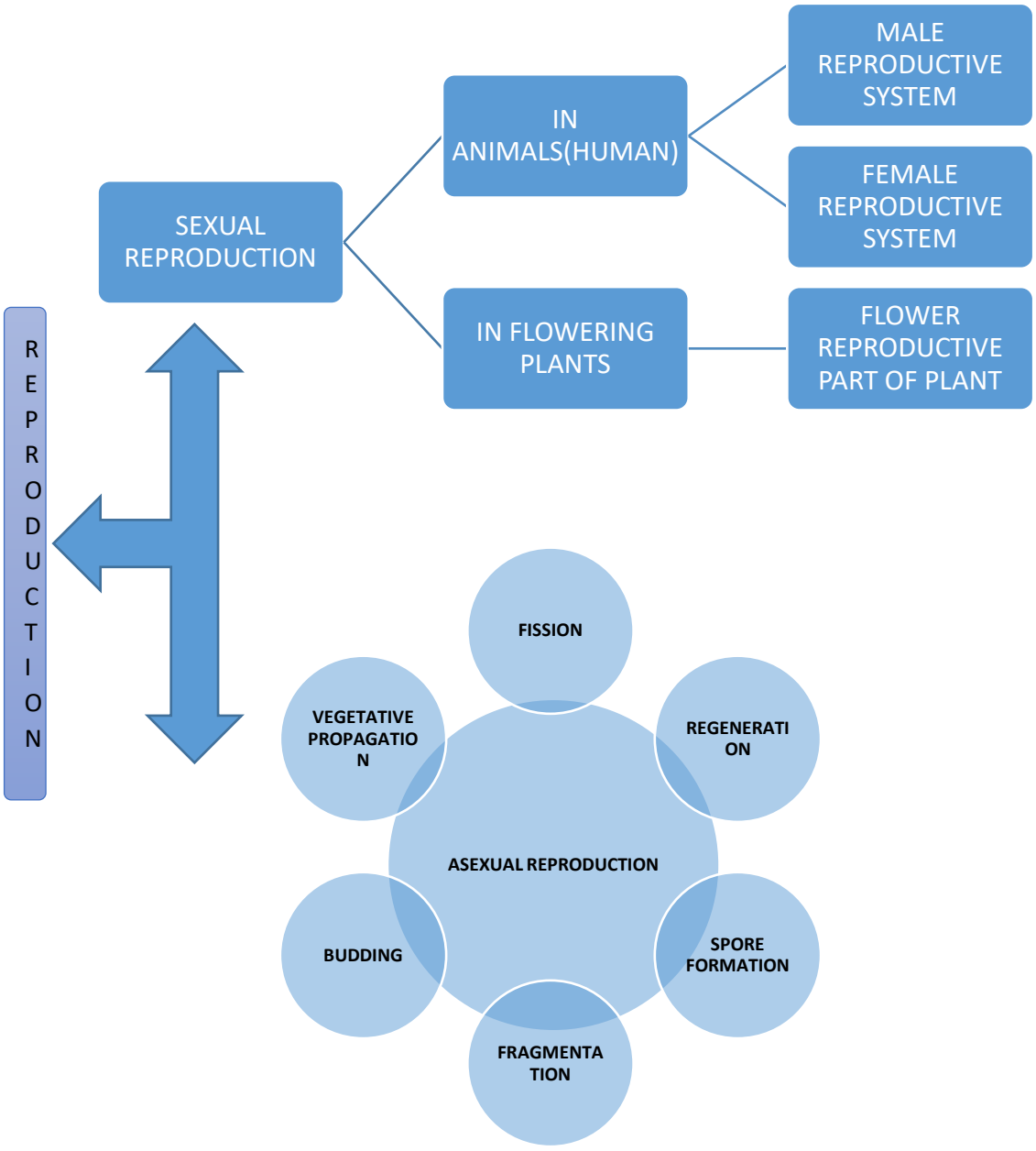


DIFFERENCES BETWEEN ASEXUAL AND SEXUAL REPRODUCTION

Characteristics	**ASEXUAL REPRODUCTION**	**SEXUAL REPRODUCTION**
No. of parent	Only one parent is involved.	Two parents are involved
Type of cell division	Mitosis occurs in reproductive cells	Meiosis occurs in reproductive cells
Gamete formation	Gamete formation doesn't take place	Gamete formation take place
Fertilization	Fertilization does not occur.	Fertilization of male and female gamete occurs to form zygote
Time duration	Takes less time to produce offspring	Takes more time to produce offspring
No. of individuals produced	A large no. of individuals can be produced at a time	Comparatively less individuals can be produced at a time
Offspring	Identical to parents	Not identical to parents
Genetic variation	Very less	Very high
Evolution	It does not participate in evolution	It participates in evolution
Example	Generally occurs in lower group of organisms such as fungus, amoeba, algae etc.	Generally occurs in higher organisms such as plants, animals, human, bacteria etc



ADVANTAGES	**DISADVANTAGES**
Higher genetic diversity	Two organism male and female needed
Help in evolution	It takes more time and energy
Strong and healthy individuals produced	Produces very less no. of individuals
One organism alone can produce offspring	Two organism male and female needed
Takes very less time to produce offspring	Weak and less efficient individuals produced
Produce a large no. of individuals	Does not help in evolution
	Low genetic diversity

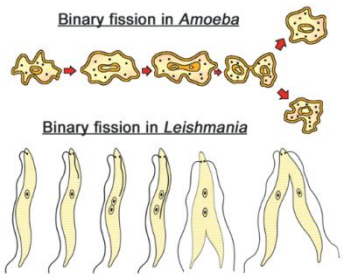


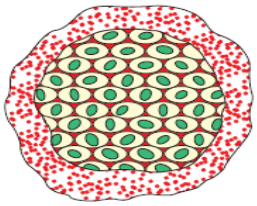
Modes of asexual reproduction

- **Fission**:- Splitting up or divide to form new individuals

Binary Fission	**Multiple fission**
Two cells are formed after division	Many cells are formed after division
Ex- Amoeba (divide in any palne)	ex- Plasmodium (Malarial parasite)

Leishmania (Divide in a fixed plane)

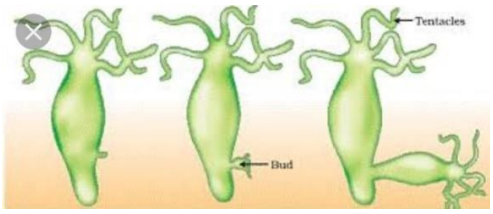


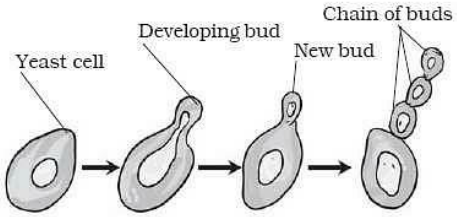


Multiple fission in Plasmodium

- **Budding**: -
  - An outgrowth develops known as bud, which detach from parent body after maturation to form new individual.

  Ex- Hydra, yeast etc





Hydra Yeast

- **Regeneration**: -
  - The process by which an organism regenerate its lost body part after any injury or damage is known as regeneration.
  - It is carried out with some specialized cells which divides to form new cells.

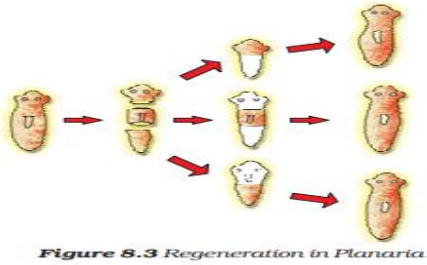
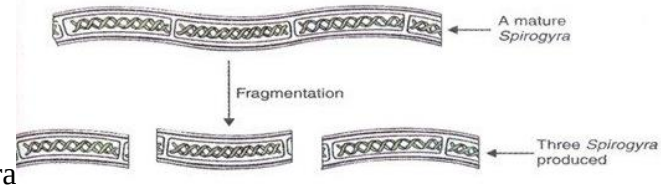


Figure 8.3 Regeneration in Planaria

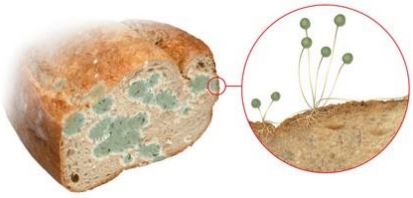
- **Fragmentation** :-
  - Mature organism breaks up their body to form many pieces or fragments,
  - each fragments grows up to form a new individual.



Ex- Spirogyara

- **Spore formation :-**
  - Spore are small bulb like structure which is covered by thick wall.
  - It develop in a rounded structure called sporangium, which is present at the tip of fungal stem called hyphae. Ex- Rhizopus (Bread mould)
  - Activity :-

Take a wet slice of bread and keep it in a dark , moist place.
After few days you will observe light green patches on bread.
This is due to development of a large no. of fungus Rhizopus ,which develops from the spores .As spores need moist condition to grow.



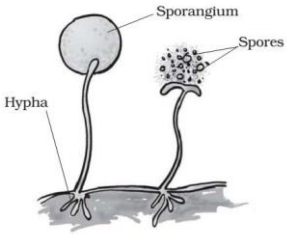


Fig. 12.7 Reproduction through spore formation in fungus

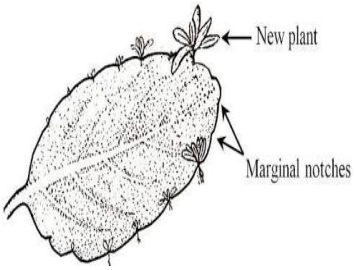
❖ **Vegetative propagation**: - When vegetative parts of plant such as root, stem develops into new plant than that process is known as vegetative propagation.

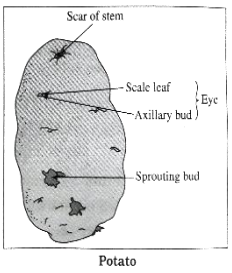
Advantages :- Seed is not required for producing new plant.

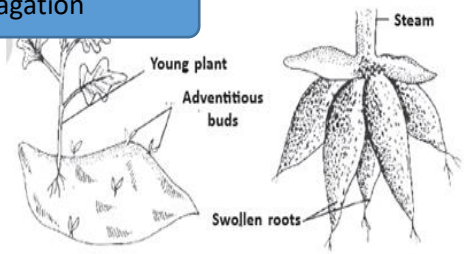
- All plants produced are genetically similar to parent plant having identical characteristics.
- It is a rapid, easier and economically cheap method

Disadvantages :- very less chance of variation in new individuals ,does not lead to evolutio

Natural methods of vegetative propagation







Vegetative propagation by roots in sweet potato

By leaf by stem by root

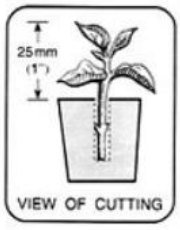
CUTTING

Cutting a small part of plant such as stem and putting into soil, it develops in new plant .

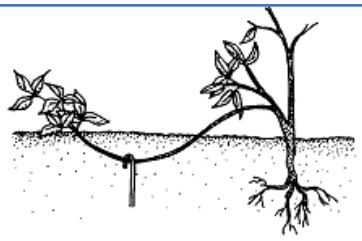
Ex- Rose, Hibiscus etc

LAYERING

A lower most branch of plant is pulled towards ground and a part of it covered with moist soil leaving the tip of branch above the ground. After some time new roots develops from the part buried



ARTIFICIAL METHOD OF VEGETATIVE PROPAGATION



CUTTING

LAYERING

GRAFTING

Process of joining two plant parts (of closely plant) related such a way that they grow as one single plant.

The rooted plant in which grafting is done called called stock.

The portion of other plant which is grafted on to the stock is known as scion. Ex- Fruit trees apple, pear etc

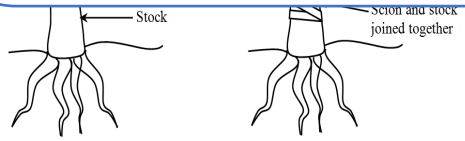
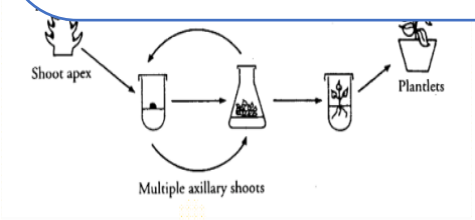


Fig. 12 Artificial vegetative propagation by grafting

TISSUE CULTURE

Process of culturing a small part of tissue or cells of plant in an artificial medium containing necessary nutrients and hormone.

It divides rapidly to form mass of cells known as callus which is transferred to a hormonal medium where it develops into small plantlets



SEXUAL REPRODUCTION IN FLOWERING PLANTS

Flower is the reproductive part of a plant.

Parts of flower and function:-

SEPAL

- **Outer most greenish part**
- **Help to protect the flower in bud condition.**

PROTECTIVE PARTS

PETAL

- **Colorful part of flower**
- **Attracts insects during pollination.**

PISTIL

- **Female reproductive part**

Consists of

- **Stigma- Where pollen attaches**
- **Style – Long tube which transfer pollen from stigma**

REPRODUCTIVE PARTS

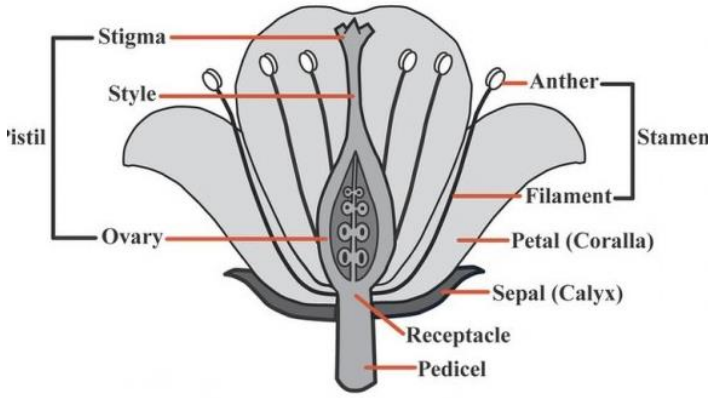
ANTHER

Male reproductive part

Consists of

- **Anther – Produces pollen**
- **Filament – Support anther**
- **Pollen – Round Yellowish powdery structure contains male gamete**

FLOWER DIAGRAM



STRUCTURE OF FLOWER

UNISEXUAL FLOWER

Contains only one reproductive part male or female in one flower .

Ex- Papaya, Watermelon

FLOWER

BISEXUAL FLOWER

Contains both male and female reproductive part in one flower

Ex- Hibiscus, Mustard

POLLINATION

Process of transfer of pollen from anther to stigma of same or different flower is known as pollination

Characteristics	**Self Pollination**	**Cross Pollination**
Definition	Transfer of pollen grains from anther to stigma of same flower	Transfer of pollen grains from anther to stigma of another flower
Pollinating agents	Pollinating agents are not required	Pollinating agents are required
Genetic variation	It doesn't create genetic variation and not participate in evolution.	It increases genetic variation and helps in evolution.
Time duration	Takes less time	Takes more time

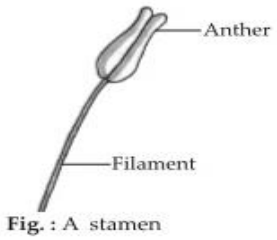
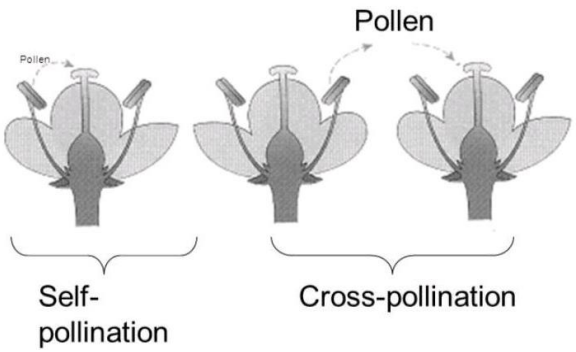


Fig. : A stamen



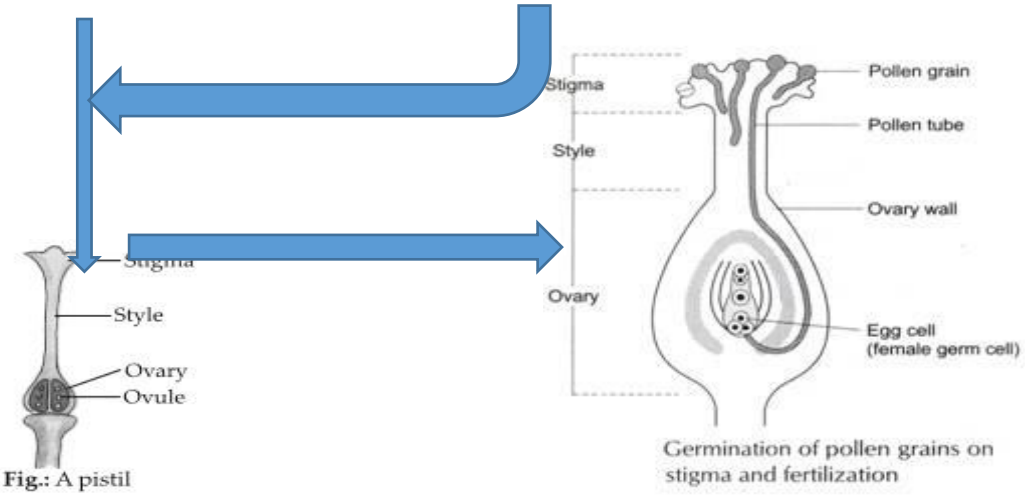
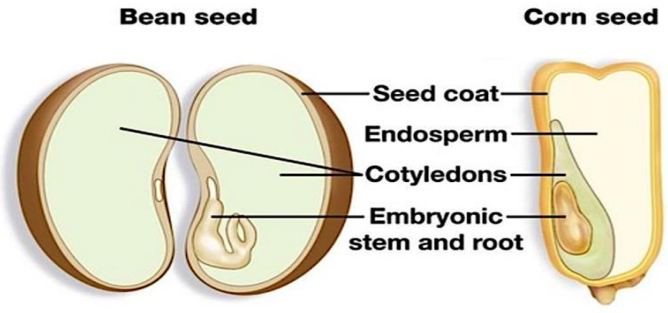


Fig.: A pistil

- After landing to stigma pollen develops a tube which reaches the ovary and release two male gametes.
- Fusion between male and female gamete occurs called **<u>fertilisation</u>**.
- After fertilisation zygote forms which develops into embryo in ovule.
- Thus ovule develops to form seed and ovary converted into fruit.

Germination

Seed under favourable conditions(Optimum light,moisture temperature) develops into plantlets,this process is called germination.



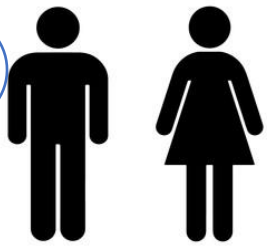
SEXUAL REPRODUCTION IN HUMAN BEINGS

Puberty

- Age of human male and females at which the reproductive organ becomes functional.
- Primary Reproductive organ start producing gametes and sex hormones.
- the boys and girls becomes sexually mature

Changes in male

- Enlargement of penis and scrotum
- Broadening



Changes in female

- Growth of breast and external genitalia
- Growth of pubic hair
- Broadening of pelvis

MALE REPRODUCTIVE SYSTEM

Scrotum

A pair of testes is covered with pouch of skin located outside the abdominal cavity.

As sperm formation require lower temperature than normal body

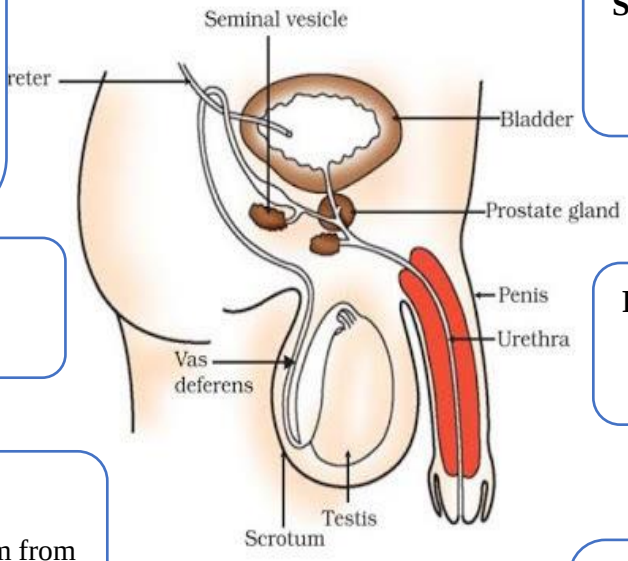
Testis

Primary sex organ produces sperm (male gametes)

Secretes male sex hormone

Seminal vesicle

Secrets fluid which provide nutrition to sperm



Human–male reproductive system

Urethra

Carries urine from urinary

Prostate gland

Secrets fluid which help in the movement of sperm

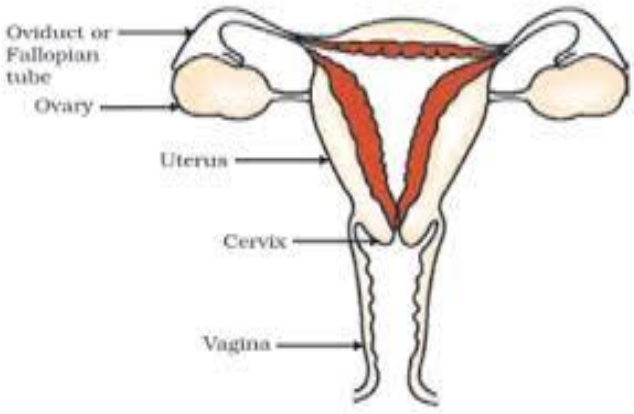
Vas deferens

Straight tube which carries sperm from testis to urethra

Penis

External genital part which ejaculate sperm into vagina during mating

Female reproductive system

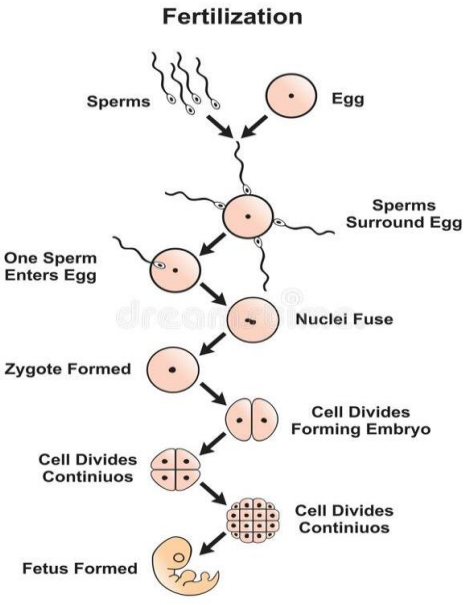


FERTILIZATION :

The process in which male and female gamete fuses together to form zygote .

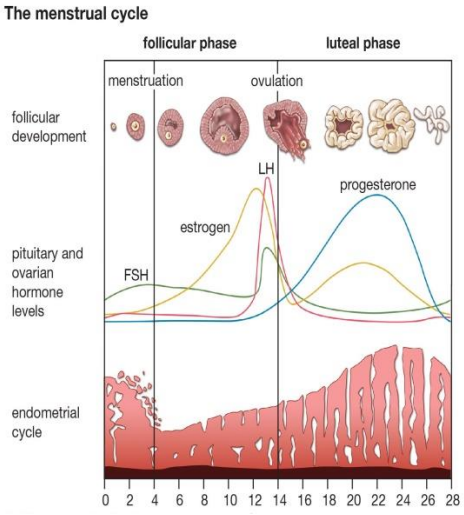
When egg is fertilised

- Zygote forms and it start dividing and form a ball of cells known as **embryo**.
- The embryo is transferred to the lining of uterus; this process is known as **implantation**.
- Embryo continues to grow and develop organ called **foetus**
- The embryo gets nutrition from mother's blood with the help of a special tissue called **placenta**.
- The development of child takes approximately nine month.
- After nine months child is born with contraction of muscles in the uterus.



When egg is not fertilised

- The thick inner lining of uterus breaks down along with blood vessels. The degenerated part of uterus along with the blood moves out of the vagina in the form of bleeding, called **menstruation**.
- It usually lasts for 3-7 days
- This cycle repeats every month after 28-29 days.
- The cycle of events taking place in female reproductive organ in ovaries and uterus, under the control of sex hormone in every 28days and marked by bleeding or menstrual flow is called **menstrual cycle**.
- **Menarche** commencement of menstruation or start of menstruation
- **Menopause** When menstruation and ovulation stops



Reproductive health :-

Sexually transmitted disease (STDs) :-

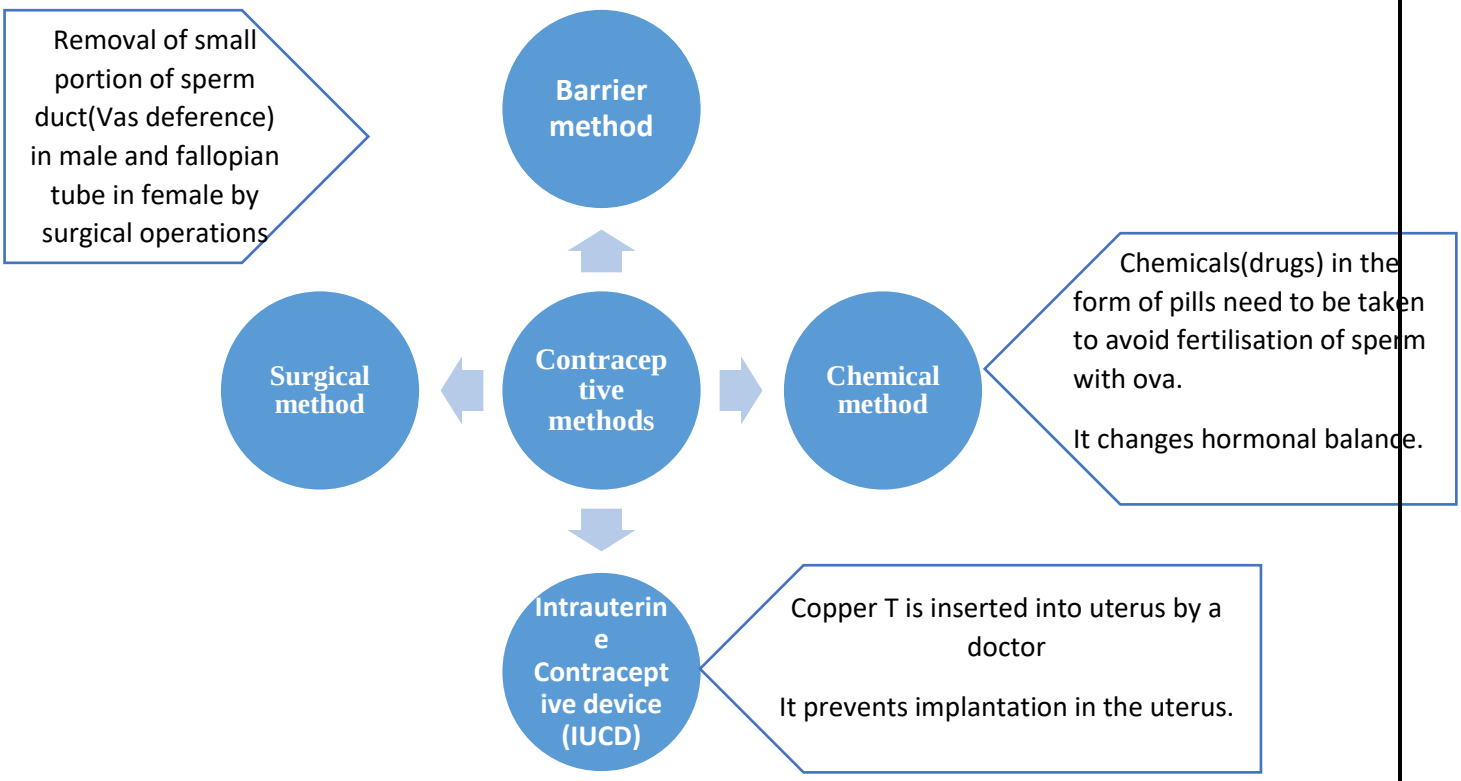
Diseases that can be transmitted during sexual act are known as sexually transmitted disease.

Example – **Bacterial diseases** – Gonorrhoea and Syphilis

Viral diseases - Wart and HIV-AIDS (Human Immuno Virus cause Acquired immune deficiency Syndrome)

Population control or Birth control:- The regulation of conception by preventive measures or devices to control the number of offspring is called birth control.

Contraceptive methods :- The methods or devices of birth control which prevent fertilisation are referred as contraception



Female foeticides

Surgery can also be used for abortion

It is medical termination of pregnancy before the foetus becomes viable.

This method is illegally used to kill female foetus who do not want a female child.

LEVEL 1

1) Asexual Reproduction takes place through budding in (1)
   a) Amoeba b) Yeast c) Plasmodium d) Leishmania
   Ans :- b) Yeast
2) Which of the following is not a part of the female reproductive system in human beings? (1)
   a) Ovary b) Uterus c) Vas deference d) Fallopian tube
   Ans :- c) Vas deference
3) The anther contains (1)
   a) Sepal b) Ovules c) Pistil d) Pollen grain
   Ans :- d) Pollen grains
4) What are the advantages of sexual reproduction over asexual reproduction ? (2)

Ans :-

- Sexual reproduction creates variation which is important for survival of species where as asexual reproduction doesn't.
- It produce healthy offspring

5) Name one sexually transmitted disease each caused due to bacterial infection and viral infection. (2)

I. Gonorrhoea caused by bacteria
II. HIV-AIDS (Human immune deficiency virus – Acquired immune deficiency syndrome) caused by virus

6) What are the changes seen in girls at the time of puberty ? (2)

Ans :- Following are the changes seen in girls at the time of puberty.

- Growth of breast and external genitalia
- Growth of pubic hair
- Broadening of pelvis
- Initiation of menstruation and ovulation
- Increase secretions from oil glands results in pimples

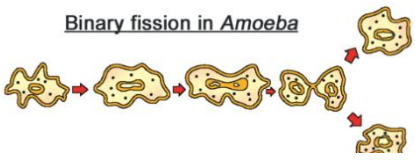
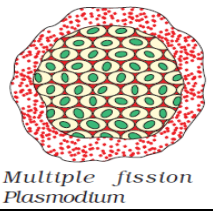
7) What is the importance of DNA copying in reproduction? (2)

Ans – DNA Copying is important because

- The DNA is information source for making proteins, and different protein leads to form different body design.
- It transfers the characters from parent to next generation.
- Produce genetic variation which leads to evolution.

8) How binary fission is different from multiple fission? (2)

Ans:-

Characteristics	Binary Fission	Multiple Fission
No. of cells produced	In binary fission a single cell divides to form two cells.	In multiple fission a single cell divides to form many daughter cells.
Covering around cell	cells are not surrounded by any extra covering after division	cells are surrounded by a thick common outer wall after division
Example	Ex- It occurs in Amoeba 	Ex – It occurs in Plasmodium  Multiple fission in Plasmodium

9) How will an organism be benefited if it reproduces through spores ? (2)

Ans:- If an organism reproduces by spores it can be benefited by the following way –

- Number of spores produced in one sporangium would be large.
- Spores can be distributed away with the help of air to avoid competition at one place.
- Spores are covered with thick walls which protect them during unfavourable conditions.

10) How is the process of pollination different from fertilisation ? (2)

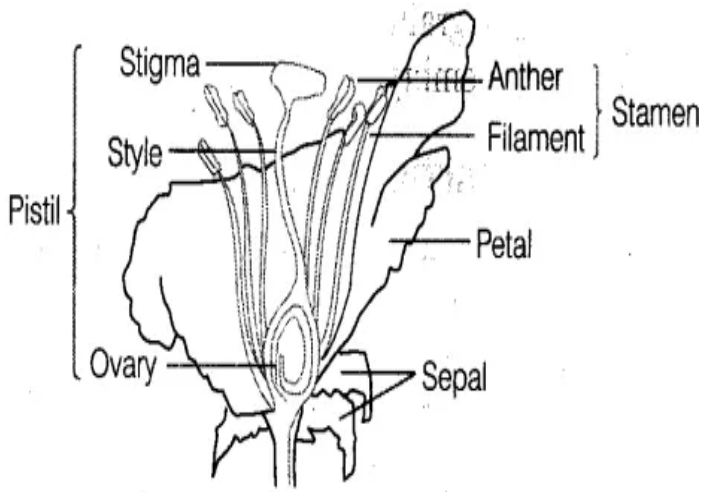
- Ans:- Pollination is a process of transferring pollen from anther to stigma of flower whereas fertilization is the process of fusion between male and female gametes which results in the formation of zygote

11) Write three methods of contraception to control increasing population ? (3)

Ans :-

- Barrier method – use of Condom, Diaphragm
- Chemical method – Oral pills which stops releasing eggs from ovary
- Surgical method – The vas deferens in male and fallopian tube in female is blocked to prevent transfer of egg and sperm and thus prevent fertilisation.

12) Draw a labelled diagram of the longitudinal section of a flower and label sepal, petals, pistil and stamen. (2)



LEVEL 2

13) Can you think of reasons why more complex organisms cannot give rise to new individuals through regeneration? (2)

Ans :-- More complex organisms cannot give rise to new individuals because

- They have very high order of organization of different organs which are interconnected and work together.
- They can regenerate a few of their body parts such as skin or hair but not a complete organism.

14) Why is vegetative propagation practised for growing some types of plants? (2)

Ans:- Vegetative propagation practised for growing plants because

- Seed is not required for producing new plant.
- All plants produced are genetically similar to parent plant having identical characteristics.
- It is a rapid, easier and economically cheap method

15) If a women is using copper T, will it help in protecting her from sexually transmitted diseases? (2)

Ans:- No , it is a contraceptive method and will prevent pregnancy and implantation of zygote but it does not protect from getting infected with sexually transmitted diseases.

16) How does the creation of variation in a species promote survival? (3)

Ans:-

- Due to variation strong offspring produced which have higher chance of survival in adverse climatic condition.
- Individuals without variation having less chance to survive.
- The surviving individuals may reproduce and develop a kind of population which is suited to the changed environment.
  Thus variation is beneficial but not necessarily for the individual

17) How does the embryo get nourishment inside the mother's body ? (2)

Ans:-

- In mother's body embryo gets nourishment from mother's blood. There is a specialised structure called placenta through which it remains connected with mother's body.
- Numerous villi are present in placenta which transfers food, oxygen and other substances to embryo.

18) How are the modes for reproduction different in unicellular and multicellular organisms? (2)

Ans

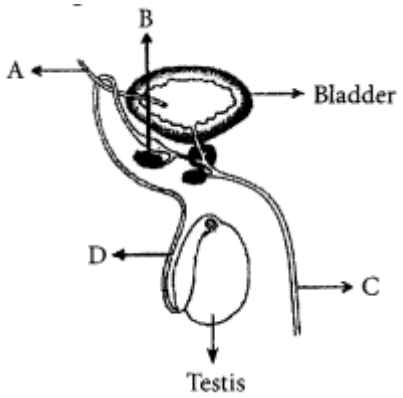
Chaacteristics	Reproduction in unicellular organism	Reproduction in unicellular organism
Type of reproduction	Asexual reproduction generally occurs in unicellular organism.	Sexual reproduction generally occurs in multicellular organism.
Specilised cell	No specialised cell for reproduction	Specialised cells are present for reproduction
Organism involved	Only one organism needed for reproduction.	Two organism needed for reproduction

19) a) Identify A,B,C and D in the following diagram. (1)

Ans :- A-Ureter B –Seminal vesicle C – Urethra D – Vas deferens

b) What is the function of part D? (1)

Ans :- It transfer sperm from testis to ureter.



20) List out the methods to avoid fertilization and in turn pregnancy to maintain healthy reproductive health. (3)

Ans:-

- Barrier method – use of Condom, Diaphragm
- Chemical method – Oral pills which stops releasing eggs from ovary
- Surgical method – The vas deferens in male and fallopian tube in female is blocked to prevent transfer of egg and sperm and thus prevent fertilisation

21) Draw a labelled diagram of female reproductive system and Write the name of the given parts and label that in diagram. (4)

a) The part produces egg b) The part where fertilisation occurs c) The part where embryo develops d) Part through which sperm enters

Ans:- a) Ovary b) Fallopian tube c) Uterus d) Vagina

Level 3

22) Two flowers are identified by a botanist with the following features that flower A is having only stamen and flower B is having both stamen and pistil. Which of the following statements is correct?

(a) Flower A will bear seeds and flower B cannot bear seeds after fertilisation.
(b) Flower A will produce pollen grains and flower B cannot produce pollen grains.
(c) Flower A cannot be fertilised and flower B can show fertilisation.
(d) Neither flower A and nor flower B can show self-pollination.

Ans :- c) Flower A cannot be fertilised and flower B can show fertilisation.

23) How does reproduction help in providing stability to populations of species?

Ans:-

- Reproduction is a process of producing same kind of species to maintain the population of that species.
- If reproduction does not occur than there might be chance of extinction of a particular species.
- So stability is maintained by keeping balance both rate of birth and rate of death.

24) What happens when

a) Planaria gets cut into two pieces
b) Bryophyllum leaves fall on the wet soil

Ans:- a) Each piece of planaria will develop into a new individual through the process of regeneration
b) When leaves falls on wet soil buds will develop from leaf notches and each bud will than develop into new plant.

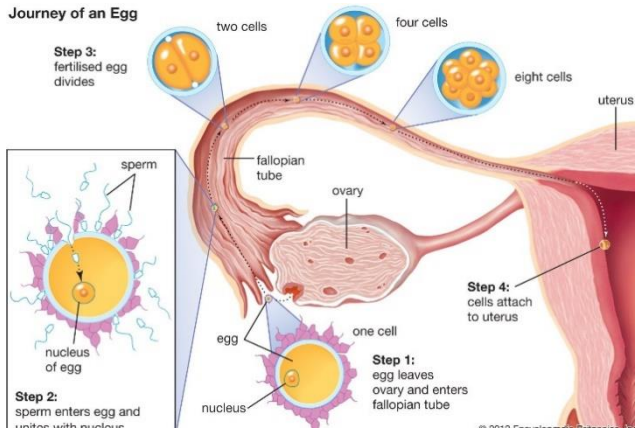
25) How do organisms whether reproduced asexually or sexually maintain a constant chromosome number through several generations.?

Ans:-

- During asexual reproduction organisms undergoes only mitotic division.
  Hence DNA of the cell is being copied and equal no of chromosomes transferred in the daughter cells. Thus chromosome number remains constant.
- In sexual reproduction, organism produces gametes through meiosis, in which the no. of chromosome becomes half in gametes. When two gametes combine to form zygote the original no of chromosomes is restored.
  Ex- In human, each parents have 46 chromosome. In the gamete sperm and egg each have half that is 23 chromosome , when sperm and egg fuse, zygote has 46 chromosomes.

Case study based questions

26) Observe the diagram and read the paragraph given below and answer given questions.



Fertilization takes place when male gamete successfully entered the ovum and two sets of genetic materials carried by the gametes fuse together, resulting in the formation of zygote. This usually takes place in the ampulla of one of the fallopian tubes. The zygote contains the combined genetic material carried by both the male and female gametes which consists of the 23 chromosomes from the nucleus of the ovum and 23 chromosomes from the nucleus of the sperm. The 46 chromosomes of the zygote undergo mitotic division which leads to the formation of the embryo.

A) Name the type of cell division occurs during gamete formation.

Ans:- Meiosis

B) Choose the incorrect option –

i) Fertilization takes place in fallopian tube

ii) Zygote formed after fertilization contains 23 pair of chromosomes

iii) After fertilization embryo gets transferred to ovary

iv) Zygote divides meiotically to form embryo

a) i and ii b) ii and iii c) iii and iv d) iv and i
Ans:- c) iii and iv

C) State the function of uterus in female reproductive system.
Ans:- Function of uterus:-

- Implantation of zygote
- Nourishment of developing embryo

D) What will happen if egg is not fertilized? Explain
Ans:- When egg is not fertilized than the thick inner lining of uterus breaks down along with blood vessels. The degenerated part of uterus along with the blood moves out of the vagina in the form of bleeding, called **menstruation**.

27) Rita brought bread in her tiffin but forgot to eat in school. The tiffin remains in her bag for three days. When she opened her tiffin box she observed that bread has gone stale and green patches developed all over the bread.

a) What might be the reason for green patches over the bread? (1)

Ans:- Green patches developed due to excessive growth of fungus over the bread.

b) What kind of reproduction is performed by the organism? (1)

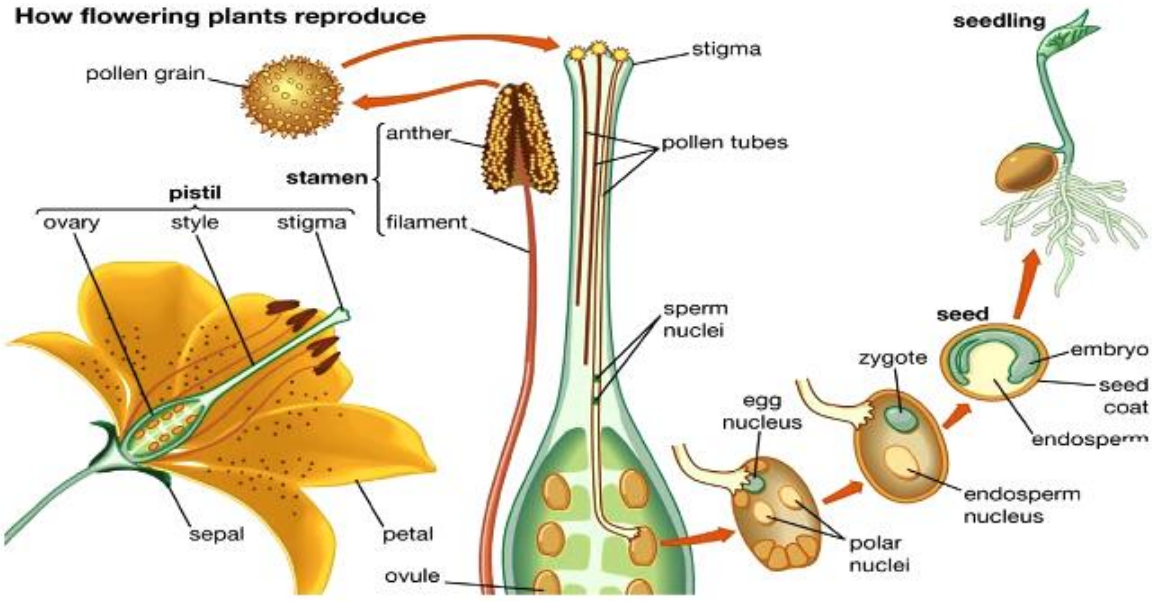
Ans:- Asexual mode of reproduction by formation of spores

c) How this method is advantageous for it? (2)

Ans:- This method is advantageous as

- Number of spores produced in one sporangium would be large.
- Spores can be distributed away with the help of air to avoid competition at one place.
- Spores are covered with thick walls which protect them during unfavourable conditions.

28) **Observe the diagram and read the paragraph given below and answer given questions.**



Schematic representation of the reproductive organs in angiosperm. In the course of male gametophyte development after meiosis, the haploid microspore develops in the locule surrounded by the tapetum in the immature anther. After disintegration of the tapetum, the pollen grain matures. At the timing of flowering, anther dehiscence occurs to release the pollen, which is then carried by wind or insects onto stigma of the pistil. The compatible pollen germinates, and its pollen tube penetrates into stigma, elongates through the style and enters into ovary. The two sperm cells finally fertilize the egg cells and the central cell to form the embryo and the endosperm respectively.

a) Name the part of stamen which produce pollen. (1)
Ans:-Anther

b) Write the parts of pistil which develops into fruit and seed. (1)
Ans :- Ovary develops into fruit and ovule develops into seed

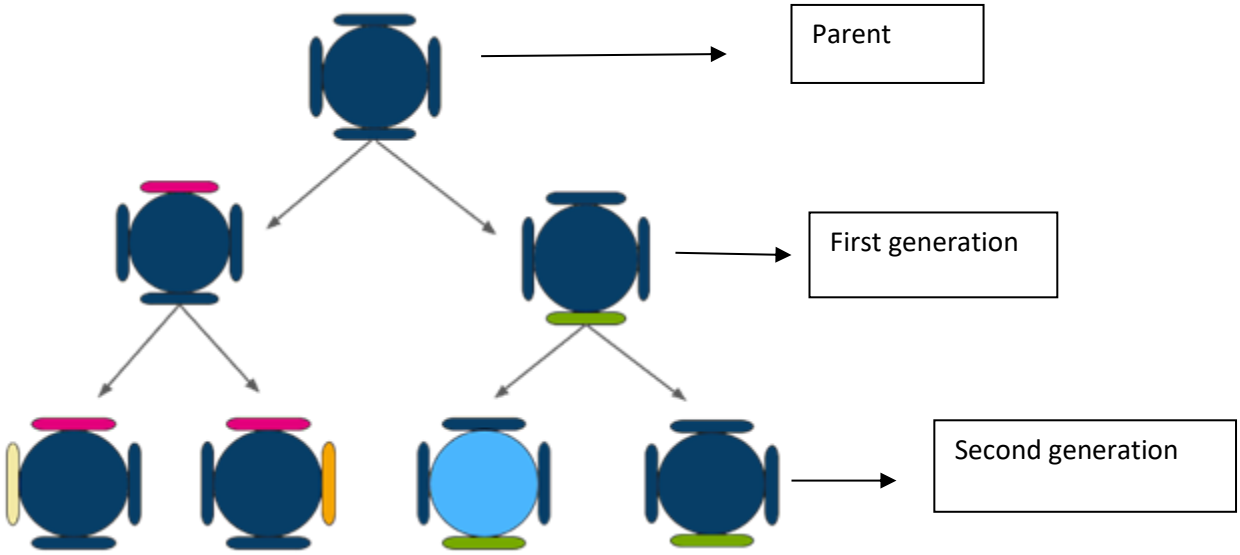
c) How pollen from anther reach the stigma? (2)
Ans :- By the process of pollination and with the help of pollinating agents such as insects or animals , pollen reach the stigma.

CHAPTER - 9

HEREDITY AND EVOLUTION

To study the mechanism by which variations are created and inherited and the long-term consequences of the accumulation of variations.

Inheritance is the process by which characters pass from one generation to another.



As given in the above diagram, a single individual reproduces, as it happens in asexual reproduction. There would be only very minor differences between them, generated due to small inaccuracies in DNA copying. However, if sexual reproduction is involved, even greater diversity will be generated.

Heredity is the process of transfer of characters from parents to offsprings.

A **trait** is a characteristic feature in an organism. Example: the black colour of the eye is an example of a trait.

Inherited traits are inherited from the parents to the offspring. We resemble our parents but not a carbon copy of them. We are very much different from our parents. These differences are called variations.

Rules for the Inheritance of Traits – Gregor John Mendel's Contributions

Gregor John Mendel worked out the rules of inheritance by carrying out experiments using pea plant. He chose pea plant as -- it was easy to grow, short life span, contrasting visible characters and self pollination. He is called the father of Genetics and genetics is the study of heredity and variation.

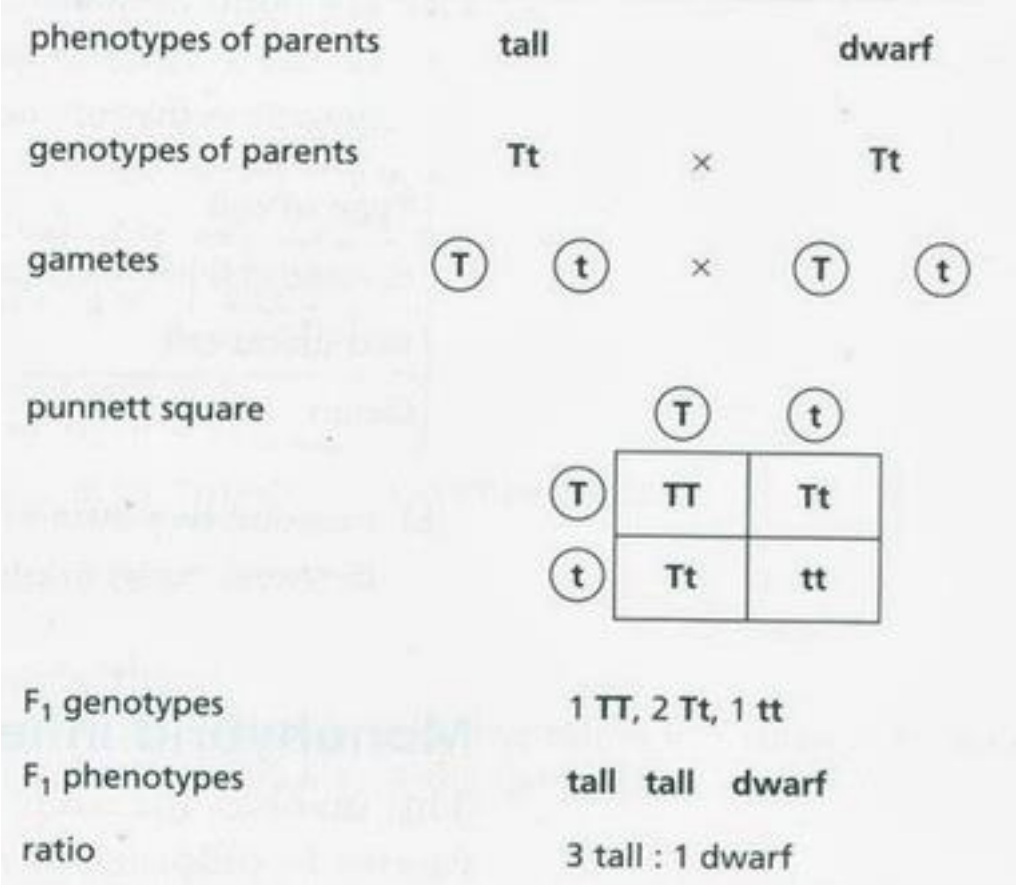
Mendel's rules of inheritance are as follows:

Each trait is controlled by a pair of factors. The factors may be similar or dissimilar.

Character	Trait	Similar factors	Dissimilar factors
Height	Tallness	TT	Tt
	Shortness	tt	

When a pure breeding tall plant was crossed with a pure breeding short plant, all the plants were tall in the first filial generation (F1).There was no medium or short plants. While the F1 plants were self pollinated, both tall and shorts were produced. Though both traits are inherited in F1 generation, only the Tallness is expressed. Traits like 'T' are called **dominant traits;** while traits like't' are called **recessive traits**.This is the Lawof Dominance.

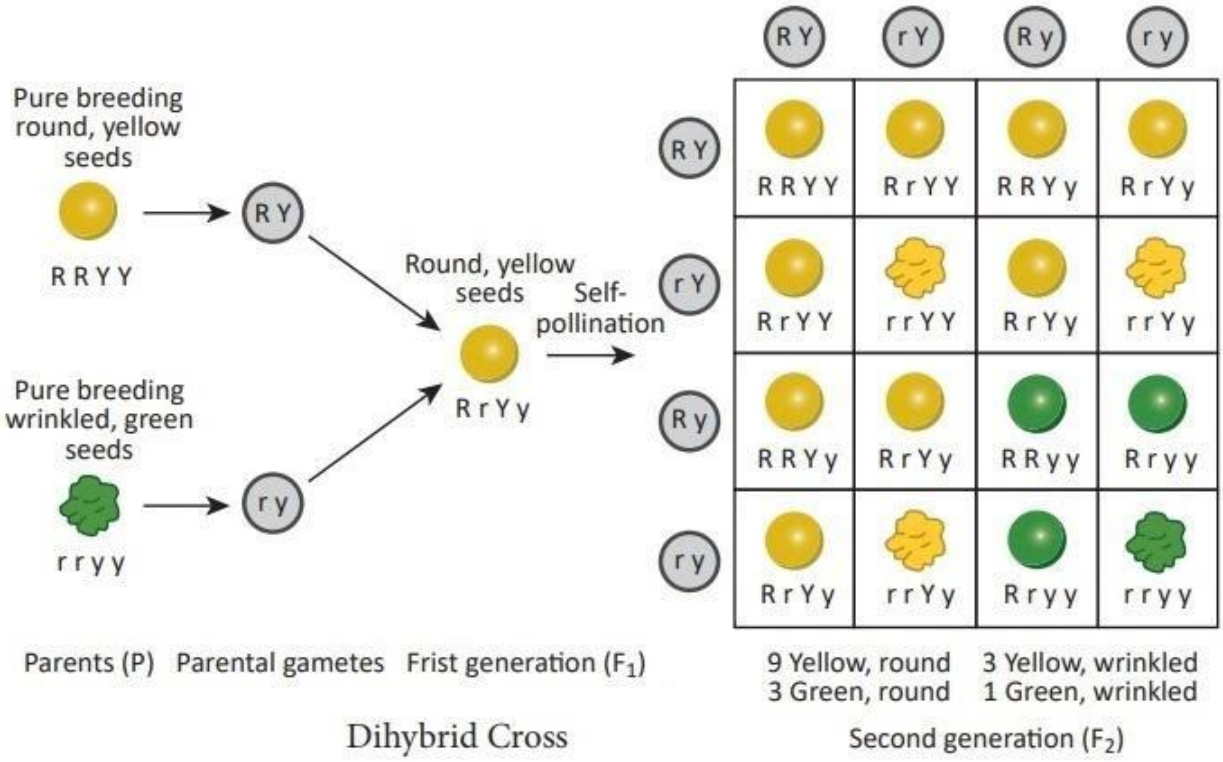
This is a monohybrid cross between parental generations that differ in a single character. A Punnett square is used to predict the possible genetic outcomes of the cross. The observable character of an organism is its **phenotype** and the genetic makeup of an organism is its **genotype**.



Mendel's Law of segregation says during gamete formation, each gamete gets only one copy of gene for a particular character. The traits for the character may be dominant or recessive.

The above monohybrid cross explains the Law of Dominance and Law of segregation.

Law of Independent Assortment is explained by a dihybrid cross which involves two characters.



Dihybrid Cross

Here in the dihybrid cross,seed shape and seed colour (yellow versus green)of two parent plants are considered.The F1 generation of offspring have Round and Yellow seeds.So, the wrinkled and green traits are not expressed as they are recessive.The F1 offspring is self crossed and the gametes formed are RY,rY,Ry,ry.Using the Punnett square,we get 16 combinations in the F2 generation.The phenotypic ratio is 9:3:3:1.Thus,we see the seed shape gets assorted independent of the seed colour.

How do these traits get expressed?

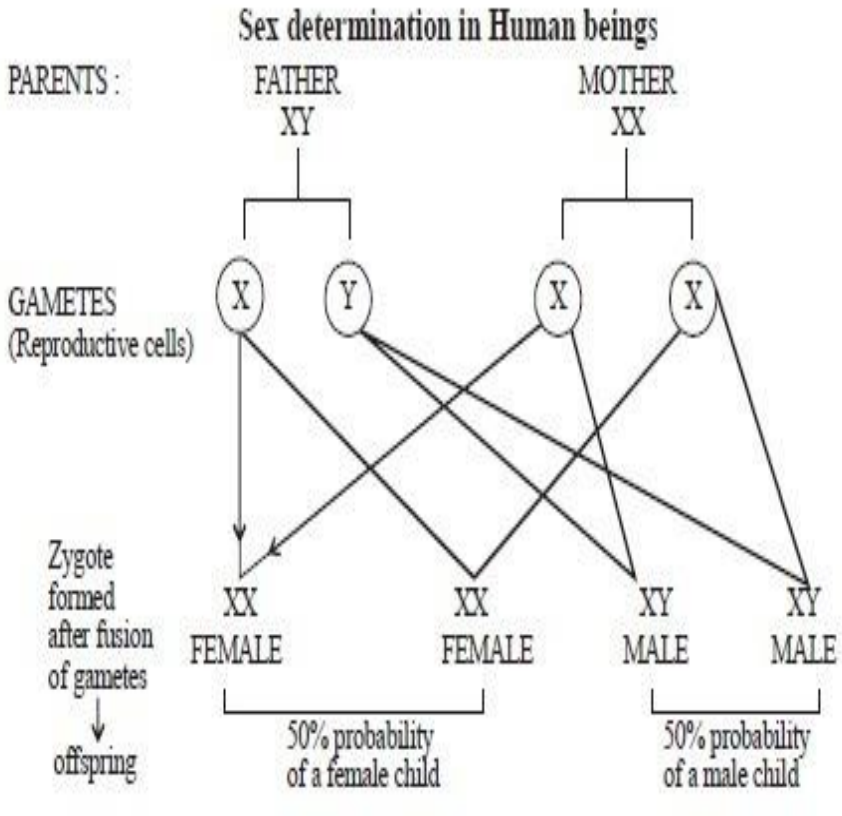
Genes control the expression of a trait or a character in an organism. They are composed of deoxyribonucleic acid or DNA which is responsible for the transmission of traits from the parent to the offsprings.The genes are present on chromosomes.Every species has a characteristic number of chromosomes. These chromosomes carry thousands of genes that pass on traits to following generations.

Both parents have an equal contribution to the genetic material of their offspring. For every trait, one set of chromosome comes from the mother, the other one comes from the father. So the gamete gets one chromosome from either of the parents. When two gametes combine, they will restore the normal number of chromosomes in the offspring, ensuring the stability of the DNA of the species.

Sex Determination

The temperature of the developing eggs decides whether the offspring will be male or female in turtles and crocodiles. In animals like snails, individuals can change sex, indicating that sex is not genetically determined. In humans, sex is determined only by chromosomes. We have 23 pairs or 46 chromosomes. The chromosomes which contribute in sex determination are

called sex chromosomes. In females it is XX and in males it is XY. The males produce two types of gametes while the females produce single type of gametes. If X type sperm fertilizes the egg cell(X), the sex of the baby will be female. If Y type sperm fuses with the egg cell, the baby is a male. Thus, the sex of the children will be determined by what they inherit from their father.



Level 1 Questions

1. Differentiate between dominant and recessive traits.

ANSWER. A dominant trait expresses itself in F1generation but a recessive trait is not expressed in F1generation.

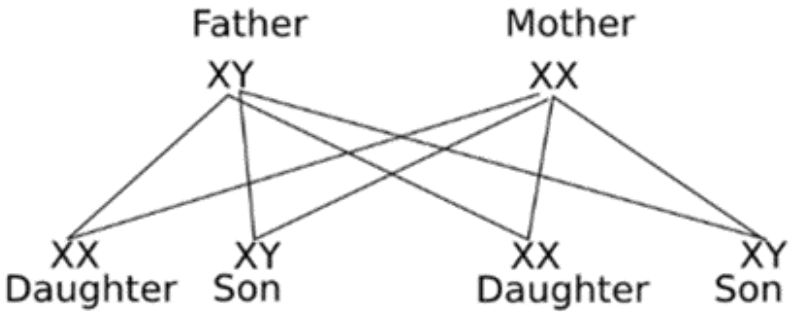
2. Who is known as father of genetics?

ANSWER. Gregor John Mendel

3. Differentiate between phenotype and genotype?

ANSWER. The observable character of an organism is its phenotype and the genetic makeup of an organism is its genotype.

4. With the help of a flow chart explain in brief how the sex of a newborn is genetically determined in human beings. Which of the two parents, the mother or the father, is responsible for determination of sex of a child?



ANSWER. In females it is XX and in males it is XY chromosomes.The males produce two types of gametes while the females produce single type of gametes. If X type sperm fertilizes the egg cell(X), the sex of the baby will be female. If Y type sperm fuses with the egg cell, the baby is a male. Thus, the sex of the children will be determined by what they inherit from their father.

5. Name the Mendel's laws of inheritance.

ANSWER. Law of Dominance, Law of segregation, **L**aw of Independent Assortment

6. Write the scientific name and the number of chromosomes present in man and garden pea?

ANSWER. *Homo sapiens* - 46 chromosomes , *Pisum sativum* - 14 chromosomes

7. What are inherited traits? Give an example.

ANSWER. Inherited traits are traits which are passed on from the parents to their progeny by transfer of genes. For example, Eye colour

8. Why did Mendel choose pea plant for his experiments?

ANSWER. It was easy to grow, had a short life span, showed contrasting visible characters and was self pollinating.

9. What are genes and where are they located?

ANSWER. Genes are composed of DNA which is responsible for the transmission of traits from the parent to the offsprings .The genes are located on chromosomes.

10.Complete the table.

Character	Dominant trait	Recessive trait
Seed shape		
height		
Seed colour		

Level 2 Questions

11. How do Mendel's experiments show that traits are inherited independently?

ANSWER. Mendel used two traits in his experiment, namely seed shape and seed colour. A dihybrid cross between two seeds with dominant (RRYY) and non-dominant (rryy) characteristics produced four different types of gametes (RY, Ry, rY and ry). The seed colour is inherited independently of the seed shape. Thus round green seeds, as well as yellow wrinkled seeds both were formed along with round yellow seeds and green wrinkled seeds. This indicates that each gamete segregates independently of the others.

12. What are monohybrid and dihybrid cross? Give one example of each.

ANSWER. A monohybrid is a cross between parents that differ in a single character and a dihybrid cross involves two characters. An example of a monohybrid cross is the cross between tall pea plants and dwarf pea plants. An example of a dihybrid cross is the cross between pea plants with yellow round and green wrinkled seeds.

13. Genes controls traits. Explain this statement with an example.

ANSWER. Plant height depends on the amount of a particular plant hormone made by a particular enzyme. If this enzyme works efficiently, a lot of hormone will be made, and the plant will be tall. If the gene for that enzyme has an alteration that makes the enzyme less efficient, the amount of hormone will be less, and the plant will be short. Thus, genes control characteristics, or traits.

14 .Different species use different strategies to determine sex of a newborn individual. It can be environmental cues or genetically determined.' Explain the statement by giving example for each strategy.

ANSWER. The temperature of the developing eggs decides whether the offspring will be male or female in turtles and crocodiles. In animals like snails, individuals can change sex, indicating that sex is not genetically determined. In humans, sex is determined only by chromosomes. The chromosomes which contribute in sex determination are called sex chromosomes. In females it is XX and in males it is XY .The males produce two types of gametes while the females produce single type of gametes. If X type sperm fertilizes the egg cell(X), the sex of the baby will be female. If Y type sperm fuses with the egg cell, the baby is a male.

15. If we cross pure-bred tall (dominant) pea plant with pure-bred dwarf (recessive) pea plant we will get pea plants of F_1 generation. If we now self-cross the pea plant of F_2 generation, then we obtain pea plants of F_2 generation.
(a) What do the plants of F_1 generation look like?
(b) State the ratio of tall plants to dwarf plants in F_2 generation.
(c) State the type of plants not found in F_1 generation but appeared in F_2 generation, mentioning the reason for the same.

ANSWER. (a) All plants of F_1 generation will be tall plants.
(b) 3:1
(c) Dwarf trait is recessive trait which was not expressed in the F_1 generation; the recessive trait gets expressed in the F_2 generation after self pollination.

Level 3 Questions

16. The genotype of Red tomato plants is denoted as RR and that of green tomato plant as Rr. When these two are crossed:
(i)What colour of fruit would you expect in their F1 progeny?
(ii)Give the percentage of green tomato plant if F1 plants are self-pollinated.
(iii) In what ratio would you find the genotype RR and Rr in the F2 progeny?
ANSWER. (i) Red (as R denotes dominant gene and is expressed in all plants of F1 generation).
(ii) 25% in F1 generation

(iii) RR-25%

Rr- plants 50%

so ratio is 1:2 in F2 progeny.

17.What is the essential feature of F1 generation?

The hybrids in F1 generation showed the phenotype of only one parent though they had the genotype of both the parents. There was no mixing of traits.

18. Write the characteristics of the offspring in the following crosses.

Cross	Offspring
RRYY x rryy	
RrYy x RrYy	
rryy x rryy	

19. How do the two factors for a character, present in diploid cells, behave at the time of gamete formation?

ANSWER. According to Mendel's law of segregation, the two factors segregate during the gamete formation and each gamete gets one factor for a character.

20. What is the genetic material and write its importance.

ANSWER. DNA is the genetic material which contains all the information of an organism. This information is inherited by the offsprings.

21. What will be sex of the baby if an egg is fertilized by the sperm having :

(i) 22+ X

(ii) 22+Y

22. Find the combination of characters in F2 generation if the F1 hybrid is self pollinated.

P RRYY x rryy

F_1 RrYy

Self pollination RrYy x RrYy

What are their ratios?

ANSWER. RrYy x RrYy F_1 plants self pollination

Male gametes RY Ry rY ry x RY Ry rY ry female gametes

So in F_2 generation, the following combinations occur.

Gametes	RY	Ry	rY	ry
RY	RRYY	RRYy	RrYY	RrYy
Ry	RRYy	RRyy	RrYy	Rryy
rY	RrYY	RrYy	rrYY	rrYy
ry	RrYy	Rryy	rrYy	rryy

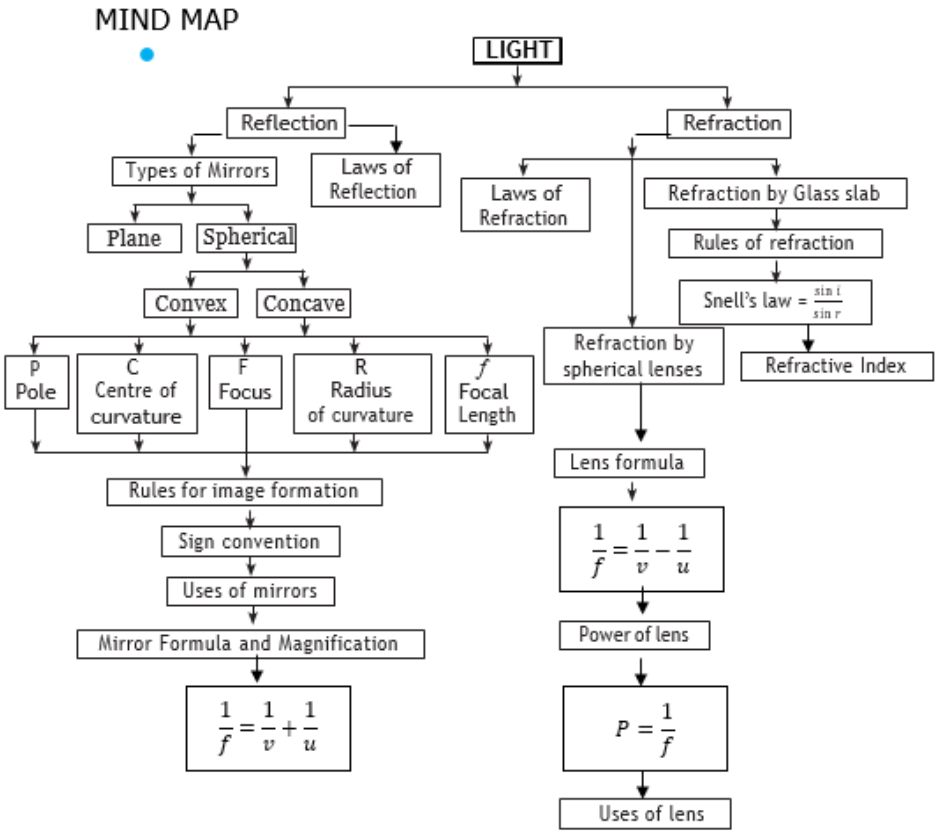
Penotypic ratio –9 Round Yellow:3round green:3wrinkled yellow:1wrinkled green

Genotypic ratio–1RRYY:2RRYy :2RrYY:4RrYy:1RRyy:2Rryy:1rrYY:2rrYy:1Rryy

CHAPTER - 10

LIGHT – REFLECTION AND REFRACTION

MIND MAP

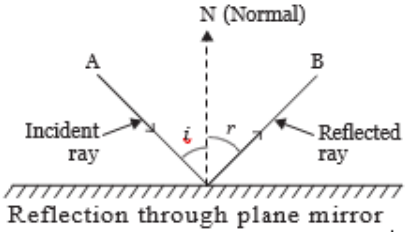


Reflection of Light: Image Formed by Spherical and Plane Mirrors

Light or **visible light** is electromagnetic radiation within the portion of the electromagnetic spectrum that is perceived by the human eye.

Ray of light: A ray of light is a hypothetical phenomena which is used to demonstrate the rectilinear propagation of light.

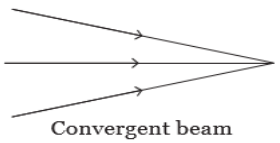
Beam of light: Collection of light rays is called beam of light.
Light has dual nature, i.e. particles as well as wave like nature.

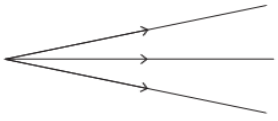


Reflection through plane mirror

Laws of Reflection:
(*i*) The angle of incidence is equal to angle of reflection.
(*ii*) The incident ray, the reflected ray, the normal to the mirror at the point of incidence all lie in the same plane.

Convergent beam: When then rays actually meet or appear to meet at a point, it is called convergent beam.


Convergent beam


Divergent beam

Divergent Beam: When rays actually diverge or appear todiverge from a point, it is called divergent beam.

Reflection: When light falls on a reflecting surface and comeback in the same medium of incident ray, it is called reflection.

Incident Ray: The ray which falls on the reflecting surface.

Reflected Ray: The ray which gets reflected back in the samemedium as the medium of incident ray.

Normal: A perpendicular drawn at the point where incident rayand reflected ray meet.

Angle of Incidence (***i***): The angle between incident ray andnormal is called angle of incidence.

Angle of Reflection (***r***): The angle between reflected ray andnormal is called angle of reflection.

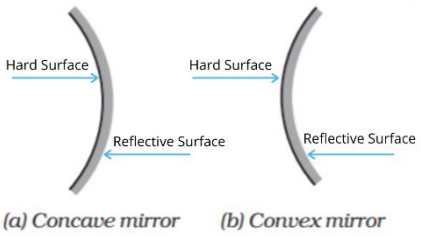
Real Image: (*i*) It is formed when light rays after reflection or refraction actually meet orintersect with each other.

(ii) It can be obtained on the screen.
(iii) It is always inverted and its size depends upon the position of object.
(iv) It is formed by both convex lens and concave mirror.

Virtual Image: When light rays appear to meet or intersect after reflection or refraction,they appear to meet when they are produced in the backward direction.

(i) It cannot be obtained on the screen.
(ii) It is always erect.
(iii) The size of image depends upon the nature of mirror or lens.
(iv) It can be formed by both concave and convex lenses and convex mirrors as well as by plane mirrors.

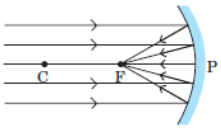
- Aperture: The width of reflecting surface from which reflection takes place is called aperture.



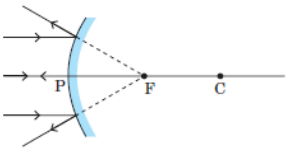
(a) Concave mirror (b) Convex mirror

Pole (P): It is the mid-point of the reflecting surface.

Centre of Curvature (C): The centre of that sphere whose spherical mirror is a part.



Focal Length of Concave Mirror



Focal Length of Convex Mirror

Radius of Curvature: It is radius of that sphere whose spherical mirror is a part. It isthe distance between pole (P) and centre of curvature (C) of the mirror. It is twice the focallength, i.e. PC = R, PC = *2f*, where '*f* ' is focal length.

Principal Axis: The straight line joining the pole and focus is called principal axis.

Focus: The point at which parallel beam meet or appear to meet after reflection is called focus.

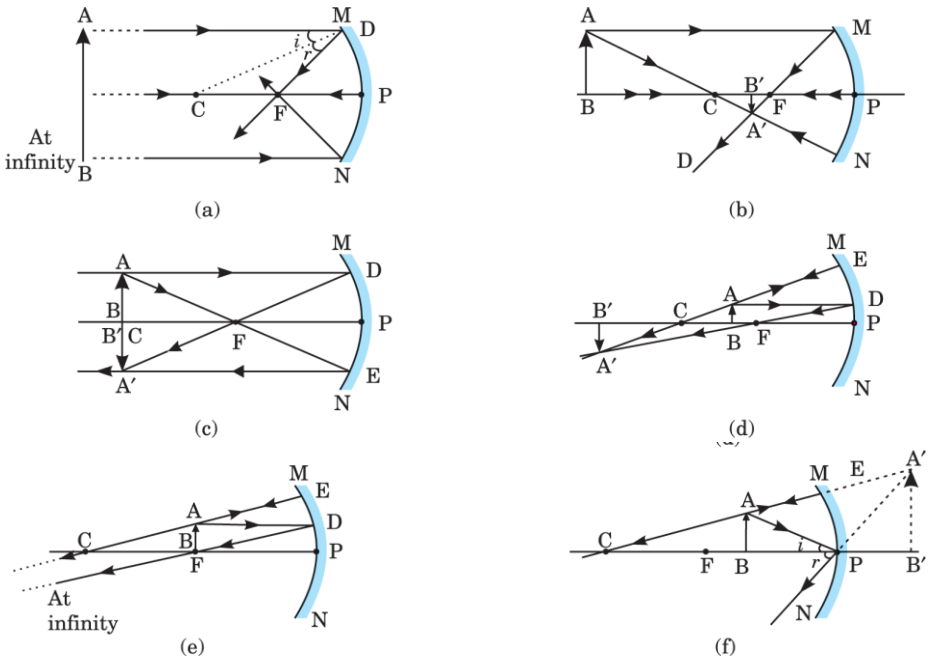
Focal Length(f): It is the distance between pole and focus.

New Cartesian Sign Conventions for spherical mirrors :

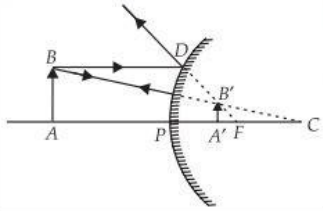
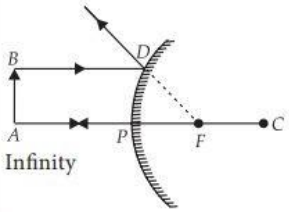
(i) The object is placed to the left of the mirror.
(ii) All distances are measured from pole of the mirror.
(iii) All distances measured in the same direction of incident ray are taken as positive and distances measured opposite to the incident ray are taken as negative.
(iv) All heights measured above the principal axis are taken positive, while all heights measured after reflection below the principal axis are taken as negative.

- If incident ray passes through 'C', it retraces the same path.
- If magnification is less than 1, size is diminished and if greater than 1, size is enlarged. Ifit is equal to 1, size of image is equal to the size of object.
- '*f* ' is taken as positive for convex mirror and negative for concave mirror.
- Image formation by a concave mirror for different positions ofthe object:

Position of Object	Position of Image	Size of Image	Nature of Image
1. At infinity (distant object)	At the focus	Highly diminished, point sized	Real and inverted
2. Beyond C	Between C and F	Smaller in size	Real and inverted
3. At C	At C	Equal size	Real and inverted
4. Between C and F	Beyond C	Enlarged	Real and inverted
5. At F	At infinity	Highly enlarged	Real and inverted
6. Between P and F	Behind the mirror	Enlarged	Virtual and erect



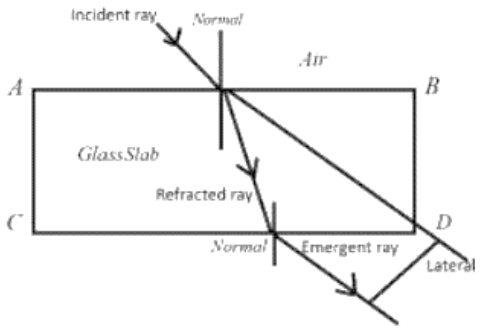
- Image formation by a convex mirror

Convex mirror				
Ray diagram		Object position	Image position	Nature of image
(a)		Between infinity and the pole	Behind the mirror between the focus and the pole	Virtual, smaller and erect
(b)		At infinity	Behind the mirror at the focus *F*	Virtual, point-sized and erect

- Uses of Concave mirror – torch, search lights, shaving mirror, dentist
- Uses of Convex mirror – real view mirror in vehicle, in sunglasses.

Refraction through a Rectangular Glass Slab:

- When light ray enters into a glass slab, then the emergent ray is parallel to the incident ray.
- This perpendicular distance between the emergent ray and incident ray when the light passes outof a glass slab is called **lateral displacement**.



- i = angle of incidence, r = angle of refraction and e = angle of emergenceAngle of incidence = Angle of emergence,

i.e. ∠i = ∠e

Refraction of Light

Refraction: The bending of light when it passes from an optically rarer medium to denser medium or vice-versa.

Causes of Refraction: Refraction is due to different speeds of light in different medium.

Laws of Refraction:
The following are the laws of refraction of light.
(i) The incident ray, the refracted ray and the normal to the interface of two transparent media at the point of incidence, all lie in the same plane.

(ii) The ratio of sine of angle of incidence to the sine of angle of refraction is a constant, for the light of a given colour and for the given pair of media. This law is also known as Snell's law of refraction. (This is true for angle $0° < i < 90°$).

If i is the angle of incidence and r is the angle of refraction, then,

$$\frac{\sin i}{\sin r} = constant$$

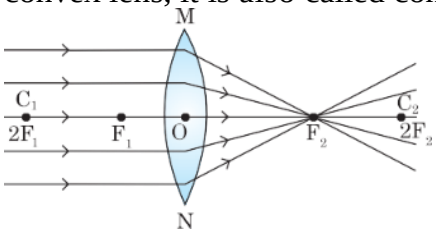
This constant value is called the refractive index of the second medium with respect to the first.

- The greater the refractive index, more the light will bend and slower will be the speed of lightin that medium. Refractive index of air is l. The refractive index of any other medium will begreater than l and cannot be smaller than l.
- The ability of a medium to refract light is also expressed in terms of optical density.
- The one which has a higher refractive index is called optically denser medium whereas themedium with lower refractive index is called optically rarer medium.
- The speed of light is more in rarer medium than denser medium.
- Speed of light slows down when it enters a denser medium from a rarer medium, therefore itbends towards the normal. When it travels from denser to rarer medium its speed increases,therefore, it bends away from the normal.

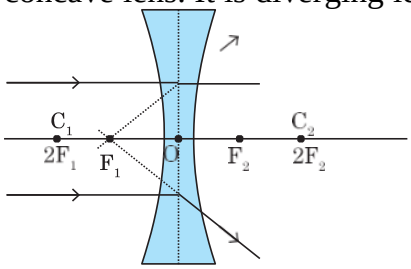
Refraction by spherical lenses:

Lens: A transparent material bound by two transparent surfaces of which atleast one surfaceis spherical is called lens.

Double convex lens: If both the spherical surfaces are bulging outwards, it is called double convex lens, it is also called converging lens.



Double concave lens: If both the spherical surfaces are curved inward, it is called double concave lens. It is diverging lens.



Centre of Curvature: The centre of that sphere whose lens forms a part is called centre of curvature of lens. It is denoted by 'C'. There are two centre of curvatures in a lens representedby C_1 and C_2 ($2F_1$, $2F_2$).

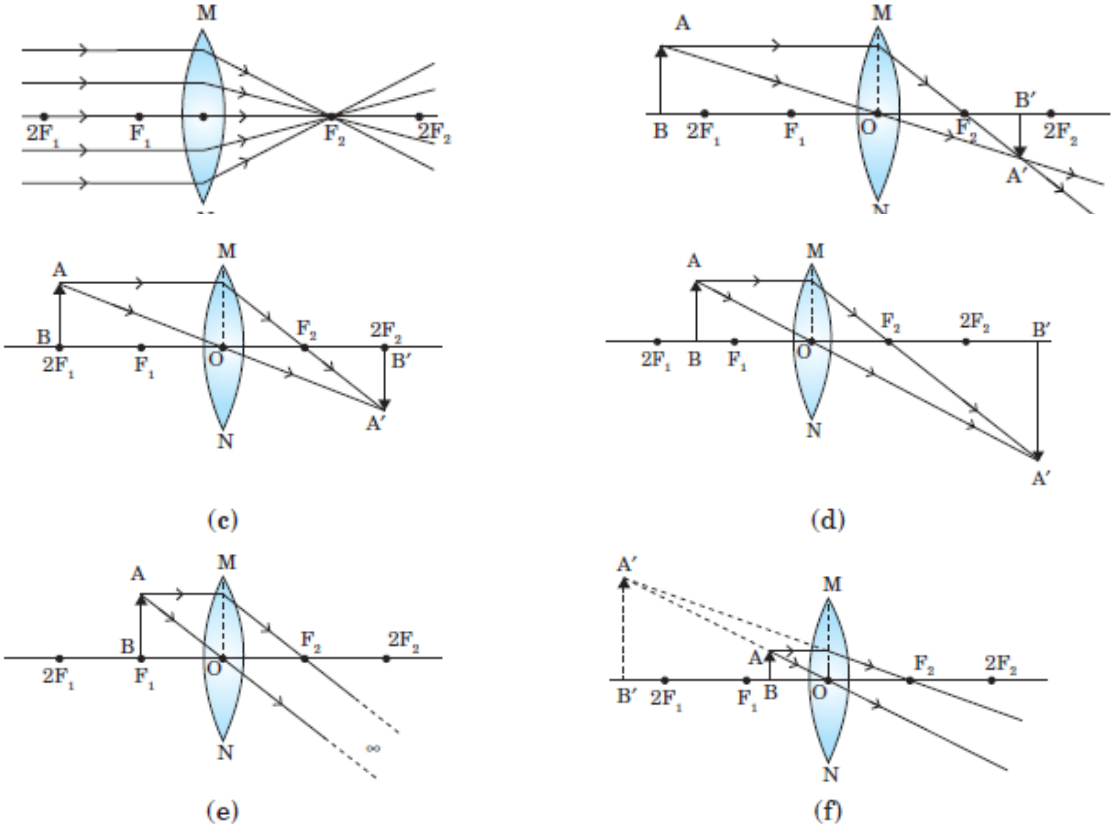
Principal axis: It is an imaginary line passing through C_1 and C_2.

Optical Centre: The central point of a lens is called optical centre 'O'. A ray passing through 'O' passes without suffering any deviation.

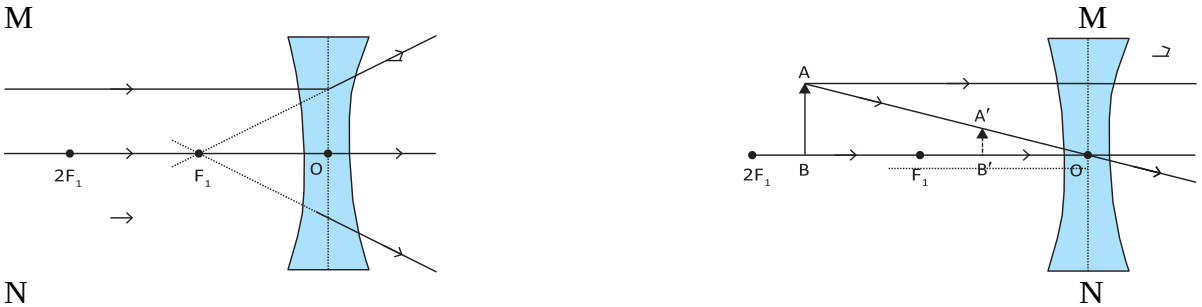
Aperture: The effective diameter of the circular outline of the spherical lens is called aperture.

- Parallel rays to the principal axis after refraction through a lens passes through the focus.
- In case of concave lens, parallel rays after refraction diverge and appears to meet at the focus.
- There is another principal focus on the other side of the lens where parallel rays meet after refraction. The two principal focus are called F_1 and F_2.
- The distance between optical centre and principal focus is called focal length.

Nature and position of images formed by convex lens:



Nature, position and relative size of the image formed by a concave lens:



(a) (b)

New Cartesian Sign conventions in spherical lenses:

(i) All distances are measured from optical centre.

(ii) The distances measured in the same direction of incident ray are taken positive and all distances measured opposite to incident ray are taken negative.

(iii) All the heights measured above the principal axis are taken positive and below the principal axis are taken negative.

Lens formula:

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\text{Magnification} = \frac{h'}{h} = \frac{\text{height of image}}{\text{height of object}} = \frac{v}{u} = \frac{\text{distance of image from O}}{\text{distance of object from O}}$$

Power of lens:

The degree of convergence or divergence of light rays is expressed in terms of power of lens. It is defined as reciprocal of focal length.

$$P = \frac{1}{f}$$

(i) When focal length is measured in metres the SI unit of power of the lens is dioptre, ($1D = 1\ m^{-1}$).

(ii) Power of lens is positive for convex lens and negative for concave lens.

- Uses of Convex lens - magnifying glass, microscopes.
- Uses of Concave lens – used in camera, flash lights.

SOLVED QUESTIONS :-

1. Focal length of a plane mirror is

(a) zero **(*b*) infinite**

(*c*) 25 cm (*d*) -25

2. When an object is kept within the focus of a concave mirror, an enlarged image is formed behind the mirror. This image is:

(a) real (*b*) inverted

(*c*) virtual and inverted **(*d*) virtual and erect**

3. Refractive index of diamond with respect to glass is 1.6. If the absolute refractive index of glass is 1.5, then the absolute refractive index of diamond is

(a) 1.4 **(b) 2.4** (c) 3.4 (d) 4.4

4. A spherical mirror and a thin spherical lens have each a focal length of -15cm. The mirror and the lens are likely to be

(a) both concave (b) both convex

(c) mirror is concave and lens is convex (d) mirror is convex and lens is concave

(Reason: For a concave lens the primary focus is on the same size as the object and its negative. In the case of a concave mirror the focus is infront of the mirror and its negative. Therefore, the mirror and lens are likely to be concave.)

5. Assertion-Reason Type Questions

For the given question, two statements are given-one labelled as Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (*a*), (*b*), (*c*) and (*d*) as given below:

(a) Both 'A' and 'R' are true and 'R' is correct explanation of the assertion.
(b) Both 'A' and 'R' are true but 'R' is not correct explanation of the assertion.
(c) 'A' is true but 'R' is false.
(d) 'A' is false but 'R' is true.

1. **Assertion:** Light travels faster in glass than in air.
Reason: Glass is denser than air.

6. A ray of light travelling in air enters obliquely into water. Does the light ray bend towards the normal or away from the normal? Why?
Ans: It bends towards the normal. This is because it is travelling from an optically rarer into an optically denser medium.

7. If the magnification of a body of size 1m is2, what is the size of the image?
Ans: Given m=2, O=1m, I=?
Using m=I/O,
I=m x O
=2 x 1 = 2m

8. A concave mirror produces three times magnified real image of an object placed at 10cm infront of it. Where is the image located?
Ans: Given m=-3, (since image is real), u=-10cm, v=?
Using the mirror formula m=-v/u,
v=-mu = -(-3x-10)=-30cm
Therefore, the image is formed 30cm in front of the mirror.

9. Give two uses of the following
(a) Concave mirror
(b) Convex lens
Ans: (a) Concave mirror used by dentist and shaving mirror. (b) Convex lens used in the correction of hypermetropia and used in magnifying glass.

10. How will you distinguish between a convex and a concave lens without touching them?
Ans: We will keep the lens close to some page of a book and see the print of the book through it. If the letters of the book appear enlarged, it is a convex lens and if they appear diminished, it is concave lens.

11.A concave mirror produces three times magnified (enlarged) real image of object placed at 10 cm in front of it. Where is the image located?
Ans: Magnification produced by a spherical mirror is given by the relation,

$$m = \frac{\text{Height of the image}}{\text{Height of the object}} = -\frac{\text{Image distance}}{\text{Object distance}}$$

$$m = \frac{h_1}{h_o} = -\frac{v}{u}$$

Let the height of the object, $h_o = h$
Then, height of the image, $h_I = -3h$ (Image formed is real)

$$\frac{-3h}{h} = \frac{-v}{u}$$

$$\frac{v}{u} = 3$$

Object distance, $u = -10$ cm
$v = 3 \times (-10) = -30$ cm
Here, the negative sign indicates that an inverted image is formed at a distance of 30 cm in front of the given concave mirror.

12. A ray of light travelling in air enters obliquely into water. Does the light ray bend towards the normal or away from the normal? Why?
Ans. The light ray bends towards the normal.
When a ray of light travels from an optically rarer medium to an optically denser medium, it gets bent towards the normal. Since water is optically denser than air, a ray of light travelling from air into the water will bend towards the normal.

13. The radius of curvature of a spherical mirror is 20 cm. What is its focal length?
Ans. Radius of curvature, $R = 20$ cm
Radius of curvature of a spherical mirror = 2 × Focal length (f)
$R = 2f$

$$f = \frac{R}{2} = \frac{20}{2} = 10 \text{ cm}$$

Hence, the focal length of the given spherical mirror is 10 cm.

14. Why do we prefer a convex mirror as a rear-view mirror in vehicles?
Ans. Convex mirrors give a virtual, erect, and diminished image of the objects placed in front of them. They are preferred as a rear-view mirror in vehicles because they give a wider field of view, which allows the driver to see most of the traffic behind him.

15. Light enters from air to glass having refractive index 1.50. What is the speed of light in the glass? The speed of light in vacuum is 3×10^8 m s^{-1}.
Ans. Refractive index of a medium n_m is given by,

$$n_m = \frac{\text{Speed of light in vacuum}}{\text{Speed of light in the medium}} = \frac{c}{v}$$

Speed of light in vacuum, $c = 3 \times 10^8$ m s^{-1}
Refractive index of glass, $n_g = 1.50$
Speed of light in the glass,

$$v = \frac{c}{n_g} = \frac{3 \times 10^8}{1.50} = 2 \times 10^8 \text{ m s}^{-1}$$

16. The refractive index of diamond is 2.42. What is the meaning of this statement?

Ans. Refractive index of a medium n_m is related to the speed of light in that medium v by the relation:

$$n_m = \frac{\text{Speed of light in air}}{\text{Speed of light in the medium}} = \frac{c}{v}$$

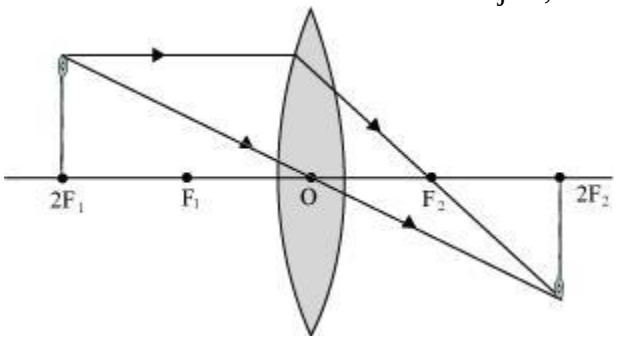
Where, c is the speed of light in vacuum/air
The refractive index of diamond is 2.42. This suggests that the speed of light in diamond will reduce by a factor 2.42 compared to its speed in air.

17. Define 1 dioptre of power of a lens.
Ans. Power of lens is defined as the reciprocal of its focal length. If P is the power of a lens of focal length F in metres, then

$$P = \frac{1}{f(\text{in metres})}$$

The S.I. unit of power of a lens is Dioptre. It is denoted by D.
1 dioptre is defined as the power of a lens of focal length 1 metre.
$\therefore 1\ D = 1\ m^{-1}$

18. A convex lens forms a real and inverted image of a needle at a distance of 50 cm from it. Where is the needle placed in front of the convex lens if the image is equal to the size of the object? Also, find the power of the lens.
Ans. When an object is placed at the centre of curvature, $2F_1$, of a convex lens, its image is formed at the centre of curvature, $2F_2$, on the other side of the lens. The image formed is inverted and of the same size as the object, as shown in the given figure.



It is given that the image of the needle is formed at a distance of 50 cm from the convex lens. Hence, the needle is placed in front of the lens at a distance of
50 cm.
Object distance, $u = -50$ cm
Image distance, $v = 50$ cm
Focal length = f
According to the lens formula,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{f} = \frac{1}{50} - \frac{1}{(-50)} = \frac{1}{50} + \frac{1}{50} = \frac{1}{25}$$

$$f = 25\,\text{cm} = 0.25\ \text{m}$$

$$\text{Power of the lens, } P = \frac{1}{f(\text{in meters})} = \frac{1}{0.25} = +4\ \text{D}$$

Hence, the power of the given lens is +4 D.

19. Name the type of mirror used in the following situations.
(a) Headlights of a car
(b) Side/rear-view mirror of a vehicle
(c) Solar furnace
Support your answer with reason.
Ans. (a) Concave mirror is used in the headlights of a car. This is because concave mirrors can produce powerful parallel beam of light when the light source is placed at their principal focus.
(b) Convex mirror is used in side/rear view mirror of a vehicle. Convex mirrors give a virtual, erect, and diminished image of the objects placed in front of it. Because of this, they have a wide field of view. It enables the driver to see most of the traffic behind him/her.
(c) Concave mirrors are convergent mirrors. That is why they are used to construct solar furnaces. Concave mirrors converge the light incident on them at a single point known as principal focus. Hence, they can be used to produce a large amount of heat at that point.

QUESTION BANK (L2)
MCQ

1 If the angle of incidence is 25^o .What will be the angle between the incident ray and reflected ray?
(a)50^0
(b)130^0
(c)25^0
(d)65^0

2 When Light travels from one medium to another it suffers
(a) reflection
(b) **refraction**
(c)dispersion
(d)none of these

3. The the power of a lens having the focal length of 1 cm is
(a) 10D
(b)1D
(c) ⅒D
(d)100D

4 The image of an object placed in front of a convex mirror is formed at
(a) the object itself
(b) twice the distance of the object in front of the mirror
(c) half the distance of the object in front of the mirror
(d) behind the mirror

5. An incident ray strikes a plane mirror at an angle of 25^o with the mirror .The angle between the incident ray and reflected ray is
(a)50^0
(b)130^0
(c) 25^0
(d)65^0

6. A pond look shallower than it really is when seeing by a person standing outside near it because of the of light
a) reflection

(b) refraction
(c)dispersion
(d)none of these
7 The focal length of lens is 0.1 m.Then the lens must be
(a)Concave
(b)Convex
(c) Cylindrical
(d)None of these

8 A full length of image of a distant tall building can definitely be seen using:
(a) a concave mirror
(b) a convex mirror
(c) a plane mirror
(d) both concave as well as plane mirror

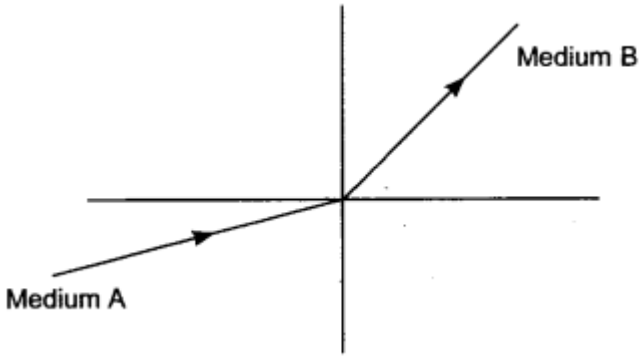
9 An object at a distance of + 15 cm is slowly moved towards the pole of a convex mirror. The image will get
(a) shortened and real
(b) enlarged and real
(c) enlarge and virtual
(d) diminished and virtual

10 A concave mirror of radius 30 cm is placed in water. It's focal length in air and water differ by
(a) 15
(b) 20
(c) 30
(d) 0

11 If a man's face is 25 cm in front of concave shaving mirror producing erect image 1.5 times the size of face, focal length of the mirror would be
(a) 75 cm
(b) 25 cm
(c)15 cm
(d)60cm

12 When object moves closer to a concave lens the image by it shift
(a) away from the lens on the same side of object
(b) toward the lens
(c) away from the lens on the other side of lens
(d) first towards and then away from the lens

13 A light ray enters from medium A to medium B as shown in figure. The refractive index of medium B relative to A will be



(a) greater than unity
(b) less than unity
(c) equal to unity
(d) zero

14 Which of the following statements is/are true?
(a) A convex lens has 4 dioptre power having a focal length 0.25 m
(b) A convex lens has -4 dioptre power having a focal length 0.25 m
(c) A concave lens has 4 dioptre power having a focal length 0.25 m
(d) A concave lens has – 4 dioptre having a focal 0.25 m

15 A student studies that the speed of light in air is 300000 kms/ sec where that of speed in a glass slab is about 197000 kms/ sec. What causes the difference in speed of light in these two media?
(a) difference in density
(b) difference in temperature
(c) difference in amount of light
(d) difference in direction of wind flo

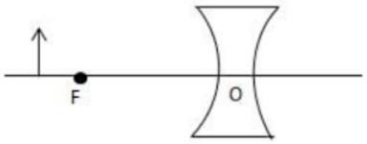
Question and Answers

1 How do you quickly approximate the focal length of a concave mirror?
Ans. Hold the concave mirror facing some distant object like a building or tree. Hold a cardboard screen in front of the mirror .Adjust the position of the screen so that a sharp image of a distant object is formed on the screen .The distance of the screen from the mirror gives us the approximate focal length of the concave mirror.

2. A coin in a glass beaker appears to rise as the beaker is slowly filled with water .Why?
Ans. It happens on account of refraction of light. A Ray of light starting from the coin goes from water to air and bends away from normal. Therefore the bottom of the beaker on which the coin lies appears to be raised.

3. When is magnification positive or negative?
Ans. When the image formed is virtual and erect ,magnification is positive .And when the image formed is real and inverted ,magnification is negative.
4 In the case of a spherical mirror,do both the sides act as reflecting surfaces?
Ans. No, only one side of the mirror act as a reflecting surface and the other side is opaque.

5 Draw the ray diagram of image formation in the following case? Write size ,position and nature of the image formed?
Ans.



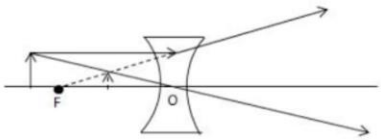


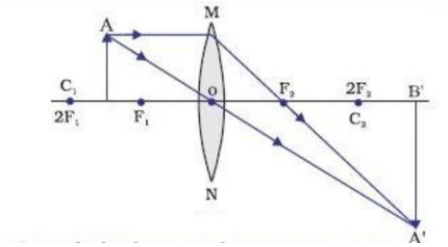
Image is virtual, erect and diminished.

6. A convex lens of focal length 50 cm and a concave lens of focal length 20 cm are placed in closed contact with each other .Calculate the lens power of the combination.
Ans.
Power of convex lens $P_1=1/f_1=1/0.5 =2D$
power of concave lens $P_2 =1/f_2 =1/-(0.2)=-5D$
Power of combination $P = P_1 + P_2$
$= 2D-5D$
$=-3D$

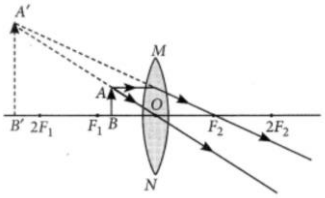
7. A man standing in front of a special mirror finds his image having a small face, big tummy and legs of normal size. What are the shapes of three parts of the mirror?
Ans. The upper part of the mirror showing a smaller face must be convex. The middle part of the mirror showing a big tummy must be concave and the lower part of the mirror showing normal legs must be plane.

8. A water tank is 6 m deep. How deep does it appear when seen normally?
Ans. As refractive index=4/3
4/3 = real depth(x)/apparent depth(y)
y=3x/4
y =(3 x 6)/4
y= 4.5 m
The water tank appears to be 4.5 m deep only.

9. In which of the following cases linear magnification is positive?
a)



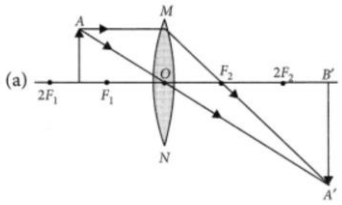
b)



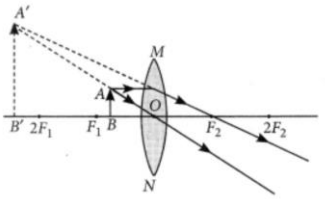
Ans. Linear magnifications positive in case (b) as the image is virtual and erect.

10. One reads a newspaper due to the light reflected from it .Why then do we not see even faint images of ourselves in the newspaper?
Ans. The newspaper causes scattering of light which is an irregular and diffused sort of reflection .From each point light goes in all directions .The image is seen only when there is a regular reflection of light.

11. Draw ray diagrams to show the formation of three times magnified (a) real and (b)virtual image of an object by a converging lens. Mark the positions of O, F and 2F in each diagram.
Ans. (a)



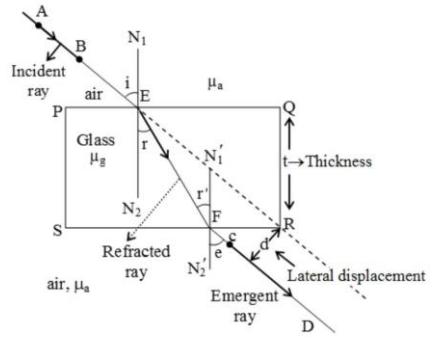
b)



1. Image formed is virtual and erect.
2. Images formed in front of the lens.
3. Image formed is enlarged.

12.A converging lens forms a real and inverted image of an object at a distance of 100 cm from it .Where should an object be placed in front of the lens so that the size of the image is twice the size of the object? Also calculate the power of the lens.
Ans v=100cm
m=v/u = -2
u=-v/2 =-100/2 =-50
1/f =1/v -1/u
1/f =1/100 - 1/(-50)
=3/100
f =100/3 cm =⅓ m
P=1/f =3D

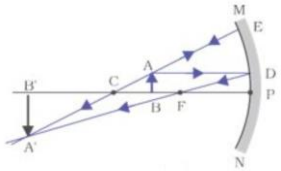
13. Draw a course of rays through a rectangular glass slab .Why is an emergent ray parallel to the incident ray? What is lateral displacement?
Ans



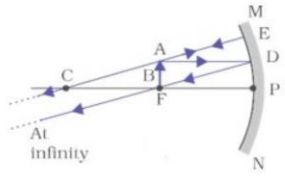
Emergent Ray is parallel to the incident ray because medium on either side of glass slab is same .In fact the bending produced on refraction at the air glass interface of the slab is equal and opposite to the bending produced on refraction at a glass air interface of the slab.
Lateral displacement in the sideways shift of the emergent ray from the direction of the original incident ray.

14. Define lens. What is the difference between convex and concave lens?
Answer:
Lens: A transparent medium bound by two surfaces, of which one or both surfaces are spherical, forms a lens:
Convex lens: A lens having two spherical surfaces, bulging outwards is called a double convex lens or convex lens.
It is thicker at the middle as compared to the edges.
Convex lens converge light.
Hence, convex lens are called converging lens.
Concave lens: A double concave lens is bounded by two spherical surfaces curved inwards.
It is thicker at edges than in the middle.
Concave lens is diverging in nature.

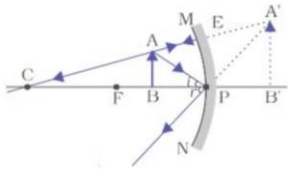
15. Draw any three ray diagram to show how the size and the nature of image of an object change when it moves from centre of curvature of concave mirror towards the pole of the mirror.
Ans
i) when the object is between C and F of a concave mirror the image is
a)real and inverted
b) larger in size than the object
c)situated beyond C



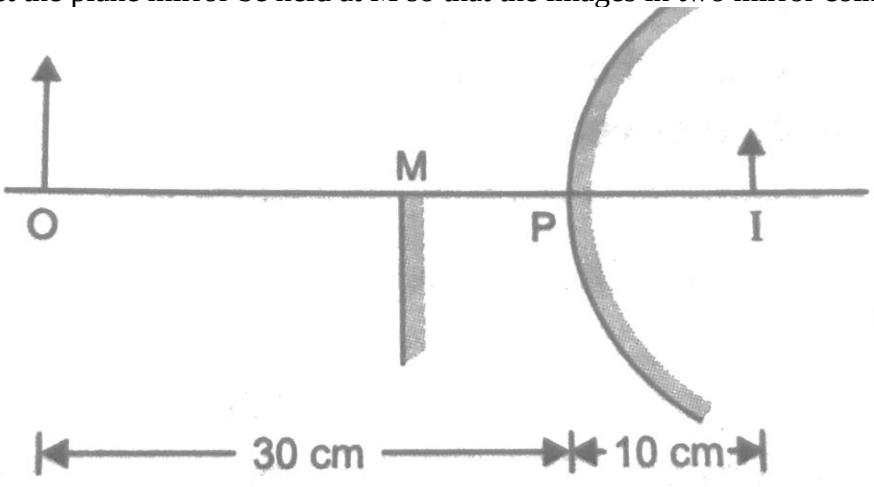
ii) When the object at the focus of concave mirror its image is
a)at infinity
b)real and inverted
c)highly enlarged or magnified.



iii) When the objectives between fnp of the concave mirror the image is
a)Virtual and erect
b)larger than the size of the object
c)behind the mirror



16. An object is held at 30 cm in front of a convex mirror of focal length 15cm. At what distance from the convex mirror should a plane mirror be held so that images in the two mirror coincide with each other
Ans
The mirror is a convex mirror
u = -30 cm
f = 15 cm
1/v +1/u =1/f
1/v =1/f -1/u
1/v =1/15 +1/30
=1/10
v =10cm
Let the plane mirror be held at M so that the images in two mirror coincide



MP=MI-PI
=½ OI-PI
=½ (30+10)-10
=10cm

17. An object is held at a distance of 20 cm from a concave lens of focal length 80 cm. What is the position and size of the image if the object is 2 cm high?
Ans u=-20cm,f=-80cm ,v=?
h_1 =2cm

h_2 =?
1/v-1/u =1/f
1/v=1/f+1/u
1/v =1/(-80) -1/20
=-5/80
v=-80/5
v= -16 cm
Thus the images at 16 cm from the lens on the same side as the object
h_2/h_1 =v/u
h_2 =v/u x h_1
=-16/-20 X2
=1.6 cm
The size of the image is 1.6 cm

18.Size of image of an object by mirror having a focal length 20 cm is observed to be reduced to 1/3rd of its size ?At what distance the object has be placed from the mirror? What is the nature of the image and the mirror?
Ans If the mirror is concave ,f=-20cm ,m=-⅓
m=-v/u
-⅓ =-v/u
v=u/3
As 1/v +1/u =1/f
3/u +1/u = - 1/20
u=- 80cm
Image would be real and inverted

If the mirror is convex,f=20cm,m=⅓
m=-v/u
⅓ =-v/u
v=-u/3
As 1/v +1/u =1/f
-3/u +1/u =1/20
u=-40 cm
Image would be virtual and erect

19. List four characteristics of the images formed by plane mirrors.
Answer: Characteristics of the image formed by a plane mirror are
(i) image distance is same as that of object distance
(ii) image formed is virtual and erect
(iii) image formed is of the same size as that of the object
(iv) image formed is laterally inverted (left appears right and right appears left).

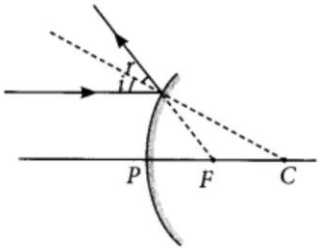
20.State the two laws of reflection of light.
Answer: Laws of reflection of light states that
(i) The angle of incidence is equal to the angle of reflection.
(ii) The incident ray, the reflected ray and the normal to the mirror at the point of incidence all lie in the same plane.

21. When an object is kept within the focus of a concave mirror, an enlarged image is formed behind the mirror. This image is
(a) real
(b) inverted
(c) virtual and inverted

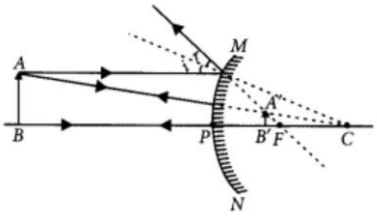
(d) virtual and erect
Answer:
(d) When an object is placed between the principal focus and pole of a concave mirror, an enlarged virtual and erect image is formed behind the mirror.

22. What is the magnification of the images formed by plane mirrors and why?
Answer: Magnification of images formed by plane mirrors is unity because for plane mirrors, the size of the image formed is equal to that of the object.

23. Draw a labelled ray diagram to show the path of the reflected ray corresponding to an incident ray of light parallel to the principal axis of a convex mirror. Mark the angle of incidence and angle of reflection on it.
Answer:



24. If the image formed by a spherical mirror for all positions of the object placed in front of it is always erect and diminished , what type of mirror is it? Draw a labelled ray diagram to support your answer. (2018)
Answer:



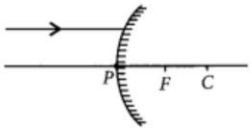
If the image formed by a spherical mirror is always erect and diminished then it is convex mirror.

25. An object is placed at a distance of 30 cm in front of a convex mirror of focal length 15 cm. Write four characteristics of the image formed by the mirror. (Delhi 2017)
Answer:
Four characteristics of the image formed by the given convex mirror are :
(i) Virtual
(ii) Erect
(iii) Diminished
(iv) Image is always formed behind the mirror between pole and focus.

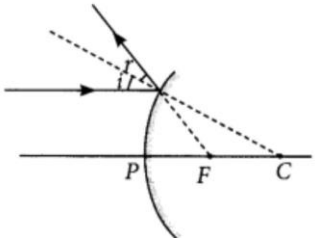
26..An object is placed at a distance of 12 cm in front of a concave mirror of radius of curvature 30 cm. List four characteristics of the image formed by the mirror.
Answer:
Radius of curvature (R) = 30 cm, object distance is 12 cm in front of the mirror. Thus we can say that object is placed between focus and pole. Four characteristics of the image formed by die given concave mirror when object is placed between pole and focus are:
(i) Virtual
(ii) Erect
(iii) Enlarged

(iv) Image is formed behind the mirror

27..A ray of light is incident on a convex mirror as shown. Redraw the diagram and complete the path of this ray after reflection from the mirror. Mark angle of incidence and angle of reflection on it.



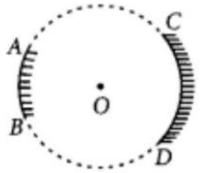
Answer:



28..Name the type of mirrors used in the design of solar furnaces. Explain how high temperature is achieved by this device.
Answer:
Concave mirrors are used in the designing of solar furnaces.
When a solar furnace is placed at the focus of a large concave mirror, it focuses a parallel beam of light on the furnace. Therefore, a high temperature is attained at the point after some time.

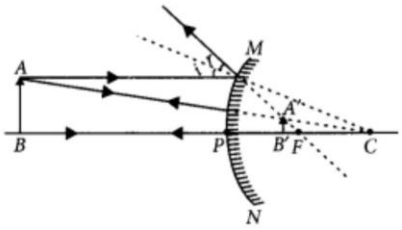
29.."The magnification produced by a spherical mirror is -3". List four informations you obtain from this statement about the mirror/ image.
Answer:
Negative sign of magnification indicates that the image is real and inverted. Since the image is real and inverted, the mirror is concave and magnification of -3 indicates that the image is magnified.

30.AB and CD, two spherical mirrors, from parts of a hollow spherical ball with its centre at O as shown in the diagram. If arc AB = 12 arc CD, what is the ratio of their focal lengths? State which of the two mirrors will always form virtual image of an object placed in front of it and why?

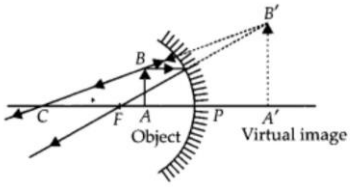


Answer:
Focal length of a mirror is given by
Focal length = Radius Curvature / 2
Since both the mirrors have same radius of curvature, therefore focal length of the two mirrors will be same, i.e.,
f1 / f2 = 1/1
Since virtual image is always formed by convex mirror. The mirror AB will always form virtual image.

31.List two properties of the images formed by convex mirrors. Draw ray diagram in support of your answer.
Answer:
Convex mirrors always form diminished, virtual and erect images.



32..The linear magnification produced by a spherical mirror is +3. Analyse this value and state the (i) type of mirror and (ii) position of the object with respect to the pole of the mirror. Draw a ray diagram to show the formation of the image in this case.
Answer:
Positive value of the magnification indicates that the image is virtual and erect.
(i) Since the image is magnified, the mirror is concave.
(ii) The object is between pole and focus of the mirror as shown



The image produced in the second case will be real and inverted.

33..A concave mirror has a focal length of 20 cm. At what distance from the mirror should a 4 cm tall object be placed so that it forms an image at a distance of 30 cm from the mirror? Also calculate the size of the image formed.
Answer:
Given f = -20 cm v = -30 cm u = ?

Using $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

$\frac{1}{u} = \frac{1}{f} - \frac{1}{v} = \frac{1}{-20} - \frac{1}{-30} = \frac{-3+2}{60}$

$\Rightarrow$ u = -60 cm

$\therefore$ Object placed at 60 cm from the mirror.

Also magnification, m = $\frac{h'}{h} = \frac{-v}{u}$

$\Rightarrow$ h' = $\frac{-(-30)}{-60} \times 4$ = -2 cm

$\therefore$ The size of the image is 2 cm.

34..The image of a candle flame placed at a distance of 30 cm from a mirror is formed on a screen placed in front of the mirror at a distance of 60 cm from its pole. What is the nature of the mirror? Find its focal length. If the height of the flame is 2.4 cm, find the height of its image. State whether the image formed is erect or inverted.
Given:
Object distance, u = – 30 cm, image size, h' = ?
Image distance, v = – 60 cm,
Object size ,h = 2.4 cm,
Focal length, f = ?
Using mirror formula

$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$ or $\frac{1}{f} = \frac{-1-2}{60} = \frac{-3}{60} =$

or f = − 20 cm

Hence, focal length is 20 cm

Also, magnification, m = $\frac{h'}{h} = \frac{-v}{u}$

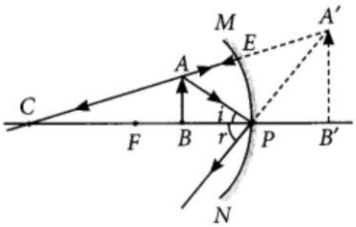
or, m = $\frac{(-60)}{(-30)}$ = -2 or $\frac{h'}{h}$ = -2

h′ = − 2 × 2.4 = − 4.8 cm

As the image formed is real, therefore the mirror is concave.
The height of the image is 4.8 cm.
The image formed is enlarged and inverted

35.List two possible ways in which a concave mirror can produce a magnified image of an object placed in front of it. State the difference if any between these two images.
Answer:
A concave mirror can produce a magnified image of an object when object is placed:
(1) In between its pole and its focus
(2) In between its focus and its centre of curvature.
Difference, between these two images:
The image produced in first case will be virtual and erect.
The image produced in second case will be real and inverted.

36.The image formed by a concave mirror is observed to be virtual, erect and larger than the object. Where should the position of the object be relative to the mirror? Draw ray diagram to justify your answer.
Answer:
The position of the object should be between P and F



37..Calculate the magnification of the image of an object placed perpendicular to the principal axis of a concave mirror of focal length 15 cm. The object is at a distance of 20 cm from the mirror.
Answer:
Given, focal length of concave mirror,
f = -15 cm
Object distance, u = -20 cm
Image distance, v = ?
Using mirror formula,

$$\frac{1}{f}=\frac{1}{v}+\frac{1}{u}$$

or $$\frac{1}{v}=\frac{1}{f}-\frac{1}{u}=\frac{1}{-15}-\frac{1}{-20}=\frac{-4+3}{60}$$

$$\frac{1}{v}=\frac{-1}{60} \quad \text{or} \quad v=-60 \text{ cm}$$

Using magnification formula,

$m = -\frac{v}{u} = -(\frac{-60}{-20})$ or m = -3

So, the magnification, m = -3.

38.(a) A security mirror used in a big showroom has radius of curvature 5 m. If a customer is standing at a distance of 20 m from the cash counter, find the position, nature and size of the image formed in the security mirror.
(b) Neha visited a dentist in his clinic. She observed that the dentist was holding an instrument fitted with a mirror. State the nature of this mirror and reason for its use in the instrument used by dentist.
Answer:
(a) Given radius of curvature of the mirror,
R = 5 m
∴ Focal length, f = R/2 = 2.5 m (convex mirror) and u = -20 m
From mirror formula,

From mirror formula,

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \text{ or } \frac{1}{v} = \frac{1}{f} - \frac{1}{u}$$

$$= \frac{1}{2.5} - \frac{1}{-20} = \frac{-20-2.5}{-20\times2.5}$$

v = 2.22 m
Thus, the image is formed 2.22 m behind the mirror. The image is diminished, virtual and erect.
(b) Concave mirrors are used by dentist. Dentist use it as it is a converging mirror and when used at close range forms a highly enlarged, virtual and erect image of the object.

39..An object is placed at a distance of 15 cm from a convex lens of focal length 20 cm. List four characteristics (nature, position, etc.) of the image formed by the lens.
Answer:
Given : Object distance, u = – 15 cm
Focal length, f = + 20 cm
Using lens formula, As |u| < |f|
The object is placed between F and optical centre of lens.
Thus, the four characteristics of the image formed by the convex lens are:
(i) Erect
(ii) Virtual
(iii) Enlarged image,
(iv) Image is formed on the same side of the lens as the object

40.What is meant by the power of a lens? What does its sign (+ve or -ve) indicate? State its S.I. unit related to focal length of a lens.
Answer: Power is the degree of convergence or divergence of light rays achieved by a lens.
It is defined as the reciprocal of its focal length.
i.e., P = 1 /f
Positive sign (+) of power indicates that lens is convex and negative sign (-) of power indicates that lens is concave.

If focal length (f) is expressed in metres, then, power is expressed in dioptres. The SI unit of power is dioptre. Thus, 1 dioptre is the power of lens whose focal length is 1 metre. $1D=1m^{-1}$

41.The refractive indices of glass and water with respect to air are 3/2 and 4/3 respectively. If speed of light in glass is 2 × 108 m/s, find the speed of light in water.
Answer:

$$\text{Given : } {}_a n_g = \frac{3}{2}, \quad {}_a n_w = \frac{4}{3}$$

Speed of light in glass, $v = 2 \times 10^8$ m/s

$$\text{We know, } {}_a n_g = \frac{\text{speed of light in air}}{\text{speed of light in medium}}$$

$$\Rightarrow \frac{3}{2} = \frac{c}{2\times10^8} \Rightarrow c = 3\times10^8 \text{ m/s}$$

$$\text{Now, } {}_a n_w = \frac{\text{speed of light in air}}{\text{speed of light in water}}$$

$$\Rightarrow \frac{4}{3} = \frac{3\times10^8}{v}$$

$$\Rightarrow v = \frac{9}{4}\times10^8 \text{ m/s} = 2.25\times10^8 \text{ m/s}$$

42..The absolute refractive indices of glass and water are 1.5 and 1.33 respectively. In which medium does light travel faster? Calculate the ratio of speeds of light in the two media.
Answer:
Given : refractive index of glass, ng = 1.5
Refractive index of water, n_w = 1.33
Since, refractive index of medium,

$$n = \frac{\text{speed of light in air } (c)}{\text{speed of light in medium } (v)}$$

For glass $n_g = \frac{c}{v_g}$ ..... (i)

For water $n_w = \frac{c}{v_w}$ ..... (ii)

Since velocity of light in medium is inversely proportional to its refractive index, the light will travel faster in optically rarer medium i.e., water.

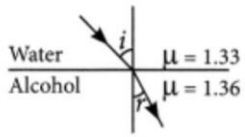
Dividing (i) by (ii),

$$\frac{n_g}{n_w} = \frac{v_w}{v_g} \quad \text{or} \quad \frac{v_g}{v_w} = \frac{n_w}{n_g}$$

$$\frac{v_g}{v_w} = \frac{1.33}{1.5}$$

So, the ratio of v_g and v_w is 1.33 : 1.5.

43.(a) Water has refractive index 1.33 and alcohol has refractive index 1.36. Which of the two medium is optically denser? Give reason for your answer.
(b) Draw a ray diagram to show the path of a ray of light passing obliquely from water to alcohol.
(c) State the relationship between angle of incidence and angle of refraction in the above case.
Answer:
(a) Here, alcohol is optically denser medium as its refractive index is higher than that of water. When we compare the two media, the one with larger refractive index is called the optically denser medium than the other as the speed of light is lower in this medium.
(b) Since light is travelling from water (rarer medium) to alcohol (denser medium), it slows down and bends towards the normal.



where i = angle of incidence and r = angle of refraction.
(c) According to Snell's law,

$$\frac{\sin i}{\sin r} = \frac{\mu_{\text{alcohol}}}{\mu_{\text{water}}} = \frac{1.36}{1.33} = 1.0225$$

$\therefore \sin i = 1.0225 \times \sin r$

44..A real image 2/3rd of the size of an object is formed by a convex lens when the object is at a distance of 12 cm from it. Find the focal length of the lens.
Answer:

Given, h' = $\frac{2}{3}$h, u = -12 cm

Magnification, $m = \frac{h'}{h} = \frac{v}{u}$

$$\Rightarrow \quad v = \frac{h'}{h} \times u = \frac{-\frac{2}{3}h}{h} \times (-12) = 8 \text{ cm}$$

Using lens formula, $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$$\Rightarrow \quad \frac{1}{f} = \frac{1}{8} - \frac{1}{-12} = \frac{3+2}{24} \quad \Rightarrow \quad f = 4.8 \text{ cm}$$

Focal length of the convex lens = 4.8 cm

QUESTION BANK (L3)

Assertion - Reasoning based questions.

These consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true and R is not the correct explanation of A

(c) A is true but R is false

(d) A is False but R is true

1 Assertion(A) Plane mirror may form a real image .

Reason (R)Plane mirror always forms a virtual image if the object is real.

Answer b

2 Assertion (A) kerosene having higher refractive index is optically denser than water although its mass density is less than that of water

Reason (R) The speed of light decides whether a medium is optically rarer or optically denser.An optically denser medium may not process greater mass density.

Answer a

3 Assertion(A) Large concave mirrors are used to concentrate sunlight to produce heat in solar furnace

Reason (R) Concave mirror converges the light rays falling on it to a point.

Answer a

4 Assertion A The power of a converging lens is positive and that of a diverging lens is negative.

Reason R because P =1/f

Answer a

5 Assertion (A) We cannot produce a real image by plane or convex mirrors under any circumstances

Reason(R) The focal length of a convex mirror is always taken as positive

Answer d

6. Assertion (A) Refractive index of glass with respect to air is different for red light and violet light.

Reason (R) Refractive index of a pair of media depends on the wavelength of light used.

Answer a

7 Assertion (A)When a concave mirror is held under water its focal length will increase.
Reason (R) The focal length of a concave mirror is independent of the medium in which it is placed.
Answer d

8 Assertion A There is no dispersion of light reflected through a rectangular glass slab.
Reason R Dispersion of light is the phenomenon of spitting of a beam of white light into its constituent colours.
Answer b

9 Assertion(A) : The centre of curvature is not a part of the mirror. It lies outside its reflecting surface.
Reason (R) : The reflecting surface of a spherical mirror forms a part of a sphere. This sphere has a centre.
Answer (a)

10. Assertion (A) : A ray passing through the centre of curvature of a concave mirror after reflection, is reflected back along the same path.
Reason (R) : The incident rays fall on the mirror along the normal to the reflecting surface.
Answer (a)

11.. Assertion (A) : Light does not travel in the same direction in all the media.
Reason (R) : The speed of light does not change as it enters from one transparent medium to another.
Answer (c)

12. Assertion(A) : The emergent ray is parallel to the direction of the incident ray.
Reason (R) : The extent of bending of the ray of light at the opposite parallel faces (air- glass interface and glass-air interface) of the rectangular glass slab is equal and opposite.
Answer (a)

13. Assertion(A) : A ray of light travelling from a rarer medium to a denser medium slows down and bends away from the normal. When it travels from a denser medium to a rarer medium, it speeds up and bends towards the normal.
Reason (R) : The speed of light is higher in a rarer medium than a denser medium.
Answer (d)

14. Assertion(A): The mirrors used in search lights are concave spherical.
Reason (R) : In a concave spherical mirror the image formed is always virtual.
Answer (c)

15. Assertion(A) : Light travels faster in glass than in air.
Reason (R) : Glass is denser than air.
Answer (d)

16. Assertion(A) : For observing traffic at the back, the driver mirror is a convex mirror.
Reason (R) : A convex mirror has a much larger field of view than a plane mirror.
Answer (a)

17. Assertion(A) : Mirror formula can be applied to a plane mirror.
Reason (R) : A plane mirror is a spherical mirror of infinite focal length.
Answer (a)

18. Assertion(A) : It is not possible to see a virtual image by eye.

Reason (R): The rays that seem to emanate from a virtual image do not in fact emanates from the image.
Answer (d)

19. Assertion(A) : When the object moves with a velocity 2 m/s, its image in the plane mirror moves with a velocity of 4 m/s.
Reason (R) : The image formed by a plane mirror is as far behind the mirror as the object is in front of it.
Answer (a)

20. Assertion(A) : The height of an object is always considered positive.
Reason (R) : An object is always placed above the principal axis in this upward direction.
Answer(a)

21. Assertion(A) : Concave mirrors are used as make-up mirrors.
Reason (R) : When the face is held within the focus of a concave mirror, then a diminished image of the face is seen in the concave mirror.
Answer (c)

22. Assertion(A) : Refractive index has no units.
Reason (R) : The refractive index is a ratio of two similar quantities.
Answer (a)

23. Assertion(A) : The formula connecting u, v and f for a spherical mirror is valid in all situations for all spherical mirrors for all positions of the object.
Reason (R) : Laws of reflection are strictly valid for plane surfaces.
Answer (c)

24. Assertion(A): A person cannot see his image in a concave mirror, unless he is standing beyond the centre of curvature of the mirror.
Reason (R) : In a concave mirror, the image formed is real provided the object is situated beyond its focus.
Answer (b)

25. Assertion(A): Virtual images are always erect.
Reason (R) : Virtual images are formed by diverging lenses only.
Answer(c)

26 Assertion (A).The value of F in a concave mirror is taken as –ve and in a convex mirror is taken as +ve.
Reason(R). All distances measured to the right of the origin are taken as +ve and those measured along the left of the origin are taken as –ve.
Answer(a)

27 Assertion (A). 1.33 is the absolute refractive index of water.
Reason (R). Air is optically denser than water.
Answer(c)

CASE STUDY QUESTIONS (4 Marks)

1 A highly polished surface such as a mirror reflects most of the light falling on it. You are already familiar with the laws of reflection of light. Let us recall these laws.
a) The angle of incidence is equal to the angle of reflection and

b) The incident ray, the normal to the mirror at the point of incidence and reflected ray all lie in the same plane. These laws of reflection are applicable to all types of reflecting surfaces including spherical surfaces. You are familiar with the formation of images by a plane mirror. Image formed by a plane mirror is always virtual and erect. The size of the image is equal to that of the object. The image formed is as far behind the mirror as the object is in the front of it . Further the image is laterally inverted.

I) If a Ray of light is normally incident on a plane mirror, calculate the angle of reflection?
a) 0^0
b) 45^0
c) 90^0
d) none of this
Ans a

ii) The angle between incident ray and reflected ray is 70^0 .What is the angle of reflection?
a)0^0
b)30^0
c)35^0
d)90^0
Ans c

iii) What is the size of the image in a plane mirror?
a)Equal to half of the object
b)equal to that of the object
c) little shorter than the object
d) none of this
Ans b

iv) What will be the nature of the image formed by a plane mirror?
a) real
b) real and erect
c)virtual
d) virtual and erect.
Ans d

v) When a ray of light passes from an optically less dense medium to more dense medium it
a)goes undeviated
b) bends towards the normal
c) Bends away from the normal
d) none of these.
Ans b

2 You must have seen people using spectacles for reading .The watch makers use a small magnifying glass to see tiny parts. The glasses used in spectacles and that by a watchmaker a example of lenses. A lens may have two spherical surfaces ,bulging outwards. It is called convex lens and converges light race.A concave lens is bounded by two spherical surfaces curved inwards .It diverges light rays.

i) What is a lens?
Ans A lens is the portion of a transparent medium bounded by two surfaces, at least one of which is a curved surface.

ii) What type of lens is a tumblr filled with water?
Ans Convex lens

iii) what type of lens is an air bubble inside water?
Ans Concave lens

iv) Which type of lens is used as a magnifying glass?
Ans Convex lens of short focal length.

3 The lens forms different types of images when objects are placed at different locations. When a ray is incident parallel to the principal axis, then after refraction it passes through the focus or appears to come from the focus. When a ray goes through the optical centre of the lens it passes without any deviation. If the object is placed between the focus and optical centre of the convex lens ,an erect and magnified image is formed.
As the object is brought closer to the convex lens from infinity to focus, the image moves away from the convex lens from focus to infinity .Also the size of the image goes on increasing and the images is always real and inverted .A concave lens always gives a virtual ,erect and diminished image irrespective to the position of the object.

(i) The location of image formed by convex lens when the object is placed at infinity is
a) at focus
b) 2F
c) at optical centre
d) between F and 2F
Answer (a)

(ii) When the object is placed at focus of concave lens the image formed is
a)real and smaller
b) virtual and inverted
c) virtual and smaller
d) real and erect
Answer (b)

(iii) The size of image formed by a convex lens when the object is placed at the focus of convex lens is
a) small
b) point size
c) highly magnified
d) same as that of object
Answer (c)

(iv) When the object is placed at 2F in front of convex lens the location of images
a) at F
b) at 2F on the other side
c) at infinity
d) between F and optical centre
Answer (b)

4 The spherical mirrors forms different types of images when the object is placed at different locations. When the image is formed on screen the images real and the image does not form on screen the images virtual. When the two reflected rays meet actually the image is real and when they appear to meet the image is virtual. A concave mirror always forms a real and inverted image for different position of the object. But if the object is placed between the focus and the pole the image formed is virtual and erect.

A convex mirror always forms a virtual, erect and diminished image. A concave mirror is used as a doctor's head mirror to focus light on body parts like ice, ears, nose etc; to be examined because it can form a erect and magnified image of the object. The convex mirror is used as a rear view mirror in automobiles because it can form and small and erect image of an object.

(i) When an object is placed at the centre of curvature of a concave mirror the image formed is
a) larger than the object
b) smaller than the object
c) same size as that of the object
d) highly enlarged
Answer (c)

(ii) No matter how far you stand from a mirror, your image appears erect .The mirror is likely to be
a) plane
b) concave
c) convex
d) either plane or convex
Answer (d)

(iii) A child is standing in front of a magic mirror she finds the image of a head bigger the middle portion of a body of the same size and that of flex smaller the following is the order of combination for the magic mirror from the top
a) plane, convex and concave
b) convex, concave and plane
c) concave plane and convex
d) convex plane and concave
Answer (c)

(iv) To get an image larger than the object one can use
a) convex mirror but not a concave mirror
b) a concave mirror but not a convex mirror
c) either a convex mirror or a concave mirror
d) a plane mirror
Answer (b)

5 A student focuses the image of a candle,placed at about 2 m from a convex lens of focal length 10 cm, on a screen. After that he gradually moves the flame towards the lens and each time focuses its image on the screen.

(i) In which direction does he move the lens to focus the flame on the screen?
a) away from the screen
b)towards the screen
c) Should not move the screen
d)toward the candle.
Ans.d

(ii)What happens to the size of the image formed on the screen?
a) size of image will decrease
b)size of the image will increase
c)remains unchanged
d)size will become too small.
Ans.b

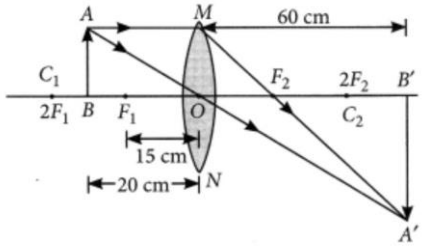
(iii)What difference is seen in the intensity of the image of the flame on the screen ?
a)intensity of the image increases b)intensive of image remain same c)intensity of the image reduces the d)image disappear
Ans.a

(iv) What is seen on the screen when the flame is very close(at about 5 cm) to the lens ?
a)a bright image
b)a magnified image
c)diminished image
d)no image
Ans d

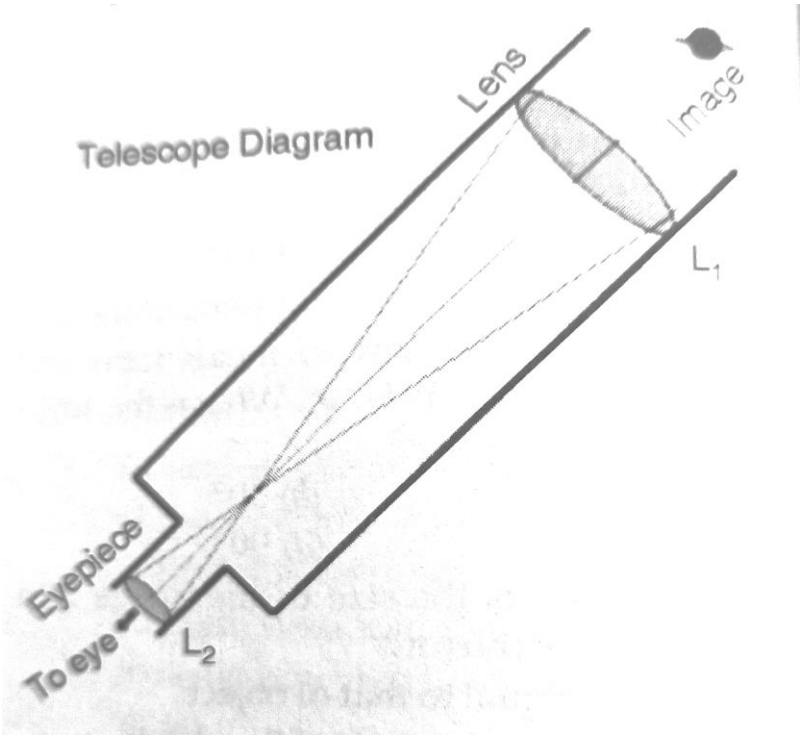
6 Analyse the following observation table showing variation of image distance (v) with object distance (u) in case of a convex lens and answer the questions that follows, without doing any calculations

S No	Object distance u(cm)	Image distance v(cm)
1	-90	+18
2	-60	+20
3	-30	+30
4	-20	+60
5	-18	+90
6	-10	+100

(a) What is the focal length of the convex lens? Give reason in support of your answer.
(b) Write the serial number of that observation which is not correct. How did you arrive at this conclusion?
(c) Take an appropriate scale to draw a ray diagram for the observation at S. No. 4 and the approximate value of magnification.
Answer:
(a) When an object is placed at 2F from a convex lens, then its image is formed on the other side of the lens at the same distance from the lens. Thus from S. No.(3) we can say that.
$f = v/2 \Rightarrow f = 30/2$
$= + 15$ cm
Thus, the focal length is + 15 cm.
(b) In this case S.No. (6) is incorrect as the object distance is between focus and pole, for such case, the image formed is virtual and on the same side as the object, hence image distance is negative.
(c) The approximate value of magnification for object distance -20 cm and image distance +60 cm is -3



7 Aarthi wanted to see the stars of the night sky .She knows that she needs a telescope to see those distant stars. She finds out that telescope which are made up of lenses are called refracting telescopes and the ones which are made up mirrors are called reflecting telescopes. So she decided to make a refracting telescope .She brought two lenses L_1 and L_2 . Out of which L_1 was bigger and $L_2$was smaller. The larger lens gathers and Bends the light while the smaller lens magnifies the image. Big lenses more powerful. So to see far away .she needed a big powerful lens. Unfortunately she realised that a big lens is very heavy . Heavy lenses are hard to make and difficult to hold in right place. Also since the light is passing through the lens ,the surface of the lens has to be extremely smooth, Any flaws in the lens will change the image .It would be like looking through a dirty window.



i) Based on the diagram shown, what kind of lenses would Aarthi need to make the telescope?
a) concave lenses
b)convex lenses
c) bi focal lenses
d)flat lenses
Ans b

ii) If the powers of lenses L_1 and L_2 are in the ratio of 4:1, what would be the ratio of the focal length of L_1 and L_2 ?
a)4:1
b)1:4
c)2:1
d)1:1
Ans b

iii) What is the formula for the magnification obtained with the lens?
a) ratio of height of image to height of the object
b)double the focal length.
c) inverse of the radius of curvature d)inverse of the object distance.
Ans a

iv) Aarti did some preliminary experiments with the lenses and found out the magnification of the eye piece (L_2) is 3. If in her experiment with L_2 she found an image at 24 cm from the lens, at what distance did she put the object?
a)72 cm
b)12 cm
c) 6cm
d)8cm
Ans d

v) Aarthi brought not so thick lenses for the telescope and polished them .What advantage, if any, would she have with her choice of lenses?
a)She will not have any advantage as even thicker lenses would give clear images.
b) Thicker lenses would have made the telescope easier to handle.
c) Not so thick lenses would not make the telescope very heavy and also allow a considerable amount of light to pass.
d) Not so thick lenses will give her more magnification.
Ans c

CHAPTER - 11

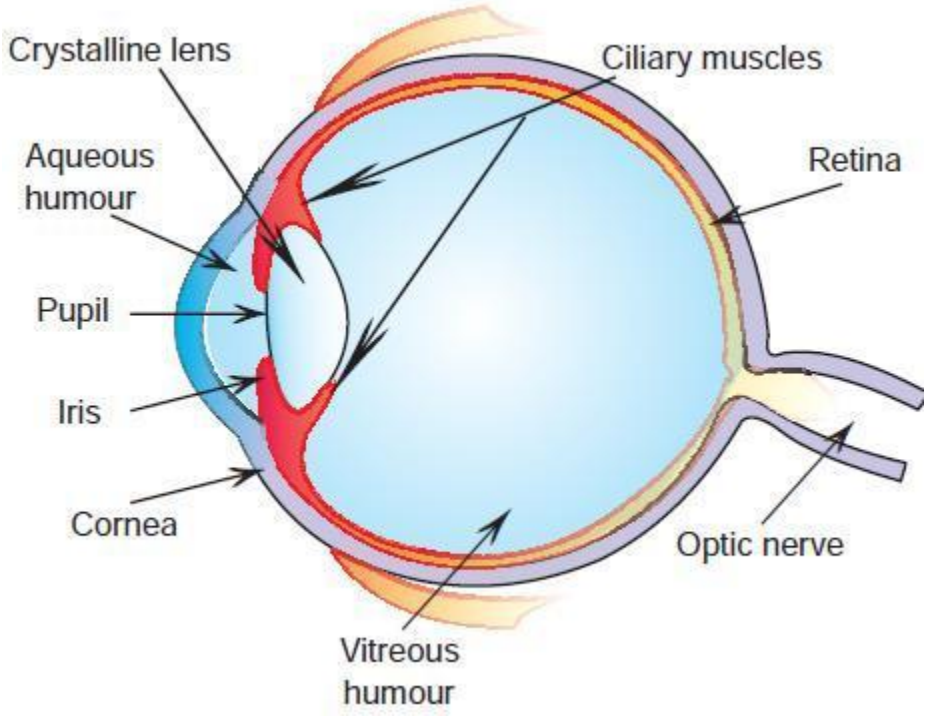
THE HUMAN EYE AND THE COLOURFUL WORLD

The human eye is one the most sensitive and most valuable sense organs. It helps us to see the objects around us and the colours as well. It acts like a camera. Eye has various important parts and they do different functions. The parts are:

1. Cornea
2. Iris
3. Pupil
4. Ciliary muscles
5. Eye lens
6. Retina
7. Blind spot
8. Optic nerves
9. Aqueous humour
10. Vitreous humour

- **Cornea** is the transparent thin membrane covering the surface of the eye ball, through which light enters in to eye. It also acts as primary lens.
- **Iris** is a dark coloured muscular diaphragm present between the cornea and lens.
- **Pupil** is a small hole in the Iris, which regulates and controls the amount of light entering the eye.
- **Ciliary muscles** hold the eye lens in position and modify the curvature and focus of the eye lens.
- **Eye lens** helps in the fine adjustment of focal length which is made of transparent jelly like material.
- **Retina** is a thin, delicate membrane with large number of light-sensitive cells called rods and cones. These cells get activated when image is formed on the retina and generate electrical signals. These signals are sent to the brain through optic nerves. Retina acts like a screen. A real, inverted and diminished image is formed by the eye lens on it.
- **Rods and Cones** are light sensitive cells of retina which are activated upon illumination. Rods are responsible for bright vision and cones are responsible for coloured vision. These cells generate electrical signals and are transmitted to brain through optical nerves.
- **Least Distance of distinct vision** is the minimum distance at which objects can be seen most distinctly without strain. It is also called Near point of the eye. For a young adult with normal vision. The near point is about 25 cm.
- **Far point of the eye** is the point at which eye can see objects clearly. Generally, it is infinity for a normal eye.
- **Persistence of vision** is the property of the eye in which the impression of the object seen by the eye remains on the retina for about $1/16^{th}$ of a second, even after the object is removed.
- **Blind Spot** is that part at which the optic nerve leaves the eye. An image formed at this point is not sent to the brain.
- **Optic nerves** pass the electric signals to brain.

- **Aqueous humour** is a clear liquid region between the cornea and the lens, which provides power to cornea.
- **Vitreous humour** fills the space between eye lens and the retina.



If any part of the eye is damaged, it will result in visual impairment.

Power of Accommodation -

The ability of the eye lens to adjust its focal length is called Accommodation. The minimum distance, up to which a person's eye can see objects clearly without strain, is called the least distance of distinct vision (or near point of the eye). For a person with normal vision, the near point is about 25 cm. The maximum distance up to which a person's eye can see objects clearly is called the far point of the eye. It is infinity for a normal eye. Thus, a normal human eye can focus at any object between 25 cm and infinity. Adjustment of focal length is carried out by the eye lens. It is of the shape of convex lens, made up of fibrous, jelly-like material. Its curvature is increased or decreased by the contraction and relaxation of ciliary muscles. The change in the curvature of the eye lens can change its focal length. When the muscles are relaxed, the lens becomes thin and its focal length increases. This enables us to see distant objects clearly. While looking at objects closer to the eye, the ciliary muscles contract, which increases the curvature of the eye lens (it becomes thicker). Thus, its focal length decreases and we are able to see nearby objects clearly.

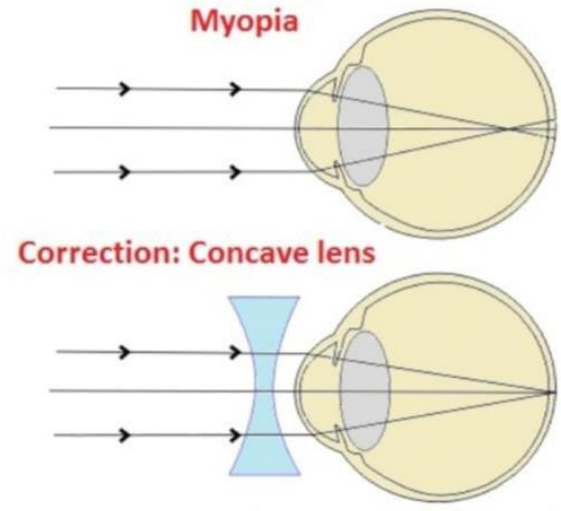
Defects of Vision and their Correction -

There are mainly three common refractive defects of vision. These are:
(i) Myopia (or near-sightedness)
(ii) Hypermetropia or hyperopia (or farsightedness)
(iii) Presbyopia

Myopia –
A myopic person can see nearby objects clearly but cannot see distant objects distinctly. A person suffering from this defect has the far point nearer than infinity, upto a distance of a few metres. Due to this defect, the image of a distant object is formed in front of the retina and not at the retina itself.
Reason: This defect may arise due to:
(a) Excessive curvature of the eye lens, or

(b) Elongation of the eyeball

Correction: It can be corrected by the use of concave lens of suitable power.



Hypermetropia –

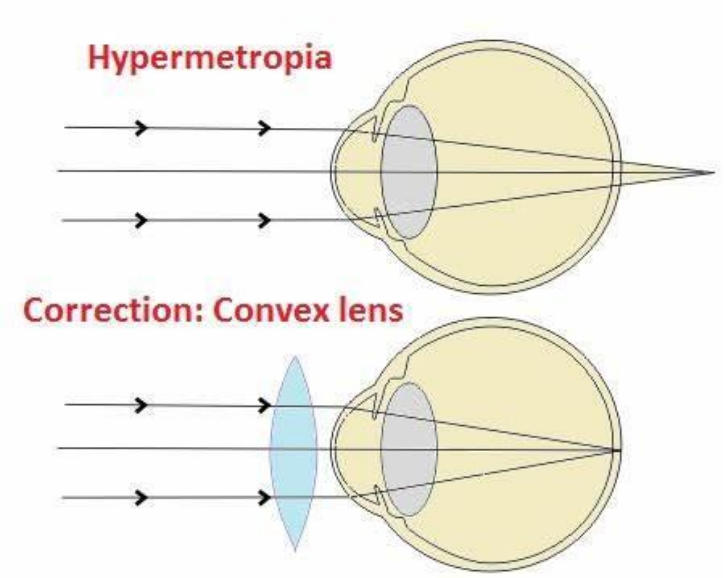
A hypermetropic person can see distant objects clearly but cannot see nearby objects distinctly. For such people, the near point is greater than the normal near point (25 cm). Such people keep a book beyond 25 cm from the eye for reading because the light rays from a nearby object meet at a point behind the retina.

Reason: This defect may arise due to

(a) Increase in the focal length of the eye lens, or

(b) The eyeball has become too small

Correction: It can be corrected by the use of convex lens of suitable power.



Presbyopia –

This problem occurs due to ageing. The power of accommodation of the eyes generally decreases with ageing. In many cases, the near point gradually recedes. Then, people cannot see nearby objects comfortably and clearly. Sometimes, a person may suffer from both myopia and hypermetropia.

Reason: This defect may arise due to:

(a) Gradual weakening of the ciliary muscles, or

(b) Diminishing flexibility of the eye lens.

Correction: This defect can be corrected by the use of bifocal lenses of suitable power. A common type of bi-focal lenses consists of both concave and convex lenses. The upper portion consists of a concave lens. It helps in distant vision. The lower part is a convex lens. It helps in near vision. These

days, it is possible to correct the refractive defects with contact lenses or through surgical interventions.

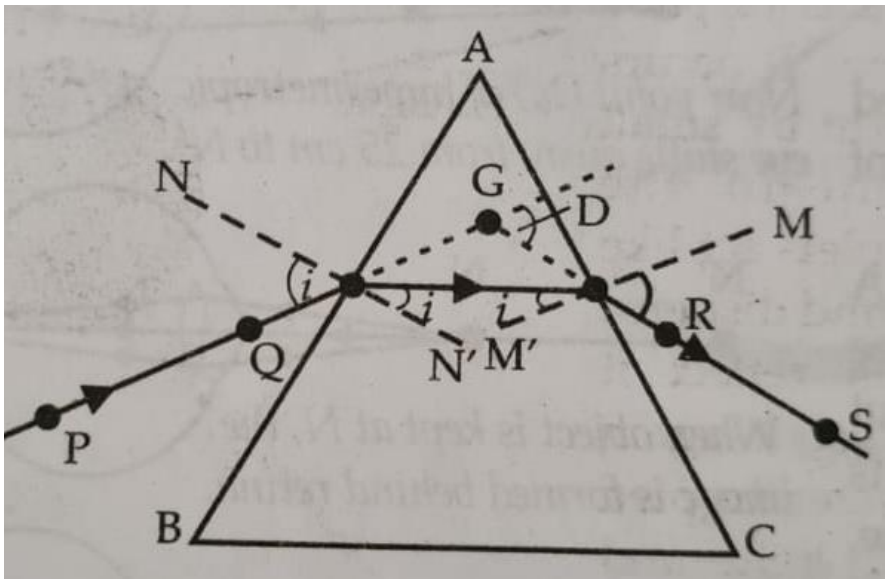
Astigmatism –
Astigmatism is an eye defect, in which a person cannot see in all directions equally. This condition arises either when the cornea or the crystalline lens or both are not perfectly spherical. This can be corrected by cylindrical lenses.

Cataract -
It is caused when the crystalline lens of people at old age becomes milky and cloudy. This causes partial or complete loss of vision. It is possible to restore vision through a cataract surgery.

Prism –
Prism is a transparent optical component, consisting of flat surfaces which refract light.

- **Refracting Edge:** It is the line along which two refracting faces meet.
- **Incident Ray:** An incident ray is a rectilinear ray of light that strikes a surface.
- **Refracted Ray:** A refracted ray is a ray that passes through an interface between two media and travels into the medium on the other side of the interface.
- **Emergent Ray:** The ray of light that comes out of the prism after refraction is called the emergent ray.
- **Angle of Prism:** It is the angle between two refracting faces of the prism.
- **Angle of incidence:** The angle of incidence is the angle formed by a ray of light with the normal drawn at the point of incidence when it strikes a surface.
- **Angle of Refraction:** It is the angle between a refracted ray and the normal at the point of incidence.
- **Angle of Emergence:** It is the angle of light coming out of a medium normal to the surface, at the point of emergence.
- **Angle of Deviation:** When the light ray is allowed to pass through the prism, it makes the emergent ray bend at an angle to the direction of the incident ray. This angle is called Angle of Deviation for the prism.

Refraction of light through prism –



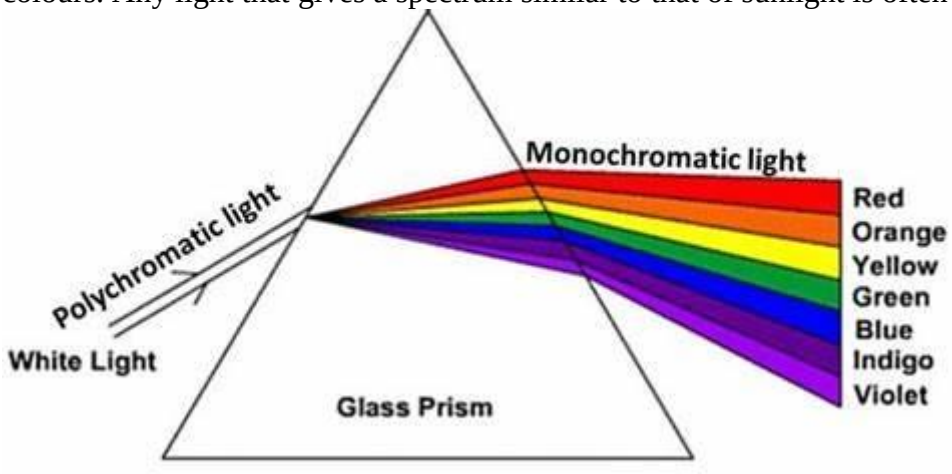
Prism has two triangular bases and three rectangular lateral surfaces. These surfaces are inclined to each other. The angle between its two lateral faces is called the angle of the prism (A). When incident ray (PQ) is allowed to fall on a refracting rectangular lateral surface (AB), it deviates from its path

due to refraction and emerges out (RS) of the other rectangular lateral surfaces (AC) as shown in the schematic diagram. The angle between the incident ray and the emergent ray is known as the angle of deviation (D).

Dispersion of Light–

The splitting of light into its component colours is called dispersion. The band of the coloured components of a light beam is called its spectrum. Different colours of light are refracted through different angles with for the same angle of incidence, as white light passes through a prism. The red light suffers the least deviation while the violet the most. Thus, the rays of each colour emerge along different paths and thus spectrum become distinctly visible.

Newton obtained the spectrum of sunlight using a glass prism. Use of extra prisms could not split the extra prisms could not split the spectra any further. On placing a second identical prism in an inverted position with respect to the first prism, he obtained a beam of white light emerging from the other side of the second prism. This observation gave Newton the idea that the sunlight is made up of seven colours. Any light that gives a spectrum similar to that of sunlight is often referred to as white light.



Reasons for Dispersion of Light –

Each colour has its own wavelength/frequency. Different colours move with same speed in air/vacuum. But their speeds in refractive media (glass) are different. Hence, refractive index of the medium for different colours is different. As a result, different colours undergo different deviations through prism. Therefore, different colours emerge from the prism at different angles.

Applications of Dispersion of Light –

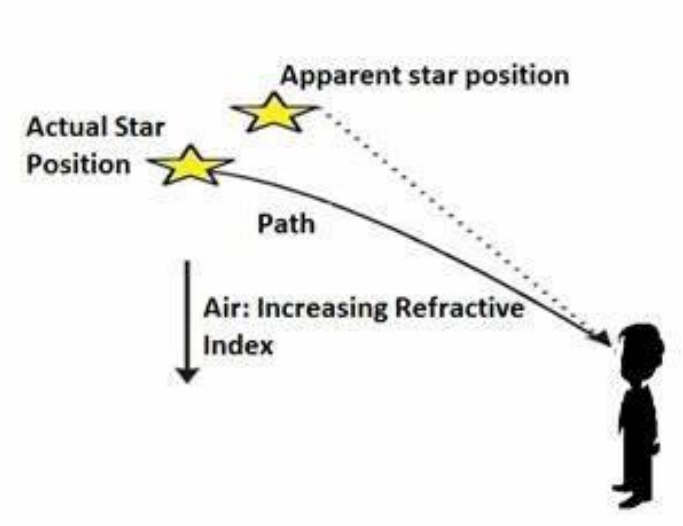
- Different colours reach our eyes.
- Rainbow formation
- Dispersion of colours in soap bubbles, CD's, etc.

Rainbow –

A rainbow is a band of spectra, which appears naturally in the sky after a rain. It occurs due to dispersion of sunlight by small water droplets, present in the atmosphere. The water droplets act like small prisms, which refract and disperse the incident sunlight, then reflect it internally, and finally refract it again when it emerges out of the water droplet. Due to the dispersion of light and internal reflection, different colours reach the observer's eye.

Atmospheric Refraction –

Apparent star position due to atmospheric refraction: When starlight enters the earth's atmosphere, it undergoes refraction continuously before it reaches the earth. The atmospheric refraction occurs in a medium of gradually changing refractive index. Since the atmosphere becomes denser closer to the earth, it bends starlight towards the normal and the apparent position of the star is slightly different from its actual position. The star appears slightly above its actual position when viewed near the horizon.



Twinkling of Stars –
The twinkling of a star is due to the atmospheric refraction of starlight. The temperature and density of layers of air of the earth's atmosphere keeps varying. Distant stars act like point sized sources of light. As the fine beam of starlight keeps deviating from its path slightly, the apparent position of the star keeps changing and the amount of light entering the eye varies. Thus, the star sometimes appears brighter, sometimes fainter which gives rise to twinkling effect.

Advance sunrise –
Due to atmosphere refraction, the sun is visible to us about two minutes before the actual sunrise and about two minutes after the actual sunset. By actual sunrise, we mean the actual crossing of the horizon by the sun. The sun appears slightly flattened at sunrise and sunset due to atmospheric refraction.

Scattering of light and its applications –
Scattering of light is the phenomenon of interaction of light with very small particles. The colour of the scattered light depends on the size of the scattering particles. Very fine particles scatter mainly blue light while particles of larger size scatter light of longer wavelengths. If the size of the scattering particles is large enough then the scattered light may even appear white. It is responsible for
(i) Blue colour of the sky
(ii) The colour of water in deep sea
(iii) Tyndall effect

Blue colour of the sky –
Scattering of light increase with decrease in the wavelength. The air molecules and other fine particles in the atmosphere have size smaller than the wavelength of visible light. Hence, they scatter blue colour (short wavelengths) more than red colour (long wavelengths). Thus, when the sunlight passes through earth's atmosphere the fine particles in air scatter the blue colour more strongly than red. This scattered blue light enters our eyes.

Tyndall effect –
It is the phenomenon in which light interacts with minute particles of the medium (colloid or suspension) such that the path of the light becomes visible due to scattering of light. The earth's atmosphere is a heterogenous mixture of minute particles (such as smoke, tiny water droplets, suspended dust particles etc). These particles are responsible for scattering of light.

White appearance of clouds -
The size of the scattering particles, the water droplets of cloud, is large enough. Hence, the scattered light may even appear white.

Colour of sun during sunrise and sunset -

During the sunrise and sunset, the Sun is near the horizon and therefore its rays pass through much larger distance in the earth's atmosphere before reaching our eyes. Near the horizon most of the blue light and shorter wavelengths are scattered away by the particles. The light that reaches our eyes is of longer wavelengths. This is why the sun appears red in colour. When the sun is overhead it would travel relatively shorter distance through the atmosphere, hence, at noon the sun appears white as only a little of the blue and violet colour are scattered.

SOLVED QUESTIONS - L1

1. What is meant by power of accommodation of the eye?

Ans - It is the ability of the eye lens to adjust its focal length.

2. A person with a myopic eye cannot see objects beyond 1.2 m distinctly. What should be the type of corrective lens used to restore proper vision?

Ans -

Distance of far point x = 1.2m

Focal length of corrective lens f = -x = -1.2m

Therefore, power of lens is P = 1/f = 1/-1.2 = -0.83 D.

Since the power is negative, the lens must be concave.

3. What is the far point and near point of the human eye?

Ans - For a normal human eye with normal vision, far point is at infinity and near point is at 25 cm from the eye.

4. A student has difficulty reading the blackboard while sitting in the last row. What could be the defect the child is suffering from? How can it be corrected?

Ans - The child is suffering from myopia or short sightedness. This can be corrected by using spectacles with concave lens of suitable focal length.

5. Why is normal eye not able to see clearly the objects placed closer than 25 cm?

Ans - It is because the focal length of eye lens cannot be decreased below a minimum limit.

6. Why does the sky appear dark instead of blue to an astronaut?

Ans - This is because at this height there is no atmosphere which can scatter the white light. Hence the sky appears dark.

7. Why do stars twinkle?

Ans - Stars twinkle at night because the intensity of star light reaching our eyes increases and decreases continuously due to atmospheric refraction. When the starlight reaching our eyes increases, the stars look bright and when the light decreases, stars appear dim. Due to this, stars appear to twinkle.

8. Explain why planets do not twinkle?

Ans - The planets are much nearer to the earth as compared to the stars so they can be treated as a collection of large number of point sized source of light. Due to the varying conditions of atmosphere, the darkest part of the twinkling effect from one point source may be overlapped by the focussed light from the point source of other regions of the planet. The total amount of light entering in to the eye remains constant. Therefore, the planets look steady and do not appear twinkle.

9. The human eye can focus on objects at different distances by adjusting the focal length of the eye lens. This is due to:

a) Presbyopia

b) Accommodation
c) Near-sightedness
d) Far-sightedness
Ans – b) Accommodation

10. The human eye forms the image of an object at its
a) Pupil
b) Iris
c) Cornea
d) retina
Ans – d) retina

11. The least distance of distinct vision for a young adult with normal vision is about:
a) 25 m
b) 2.5 cm
c) 25 cm
d) 2.5 m
Ans – c) 25 cm

12. The change in focal length of an eye lens is caused by the action of the:
a) Pupil
b) Retina
c) Ciliary muscles
d) Iris
Ans – c) Ciliary muscles

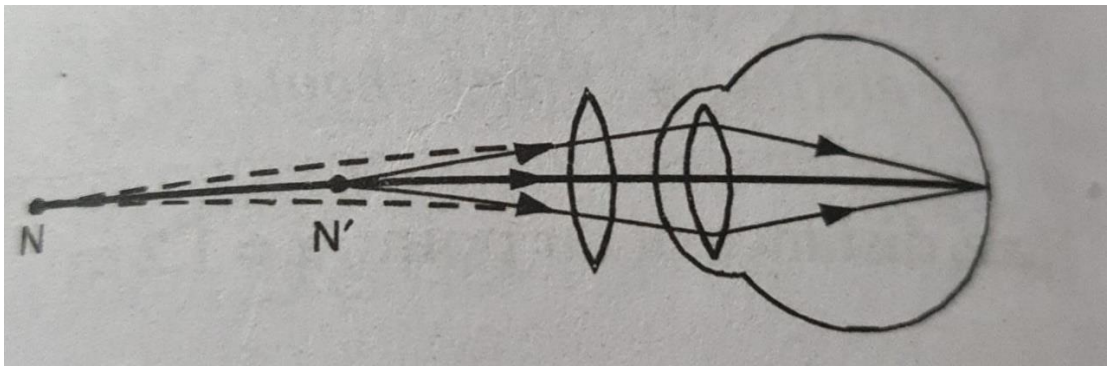
13. A person needs a lens of power -5.5 D for correcting his distant vision. For correcting his near vision, he needs a lens of power +1.5 D. What is the focal length of the lens required for correcting distant vision and near vision?
Ans –
For distant vision, f = ?, P = -5.5 D
Using the relation,
P = 1/f
(or) f = 1/P
(or) f = 100/-5.5 = -18.2 cm.

For near vision, f = ?, P = +1.5 D
Using the relation,
P = 1/f
(or) f = 1/P
(or) f = 100/1.5 = 66.7 cm.

14. The far point of a myopic person is 80 cm in front of the eye. What is the nature and power of the lens required to correct the problem?
Ans – Distance of far point, x = 80 cm, P = ?
For viewing distant objects, focal length of corrective lens,
f = -x = -80 cm
Using the relation,
P = 1/f = 100/f = 100/-80 = -1.25 D
The lens is Concave in nature.

15. Make a diagram to show how hypermetropia is corrected. The near point of a hypermetropic eye is 1 m. What is the power of the lens required to correct this defect? Assume that the near point of the normal eye is 25 cm.

Ans –



Given, v = -1 m = -100 cm, u = -25 cm, f = ?

Using the relation,

$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$

$$-\frac{1}{100} + \frac{1}{25} = \frac{1}{f}$$

f = 33.3 cm

Hence, power of lens required

P = 1/f = 100/33.3 = 3D

16. Why is a normal eye not able to see clearly the objects placed closer than 25 cm?

Ans – It is because the focal length of the eye lens cannot be decreased below a certain minimum limit.

17. What happens to the image distance in the eye when we increase the distance of an object from the eye?

Ans - For a normal eye, image distance in the eye is fixed. This is equal to the distance of retina from the eye lens. When we increase the distance of the object from the eye, focal length of eye lens is changed on account of power of accommodation of the eye so as to keep the image distance constant.

SOLVED QUESTIONS - L2

1. Name the component of the eye that is responsible for the adjustment of the eye lens.
Ans – Ciliary muscles

2. Mention the role of optic nerve in the human eye.
Ans – The optic nerve transmits the visual information in the form of electrical signal generated at retina to the brain.

3. List the three phenomenon of light responsible for formation of rainbow in the sky.
Ans – Refraction, Dispersion and Total Internal Reflection

4. Why does it take some time to see the objects in dim light when you enter the room from bright sunlight outside?
Ans – In bright sunlight, the iris contracts the pupil to allow less light to enter the eye and in dim light, the iris expands the pupil to admit more light to see the object clearly. Therefore, it takes some time to increase the size of pupil in dim light.

5. A person is advised to wear spectacles with convex lenses. What type of defect of vision is he suffering from?
Ans – Hypermetropia or far-sightedness. In this defect, person is unable to see nearby objects clearly due to increase in focal length of eye lens.

6. When is a person said to have developed cataract? How is the vision of such a person restored?
Ans - When the crystalline lens of eye becomes hazy (or even opaque) due to the formation of thin membrane over it, this causes partial or complete loss of vision. This defect of eye is called cataract. The vision of the defected eye can be restored by the cataract surgery.
7. Which part of the eye has delicate membrane and containing large number of light sensitive cells?
Ans – Retina contains large number of light-sensitive cells known as rods and cones.

8. (a) Name the defects of vision when a person cannot see clearly:
(i) the nearby objects
Ans – Hypermetropia
(ii) the distant objects
Ans – Myopia
(b) Ritu needs a lens of power -2D for correcting her vision.
(i) What kind of defect in vision is she suffering from?
Ans – Ritu is suffering from myopia or short-sightedness
(iii) What are the possible causes of this defect?
Ans –

- Increase in size of eye ball
- Decrease in focal length of eye lens

(iv) What is the nature of corrective lens?
Ans – Concave / Diverging lens

9. What is presbyopia? State its cause. How is it corrected?
(or)
An old person finds it difficult to see nearby objects comfortably and distinctly without corrective eye glasses.
(i) What defect of vision is he suffering from?

(ii) List two causes for the development of this defect.
(iii) What kind of lens will be required to see objects clearly the nearby as well as distant objects? Give reasons.
Ans – (i) Presbyopia

- Presbyopia is a condition that occurs as part of normal ageing.
- Due to loss of power of accommodation of the eye, with age, objects at a normal near working distance will appear blurry. The near point gradually recedes away. This defect of eye is called Presbyopia.
- Sometimes, a person may suffer from both myopia and hypermetropia.

(ii) Presbyopia is caused due to

- Weakening of ciliary muscles, and
- Eye lens becomes less flexible and elastic, i.e., reducing ability of eye lens to change its curvature with the help of ciliary muscles.

(iii) **Bifocal lens** will be required to see clearly nearby as well as the distant object.

- For myopic defect, upper part of bifocal lens consists of a concave lens used for distant vision and to correct hypermetropia, lower part of bifocal lens consists of a convex lens. It facilitates near vision.

10. What is Tyndall effect? Give an example of a phenomenon where Tyndall effect can be observed.
Ans –
The phenomenon of scattering of light by the particles of a colloidal solution is called Tyndall effect. A fine beam of sunlight entering a room consists of suspended particles of dust, in which path of the beam of light is visible – Tyndall effect.

11. Why are we not able to see things clearly when we come out of a dark room?
Ans – In dim light, the iris expands the pupil to allow more light to enter. So, when we come out of a dark room into the bright area, a large amount of light enters into our eyes and due to glare feeling, we are not able to see the things clearly.

12. Why are danger signal lights red in colour?
Ans – The wavelength of the red colour is longer than other colours. The red colour is least scattered while passing through the atmosphere and therefore, travels a large distance and can be seen through a large distance. Hence, the danger signals make use of red light.

13. What is the cause of blue colour of the ocean?
Ans – The ocean appears bluish because the water molecules scatter blue light more strongly than other colours.

14. How does the sky appear from the surface of the moon?
Ans - The sky appears dark from the surface of the moon because there is no atmosphere which can scatter light.

15. Name the condition resulting due to the eye lens becoming cloudy?
Ans - It is Cataract. The crystalline lens of the eye becomes opaque and gradually further, this membrane grows and the whole lens becomes opaque and appears cloudy.

SOLVED QUESTIONS – L3

Multiple Choice Questions –

1. In case of human eye, when light rays enter the eye, most of the refraction occurs at the:
(a) Crystalline lens
(b) Outer surface of the cornea
(c) Iris
(d) Pupil
Ans – (a) Crystalline lens

2. At noon, the sun appears white as:
(a) Light is least scattered
(b) Blue colour is scattered the most
(c) Red colour is scattered the most
(d) All the colours of the white light are scattered away
Ans – (a) Light is least scattered

3. Which of the following phenomena contributes significantly to the reddish appearance of the sun at sunrise?
(a) Scattering of light
(b) Dispersion of light
(c) Total internal reflection of light
(d) Reflection of light from the earth
Ans – (a) Scattering of light

4. The bluish colour of water in deep sea is due to:
(a) Reflection of sky in water
(b) Scattering of light
(c) The presence of algae and other plants found in water
(d) Absorption of light by the sea
Ans – (b) Scattering of light

5. The black opening between the aqueous humour and the lens is called:
(a) Retina
(b) Iris
(c) Cornea
(d) Pupil
Ans – (d) Pupil

6. The defect of vision in which the person is able to see distant object distinctly but cannot see nearby objects clearly is called:
(a) Long sightedness
(b) Far-sightedness
(c) Hypermetropia
(d) All the above
Ans – (d) All the above

7. Bi-focal lens are required to correct
(a) Cataract
(b) Hypermetropia
(c) Myopia
(d) Presbyopia
Ans – (d) Presbyopia

8. The image formed on the retina of the human eye is:
(a) Virtual and inverted
(b) Real and inverted
(c) Real and erect
(d) Virtual and erect
Ans – (b) Real and inverted

9. A person cannot see distinctly objects kept beyond 2 m. This defect can be corrected by using a lens of power
(a) + 0.5 D
(b) -0.5 D
(c) +0.2 D
(d) -0.2 D
Ans – (b) -0.5 D

10. The colour of the light which is deviated the least by a prism in the spectrum of white light is
a) Red
b) Violet
c) Yellow
d) Green
Ans – a) Red

11. Twinkling of stars is due to atmospheric
a) dispersion of light by water droplets
b) scattering of light by dust particles
c) refraction of light by different layers of varying refractive indices.
d) internal reflection of light by clouds.
Ans – c) refraction of light by different layers of varying refractive indices

12. The focal length of the eye lens increases when eye muscles-
a) are relaxed and lens becomes thicker.
b) contract and lens become thicker.
c) are relaxed and lens becomes thinner.
d) contract and lens become thinner.
Ans – a) are relaxed and lens becomes thicker

Competency Based Questions

1. Rahul went to an eye specialist for check-up. He prescribed him to use spectacle lens of +0.5 D power.
(a) Name the defect of vision he is suffering from.
(b) Find the focal length of the spectacle lens.
(c) What is hypermetropia and myopia? What are their causes? How are they rectified?
Ans –
(a) Hypermetropia

(b) f = 1/D; f = 1/0.5 = 2 m (convex lens)

(c) **Hypermetropia**:

A person suffering from this defect can see distant objects clearly but cannot see nearby objects clearly (the near point lies farther away than 25 cm).
Causes –

- The eyeball is too short, or
- The ciliary muscle is unable to change the shape of the lens to focus the image (the focal length of the eye lens increases)

Hypermetropia can be corrected by using convex lens

Myopia:
Myopia or short-sightedness can see nearby objects clearly but cannot see far away objects clearly.
Causes –

- The eyeball is longer than normal, or
- The focal length of the eye lens decreases

This can be corrected by using concave lens

2. What is astigmatism and how is this defect corrected?
Ans – When a person is unable to see equally in all directions, the defect is called Astigmatism. This is because the eye lens develops different curvatures in different planes. This can be corrected by using cylindrical lens.

3. Why do we observe difference in colours of the sun during sunrise, sunset and noon?
Ans – This is because of scattering of light. During sunrise and sunset, sun appears to be red in colour and at noon, the sun appears white as only a little of blue and violet colours are scattered. Near the horizon, most of the blue light and shorter wavelengths are scattered away by the particles during sunrise and sunset. Hence, the light which reaches our eyes is with longer wavelengths. This gives rise to the reddish appearance of the sun.

Assertion and Reasoning: Here two statements are given-one is Assertion and the other is Reason. Select the correct answer from a,b,c and d.
a. Both A and R are true and R is the correct explanation of the assertion.
b. Both A and R are true but R is not the correct explanation of the assertion.
c. A is true but R is false.
d. A is false but R is true.

1. Assertion [A] - The stars twinkle while the planets do not.
Reason [R] – The stars are much bigger in size than the planets.
Ans - Both A and R are true but R is not the correct explanation of the assertion.
2. Assertion [A] - Sun appears red during sunrise and sun set
Reason [R] - Scattering of light is directly proportional to the wavelength.
Ans - A is true and but R is false.
3. Assertion [A]: Blind spot is a small area of the retina which is insensitive to light where the optic nerve leaves the eye.
Reason [R]: There are no rods or cones present at the junction of optic nerve and retina in the eye.
Ans – (a) Both the Assertion and the Reason are correct and the Reason is the correct explanation of the Assertion.
4. Assertion [A]: The rainbow is a man-made spectrum of sunlight in the sky.
Reason [R]: The rainbow is formed in the sky when the sun is shining and presence of water droplets at the same time.
Ans – (d) The statement of Assertion is false but the Reason is true.
5. Assertion [A] - Owls can see clearly during night
Reason [R] – They have large number of rods on their retina
Ans - Both A and R are true but R is not the correct explanation of the assertion.

Case – Based Questions

1. Answer the questions that follow on the basis of your understanding of the following case and the related studied concepts:

Two children went to the park with their grandfather. On reaching the park, the children joined others to play, while their grandfather after taking three rounds of the park, sat on the chair, took out newspaper from his bag and began to read with the help of his spectacle. After sometime, he realised that it was too long to see the children, he looked around, but though he has worn spectacle, he couldn't see anything. He then realised that he had forgotten his other spectacle, which he used to see the far away places, were left at home. He began calling them by their names, but due to the large distance, his voice was not reaching the children. Another man sitting beside him realised the problem and helped him to reach the children.

(a) The eye-defect from which the grandfather was suffering is

(i) Presbyopia

(ii) Hypermetropia

(iii) Myopia

(iv) Cataract

Ans – (i) Presbyopia

(b) The type of spectacles that should be worn by the grandfather to correct the eye-defect should be

(i) Convex lens

(ii) Bifocal lens

(iii) Concave lens

(iv) Cylindrical lens

Ans – (ii) Bifocal lens

(c) The cause of eye defect by which the grandfather was suffering is

(i) Shape of eye is shorter than usual

(ii) Eye ball is slightly too long

(iii) Decreasing flexibility of the lens with age

(iv) A cornea with asymmetric curvature

Ans – (iii) decreasing flexibility of the lens with age

(d) An object that is close to the grandfather eyes would be focussed

(i) In front of the retina

(ii) On the retina correctly

(iii) Behind the retina

(iv) Correctly in some planes of retina but not others

Ans – (iii) Behind the retina

(e) The focal length of eye lens decreases when eye muscles are

(i) Relaxed and lens become thinner

(ii) Contract and lens become thinner

(iii) Relaxed and lens become thicker

(iv) Contract and lens become thicker

Ans – (iv) Contract and lens become thicker

Source – Based Questions

1. A rainbow is one of the most spectacular natural light shows observed in the sky. A number of scientists and mathematicians including Aristotle, Bacon, Newton have worked on the explanation of various observations on rainbows. To understand the formation of rainbow, one should actually study the refraction, internal reflection, dispersion, and total deviation of white light by the spherical water drop. A rainbow is produced when sunlight falls and gets diverted to the eyes of the observer due to a large number of water droplets in the sky on a rainy day. In addition to primary rainbow,

there is a secondary rainbow, which occurs in the same manner as the primary rainbow but due to two internal reflections. In nature, we can observe only primary and secondary rainbows.

Answer the following questions -

1. What is Refraction?

Ans – The phenomenon of change in the direction of light rays in the second medium, when it enters obliquely from one transparent medium to another.

2. List two essential conditions for observing a rainbow.

Ans -

a) The presence of water droplets in the atmosphere
b) The sun must be at the back of the observer

3. What is the shape of the rainbow?

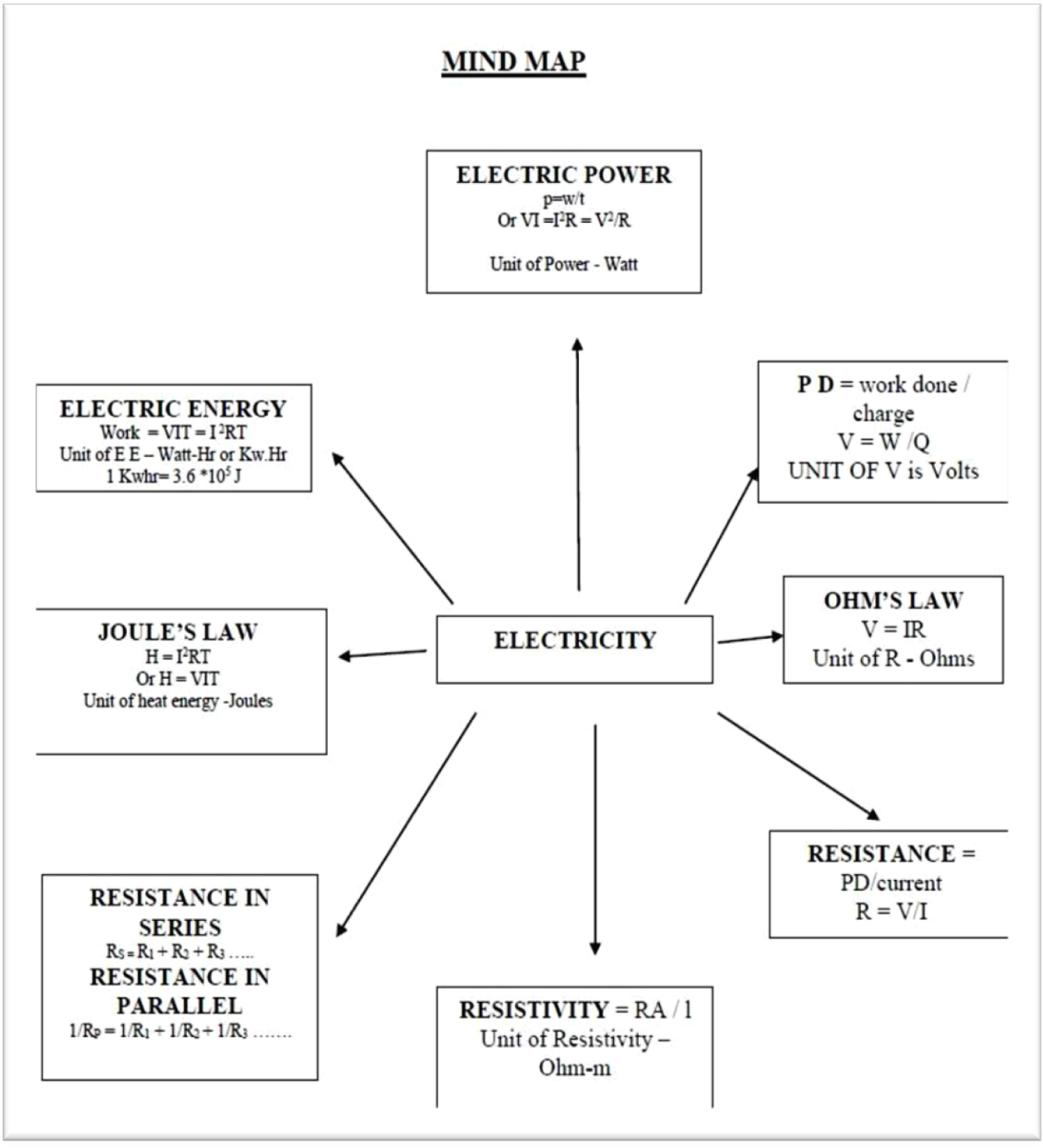
Ans – Its shape is an arc along the circumference of a circle.

4. Why red colour appears on the top of the rainbow?

Ans – Red colour has the longest wavelength among the visible colours and bends the least.

CHAPTER - 12

ELECTRICITY



Charge is a fundamental particle in an atom. It may be positive or negative.
• Like charges repel each other.
• Unlike charges attract each other.

Coulomb (C) :S. I. unit of charge
1 Coulomb charge = Charge present on approx. 6×10^{18} electrons

• Charge on 1 electron = Negative charge of 1.6×10^{-19} C

Q = *ne*

Where Q = Charge (total)

n = No. of electrons

e = Charge on 1 electron

Current (I) : The rate of flow of charge is called current.

$$\text{Current} = \frac{\text{Charge}}{\text{Time}}$$

I = Q /t

(I – current Q – quantity of charge t – time)

S. I. unit of current = Ampere (A)

1 A = 1 Cs^{-1}

1 mA = 10^{-3} A

1 μA = 10^{-6} A

Current is measured by Ammeter. Its symbol is

Ammeter has low resistance and always connected in series.

Potential Difference (V)

Work done to move a unit charge from one point to another.

1 Volt : When 1 joule work is done in carrying one Coulomb charge then potential difference is called 1 volt.

$$V = \frac{W}{Q}$$

S. I. unit of Potential difference = Volt (V)

1 V = 1 JC^{-1}

1 Volt : When 1 joule work is done in carrying one Coulomb charge then potential difference is called 1 volt.

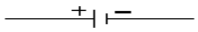
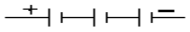
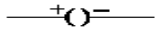
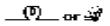
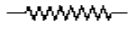
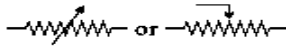
Voltmeter : Instrument to measure potential difference.• It has high resistance and always connected in parallel.

Symbol is

• Cell is the simplest device to maintain potential difference.

• Current always flow from higher potential to lower potential.

Symbols of Some Commonly Used Components in Circuit:

Electric cell	:	
Battery	:	
Key (open)	:	
Key (closed)	:	
Wire joint	:	
Wire Crossing (without join)	:	
Electric bulb	:	
Resistance	:	
Rheostat	:	
Ammeter	:	

Ohm's Law

Potential difference across the two points of a metallic conductor is directly proportional to current passing through the circuit provided that temperature remains constant.

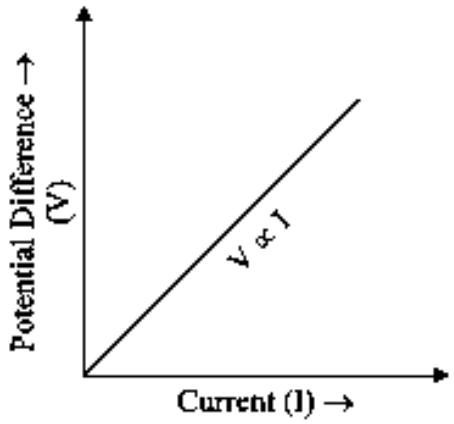
• Mathematical expression for Ohm's law :

$V \propto I$

$V = IR$

R is a constant called resistance for a given metal.

• V-I graph for Ohm's law :



Resistance (R) : It is the property of a conductor to resist the flow of charges through it.

• Ohm (Ω) : S. I. unit of resistance.

$$1\ \text{ohm} = \frac{1\ \text{volt}}{1\ \text{ampere}}$$

• When potential difference is 1 V and current through the circuit is 1 A, then resistance is 1 ohm.

Rheostat: Variable resistance is a component used to regulate current without changing the source of voltage.

Factors on which the Resistance of a Conductor depends:

Resistance of a uniform metallic conductor is

(i) directly proportional to the length of conductor,

(ii) inversely proportional to the area of cross-section,

(iii)directly proportional to the temperature and

(iv) depend on nature of material.

Resistivity (ρ)

It is defined as the resistance offered by a cube of a material of side 1 m when current flows perpendicular to its opposite faces.

Its S.I. unit is ohm-metre (Ωm).

• Resistivity does not change with change in length or area of cross-section but it changes with change in temperature.

• Range of resistivity of metals and alloys is 10−8 to 10−6 Ωm.

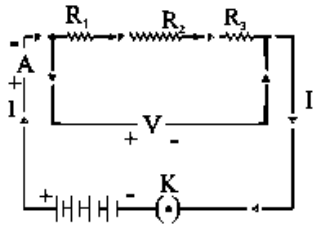
• Range of resistivity of insulators is 1012 to 1017 Ωm.

• Resistivity of alloy is generally higher than that of its constituent metals.

• Alloys do not oxidize (burn) readily at high temperature, so they are commonly used in electrical heating devices.

• Copper and aluminium are used for electrical transmission lines as they have low resistivity.

Resistors in Series



When two or more resistors are connected end to end, the arrangement is called series combination.

• Total/resultant/overall/effective resistance in series

$R_s = R1 + R2 + R3$

• Current through each resistor is same.

• Equivalent resistance is larger than the largest individual resistance.

• Total voltage = Sum of voltage drops

$V = V1 + V2 + V3$

• Voltage across each resistor:

$V1 = IR1$

$V2 = IR2$ [V1 + V2 + V3 = V]

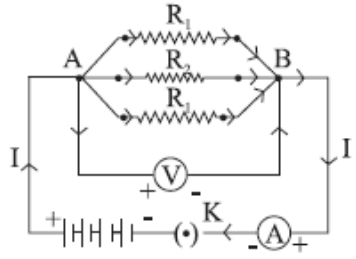
$V3 = IR3$ V = IR

$V = IR_1 + IR_2 + IR_3$

$\Rightarrow IR = I(R_1 + R_2 + R_3)$

$\Rightarrow R = R1 + R2 + R3$

Resistors in Parallel



Voltage across each resistor is same and equal to the applied voltage.

• Total current is equal to sum of currents through the individual resistances.

$I = I_1 + I_2 + I_3$

• Reciprocal of equivalent resistance is equal to sum of reciprocals of individual resistances.

• Equivalent resistance is less than the value of the smallest individual resistance in the combination.

Advantages of Parallel Combination over Series Combination
(i) In series circuit, when one component fails, the circuit is broken and none of the component works.
(ii) Different appliances have different requirement of current. This cannot be satisfied in series as current remains same.
(iii) The total resistance in a parallel circuit is decreased.

Heating Effect of Electric Circuit
If an electric circuit is purely resistive, the source of energy continually get dissipated entirely in form of heat. This is known as heating effect of electric current.
As $E = P \times T \Rightarrow VIt\{E = H\}$
Heat produced, $H = VIt\{V = IR\}$
Or Heat produced, $H = I^2Rt$

Joule's Law of Heating
It states that the heat produced in a resistor is
(i) directly proportional to square of current, $\mathbf{H \propto I^2}$
(ii) directly proportional to resistance for a given current, $\mathbf{H \propto R}$
(iii) directly proportional to time for which current flows through the conductor,
$\mathbf{H \propto t.}$
So, H = **I2Rt**

• Heating effect is desirable in devices like electric heater, electric iron, electric bulb, electric fuse, etc.
• Heating effect is undesirable in devices like computers, computer monitors (CRT), TV, refrigerators etc.
• In electric bulb, most of the power consumed by the filament appears a heat and a small part of it is radiated in form of light.

• Filament of electric bulb is made up of tungsten as
(i) it does not oxidise readily at high temperature.
(ii) it has high melting point (3380º C).
• The bulbs are filled with chemically inactive gases like nitrogen and argon to prolong the life of filament.

Electric Fuse: It is a safety device that protects our electrical appliances in case of short circuit or overloading.
• Fuse is made up of pure tin or alloy of copper and tin.
• Fuse is always connected in series with live wire.
• Fuse has low melting point.
• Current capacity of fuse is slightly higher than that of the appliance.

Electric Power: The rate at which electric energy is consumed or dissipated in an electric circuit.
$P = VI$
$P = I^2R$
S.I. unit of power = Watt (W)
1 Watt = 1 volt × 1 ampere
• **Commercial unit of electric energy** = Kilo Watt hour (KWh)
1 KWh = 3.6×10^6 J
1 KWh = 1 unit of electric energy

PHYSICAL QUANTITY	SI UNIT	SYMBOL
ELECTRIC CURRENT	Ampere	A
ELECTRIC POTENTIAL	Volt	V
ELECTRIC CHARGE	Coulomb	C
ELECTRIC POWER	watt	W
ELECTRICAL ENERGY	Kilowatt hour	Kw h
Heat energy	joule	J
RESISTANCE	Ohm	Ω
RESISTIVITY	Ohm metre	Ω m

QUESTIONS FOR L1

Question:
What is electric current? What is its SI unit? (1M)
Answer: The rate of flow of charge is called electric current. Ampere (A) is its SI unit.

Question:
What is potential difference? Write its SI unit. (1M)
Answer: Work done to move a unit charge from one point to another is called potential difference. Its SI unit is Volt (V)

Question:
Name a device that helps to maintain a potential difference across a conductor(1M)
Answer: A battery.

Question:
Is electric potential a scalar or a vector quantity? (1M)
Answer: Electric potential is a scalar quantity.

Question:
How is ammeter connected in the circuit to measure electric current? (1M)
Answer: Ammeter is connected in series in an electric circuit.

Question:
Name the device which is often used to change the resistance without changing the voltage source in an electric circuit. (1M)
Answer: Rheostat is the device which is often used to change the resistance without changing the voltage source in an electric circuit.

Question :
Name the material with the least resistivity(1M)
Answer: Silver

Question:
An circuit is left on for several minutes, causing the connecting copper wire to become hot. As the temperature of the wire increases, the electrical resistance of the wire (1M)
(a) decreases.
(b) remains the same.
(c) increases.
(d) increases for some time and then decreases
Answer: (c) increases
Question:

Calculate the number of electrons constituting one coulomb of charge. (1M)
Answer:
Charge on one electron, e = 1.6 x 10^{-19} C
Total charge, Q = 1 C
Number of electrons, n = Q/e = 1C /1.6x10^{-19} = 6.25 x 10^{18}

Question:
How much energy is given to each coulomb of charge passing through a 6 V battery?
Answer:
Energy given by battery = charge x potential difference
or W = QV = 1C X 6V = 6J.

Question:
Why is tungsten used for making bulb filaments of incandescent lamps? (2M)
Answer: Tungsten is used for making filaments of incandescent lamps because tungsten can sustain high temperature and it has high melting point (3380°C), with high resistivity.

Question:
Judge the equivalent resistance when the following are connected in parallel:
(i) 1 Ω and 10^6 Ω,
(if) 1 Ω and 10^3 Ω and 10^6 Ω.
Answer:
When the resistances are connected in parallel, the equivalent resistance is smaller than the smallest individual resistance.
(i) Equivalent resistance < 1 Ω.
(ii) Equivalent resistance < 1 Ω.

Question:
What is the commercial unit of electrical energy? (1M)
(a) Joules
(b) Kilojoules
(c) Kilowatt-hour
(d) Watt-hour
Answer: (c) Kilowatt-hour

Question:
1 kWh = ……. J (1M)
(a) 3.6 × 10^{-6} J
(b) 13.6 × 10^6 J
(c) 3.6 × 10^6 J
(d) 13.6 × 10^{-6} J
Answer: (a) 3.6 × 10^6 J

Question:
What happens to resistance of a conductor when temperature is increased? (1M)
Answer: Resistance of a conductor increases with the increase in temperature.

Question:
An electric iron of resistance 20Ω takes a current of 5 A. Calculate the heat developed in 30 s. (2M)
Answer:
Here, R = 20 Ω, I = 5 A, t = 3s
Heat developed, H = I^2 R t = 25 x 20 x 30 = 15,000 J = 1.5 x 10^4 J

Question:
Why are coils of electric toasters and electric irons are made of an-alloy rather than a pure metal? (2M)
Answer: The coils of electric toasters, electric irons and other heating devices are made of an alloy rather than a pure metal because (i) the resistivity of an alloy is much higher than that of a pure metal, and (ii) an alloy does not undergo oxidation (or burn) easily even at high temperature, when it is red hot.

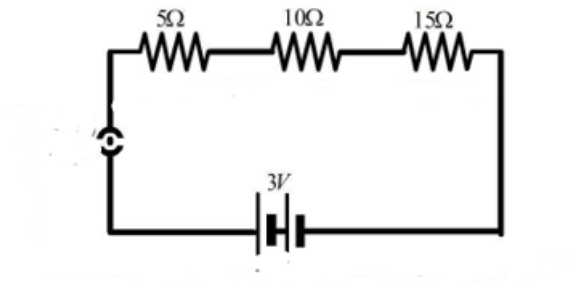
Question:
State Ohms law. (1M)
Answer:
It states that the potential difference V, across the ends of a given metallic wire in an electric circuit is directly proportional to the current flowing through it, provided its temperature remains the same.
Mathematically,
$V \propto I$
$V = RI$
where R is resistance of the conductor.

Question
What are the factors on which resistance of a conductor depends? (2M)
Answer:
The resistance of the conductor depends on the following factors:

- The temperature of the conductor
- The cross-sectional area of the conductor
- Length of the conductor
- Nature of the material of the conductor

Electrical resistance is directly proportional to the length (L) of the conductor and inversely proportional to the cross-sectional area (A).

Question:
a) A piece of wire is measured to have resistivity in the order of $10^{19}\Omega$ m. What should its material be classified into? (1M)
b) Draw the schematic diagram of an electric circuit consisting of a battery of two cells of 1.5V each, three resistors with resistance of 5ohm, 10 ohm and 15 ohm respectively and a plug key all connected in series (2M)
Answer: a) Insulators.
b)



Question:
List the advantages of connecting electrical devices in parallel with an electrical source instead of connecting them is series. (3M)
Answer: Advantages of parallel combination over series combination are:
1) In parallel combination each appliance gets the full voltage.
2) If one appliance is switched on/off others are not affected.

3) The parallel circuit divide the current through the appliances. Each appliance gets proper current depending on its resistance.
4) In a parallel combination it is very easy to connect or disconnect a new appliance without affecting the working of other appliances**.**

QUESTIONS FOR L2

Question: Two resistors connected in series give an equivalent resistance of 10 Ω. When connected in parallel, give 2.4 Ω. Then the individual resistance is (1M)
(a) each of 5 Ω
(b) 6 Ω and 4 Ω
(c) 7 Ω and 4 Ω
(d) 8 Ω and 2 Ω
Answer: Option (b)

Question :
An electric bulb is connected to a 240V generator. The current is 0.6 A. What is the power of the bulb? (1M)
(a) 144 W
(b) 114 W
(c) 14.4 W
(d) 0.0144 W
Answer:
Here, V = 240 V, I = 0.6 A
∴ Power (P) = VI = 240 x 0.60 = 144 W

Question :
A battery of 10 volt carries 20,000 C of charge through a resistance of 20 Ω. The work done in 10 seconds is (1M)
(a) 2×10^3 joule
(b) 2×10^5 joule
(c) 2×10^4 joule
(d) 2×10^2 joule
Answer :b
Explanation: (b) W= qV= 20000 × 10 = 2,00, 000 = 2×10^5 J

Question:
A piece of wire is measured to have resistivity in the order of 10^{19} Ω m. What should its material be classified into? (1M)
Answer: Insulators

Question. What is the SI unit of resistivity. (1M)
Answer: The SI unit of resistivity ohm-metre (Ωm).

Question:
Why does the cord of an electric heater not glow while the heating element does? (2M)
Answer.
The heating element of the heater is made up of alloy which has very high resistance so when current flows through the heating element, it becomes too hot and glows red. But the resistance of cord which is usually of copper or aluminium is very low so it does not glow.

Question:
State joule's law of heating. (1M)

Answer: Joule's law of heating states that,
when a current 'I ' passes through a conductor of resistance 'R' for time 't' then the heat developed in the conductor is equal to the product of the square of the current, the resistance and time.
$H=I^2\times R\times t$

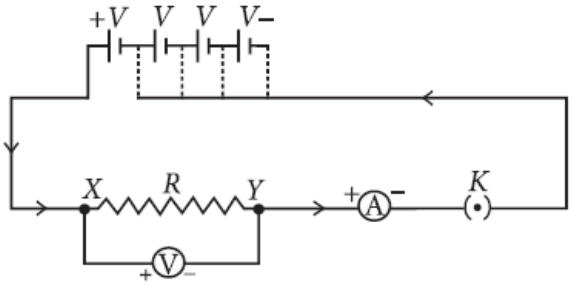
Question :
What is the difference between kilo watt and kilo watt hour. (1M)
Answer: Kilo watt is the unit of electric power and kilo watt hour is the commercial unit of electric energy.

Question:
An electric current of 4.0 A flows through a 12 Ω resistor. What is the rate at which heat energy is produced in the resistor? (1M)
Answer: Given: I = 4 A, R = 12 Ω
Rate of production of heat energy, $P = I^2R = 42 \times 12 = 192$ W.

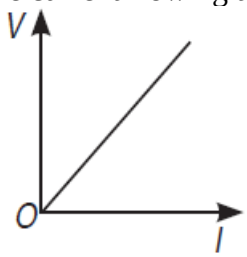
Question:
The maximum resistance which can be made using four resistors each of resistance 1/2 Ω is (1M)
(a) 2 Ω
(b) 1 Ω
(c) 2.5 Ω
(d) 8 Ω
Answer:
(a) The maximum resistance can be produced from a group of resistors by connecting them in series.
Thus, $R_s = 12\ \Omega + 12\ \Omega + 12\ \Omega + 12\ \Omega = 2\ \Omega$

Question:
Explain the use of an electric fuse. What type of material is used for fuse wire and why? (2M)
Answer:
Electric fuse protects circuits and appliances by stopping the flow of any unduly high electric current. It consists of a piece of wire made of a metal or an alloy of appropriate melting point, for example aluminium, copper, iron, lead etc. If a current larger than the specified value flows through the circuit, the temperature of the fuse wire increases. This melts the fuse wire and breaks the circuit.

Question:
(a)Define Ohm's law. Draw a labelled circuit diagram to verify this law in the laboratory. (2M)
(b)If you draw a graph between the potential difference and current flowing through a metallic conductor, what kind of curve will you get? Explain how would you use this graph to determine the resistance of the conductor? (2M)
Answer: Ohm's law: It states that the potential difference *V*, across the ends of a given metallic wire in an electric circuit is directly proportional to the current flowing through it, provided its temperature remains the same. Mathematically,
$V \propto I$
$V = RI$
where *R* is resistance of the conductor



(b)The shape of the graph obtained by plotting potential difference applied across conductor against the current flowing through it will be a straight line.



According to Ohm's law,
$V = IR$ or $R = V/I$
So, the slope of *V-I* graph at any point represents the resistance of the given conductor.

QUESTIONS FOR L3

Assertion - Reasoning based questions (1M)

Answer these questions selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true and R is not the correct explanation of A
(c) A is true but R is false
(d) A is False but R is true

Question :
Assertion (A): If a graph is plotted between the potential difference and the current flowing, the graph is a straight line passing through the origin.
Reason (R): The current is directly proportional to the potential difference
Answer: (a)

Question:
Assertion: A bird perches on a high-power line and nothing happens to the bird.
Reason: The circuit is incomplete for the bird sitting on high power line.
Answer: (a)

Question:
Assertion (A) : Heater wire must have high resistance and high melting point.
Reason (R) : If resistance is high, the electric conductivity will be less.
Answer: (b)

Question:
Assertion (A): Longer wires have greater resistance and the smaller wires have lesser resistance.
Reason (R): Resistance is inversely proportional to the length of the wire.
Answer: (c)

Question:
Assertion (A): Alloys are commonly used in electrical heating devices, like electrical iron, toasters etc.
Reason (R): Alloys do not oxidise readily at high temperatures.
Answer: (a)

Question:
Which one among a bar of an alloy of mass 2 kg and a 3 kg iron bar of same dimension has greater resistivity? (1M)
(a) Iron bar because it has higher mass.
(b) Alloy bar because it has lower mass.
(c) Iron bar because it has same types of atoms.
(d) Alloy bar because it has different types of atoms.
Answer: (d)

Question:
The maximum resistance which can be made using four resistors each of 2 Ω is (1M)
(a) 2 Ω
(b) 4 Ω
(c) 8 Ω
(d) 16 Ω (2020)
Answer: (c)
A group of resistors can produce maximum resistance when they all are connected in series.
∴ R_s = 2 Ω + 2 Ω + 2 Ω + 2 Ω = 8 Ω

Question:
Choices for the correct combination of elements from column-I and column-II are given as options (a), (b), (c) and (d) select the correct combination? (1M)

Column-I	Column-II
(P) Current	1. ohm
(Q) Potential	2. ampere
(R) Resistance	3. ohm m
(S) Resistivity	4. volt

(a) P-2, Q-4, R-1, S-3 **(b) P-3, Q-4, R-2, S-1**
(c) P-4, Q-3, R-1, S-2 **(d) P-2, Q-1, R-4, S-3**
Answer: (a) : P – 2, Q – 4, R – 1, S – 3

Question:
Define electrical resistance of a conductor. (1M)
Answer:
It is the property of a conductor to oppose the flow of electric charge through it.
Resistance of a conductor, R =V/I, where V is the potential difference across the conductor and I is the current flowing through the conductor.
Question:
An electric lamp of 100 Ω, a toaster of resistance 50 Ω, and a water filter of resistance 500 Ω are connected in parallel to a 220 V source. What is the resistance of an electric iron connected to the same source that takes as much current as all three appliances, and what is the current through it? (2M)
Answer: Resistance of electric lamp, R_1 = 100 Ω
Resistance of toaster, R_2 = 50 Ω
Resistance of water filter, R_3 = 500 Ω

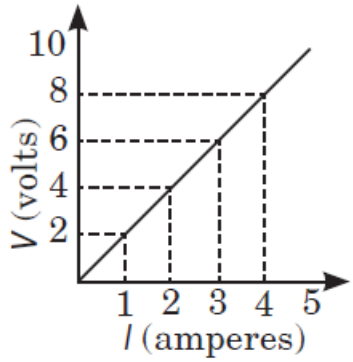
Equivalent resistance R_p of the three appliances connected in parallel, is

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{100} + \frac{1}{50} + \frac{1}{500} = \frac{16}{500}$$

$$R_p = \frac{500}{16}\,\Omega = 31.25\,\Omega.$$

Question:
Work of 14 J is done to move 2 C charge between two points on a conducting wire. What is the potential difference between the two points? (2M)
Answer: 7 V
Work done = Charge moved x Potential difference.
W = Q x V
W = work done = 14 J
Q = Charge = 2 C
V = potential difference
14 = 2 x V
=> V =14/2 = 7
the potential difference between the two points = 7 V

Question
Study the *V-I* graph for a resistor as shown in the figure and prepare a table showing the values of *I* (in amperes) corresponding to four different values *V* (in volts). Find the value of current for *V* = 10 volts. How can we determine the resistance of the resistor from this graph? (3M)



Answer:
Hence, the value of current for *V* = 10 volts is 5 amperes
(or 5 A).
From Ohm's law, *V* = *IR*,
We can write, *R* = *VI*
At any point on the graph, resistance is the ratio of values of *V* and I. Since, the given graph is straight line so, the slope of graph will also give the resistance of the resistor

$$R = \frac{10\ \text{V}}{5\ \text{A}} = 2\ \Omega$$

Alternately, $R = \frac{(8-2)\ \text{V}}{(4-1)\ \text{A}} = \frac{6\ \text{V}}{3\ \text{A}} = 2\ \Omega$

Question:
Establish the relationship between 1 kWh and SI unit of energy (joule). (2M)
Answer:
Commercial unit of electrical energy is kWh. 1 kWh is the amount of electric energy

consumed by 1000 W electric appliance when operates for 1 hour. 1 kWh = 1000 W x 3600 s = 1000 Js^{-1} x3600 s =3.6 x10^6J.

Question:
What is **(a)** the highest and **(b)**the lowest total resistance that can be secured by a combination of four resistance of 4Ω,8Ω,12Ω and 24Ω ? (4M)
Answer:
(a) When all four resistances must be connected in series, the highest resistance is achieved. In that instance, the outcome
R=R1+R2+R3+R4
= 4+8+12+24
= 48Ω
The highest resistance is 48 Ω.
(b) The lowest total resistance that can be secured by a combination of four resistance of 4Ω,8Ω,12Ω and 24Ω?
All four resistances must be connected in parallel to produce the lowest resistance.
1/R=1/R1+1/R2+1/R3+1/R4
= 1/4 +1/8 +1/12 + 1/24
= 12/24
The lowest resistance is 2Ω.

Question:
Two identical resistors are first connected in series and then in parallel. Find the ratio of equivalent resistance in two cases (2M)
Answer: Let resistance of each resistor be R.
For series combination,
$R_s = R_1 + R_2$
So, $R_s = R + R = 2R$
For parallel combination,

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} \quad \text{or} \quad R_p = \frac{R_1 R_2}{R_1 + R_2}$$

$$\text{So, } R_p = \frac{R \times R}{R + R} = \frac{R}{2}$$

$$\text{Required ratio} = \frac{R_s}{R_p} = \frac{2R}{R/2} = 4:1$$

The ratio of equivalent resistance=4:1

Question:
Two wires A and B are of equal length, different cross-sectional areas and made of same metal.
(a) (i) Name the property which is same for both the wires,
(ii) Name the property which is different for both the wires.
(b) If the resistance of wire A is four times the resistance of wire B, calculate
(i) the ratio of the cross-sectional areas of the wires and
(ii) The ratio of the radii of the wire.
Answer
(a)(i) Resistivity. This is due to the reason that the resistivity is the property of the material of which the wire is made. As both the wires are made of the same metal, their resistivity is the same.
(ii) Resistance. As both the wires are of different cross-sectional area, their resistances are different ($r \propto 1/A$)

(b) (i) For wire A, $R_1 = \frac{\rho l}{A_1}$ and for wire B, $R_1 = \frac{\rho l}{A_2}$ Thus, $\frac{R_2}{R_1} = \frac{A_1}{A_2}$

Since $R_1 = 4R_2$, $\frac{R_2}{R_1} = \frac{1}{4}$ Thus, $\frac{A_1}{A_2} = \frac{1}{4}$

(ii) As $A_1 = \pi r_1^2$ and $A_2 = \pi r_2^2$, $\frac{A_1}{A_2} = \frac{\pi r_1^2}{\pi r_2^2} = \left(\frac{r_1}{r_2}\right)^2$

As $\frac{A_1}{A_2} = \frac{1}{4}$, $\left(\frac{r_1}{r_2}\right)^2 = \frac{1}{4}$ or $\frac{r_1}{r_2} = \frac{1}{2}$.

Question:

Read the passage given below and answer the following questions. (4 M)

Several resistors may be combined to form a network. The combination should have two end points to connect it with a battery or other circuit elements. When the resistances are connected in series, the current in each resistance is same but the potential difference is different in each resistor. When the resistances are connected in parallel, the voltage drop across each resistance is same but the current is different in each resistor.

Question:

(i). The household circuits are connected in

(a) series combination

(b) parallel combination

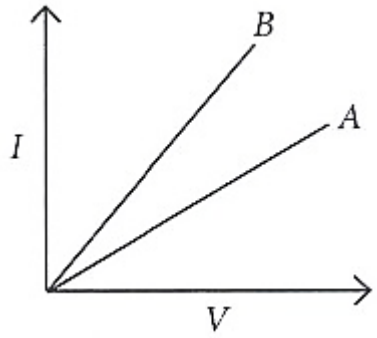
(c) both (a) and (b)

(d) none of these

Answer: (b)

Question:

The two wires of each of resistance R, initially connected in series and then in parallel. In the graph it shows the resistance in series and in parallel. Which of the following is correct?



(a) A denotes parallel combination.

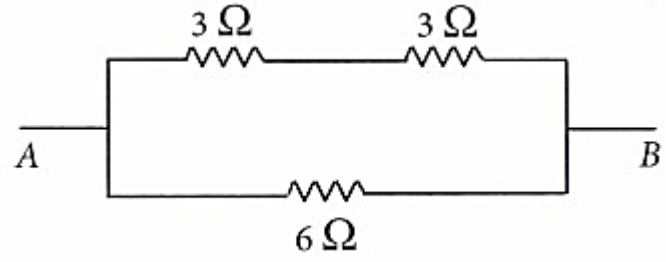
(b) B denotes series combination.

(c) A denotes series combination and B denotes parallel combination.

(d) None of these.

Answer: (a) A' represents parallel combination because A is less steep than B so resistance of 'A' is less than 'B'. As we know resistance in parallel combination is less than series combination.

Question
(iii) The equivalent resistance between A and B is



(a) 6 Ω (b) 9 Ω
(c) 3 Ω (d) 12 Ω
Answer: (c) 3 Ω

Question
(iv) Identify the combination which is not a series connection.
a) Fuses
b) Decorative bulbs
c) Domestic appliances
d) Both a and c
Answer: (c) Domestic appliances

Read the passage given below and answer the following questions. (4 M)
The heating effect of current is obtained by transformation of electrical energy in heat energy. Just as mechanical energy used to overcome friction is converted into heat, in the same way, electrical energy is converted into heat energy when electric current flows through a resistance wire. The heat produced in a conductor, when a current flows through it is found to depend directly on (a) strength of current (b) resistance of the conductor (c) time for which the current flows. The electrical fuse, electrical heater, electric iron, electric geyser etc. all are based on the heating effect of current.

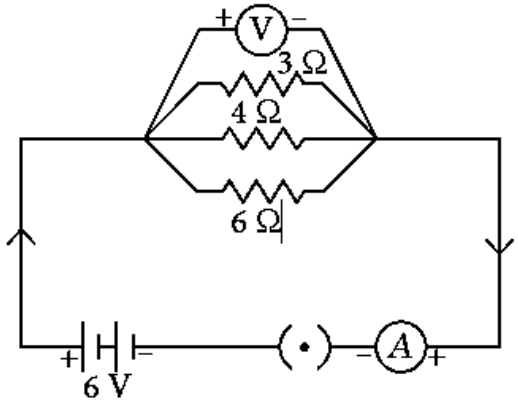
Question:
(i) What are the properties of heating element?
(a) High resistance, high melting point
(b) Low resistance, high melting point
(c) High resistance, low melting point
(d) Low resistance, low melting point.
Answer: (a) High resistance, high melting point

Question:
(ii) What are the properties of electric fuse?
(a) Low resistance, low melting point
(b) High resistance, high melting point.
(c) High resistance, low melting point
(d) Low resistance, high melting point
Answer: (a) Low resistance, low melting point

Question:
(iii) When the current is doubled in a heating device and time is halved, the heat energy produced is
(a) doubled (b) halved
(c) four times (d) one fourth times
Answer: (a) doubled

Question:
(iv) The amount of heat produced in a conductor is
(a) directly proportional to the current flowing through it
(b) inversely proportional to the current flowing through it
(c) directly proportional to the square of the current flowing through it
(d) inversely proportional to the square of current flowing through it.
Answer: (c) directly proportional to the square of the current flowing through it

Question:
In the given circuit diagram calculate
(i) the total effective resistance of the circuit. (2 M)
(ii) the current through each resistor. (2 M)



Answer:
For the given circuit
$R1$ = 3 W, $R2$ = 4 W, $R3$ = 6 W and V = 6 V.
(i) Total effective resistance of the circuit, Req is given by

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{3} + \frac{1}{4} + \frac{1}{6} = \frac{9}{12}$$

$$\text{or,} \quad R_{eq} = \frac{12}{9}\ \Omega = \frac{4}{3}\ \Omega = 1.33\ \Omega$$

(ii) Since, potential difference across each resistor connected in parallel is same.
So, $V1 = V2 = V3 = 6$ V
Applying Ohm's law,

$$V_1 = I_1 R_1 \text{ or } I_1 = \frac{V_1}{R_1} \quad \text{or} \quad I_1 = \frac{6}{3}\ \text{A} = 2\ \text{A}$$

$$\text{Similarly, } I_2 = \frac{6}{4}\ \text{A} = 1.5\ \text{A} \quad \text{and} \quad I_3 = \frac{6}{6}\ \text{A} = 1\ \text{A}$$

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CHAPTER - 13

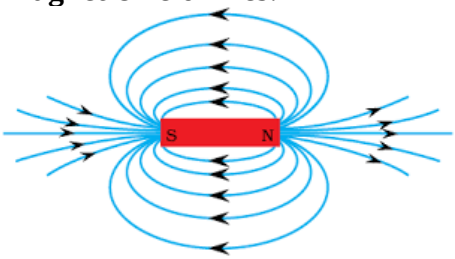
MAGNETIC EFFECTS OF ELECTRIC CURRENT

Magnet: Magnet is an object that attracts objects made of iron, cobalt and nickel. Magnet comes to rest in North – South direction, when suspended freely.

Properties of Magnet 1. A free suspended magnet always points towards the north and south direction 2. The pole of a magnet which points toward north direction is called north pole or north-seeking 3. The pole of a magnet which points toward south direction is called south pole or south seeking.4. Like poles of magnets repel each other while unlike poles of magnets attract each other.

Magnetic field: The area around a magnet where a magnetic force is experienced is called the magnetic field. It is a quantity that has both direction and magnitude, (i.e., Vector quantity).

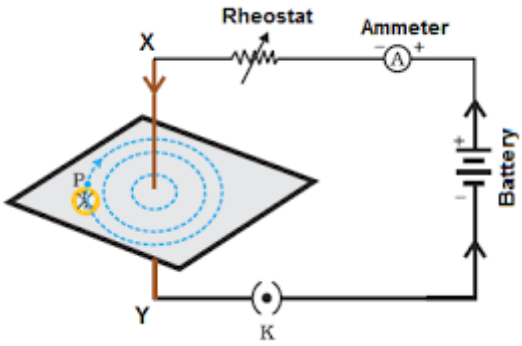
Magnetic field lines:



The imaginary lines of magnetic field around a magnet are called field line or field line of magnet. When iron fillings are allowed to settle around a bar magnet, they get arranged in a pattern which mimics the magnetic field lines. Field line of a magnet can also be detected using a compass. Magnetic field is a vector quantity, i.e., it has both direction and magnitude.

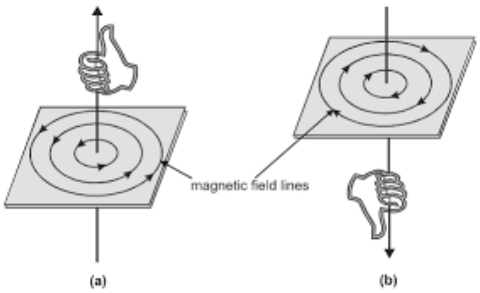
Properties of Magnetic field lines: (i)They do not intersect each other. (ii)It is taken by convention that magnetic field lines emerge from North Pole and merge at the South Pole. Inside the magnet, their direction is from South Pole to North Pole. Therefore, magnetic field lines are closed curves. (iii)The density of the field lines gives the strength of the magnetic field.

Magnetic field lines due to a current through a straight conductor (wire) A current carrying straight conductor has magnetic field in the form of concentric circles, around it. Magnetic field of current carrying straight conductor can be shown by magnetic field lines. The direction of magnetic field through a current carrying conductor depends upon the direction of flow electric current.

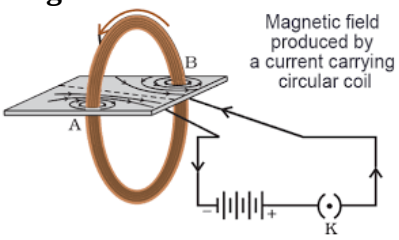


If the current is flowing from north to south, the direction of magnetic field will be clockwise. The direction of magnetic field, in relation to direction of electric current through a straight conductor can be depicted by using the Right-Hand Thumb Rule. It is also known as Maxwell's Corkscrew Rule.

Right hand thumb rule: If a current carrying straight conductor is held in your right hand such that the thumb points towards the direction of current, then the wrapped fingers show the direction of magnetic field lines.

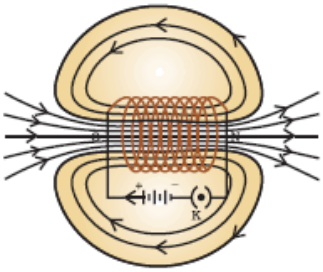


Magnetic field lines due to a current through a circular loop.

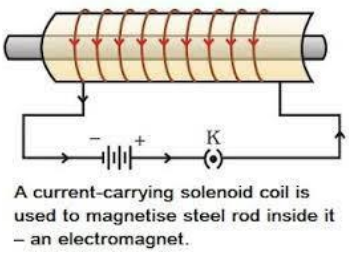


The strength of the magnetic field at the centre of the loop (coil)depends on:
(i)The radius of the coil- The strength of the magnetic field is inversely proportional to the radius of the coil. If the radius increases, the magnetic strength at the centre decreases.
(ii)The number of turns in the coil: As the number of turns in the coil increase, the magnetic strength at the centre increases, because the current in each circular turn is having the same direction, thus the field due to each turn adds up.
(iii)The strength of the current flowing in the coil: as the strength of the current increases, the strength of the magnetic fields also increases.

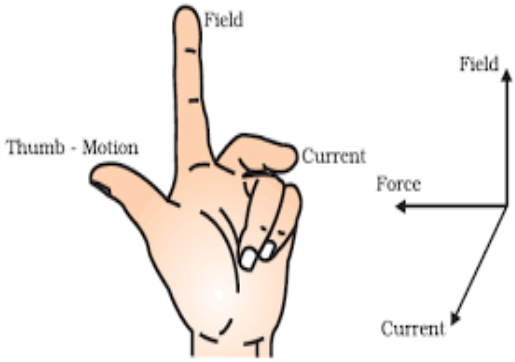
Solenoid:



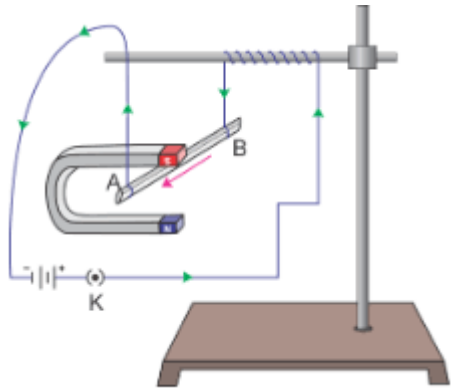
A coil of many turns of insulated copper wire wrapped in the shape of a cylinder is called a Solenoid. Magnetic field produced by a Solenoid is similar to a bar magnet. The strength of magnetic field is proportional to the number of turns & magnitude of current.
Magnetic field lines are parallel inside the solenoid, similar to a bar magnet, which shows that magnetic field is same at all points inside the solenoid.
Electromagnet: An electromagnet consists of a long coil of insulated copper wire wrapped on a soft iron core.



Fleming's Left-hand rule: Stretch the thumb, forefinger and middle finger of left hand such that they are mutually perpendicular. Forefinger points in the direction of magnetic field and middle finger in the direction of current, then the thumb gives the direction of force acting on the conductor.



Force on a current carrying conductor in a magnetic field: A current carrying conductor exerts a force when a magnet is placed in its vicinity. Similarly, a magnet also exerts equal and opposite force on the current carrying conductor. This was suggested by Marie Ampere, a French Physicist and considered as founder of science of electromagnetism.

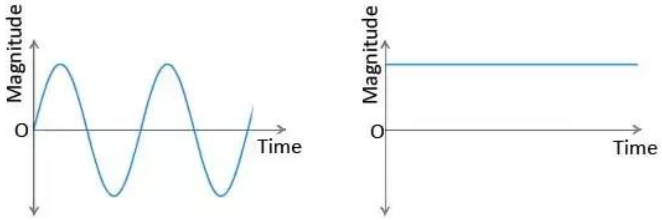


The direction of force over the conductor gets reversed with the change in direction of flow of electric current. It is observed that the magnitude of force is highest when the direction of current is at right angles to the magnetic field.

A.C – Alternate Current: Current in which direction is changed periodically is called Alternate Current. In India, most of the power stations generate alternate current. The direction of current changes after every 1/100 second in India, i.e. the frequency of A.C in India is 50 Hz. A.C can be transmitted to a long distance without much loss of energy.

D.C – Direct Current: Current that flows in one direction only is called Direct current. Electrochemical cells produce direct current.

Alternating Current	Direct Current
AC is safe to be transferred over longer distance even between two cities and can maintain the electric power.	DC cannot travel for a very long distance. It loses electric power.
The rotating magnets cause the change in direction of electric flow.	The steady magnetism makes DC flow in a single direction.
The frequency of AC is 50 Hz in India.	DC has no frequency or zero frequency.
In AC the flow of current changes its direction forward and backward periodically.	It flows in a single direction steadily.
Electrons in AC keep changing their directions – backward and forward.	Electrons only move in one direction – that is forward.

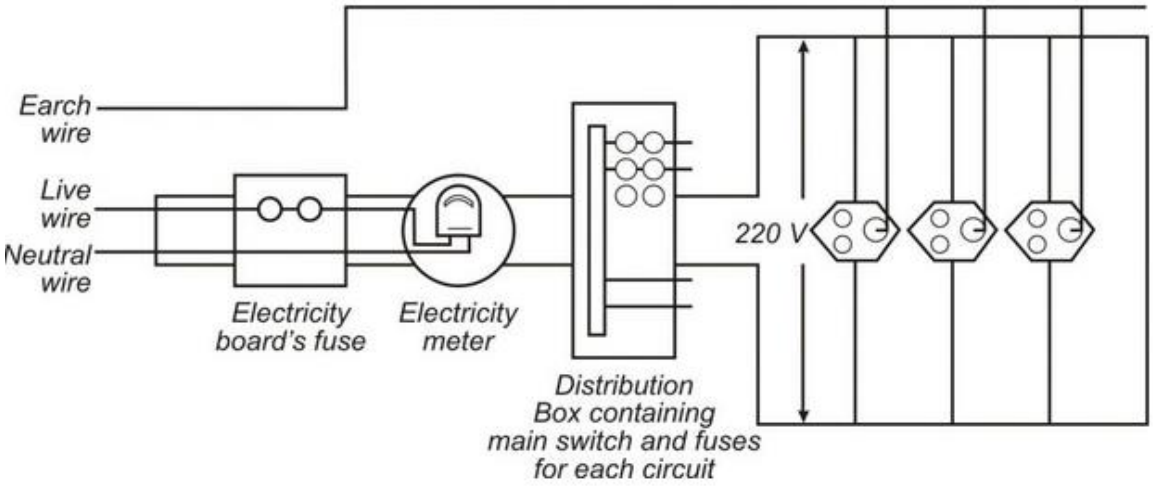


Alternating Current Direct Current

Following are the advantages of alternating current over direct current:

- AC is less expensive and easy to generate than DC.
- The distance covered by AC is more than that of the DC.
- The power loss during transmission in AC is less when compared to DC.

Domestic electric circuits: We receive electric supply through mains supported through the poles or cables. In our houses we receive AC electric power of 220V with a frequency of 50Hz. The 3 wires are as follows- (i) Live wire- (Red insulated, Positive) (ii)Neutral wire- (Black insulated, Negative) (iii)Earth wire- (Green insulated) for safety measure to ensure that any leakage of current to a metallic body does not give any serious shock to a user. Short circuit: is caused by touching of live wire and neutral wire Fuse: is a protective device used for protecting the circuits from short circuiting and over loading.



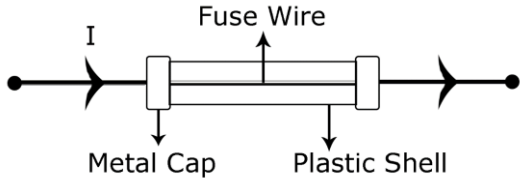
Short-circuiting and overloading

The use of an electric fuse prevents the electric circuit and the appliance from a possible damage by stopping the flow of high electric currents. There are faults in electrical circuits due to which heavy

current may flow through the circuit that results in the overheating of live wires. Short-circuiting takes place when a uncovered live wire touches a uncovered neutral wire. Normally sub-standard wires wear out soon and may cause short-circuiting.
Overloading of electrical circuit occurs, when the number of appliances operated on the circuit at the same time exceeds the limits the circuit wiring can withstand. We know that in domestic circuits all the appliances are connected in parallel. In parallel circuits, as we add more and more appliances more current is drawn from the supply. If the total current drawn by all the appliances at a particular time exceeds, the bearing capacity of that wire, the wires of the domestic wiring heat up, leading to **'overloading'**. It may happen because of connecting too many devices to the same (one single) socket.

Electric Fuse: It is a protective device used for protecting the circuit from short-circuiting and overloading. It is a piece of thin wire of material having a low melting point and high resistance.

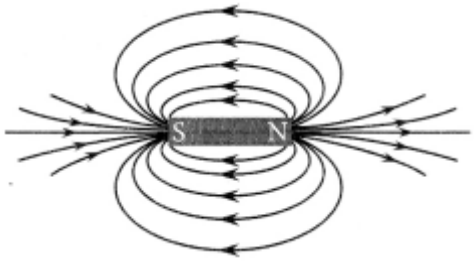
- Fuse is always connected to live wire.
- Fuse is always connected in series to the electric circuit.
- Fuse is always connected to the beginning of an electric circuit.
- Fuse works on the heating effect.



QUESTION BANK
LEVEL 1

1. Draw magnetic field lines around a bar magnet. Name the device which is used to draw magnetic field lines.

Answer:



Compass needle is used to draw magnetic field lines.

2. Choose the incorrect statement from the following regarding magnetic lines of the field

(a) The direction of the magnetic field at a point is taken to be the direction in which the north pole of a magnetic compass needle points

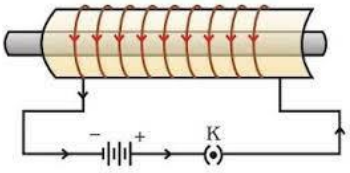
(b) Magnetic field lines are closed curves

(c) If magnetic field lines are parallel and equidistant, they represent zero-field strength

(d) The relative strength of the magnetic field is shown by the degree of closeness of the field lines

Answer: (c) If magnetic field lines are parallel and equidistant, they represent zero-field strength

3. (a) What is an electromagnet? List any two uses.
(b) Draw a labelled diagram to show how an electromagnet is made.
(c) State the purpose of soft iron core used in making an electromagnet.
(d) List two ways of increasing the strength of an electromagnet if the material of the electromagnet is fixed.
Answer:
A strong magnetic field produced inside a solenoid can be used to magnetise a piece of magnetic material, like soft iron, when placed inside the coil. The magnet so formed is called an electromagnet.



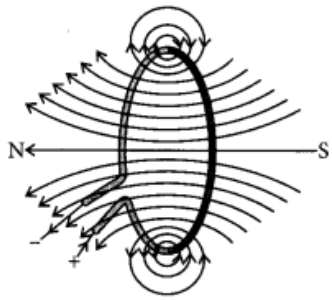
A current-carrying solenoid coil is used to magnetise steel rod inside it – an electromagnet.

Electromagnets are used in electric motors and generators, electric bells and buzzers, loudspeakers and headphones etc.
(c) The soft iron core placed in an electromagnet increases the strength of the magnetic field produced. Thus, increasing the strength of electromagnet.
(d) The strength of electromagnet can be increased by
(i) Increasing the current passing through the coil.
(ii) Increasing the number of turns in the coil.

4. What are magnetic field lines? List three characteristics of these lines.
Answer:
Magnetic field lines: These are the imaginary close curves which are used to represent the magnetic field around the magnet.

5. The properties of the magnetic field lines are listed below:
- Magnetic field lines start at the north pole and end at the south pole.
- Magnetic field lines do not intersect each other, because there can't be two directions of the magnetic field at any one point.
- The degree of closeness of the field lines depends upon the strength of the magnetic field. Stronger the field, closer are the field lines.

6. Draw the magnetic field lines through and around a single loop of wire carrying electric current. Name and state the rule to find out the direction of magnetic field inside and around the loop.
Answer:



Magnetic field lines of the field produced by a current-carrying circular loop.

Right hand thumb rule: When a current carrying straight conductor is held in the right hand in such a way that the thumb points towards the direction of the current, then the fingers will wrap around the conductor in the direction of the field lines of the magnetic field.

7. Choose the correct option. The magnetic field inside a long straight solenoid-carrying current
a) is zero.
b) decreases as we move towards its end.
c) increases as we move towards its end.
d) is the same at all points.
Answer: d. is the same at all points
The magnetic field inside a long straight current carrying solenoid is uniform therefore it is the same at all points.

8. Which of the following property of a proton can change while it moves freely in a magnetic field? (There may be more than one correct answer.)
a) Mass
b) Speed
c) Velocity
d) Momentum
Answer:(c) and (d) When a proton enters the region of magnetic field, it experiences magnetic force. Due to which the path of the proton becomes circular. As a result, the velocity and the momentum change.
9. Write one application of Flemings left hand rule.
Answer:
Flemings left hand rule is used to find the direction of force on a current carrying conductor placed in a magnetic field acting perpendicular to the direction of current.

10. Define alternating current and direct current.
Explain why alternating current is preferred over direct current for transmission over long distances.
Answer:
Alternating current (A.C.): An electric current whose magnitude changes with time and direction reverses periodically is called alternating current.
Direct current (D.C.): An electric current whose magnitude is either constant or variable but the direction of flow in a conductor remains the same is called direct current.
A.C. can be transmitted to distant places without much loss of electric power than D.C. That is why A.C. is preferred over D.C. for transmission of current over a long distance.

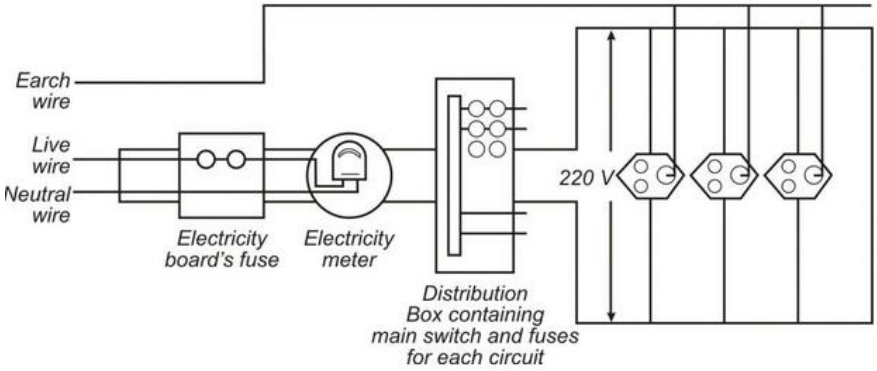
11. Mention and explain the function of an earth wire. Why it is necessary to earth metallic appliances?
Answer:
Many electric appliances of daily use like electric press, heater, toaster, refrigerator, table fan etc. have a metallic body. If the insulation of any of these appliances melts and makes contact with the metallic casing, the person touching it is likely to receive a severe electric shock. This is due to the reason that the metallic casing will be at the same potential as the applied one. Obviously, the electric current will flow through the body of the person who touches the appliance. To avoid such serious accidents, the metal casing of the electric appliance is earthed. Since the earth does not offer any resistance, the current flows to the earth through the earth wire instead of flowing through the body of the person.

12. Give reason for the following:
(a) The burnt-out fuse should be replaced by another fuse of identical rating.
(b) It is dangerous to touch the live wire of the main supply rather than neutral wire.
(c) In household circuit, parallel combination of resistances is used.
(d) Using fuse in a household electric circuit is important.

(a) A burnt-out fuse should be replaced with identical rating because it helps in protecting the circuit from overloading and short circuiting. If a fuse of higher rating is used then it may not melt and cut off the supply during overloading. Similarly, a fuse of lower rating may melt frequently even for a normal flow of current. This results in decreasing the efficiency of the circuit.
(b) Live wire is at 220V and neutral wire is at zero volt since the electric current flows from higher potential to lower potential, we can get an electric shock by touching live wire but that is not the case with neutral wire.
(c) In parallel combination, each resistor gets same potential from the source. We can use separate on/off switches with each appliance. Also, in case if any one resistor fails then the circuit will not break. So, it is safe and convenient to connect household circuit in parallel combination of resistors
(d) Fuse is an important safety device. It is used in series with any electrical appliance and protects it from short-circuiting and overloading.

13. (a) Name two safety measures commonly used in an electric circuit and appliances. (b) What precaution should be taken to avoid the overloading of domestic electric circuits?
Answer:
(a) Fuse and the connection of earthing wire are the two-safety measure commonly used in electric circuit and appliances.
(b) Provide fuses/MCBs of proper rating.

14. (a) Draw a schematic diagram of a common domestic circuit showing provision of
(i) Earth wire,
(ii) Main fuse
(iii) Electricity meter and
(iv) Distribution box.
(b) Distinguish between short circuiting and overloading.
Answer:



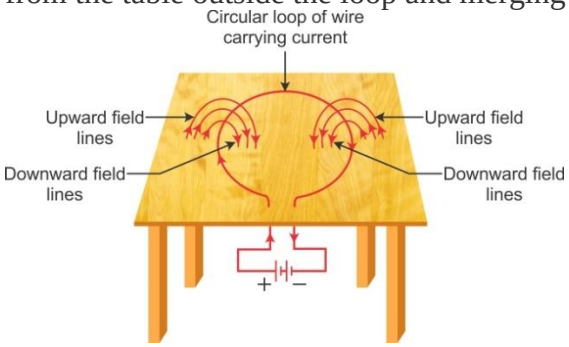
(b) Overloading: The condition in which a high current flow through the circuit and at the same time too many appliances are switched on then the total current drawn through the circuit may exceed its rated value. Short circuiting: The condition when the live wire comes in direct contact with the neutral wire, due to which a high current flow in the circuit.
15. The most important safety method used for protecting home appliances from short-circuiting or overloading is (a) earthing
(b) use of fuse
(c) use of stabilizers
(d) use of electric meter
Answer: (b) use of fuse
Fuse has thin wire of short length made of tin and lead in the ratio of 75: 25%. When current exceeds specified limit fuse melts and breaks the circuits thereby protecting home appliances.

16. When is the force experienced by a current–carrying conductor placed in a magnetic field largest?

Answer: When the direction of the current is perpendicular to the direction of the magnetic field is when the force experienced is the largest.

17. Consider a circular loop of wire lying in the plane of the table. Let the current pass through the loop clockwise. Apply the right-hand rule to find out the direction of the magnetic field inside and outside the loop**.**

For the downward direction of the current, the direction of the magnetic field will be as if emerging from the table outside the loop and merging with the table inside the loop. Similarly, for current flowing in an upward direction, the direction of the magnetic field will be as if they are emerging from the table outside the loop and merging with the table inside the loop, as shown in the figure.

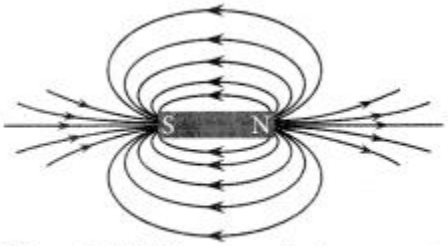


LEVEL 2

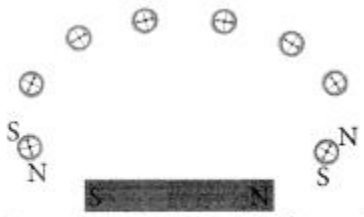
1. Design an activity to demonstrate that a bar magnet has a magnetic field around it.

Answer:

One can easily demonstrate the presence of field lines around a bar magnet using compass needles. Place the magnet on a white sheet and mark its boundaries on sheet. Place the compass near the north pole of magnet and mark the position of needle. Now move the compass such that its south pole occupies the position previously occupied by its north pole. Repeat this step several times and you will have pattern as shown in the figure.



Magnetic field lines around a bar magnet



Drawing a magnetic field line with the help of a compass needle

Repeat the above procedure and draw as many lines as you can. These lines represent the magnetic field around the magnet. These are known as magnetic field lines.

2. What are magnetic field lines? Justify the following statements:

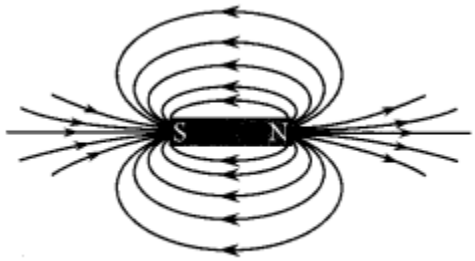
(a) Two magnetic field lines never intersect each other.

(b) Magnetic field are closed curves.

Answer:

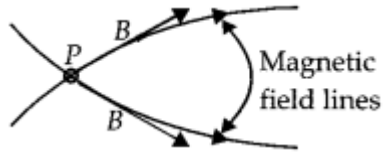
Imaginary continuous closed curves used to represent the magnetic field in a region is known as

magnetic field lines. It is directed from north pole to south pole outside the magnet and south pole to north pole inside the magnet.



Magnetic field lines around a bar magnet

(a) The direction of magnetic field (B) at any point is obtained by drawing a tangent to the magnetic field line at that point. In case, two magnetic field lines intersect each other at the point P as shown in figure, magnetic field at P will have two directions, shown by two arrows, one drawn to each magnetic field line at P, which is not possible.



(b) It is taken by convention that the field lines emerge from north pole and merge at the south pole. Inside the magnet, the direction of field lines is from its south pole to its north pole. Thus, the magnetic field lines are closed curves.

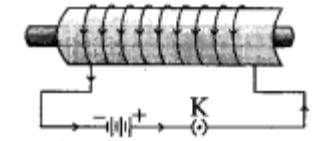
3.A compass needle is placed near a current carrying straight conductor. State your observation for the following cases and give reasons for the same in each case.
(a) Magnitude of electric current is increased.
(b) The compass needle is displaced away from the conductor.
Answer:
(a) As the amount of magnetic field strength is directly proportional to the amount of current, so the deflection of compass needle increases. **$B \propto I$**
(b) Since magnetic field strength at a point is inversely proportional to the distance from the wire. Hence deflection of compass decreases when it is displaced away from the conductor.

$$\text{i.e., } B \propto \frac{I}{r}\begin{cases} B \rightarrow \text{magnetic field} \\ I \rightarrow \text{current} \\ r \rightarrow \text{distance between wire and point of observation} \end{cases}$$

4. (a) State three factors on which the strength of magnetic field produced by a current carrying solenoid depends.
(b) Draw circuit diagram of a solenoid to prepare an electromagnet.
Answer:
(a) Strength of magnetic field produced by a current carrying solenoid depends upon the following factors:

- number of turns in the coil
- amount of current flowing through it
- radius of coil
- Material of core of the solenoid.

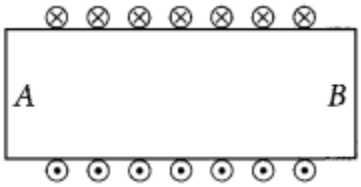
(b) A strong magnetic field produced inside a solenoid can be used to magnetise a piece of magnetic material, like soft iron, when placed inside the coil. The magnet so formed is called an electromagnet.



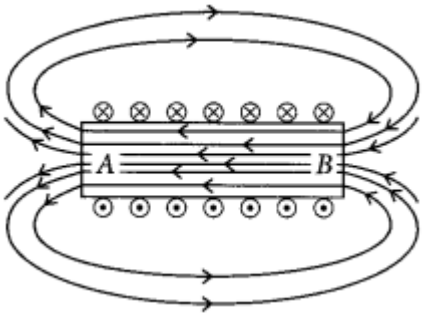
An electromagnet-A current-carrying solenoid coil which is used to magnetise steel rod inside it.

5. The strength of the magnetic field inside a long current carrying straight solenoid is
(a) more at the ends than at the centre
(b) minimum in the middle
(c) same at all points
(d) found to increase from one end to the other
Answer: (c) same at all points
Inside the solenoid magnetic field lines are straight. This indicates a strong magnetic field. Hence magnetic field is uniform at all points inside the solenoid.

6. Diagram shows the lengthwise section of a current carrying solenoid. ⊗ indicates current entering into the page, ⊙ indicates current emerging out of the page. Decide which end of the solenoid A or B, will behave as north pole. Give reason for your answer. Also draw field lines inside the solenoid.

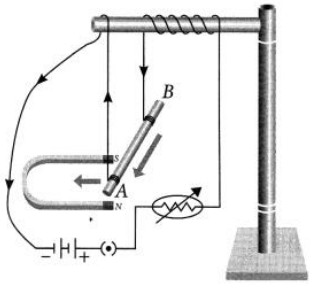


Answer:



Using right hand thumb rube we can draw the magnetic field lines around the conductor as shown. From figure, end A of solenoid act as north pole and end B will act as south pole. Inside the solenoid field lines are in the form of parallel straight lines.

7. Describe an activity with labelled diagram to show that a force acts on current carrying conductor placed in a magnetic field and its direction of current through conductor. Name the rule which determines the direction of this force.
Answer:
A small aluminium rod suspended horizontally from a stand using two connecting wires. Place a strong horseshoe magnet in such a way that the rod lies between the two poles with the magnetic field directed upwards. For this, put the north pole of the magnet vertically below and south pole vertically above the aluminium rod.



Connect the aluminium rod in series with a battery, a key and a rheostat. Pass a current through the aluminium rod from one end to other (B to A). The rod is displaced towards left. When the direction of current flowing through the rod is reversed, the displacement of rod will be towards right. Direction of force on a current carrying conductor is determined by Fleming's left-hand rule.

8. Alternating current has a frequency of 50 Hz. What is meant by this statement? How many times does it change its direction in one second? Give reason for your answer.
(ii) Mention the frequency of D.C that is given by a cell.
Answer:
(i) The frequency of household supply of A.C. in India is 50 Hz. This means, A.C. completes 50 cycles in one second. Thus, A.C. changes direction $2 \times 50 = 100$ times in one second.
(ii) Frequency of D.C. is zero as its direction does not change with time.

8. At the time of short circuit, the electric current in the circuit.
(a) vary continuously
(b) does not change
(c) reduces substantially
(d) increases heavily.
Answer:
(d) At the time of short circuit, the live and neutral wire come in direct contact, thus increasing the current in the circuit abruptly

9. (a) Fuse acts like a watchman in an electric circuit. Justify this statement.
(b) Mention the usual current rating of the fuse wire in the line to
(i) lights and fans
(ii) appliance of 2 kW or more power.
Answer:
(a) When an unduly high electric current flows through the circuit, the fuse wire melts due to joule heating effect and breaks the circuit. Hence, it keeps an eye on the amount of current flowing and also stops the current if exceeds the maximum value. So, fuse acts like a watchman in an electric circuit.
(b) (i) A fuse of rating 5A is usually used for lights and fans.
(ii) A fuse of rating 15 A is usually used for appliance of 2 kW or more power.

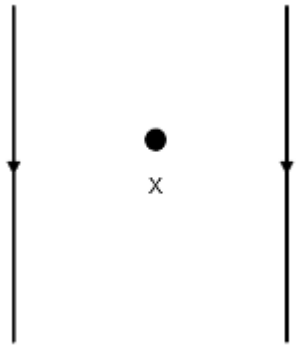
10. A student while studying the force experienced by a current carrying conductor in a magnetic field records the following observations:
1. The force experienced by the conductor increases as the current is increased.
2. The force experienced by the conductor decreases as the strength of the magnetic field is increased. Which of the two observations is correct and why?
Answer:
Force experienced by a current carrying conductor in a magnetic field is given by $F = B\,I\,l$, where B is magnetic field, I is current and l is the length of the conductor.
Observation 1. is correct because F increases with increase in I. However, observation 2.is incorrect because F increases with increase in B.

11. How does the strength of the magnetic field at the centre of a circular coil of a wire depends on
(a) radius of the coil
(b) number of turns of the wire of the coil ?

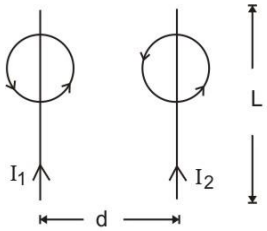
Answer:

The strength of magnetic field at the centre of the circular coil is
(a) inversely proportional to the radius of the coil and
(b) directly proportional to the number of turns of the wire of coil.

12. The following diagram shows two parallel straight conductors carrying same current. Copy the diagram and draw the pattern of the magnetic field lines around them showing their directions. What is the magnitude of magnetic field at a point 'X' which is equidistant from the conductors? Give justification for your answer.



Answer:



The direction of the magnetic field formed by a current-carrying wire can be determined by the right-hand rule. If we place our thumb in the direction of the current, we can determine the direction of the magnetic field as the direction our fingers point in.
For the cable on the left side, the magnetic field will be coming out of the page in the region between the two wires from the right-hand rule.
For the cable on the right side, the magnetic field will be going into the page in the region between the two wires.
So, we can expect the magnetic field in the region between the two wires to oppose each other. So, the magnetic field due to the two cables cancel each other out in the middle of the two wires.

13. Imagine that you are sitting in a chamber with your back to one wall. An electron beam, moving horizontally from back wall towards the front wall, is deflected by a strong magnetic field to your right side. What is the direction of magnetic field?
Answer: The direction of the magnetic field can be determined using the Fleming's Left hand rule. The direction of the magnetic field will be perpendicular to the direction of current and the direction of deflection, i.e., either upward or downward. The direction of the current is from the front wall to the back wall because negatively charged electrons move from the back wall to the front wall. The directed of the magnetic force is rightward. Hence, using Fleming's left hand rule it can be concluded that the direction of the magnetic field inside the chamber is downward.

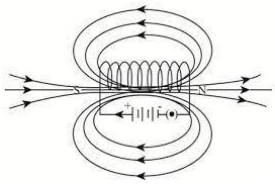
14. List two methods of producing magnetic fields.
Answer: Following are the methods of producing magnetic fields:

- By using a permanent magnet we can produce magnetic field and it can be visualized by spreading iron fillings on a white paper and keeping a magnet beneath the paper.
- A current carrying straight conductor produces magnetic field.
- Different types of conductors such as solenoid and circular loop can be used to see the presence of magnetic field.

15. An electric oven of 2 kW power rating is operated in a domestic electric circuit (220 V) that has a current rating of 5 A. What result do you expect? Explain.
Solution:
The current drawn by the electric oven can be calculated using the formula
$P = V \times I$
$I = P/V$
Substituting the values, we get
I = 2000 W/220 V = 9.09 A
The current drawn by the electric oven is 9.09 A which exceeds the safe limit of the circuit. This causes the fuse to melt and break the circuit.

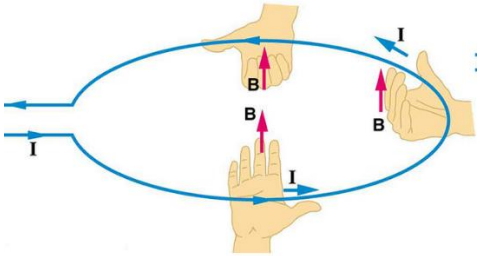
LEVEL 3

1. Give reason for the following
(i) There is either a convergence or a divergence of magnetic field lines near the ends of a current carrying straight solenoid.
(ii) The current carrying solenoid when suspended freely rests along a particular direction.
Answer:
(i) There is either a convergence or a divergence of magnetic field lines near the ends of a current carrying straight solenoid because it behaves similar to that of a bar magnet and has a magnetic field line pattern similar to that of a bar magnet. Thus, the ends of the straight solenoid behave like poles of the magnet, where the converging end is the south pole and the diverging end is the north pole.



(ii) The current carrying solenoid behaves similar to that of a bar magnet and when freely suspended aligns itself in the north-south direction.

2. Find the direction of magnetic field due to a current carrying circular coil held:
(i) vertically in North – South plane and an observer looking it from east sees the current to flow in anticlockwise direction,
(ii) vertically in East – West plane and an observer looking it from south sees the current to flow in anticlockwise direction,
(iii) horizontally and an observer looking at it from below sees current to flow in clockwise direction.
Answer:

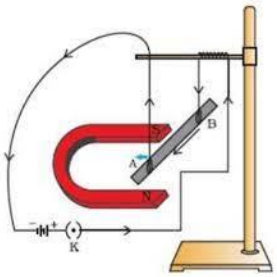


According to right hand rule, the direction of magnetic field is
(i) west to east
(ii) north to south
(iii) into the paper.

3. State the effect of a magnetic field on the path of a moving charged particle. State the direction of magnetic field in the following case.

Answer:
(a) A charged particle moving in a magnetic field may experience a force in the direction perpendicular to direction of magnetic field and direction of motion of particle. This force deflects the charged particle from its path.
(b) Using Fleming's left-hand rule, the direction of magnetic field is out of the plane of paper

4. A current carrying conductor is placed in a magnetic field. Now answer the following.
(i) List the factors on which the magnitude of force experienced by conductor depends.
(ii) When is the magnitude of this force maximum?
(iii) State the rule which helps, in finding the direction of motion of conductor.
(iv) If initially this force was acting from right to left, how will the direction of force change if:
(a) direction of magnetic field is reversed?
(b) direction of current is reversed?



Answer:
(i) When a current carrying wire is placed in a magnetic field, it experiences a magnetic force that depends on
(a) current flowing in the conductor
(b) strength of magnetic field
(c) length of the conductor
(d) angle between the element of length and the magnetic field.
(ii) Force experienced by a current carrying conductor placed in a magnetic field is largest when the direction of current is perpendicular to the direction of magnetic field.
(iii) The rule used in finding the direction of motion of the conductor placed in a magnetic field is Flemings left hand rule.
Fleming's left-hand rule is as follows:
Stretch out the thumb, the forefinger, and the second (middle) finger of the left hand so that these are at right angles to each other. If the forefinger gives the direction of the magnetic field (N to S), the

second (middle) finger the direction of current then the thumb gives the direction of the force acting on the conductor.
(iv)(a) Direction of force will be reversed when direction of magnetic field is reversed, i.e., now force on conductor will act from left to right. (b)Direction of force will be reversed, if the direction of current is reversed, i.e., the force on the conductor will act from left to right.

5. State whether an alpha particle will experience any force in a magnetic field if (alpha particles are positively charged particles)
(i) it is placed in the field at rest.
(ii) it moves in the magnetic field parallel to field lines.
(iii) it moves in the magnetic field perpendicular to field lines.
Justify your answer in each case.
Answer:
(i) No, alpha particle will not experience any force if it is at rest, because only moving charge particle can experience force when placed in a magnetic field.
(ii) No, alpha particle will not experience any force if it moves in the magnetic field parallel to field lines because charge particle experiences force only when it moves at an angle other than 0° with magnetic field.
(iii) Alpha particle will experience a force in the direction perpendicular to the direction of magnetic field and direction of motion of alpha particle.

6. A uniform magnetic field exists in the plane of paper pointing from left to right as shown in Figure 13.3. In the field an electron and a proton move as shown. The electron and the proton experience
(a) forces both pointing into the plane of paper
(b) forces both pointing out of the plane of paper
(c) forces pointing into the plane of paper and out of the plane of paper, respectively
(d) force pointing opposite and along the direction of the uniform magnetic field respectively

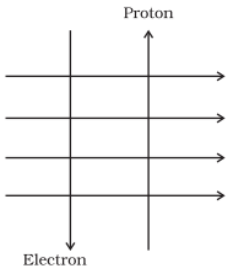
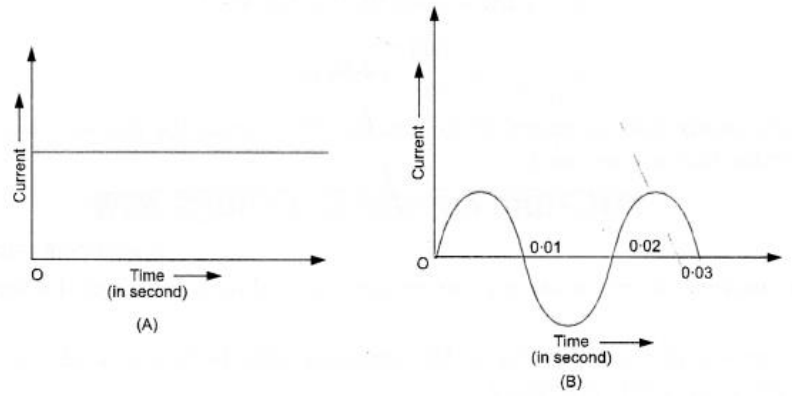


Fig. 13.3

Answer: (a) forces both pointing into the plane of the paper
Direction of movement of electron is opposite to the direction of electric current. This will make the current move upwards. If the index finger shows the direction of magnetic field, ring finger shows the current direction and direction of thumb into paper.
7. State whether an alpha particle will experience any force in a magnetic field if (alpha particles are positively charged particles)
1. it is placed in the field at rest.
2. it moves in the magnetic field parallel to field lines.
3. it moves in the magnetic field perpendicular to field lines. Justify your answer in each case.
Answer:
Force acting a particle having charge q moving with velocity u in a magnetic field B is given by $F = qv B \sin \theta$
where θ is the angle between velocity V and magnetic field B.
1. When alpha particle is at rest i.e. $V = 0$, then $F = 0$ (No force)
2. When alpha particle moves parallel to the magnetic field, $\theta = 0°$, then
$F = qvB \sin 0° = 0$ (No force)

3. When alpha particle moves perpendicular to magnetic field, $\theta = 90°$, then
$F = qvB \sin 90° = qvB$ (maximum force) on magnetic field due to current passing through a circular wire or loop.

8. Current-time graphs from two different sources are shown in the following diagrams.



Now answer the following questions.

1. Name the type of current shown by graph A and graph B.
2. Name any one source of the current shown by graph A and graph B.
3. What is the frequency of current in case B ?
4. Write two differences between the current shown by graphs A and B.

Answer:

1. Graph A represents direct current (DC). Graph B represents alternating current (AC).
2. A dry cell is the source of current shown by graph'A. An AC generator is the source of current shown by the graph B.
3. From graph B, time period, T = 0.02 s. Therefore, frequency of current,

$$f = \frac{1}{T} = \frac{1}{0.02} = 50 \text{ Hz.}$$

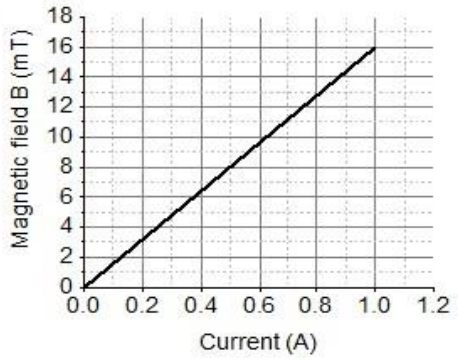
4. DC

(i) The magnitude of direct current is constant and flows in one direction only.
(ii) Direct current cannot be used for large scale supply of electricity for household purpose.
(iii) The frequency of direct current is zero.

AC

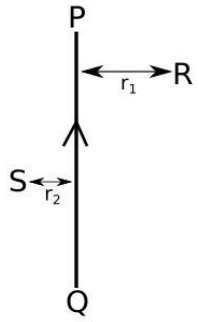
(i) The magnitude of AC changes with time and direction of alternating current reverses periodically.
(ii) Alternating current is used to run electrical appliances like electric bulb, electric heater, electric iron, refrigerator etc.
(iii) Frequency of alternating current in India is 50 Hz.

9. A solenoid is a long helical coil of wire through which a current is run in order to create a magnetic field. The magnetic field of the solenoid is the superposition of the fields due to the current through each coil. It is nearly uniform inside the solenoid and close to zero outside and is similar to the field of a bar magnet having a north pole at one end and a south pole at the other depending upon the direction of current flow. The magnetic field produced in the solenoid is dependent on a few factors such as, the current in the coil, number of turns per unit length etc.
The following graph is obtained by a researcher while doing an experiment to see the variation of the magnetic field with respect to the current in the solenoid.
The unit of magnetic field as given in the graph attached is in milli-Tesla (mT) and the current is given in Ampere.



(i)What type of energy conversion is observed in a linear solenoid?
(a) Mechanical to Magnetic (b) Electrical to Magnetic (c) Electrical to Mechanical (d) Magnetic to Mechanical
(ii)What will happen if a soft iron bar is placed inside the solenoid?
(a)The bar will be electrocuted resulting in short-circuit.
(b)The bar will be magnetised as long as there is current in the circuit.
(c)The bar will be magnetised permanently.
(d)The bar will not be affected by any means.
(iii)After analysing the graph, a student writes the following statements.
I. The magnetic field produced by the solenoid is inversely proportional to the current.
II. The magnetic field produced by the solenoid is directly proportional to the current.
III. The magnetic field produced by the solenoid is directly proportional to square of the current.
IV. The magnetic field produced by the solenoid is independent of the current.
Choose from the following which of the following would be the correct statement(s).
a. Only IV
b. I and III and IV
c. I and II
d. Only II
(iv)From the graph deduce which of the following statements is correct.
(a)For a current of 0.8A the magnetic field is 13 mT
(b)For larger currents, the magnetic field increases non-linearly.
(c)For a current of 0.8A the magnetic field is 1.3 mT
(d)There is not enough information to find the magnetic field corresponding to 0.8A current.
Answer: (i) c. Electrical to Mechanical (ii) b. The bar will be magnetised as long as there is current in the circuit. (iii) d. Only II (iv) a. For a current of 0.8A the magnetic field is 13 mT.

10. PQ is a current carrying conductor in the plane of the paper as shown in the figure below.



(i) Find the directions of the magnetic fields produced by it at points R and S?
(ii) Given $r_1 > r_2$, where will the strength of the magnetic field be larger? Give reasons.
(iii) If the polarity of the battery connected to the wire is reversed, how would the direction of the magnetic field be changed?
(iv) Explain the rule that is used to find the direction of the magnetic field for a straight current carrying conductor.

Answer: (i) The magnetic field lines produced is into the plane of the paper at R and out of it at S. (ii) Field at S > Field at P Magnetic field strength for a straight current carrying conductor is inversely proportional to the distance from the wire. (iii) The current will be going from top to bottom in the wire shown and the magnetic field lines are now in the clockwise direction on the plane which is perpendicular to the wire carrying current. (iv) Right hand thumb rule. The thumb is aligned to the direction of the current and the direction in which the fingers are wrapped around the wire will give the direction of the magnetic field.

11. **Following questions consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:**
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

(i) Assertion(A): On changing the direction of flow of current through a straight conductor, the direction of a magnetic field around the conductor is reversed.
Reason (R) : The direction of magnetic field around a conductor can be given in accordance with left hand thumb rule. **Answer:** (c)

(ii) **Assertion(A):** A compass needle is placed near a current carrying wire. The deflection of the compass needle decreases when the magnitude of an electric current in the wire is increased.
Reason (R) : Strength of a magnetic field at a point near the conductor increases on increasing the current. **Answer:** (d)

(iii)Assertion(A) : On freely suspending a current-carrying solenoid, it comes to rest in N-S direction just like a bar magnet.
Reason (R) : One end of current carrying straight solenoid behaves as a North pole and the other end as a South pole. **Answer:** (a)
(iv)Assertion(A) : Alternating Current is used in household supply.
Reason (R) : AC electric power can be transmitted over long distances without much loss of energy. **Answer: (a)**

(v)Assertion(A) : The strength of the magnetic field at the centre of a circular coil of a wire depends on the radius of the coil
Reason (R) : The strength of the magnetic field at the centre of a circular coil of a wire depends on the number of turns of the wire in the coil. **Answer: (b)**

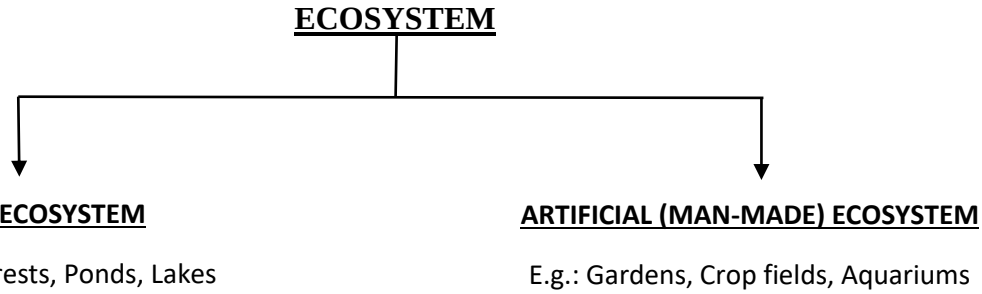
12**.** It is established that an electric current through a conductor produces a magnetic field around it. Is there a similar magnetic field produced around a thin beam of moving (i) alpha particles, (ii) neutrons? Justify your answer in each case.
Answer: (i) Yes,
(ii) No.
Alpha particles are positively charged particles and therefore a thin beam of moving alpha particles constitutes a current in the direction of motion of the alpha particles. The neutrons on the other hand are electrically neutral and therefore there is no current associated with the thin beam of moving neutrons.

CHAPTER - 15
OUR ENVIRONMENT

NOTES:

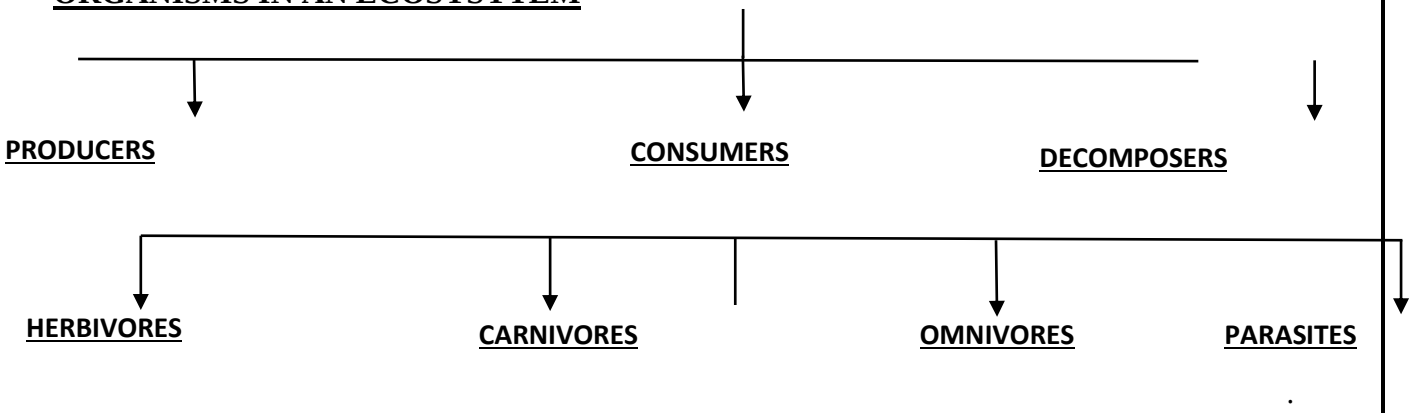
- When the **biotic** and the **abiotic** components of an area interact together and are dependent upon each other, they form an **ECOSYSTEM**.

- **Biotic components** comprise of living organisms and the **abiotic components** comprise of physical factors like temperature, rainfall, wind, soil and minerals.



- Organisms in an ecosystem can be grouped as **producers**, **consumers** and **decomposers** according to the manner in which they obtain their sustenance from the environment.

ORGANISMS IN AN ECOSYSYTEM



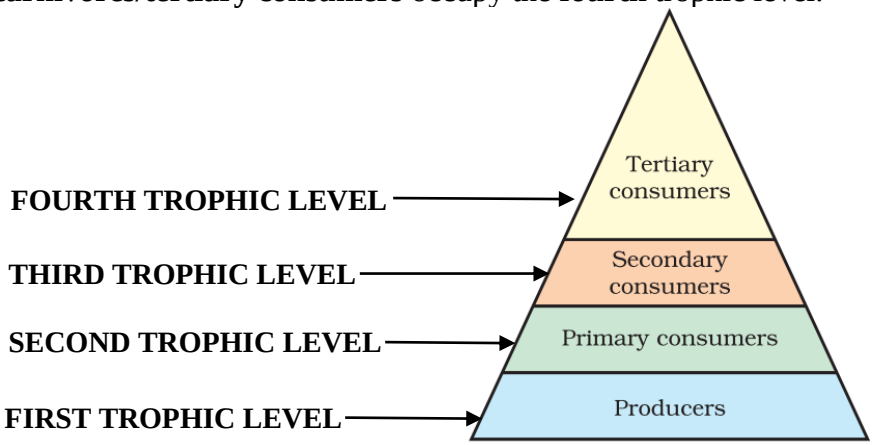
- A series of organisms feeding upon one another at different levels forms a **FOOD CHAIN**.

E.g.: GRASS → DEER → LION

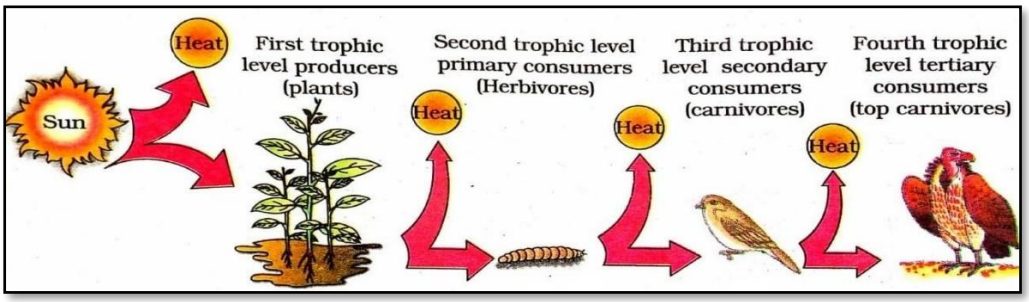
- Each step or level of a food chain is called a **TROPHIC LEVEL.**

- **Autotrophs/producers** occupy the **first** trophic level. They fix up the solar energy and make it available for heterotrophs or the consumers.

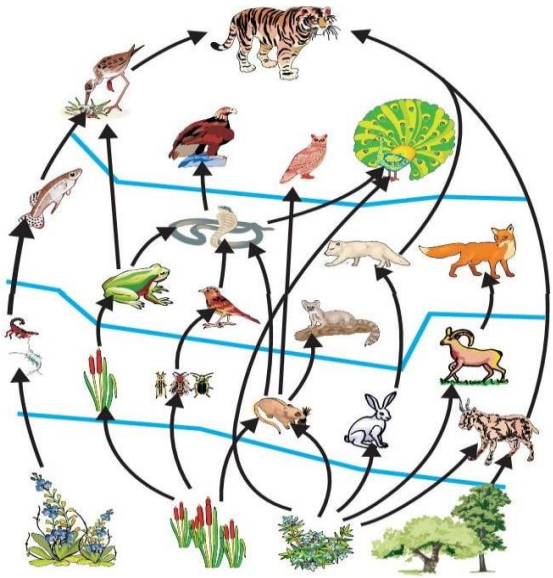
- **Herbivores/primary consumers** come at the **second** level.
- **Small carnivores/secondary consumers** come at the **third** level.
- **Larger carnivores/tertiary consumers** occupy the **fourth** trophic level.



- Green plants, in a terrestrial ecosystem, capture only about **1% of the energy of sunlight** that falls on their leaves and convert it into food energy.
- In a food chain, only **10% of energy is transferred** from one trophic level to the next, rest of it is lost to the environment as heat or utilised in performing functions like digestion, reproduction, growth etc.



- Since only a little amount of energy is transferred from one trophic level to the next, food chains generally consist of **only three or four steps**. The loss of energy at each step is so great that very little usable energy remains after four trophic levels.
- A **greater number of individuals** are usually present at the **lower trophic levels** of an ecosystem. The greatest number is of the producers.
- The length and complexity of food chains vary greatly. Each organism is generally eaten by two or more other kinds of organisms which in turn are eaten by several others. So instead of a straight-line food chain, the relationship can be shown as a series of branching lines as depicted below:

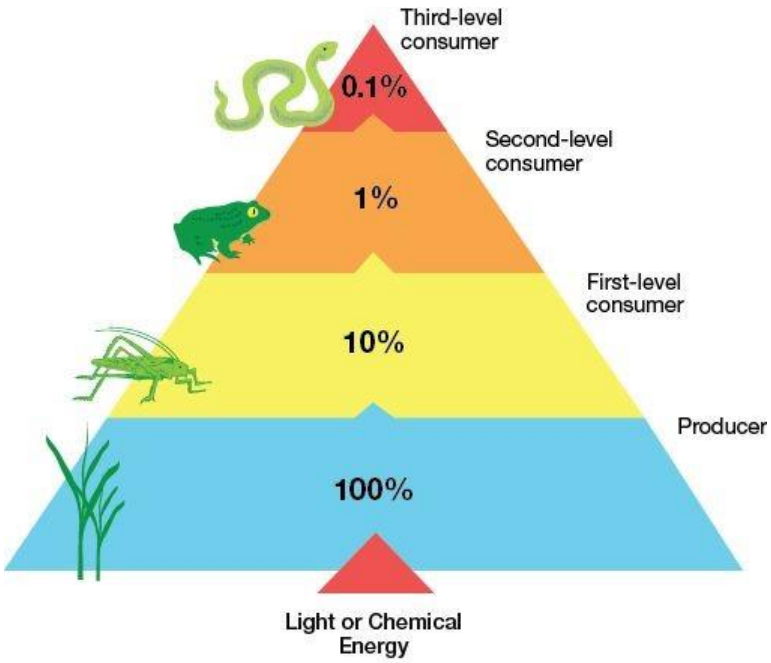


- Such a network of interconnected food chains is called a **FOOD WEB.**

- The flow of energy in a food chain or a food web is **ALWAYS UNIDIRECTIONAL**.

- As it moves progressively through the various trophic levels it does not revert back and is no longer available to the previous level.

- Since energy always moves in the forward direction and gets diminished progressively at successive trophic levels, the flow of energy, if represented graphically in the form of a pyramid, comes out to be **ALWAYS UPRIGHT**.



- **BIOLOGICAL MAGNIFICTAION**: Progressive accumulation of non-biodegradable chemicals at successive trophic levels of a food chain/web.
- ✓ As we move forward in a food chain/web, the concentration of chemicals at the successive trophic levels keeps on increasing.
- ✓ As human beings occupy the top level in any food chain, the maximum concentration of these chemicals get accumulated in our bodies.

- ✓ That's why food grains such as wheat and rice, vegetables and fruits, and even meat, often contain high levels of pesticide residues. They cannot always be removed by washing or other means.

- **<u>OZONE DEPLETION</u>**: Gradual thinning of Earth's ozone layer in the upper atmosphere, caused by the release of chemical compounds, from industries and other human activities.
- ✓ Ozone (O_3) is a molecule formed by three atoms of oxygen.
- ✓ While oxygen (O_2) is essential for survival of life on earth, ozone, is a deadly poison.
- ✓ At higher levels of the atmosphere, ozone performs the essential function of shielding earth's surface from ultraviolet (UV) radiations of the Sun.
- ✓ These radiations are highly damaging to organisms. They are known to cause **skin cancer** in human beings.
- ✓ At higher levels of atmosphere, high energy UV radiation acts on oxygen (O_2) molecule, splitting it apart into free oxygen (O) atoms.
- ✓ These atoms then combine with the molecular oxygen to form ozone (O_3).

$$O_2 \xrightarrow{UV} O + O$$

$$O + O_2 \longrightarrow O_3$$

- ✓ Synthetic chemicals like **chlorofluorocarbons (CFCs)**, used as refrigerants, in fire extinguishers, air conditioners and aerosol sprays, are mainly responsible for ozone depletion.
- ✓ In 1987, the **United Nations Environment Programme (UNEP)** passed an agreement to freeze CFC production at 1986 levels.
- ✓ It is now mandatory for all the manufacturing companies to make CFC-free refrigerators throughout the world.

- **<u>BIODEGRADABLE SUBSTANCES</u>**: Substances which can be broken down or decomposed by the action of bacteria/other saprophytes. E.g.: Products derived directly from nature like Wood, Cotton, Jute, etc.

- **<u>NON-BIODEGRADABLE SUBSTANCES</u>**: Substances which cannot be broken down or decomposed by the action of bacteria/other saprophytes. E.g.: Artificial substances like Plastics, Thermocol, Styrofoam etc.

<u>ANSWERS TO IN-TEXT QUESTIONS</u>

<u>Pg-260</u>

1) Each step or level of a food chain is called a **<u>TROPHIC LEVEL.</u>** In the food chain shown below, the first trophic level is occupied by GRASS (producer), the second by DEER (primary consumer; herbivore) and the third trophic level by LION (secondary consumer; carnivore).

GRASS ⟶ **DEER** ⟶ **LION**

2) Decomposers help keep the environment clean by decomposing the dead and decaying matter and waste products of other organisms.
They also help in recycling of nutrients back to the soil from where they can be used up again by plants.

<u>Pg-262</u>

1) Not all substances present around us can be broken down alike by decomposers.
Natural substances like wood, paper, cotton, jute etc. which can be decomposed by microorganisms are called **BIODEGRADABLE**.
Artificial/man-made substances like plastic or thermocol which cannot be decomposed by microorganisms are called **NON-BIODEGRADABLE**.

2) (i)They help keep the environment clean by getting decomposed.
(ii)They help in the recycling of nutrients back to the soil and maintaining its fertility.

3) (i)Non-biodegradable chemicals lead to the phenomenon of bio-magnification.
(ii)These substances also lead to the pollution of our natural resources like air, water, soil etc.

Pg-264

1) Ozone is a colourless, toxic, highly reactive gas. One molecule of ozone is composed of three atoms of oxygen.
A layer of ozone, present in the upper atmosphere, protects earth's surface from the harmful UV radiations of the sun. These radiations are highly damaging to organisms and are known to cause skin cancer in human beings.

2) (i)By segregating waste and dumping it into the right designated dustbin (wet, dry, domestic hazardous etc.)
(ii)By opting for biodegradable options instead of non-biodegradable ones whenever and wherever possible.
E.g.: Choosing cotton/jute bag over plastic ones.
Choosing reusable steel cutlery or eating over a banana leaf instead of disposable one-time use ones.

ANSWERS

1) (a)Grass, flowers and leather.
Explanation: Option (b) contains plastic which is non-biodegradable. Option (c) and (d) contain cake which is a finished product made by using several artificial and refined substances like oil etc. which are non-biodegradable.

2) (b)Grass, goat and human.
Explanation: The first trophic level in a food chain is always occupied by producers, second by primary consumers and third by secondary consumers.

3) (d)All of the above.

4) Killing all the organisms of a particular trophic level would lead to an ecological imbalance. It would also lead to a disproportionate increase/decrease in the population of the organisms of the previous or successive trophic levels.
E.g.: If all the deer were to be killed, the grass population might increase because there would be no deer to feed upon it. Also the lion population would decrease as there would be no deer for it to feed upon.

5) Yes, the impact of removing all the organisms in a trophic level will be different for different trophic levels.

GRASS ⟶ **DEER** ⟶ **LION**

For example, if deer were to be removed from the above food chain, the effect seen on the first and the third trophic level would be entirely different.
Due to absence of deer, the producer population would increase unchecked whereas the carnivore population would decrease due to unavailability of food.

6) Progressive accumulation of non-biodegradable chemicals at the successive trophic levels of a food chain or web is called **BIOLOGICAL MAGNIFICATION.**
Yes, the extent of magnification is different at different levels of the ecosystem. As we progress further in a food chain or web, the concentration of these chemicals at each trophic level increases.

7) **(i)**Non-biodegradable waste substances cannot be decomposed by microorganisms.
(ii) Because of being non-biodegradable, it keeps on piling up and later, dumping becomes a problem.
(ii) Non-biodegradable chemicals enter the food chain and lead to bio-magnification.
(iv) They disturb the soil quality, fertility and pH, hence affecting agriculture.
(v) They pollute our natural resources like air, water, soil etc.

8) Too much of biodegradable waste in the environment can lead to the following harmful effects:
(i) As the process of decomposition is slow, the waste substances will very soon start piling up and lead to dumping as well as space shortage problems.
(ii) The heap of dead and decaying matter will become a breeding ground for various disease carrying pathogens.
(iii) The decaying heap will also become the source of an awful smEll, which when inhaled by humans, might prove to be harmful and disturbing.

9) The layer of ozone present in the upper atmosphere protects the earth's surface from harmful cancer-causing UV radiations coming from sun.
In the absence of this protective layer, the earth will get exposed to the harmful effects of these radiations. Hence, the depletion of ozone layer is a cause for concern.

To prevent the ozone layer from depleting further, in 1987, the United Nations Environment Programme (UNEP) passed an agreement to freeze CFC production at 1986 levels. It is now mandatory for all the manufacturing companies to make CFC-free refrigerators throughout the world.

LEVEL 1

1) What is an ecosystem? **(1M)**

Ans) When the **biotic** and the **abiotic** components of an area interact together and are dependent upon each other, they form an **ECOSYSTEM**.

2) Give two examples each of the biotic and abiotic factors that can be found in an ecosystem. **(1M)**

Ans) Biotic factors: Plants and Animals
Abiotic factors: Rainfall and Soil.

3) Which chemical is primarily responsible for the depletion of ozone layer? **(1M)**

Ans) CFCs (chlorofluorocarbons)

4) What is a food chain? **(1M)**

Ans) A series of organisms feeding upon one another at different levels forms a **FOOD CHAIN**.

5) What is a food web? **(1M)**

Ans) A network of interconnected food chains is called a **FOOD WEB.**

6) What are biodegradable substances? Give an example. **(1M)**

Ans) Substances which can be broken down or decomposed by the action of bacteria/other saprophytes are known as **BIODEGRADABLE SUBSTANCES**. E.g.: Products derived directly from nature like Wood, Cotton, Jute, etc.

7) What are non-biodegradable substances? Give an example. **(1M)**

Ans) Substances which cannot be broken down or decomposed by the action of bacteria/other saprophytes are known as **NON-BIODEGRADABLE SUBSTANCES**. E.g.: Artificial substances like plastics, Thermocol, Styrofoam etc.

8) What are producers? At which trophic level can you find them in a food chain? **(2M)**

Ans) Producers, in a food chain, fix up the solar energy and make it available for heterotrophs or the consumers. They always occupy the first trophic level.

9) What are primary consumers? At which trophic level of a food chain can you find them? **(2M)**

Ans) Organisms which are dependent directly upon plants for obtaining nutrition are called **primary consumers**. They are usually herbivores and always occupy the second trophic level in a food chain.

10) What are secondary consumers? At which trophic level of a food chain can you find them? **(2M)**

Ans) Organisms which are dependent upon primary consumers or herbivores for obtaining nutrition are called **secondary consumers**. They are usually carnivores and may be found at the third, fourth or higher trophic levels.

DIFFICULTY LEVEL 2

1) Can a garden be called an ecosystem? Give reasons for your answer. **(2M)**

Ans) Yes, a garden can very well be called an ecosystem because in it, the biotic components like different plants, such as grasses, trees; flower bearing plants like rose, jasmine, sunflower; and animals like frogs, insects and birds interact with each other and their growth, reproduction and other activities are affected by the abiotic components of the garden ecosystem.

2) Why is a crop field called an artificial ecosystem? **(2M)**

Ans) A crop field is called an artificial ecosystem because it is created, modified and managed by humans. Biotic factors like crop plants are dependent upon abiotic factors like type and quality of soil for their growth, but the type of crop plants that grow in the field is decided by humans.

3) Depict the process of formation of ozone through chemical equations. **(2M)**

Ans)

$$O_2 \xrightarrow{UV} O + O$$

$$O + O_2 \longrightarrow \underset{\textbf{(Ozone)}}{O_3}$$

4) Why is it necessary to conserve our environment? **(2M)**

Ans) It is very necessary to conserve our environment so that:

- proper ecological balance is maintained.
- survival of all life forms present on earth is ensured.
- natural resources are conserved.
- continuity of various nutrient cycles is maintained.

5) Is it really worth it to invest extra time and take the pain and trouble for segregating waste? What difference would it make if waste segregation is not done? Give reasons for your answers. **(3M)**

Ans) Waste segregation is, indeed, an importance step in **ensuring proper waste management**.

We know that the type of waste we generate is not uniform in quality, it may be degradable or non-degradable and hence, require different methods of handling, which won't be possible without adequate segregation.

For e.g.: Biodegradable waste can be converted into manure but non-biodegradable one cannot, it is better recycled or reused, hence, segregation of both is strictly advisable.

6) The first trophic level in any food chain is always occupied by the producers. Why is it so? **(2M)**

Ans) It is so because only producers can trap solar energy, fix it and make it available for other organisms.

7) Which one among the following will you **ALWAYS** find at the second trophic level? (1M)

Producers, Carnivores, Omnivores, Herbivores, Decomposers.

Ans) Herbivores, because they are directly dependent upon plants for obtaining nutrition.

8) Why are green plants called **'PRODUCERS'**? **(2M)**

Ans) Green plants are called **'PRODUCERS'** because they are responsible for **PRODUCING** food for other organisms present on earth. They do so by trapping solar energy through the process of **photosynthesis.**

9) What efforts can we make at our own level to deal with biodegradable waste generated in our daily lives? **(3M)**

Ans) To help deal with biodegradable waste generated by us in our daily lives, we can take the following steps:

- Ensuring proper waste segregation and dumping wet, biodegradable waste only in the green dustbin.
- Not mixing wet waste with oily, cooked, hazardous or non-biodegradable substances.
- Making a compost pit in our garden and preparing compost out of our own wet waste.

10) Which one amongst the following organisms are you likely to find at the same trophic level? **(2M)**

Deer Snake Peacock Rabbit Lion

Ans) Deer and rabbit, because both are herbivores and are directly dependent upon plants for obtaining nutrition.

DIFFICULTY LEVEL 3

1) 'Decomposers are also called the cleaners of our environment'. Justify the statement. **(3M)**

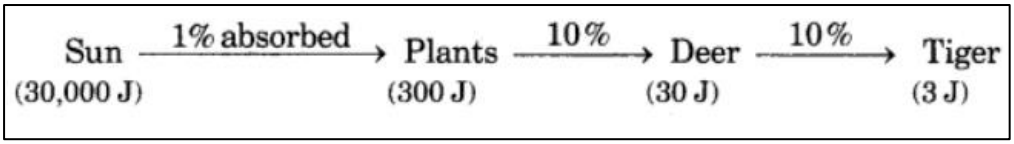
Ans) Decomposers are rightly called the **'cleaners'** of the environment as they help keep it clean by breaking down the waste substances of other organisms. They also decompose the dead and decaying matter of other organisms.

2) Calculate the amount of energy available at each of the trophic levels in the food chain shown below, if the amount of energy available to plant from the sun is 30,000 J. **(3M)**
PLANTS ⟶ DEER ⟶ TIGER

Ans) Plants can trap only 1% of the sun's energy available to them.
Hence, 1% of 30,000, i.e., 1/100 x 30,000 = **300 J.** = Energy available at I trophic level.

Only 10% of energy is transferred from one trophic level to the next.
Hence, energy available at II trophic level = 10% of 300 J = 10/100 x 300 = **30 J**.

Energy available at III trophic level = 10% of 30 J = 10/100 x 30 = **3 J.**



3) Why is it uncommon to find a food chain with more than four trophic levels? **(3M)**
Ans) Since only a little amount of energy is transferred from one trophic level to the next, food chains generally, consist of only three or four steps. The loss of energy at each step is so great that very little usable energy remains after four trophic levels.

4) Why can't food chains be found in isolation in an ecosystem? **(3M)**
Ans) Each organism is generally eaten by two or more other kinds of organisms which in turn are eaten by several others. So instead of a straight-line food chain, the dependency of organisms upon each other for food can be depicted as a series of branching lines known as **FOOD WEB**.

5) The number of malarial patients in a village increased tremendously when large number of frogs were exported from the village. Why is it so? **(3M)**
Ans) Frogs are known to feed upon mosquito larva. In the absence of these frogs, the larva thrived well, unchecked, hence giving rise to a large number of mosquitoes in the village. As a result, the incidences of people falling ill due to malaria increased as well.
A decrease in the number of frogs lead to an increase in the number of mosquitoes. This example demonstrates the fact that all the organisms in an ecosystem irrespective of their size are inter-dependent and inter-related.

6) Earth has been witnessing a continuous increase in temperatures over the past few years. What, according to you, is the reason behind this? **(3M)**
Ans) This is happening primarily because of disturbed ecological balance, which, in turn, is a result of increased deforestation.
As we already know, **in an ecosystem, both the biotic and the abiotic factors are inter-dependent and inter-related.**
A decrease in the number of trees (biotic factor) resulted in disturbed climatic conditions (abiotic factor).

7) What is the percentage of solar energy trapped and utilized by plants in a terrestrial ecosystem? **(1M)**

Ans) In a terrestrial ecosystem, green plants capture only about 1% of the sun's energy available to them.

8) In a lake heavily contaminated with non-biodegradable pesticides due to indiscriminate use of the same in nearby crop fields, which one of the following organisms living in the lake will contain the maximum amount of pesticide? (2M)

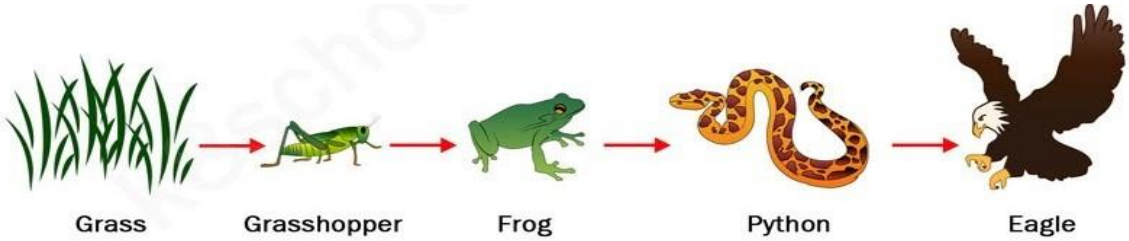
Small fish Zooplankton Big fish Phytoplankton.

Ans) Arranging the organisms given above in the order of their interdependence for food, we'll get a food chain as shown below:

Phytoplankton ⟶ Zooplankton ⟶ Small Fish ⟶ Big Fish

As the accumulation of non-biodegradable chemicals increases when we move forward in a food chain, the concentration of pesticides will be the highest in **BIG FISH.**

9) Given below is an example of a food chain containing five trophic levels. **(5M)**



(i) If the amount of energy available at the second trophic level is 10,000 J, how much amount of energy will the python have access to?

Ans) As can be seen from the food chain, python is occupying the IV trophic level.
Energy at II level: 10,000 J
Energy at III level: 10% of 10,000 = 1000 J
Energy at IV level = 10% of 1000 = 100 J.

Therefore, the python will have access to **100 J** of energy.

(ii) Occupants of which trophic level will have access to the maximum amount of energy?
Ans) I trophic level.

(iii) Occupants of which trophic level will have access to the least amount of energy?
Ans) V trophic level

(iv)A student calculated the amount of energy available for both the python and the eagle to be 100J. Is that possible? Why or why not?
Ans) NO, that is not possible. The eagle and the python are occupying different trophic levels and the amount of energy available at different levels varies (as shown in answer (i)). As we move progressively through a food chain, the amount of energy available at each trophic level decreases.

10) Case study based question - Given below is the headline of a newspaper article dated Nov. 1, 1994.

Los Angeles Times

Industry Shivers at Ban on CFC Refrigerants : Environment: An end to production of the ozone-eroding chemicals next year is forcing a costly transformation on American businesses.

Why do you think was the government so insistent upon imposing a ban on the use of CFCs despite the heavy losses different businesses had to incur? Was it really necessary to take this step? **(3M)**

Ans) The government's insistence on banning the use of CFCs made complete sense as these chemicals were responsible for the depletion of earth's protective layer, the **OZONE**.
The layer of ozone, in the upper atmosphere, is responsible for protecting earth's surface from harmful UV radiations coming from the sun.
Depletion in the ozone layer exposes the earth's surface to these harmful radiations, which are dangerous for living organisms and known to cause cancer in humans.

Continuing the use of CFCs would mean worsening this problem and paving your way to your own grave by yourself!!!!

KENDRIYA VIDYALAYA SANGATHAN,CHENNAI REGION
BLUEPRINT FOR SAMPLE PAPER 1 -MARCH 2023

Max. Marks: 80 **Time Allowed: 3 hours**

SCIENCE (086)

S.No.	TYPE OF QUESTION → / Unit ↓	MCQ /A & R 1m	SA-I 2m	SA- II 3m	LA 5m	Case Based 4m	TOTAL
1.	Chemical Substances	1(8)	2(1)	3(2)	5(1)	4(1)	**25(13)**
2.	World of Living	1(6)	2(4)	3(2)	5(1)	-	**25(13)**
3.	Natural Phenomenon	1(1)	-	3(3)	-	4(1)	**14(5)**
4.	Effects of current	1(4)	2(1)	-	5(1)	-	**11(6)**
5.	Natural Resources	1(1)	-	-	-	4(1)	**5(2)**
	TOTAL	**20(20)**	**12(6)**	**21(7)**	**15(3)**	**12(3)**	**80(39)**

***Note:** **Figures within brackets indicate the number of questions and figures outside the bracket indicate the marks for each question.**

KENDRIYA VIDYALAYA SANGATHAN, CHENNAI REGION
Sample Question Paper -1 -2022-23

STD:X **SUB: SCIENCE (086)**
Max. Marks: 80 **Time Allowed: 3 hours**

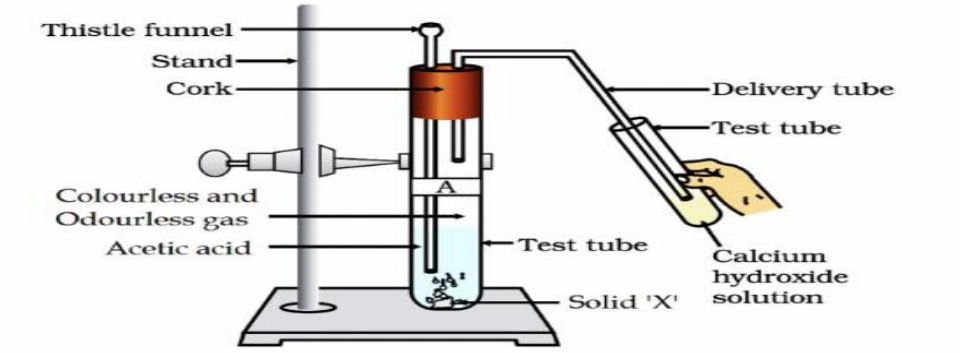
General Instructions:

i. This question paper consists of 39 questions in 5 sections.
ii. All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.
iii. Section A consists of 20 objective-type questions carrying 1 mark each.
iv. Section B consists of 6 Very Short questions carrying 02 marks each. Answers to these questions should be in the range of 30 to 50 words.
v. Section C consists of 7 Short Answer type questions carrying 03 marks each. Answers to these questions should be in the range of 50 to 80 words
vi. Section D consists of 3 Long Answer type questions carrying 05 marks each. Answers to these questions should be in the range of 80 to 120 words.
vii. Section E consists of 3 source-based/case-based units of assessment of 04 marks each with sub-parts.

SECTION - A

Select and write one most appropriate option out of the four options given for each of the questions 1 – 20

1.Identifythe gas released in the following experiment.



(a) Nitrogen (b) Hydrogen (c) Oxygen (d) Carbon dioxide

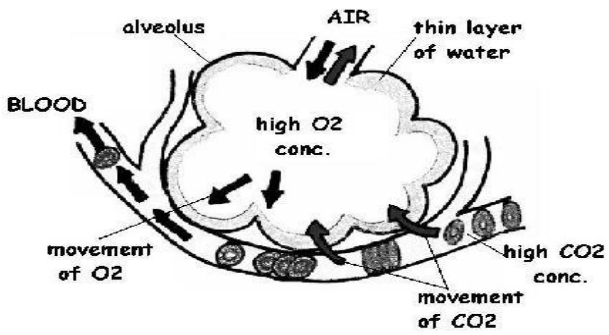
2. Study the following table and choose the correct option:

Salt	Parent Acid	Parent Base	Nature of Salt
A) Sodium Chloride	HCI	NaOH	Basic
B) Sodium Carbonate	H_2CO_3	NaOH	Neutral
C) Sodium Sulphate	H_2SO_4	NaOH	Acidic
D)Sodium Acetate	CH_3COOH	NaOH	Basic

3.Which of the following salts does not contain water of crystallization?
(a)Blue Vitriol (b) Baking Soda (c)Washing Soda (d) Gypsum

4.Which one of the following oxide (s) is /are soluble in water to form alkalies?
(i)Na_2O (ii) SO_2 (iii) K_2O (iv) NO_2
(a) i and iii (b) i only (c) ii and iv (d) iii only

5) Generally, non-metals are not lustrous. Which of the following non-metal is lustrous ?
(a)Sulphur (b) Oxygen (c) Nitrogen (d) Iodine
6) Butanone is a four - carbon compound with the functional group
(a) Carboxylic acid (b) Aldehyde (c) Ketone (d) Alcohol
7) Two metals that melt when we keep them on our palm:
(a) Gallium, Gold (b) Gallium, Caesium (c)Caesium, S (d) Gold, Silver
8) Opening and closing of stomatal pore depends on
(a) Atmospheric temperature (b) Oxygen concentration around stomata
(c) Carbon dioxide concentration around stomata (d) Water content in the guard cell
9) Given below is a diagrammatic representation of a process taking place in the human body:



In which of these regions/ organs could it be occurring?
(a) Lungs (b) Heart (c) Brain (d) Kidney
10)A negative sign in the magnification value indicates that the image is
(a) real and inverted (b) real and erect (c) virtual and erect (d) virtual and inverted
11) Two bulbs of 100 W and 40W are connected in series. The current through the 100W bulb is 1A. The current through the 40W bulb will be
(a) 0.4A (b) 0.6A (c) 0.8A (d)1 A
12)Name a device that helps to maintain a potential difference across a conductor
(a) Voltmeter (b)Ammeter (c) Battery (d) Galvanometer
13)The most important safety method used for protecting home appliances from short circuiting or overloading is
(a) Earthing (b) Use of fuse (c) Use of stabilisers (d) Use of electric meter
14. Which part of the brain maintains posture and equilibrium of the body?
(a) Cerebellum (b) Cerebrum (c) Pons (d) Medulla
15. The organ through which the developing foetus obtains its food from the mother is
(a) Ureter (b) Uterus (c) Placenta (d) Zygote

16. Depletion of Ozone is mainly due to _____
(a) Chlorofluorocarbon compounds (b) Carbon monoxide (c) Methane (d) Pesticide

Q. no 17 to 20 are Assertion - Reasoning based questions.
These consist of two statements – Assertion (A) and Reason (R).
Answer these questions by selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true and R is not the correct explanation of A
(c) A is true but R is false
(d) A is False but R is true

17) Assertion: In esterification, carboxylic acid and alcohol react in the presence of acid to give ester.
Reason: Esterification is the reverse of saponification.
18) Assertion: Hydrochloric acid helps in the digestion of food in the stomach.
Reason: Hydrochloric acid creates an acidic medium to activate protein digesting enzymes.
19) Assertion: Zygote with two X chromosomes develops into a boy.
Reason: If the egg cell carrying an X chromosome fuses with sperm carrying Y chromosome, the resulting child would be a boy.

20) Assertion: Magnetic field lines never intersect.
Reason: At a particular point, magnetic field has only one direction.

SECTION – B

Q. no. 21 to 26 are very short answer questions

21) Write equations for the reactions of
(a) Iron with steam
(b) Calcium with water

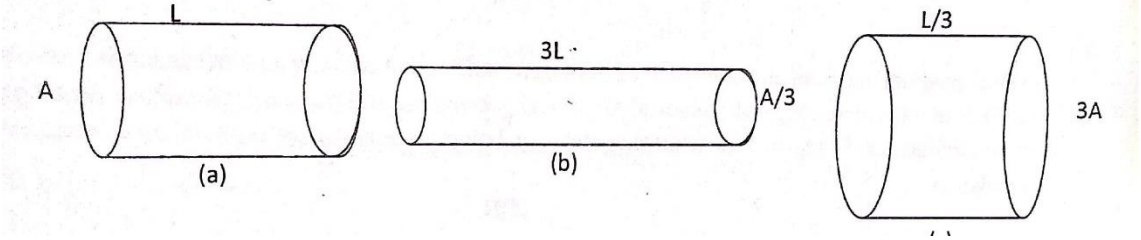
(Or)

(a) Why do ionic compounds have a high melting point?
(b) Show the formation of NaCl by the transfer of electrons?

22) What are the methods used by plants to get rid of excretory products?
23) Explain the role of auxins in the bending of plant towards light.
24) Why did Mendel choose pea plants for his experiments in heredity. Mention any two reasons.
25) State Ohm's law and give its mathematical relation.

(Or)

The figure below shows three cylindrical copper conductors along with their areas and length. Compare the resistance and resistivity of the three conductors.



26) Mention any four post fertilization changes taking place in a flower.

SECTION - C

Q.no. 27 to 33 are short answer questions.

27) A compound 'X' of sodium is used as an antacid and it decomposes on strong heating.
a) Name the compound 'X' and give its chemical formula.
b) Write a balanced chemical equation to represent the decomposition of 'X'.

c) Give one use of compound 'X' besides its use as an antacid.

28) Write **one** equation each for decomposition reactions where energy is supplied in the form of

a) Heat (b) Light (c) Electricity

29) What are **three** different ways in which glucose is oxidized to provide energy in various organisms?

(**OR)**

State the role played by the following in the process of digestion

(a) Enzyme trypsin (b) Enzyme lipase (c) Bile juice

30) Draw reflex arc and label any four parts.

31) A 10cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 12cm. The distance of the object from the lens is 18cm. Find the nature, position and size of the image form.

32) A student needs spectacle of power -0.5D for the correction of his vision.

a) Name the defect in vision the student is suffering from.

b) Find the nature and focal length of the corrective lens.

c)List two causes of this defect.

33) a) State the laws of refraction of light.

b) A ray of light travelling in air enters obliquely into water. Will the light ray bend towards the normal or away from the normal?

SECTION - D

Q.no. 34 to 36 are long answer questions.

34) What happens when

a) Ethanol is treated with alkaline potassium permanganate?

b) Ethanol is heated with excess concentrated sulphuric acid at 443K?

c) A piece of sodium metal is dropped into ethanol?

d) When hydrogen gas is passed through ethene in presence of nickel catalyst?

e) When ethanoic acid reacts with sodium carbonate?

(**OR)**

a) What are structural isomers? Draw any two isomers of pentane.

b) Draw the electron dot structure of ethene.

c) State any two physical properties properties of carbon.

d) A mixture of oxygen gas and ethyne is burnt for welding. Can you tell why a mixture of ethyne and air is not used?

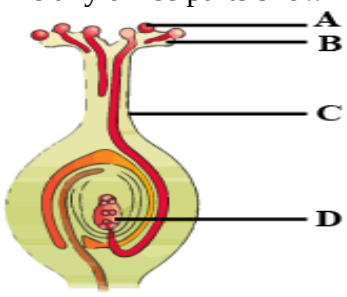
35. (a)Suggest any **two** categories of contraceptive methods to control the size of human population. Also explain each method briefly. (2)

(b) Name **two** bacterial and two viral infections each that can get sexually transmitted. (2)

(c)Mention the role of prostate gland and seminal vesicle in the human male reproductive system. (1)

(OR)

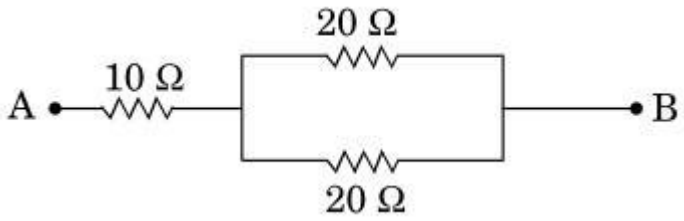
(a) Name any **three** parts shown in the diagram and write their functions. (3)



(b) List any **two** advantages of practising vegetative propagation. (2)

36. (a)Three resistorsR_1, R_2 and R_3 are connected in parallel and the combination is connected to a battery, ammeter, voltmeter and key. Draw a suitable circuit diagram and obtain an expression for the equivalent resistance of the combination of the resistors. (3)

(b)Calculate the equivalent resistance of the following network. (2)



SECTION - E

Q.no. 37 to 39 are case-based/data-based questions with 2 to 3 short sub-parts. Internal choice is provided in one of these sub-parts.

37) Read the given passage and answer the questions that follow:

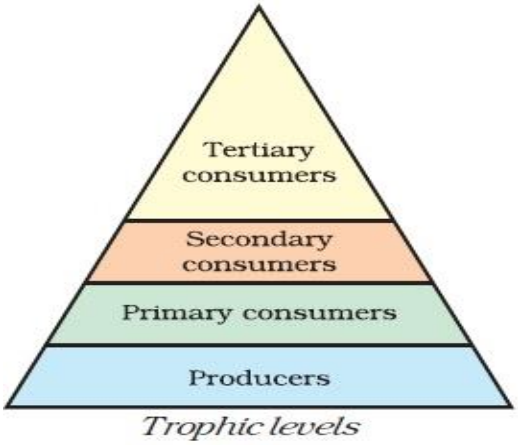
Soaps and detergents are widely used as cleaning agents. Chemically soaps and detergents are quite different from each other. The common feature of soaps and detergents is that when dissolved in water the molecules of soap and detergent tend to concentrate at the surface of the solution or at interface. Therefore, the surface tension of the solution is reduced, it causes foaming of the solution. A sample of water which gives lather with soap with difficulty is known as hard water, while a sample of water which gives lather with soap easily is known as soft water. Hardness of water is due to the presence of bicarbonates, sulphates and chlorides of calcium and magnesium. When hardness of water is due to the presence of bicarbonates of magnesium and calcium, it is called temporary hardness. When hardness of water is due to the presence of sulphates and chlorides of magnesium and calcium, it is called permanent hardness.

a) What is the difference between the molecules of soap and detergents chemically?
b) List two problems that arise due to the use of detergents instead of soaps.
c) Why does micelle formation take place when soap is added to water?
d) Why do soaps not form lather in hard water?

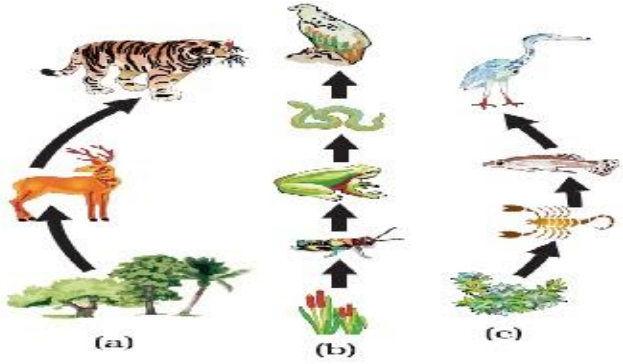
OR

38) Food chains are very important for the survival of most species. When only one element is removed from the food chain it can result in extinction of a species in some cases. The foundation of the food chain consists of primary producers.

Primary producers, or autotrophs can use either solar energy or chemical energy to create complex organic compounds, whereas species at higher trophic levels cannot and so must consume producers or other life that itself consumes producers. Because the sun's light is necessary for photosynthesis, most life could not exist if the sun disappeared. Even so, it has recently been discovered that there are some forms of life, chemotrophs, that appear to gain all their metabolic energy from chemosynthesis driven by hydrothermal vents, thus showing that some life may not require solar energy to thrive.



Trophic levels



Food chain in nature (a) in forest, (b) in grassland and (c) in a pond

(a) If 10,000 J solarenergy falls on green plants in a terrestrial ecosystem, what amount of solar energy will be converted into food energy?
(i) 10,000 J (ii)100 J (iii) 1000 J (iv) it will depend on the type of the terrestrial plant.

(b) Mr. is eating curd/yogurt. For this food intake in a food chain he should be considered as occupying:
(i) first trophic level (ii) second trophic level (iii) third trophic level (iv) fourth trophic level

(c) The decomposers are not included in the food chain. The correct reason for the same is because decomposers:
(i) act at every trophic level of the food chain
(ii) do not breakdown organic compounds
(iii) convert organic material to inorganic forms
(iv) release enzymes outside their body to convert organic material to inorganic forms

(d) Matter and energy are two fundamental inputs of an ecosystem. Movement of
(i) energy is bidirectional and matter is repeatedly circulating
(ii) energy is repeatedly in circulation and matter is unidirectional
(iii) energy is unidirectional and matter is repeatedly circulating
(iv) energy is multidirectional and matter is bidirectional

(OR)

(d)Which of the following limits the number of trophic levels in a food chain?
(i)Decrease in energy at higher trophic levels
(ii)Less availability of food
(iii)Polluted air
(iv)Water

39. The foundation of modern optics lays in 1672 when Sir Issac Newton published his paper on the bending of light through prism. His experiments in bending of light through prism led, eventually, to the revolutionary discovery of the existence in white light of a mixture of distinct coloured rays, distinguishable when refracted through a prism of transparent material. In his experiment, he set up a prism near his window and projected a beautiful spectrum on to the far wall at 22 feet away. Further to prove that the prism was not colouring the light, he refracted the light back together.
Prism has the capacity to reverse the direction of light by internal reflection and redirected the light at a defined angle.

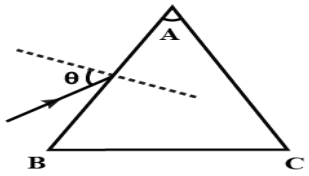
(a)Name the colour which deviates maximum when passing through prism?

(b) When we place a combination of two identical prisms arranged together in inverted position with respect to each other in the path of narrow beam of white light the emergent beam from the other side of second prism is of
(i) White light (ii) Yellow light (iii) Red light (iv) Violet light

(c)Why does white light get split while passing through prism?

(OR)

(c) Complete the following diagram and label the angle of incidence, angle of refraction, angle of emergence and angle of deviation.



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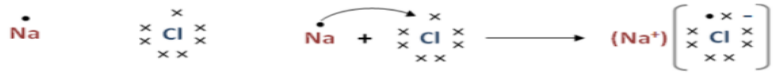
KENDRIYA VIDYALAYA SANGATHAN, CHENNAI REGION

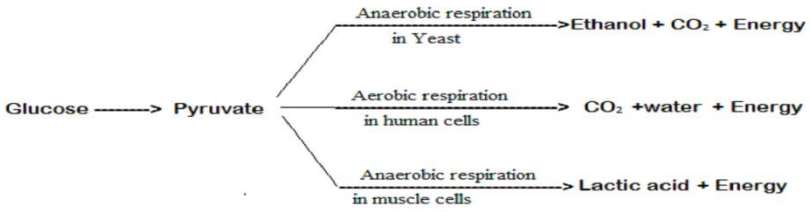
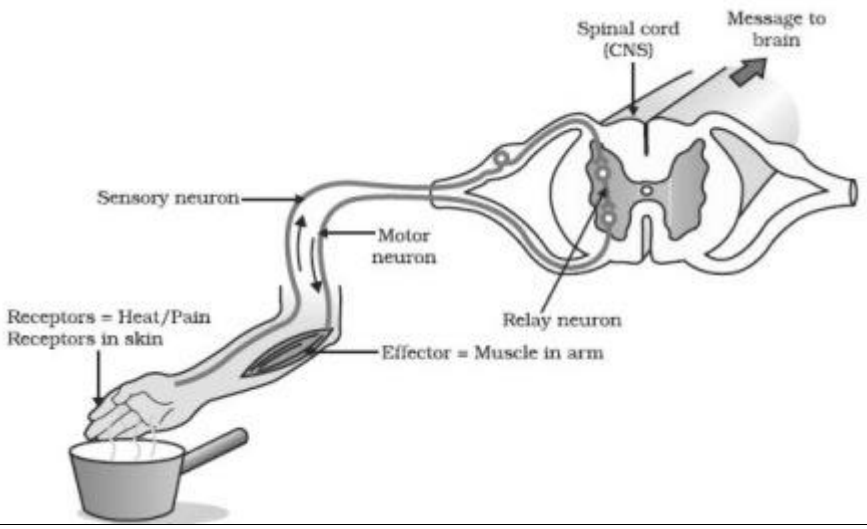
MARKING SCHEME

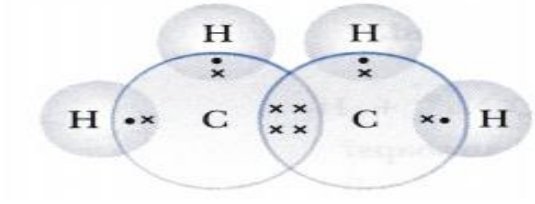
Max. Marks: 80 **Time Allowed: 3 hours**

SCIENCE (086)

SECTION - A		
S .NO	**QUESTION**	**MARKS**
1.	(d) Carbondioxide	**1**
2.	(d)Sodium Acetate	**1**
3.	(b) Baking soda	**1**
4.	(a) i and iii	**1**
5.	(d)Iodine	**1**
6.	(c)Ketone	**1**
7.	(b)Gallium,Caesium	**1**
8.	(d)Water content in the guard cell	**1**
9.	(a)Lungs	**1**
10.	(a)Real and inverted	**1**
11.	(d)1A	**1**
12.	(c)Battery	**1**
13.	(b)Use of fuse	**1**
14.	(a)Cerebellum	**1**
15.	(c) Placenta	**1**
16.	(a)Chlorofluorocarbon compounds	**1**
17.	**(a)** Both A and R are true and R is the correct explanation of A	**1**
18.	(a) Both A and R are true and R is the correct explanation of A	**1**
19.	(d) A is False but R is true	**1**
20.	**(a)** Both A and R are true and R is the correct explanation of A	**1**
SECTION – B		
21.	(a) $Fe + H_2O \rightarrow Fe_3O_4 + H_2$ (b) $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$ (OR) (a) Since the electrostatic forces of attraction between oppositely charged ions are strong, their melting point is high. (b) 	**1** **1** **1** **1**
22.	1. Transpiration is the exhalation of water vapour via the stomata. 2. The gaseous wastes like carbon dioxide during night are removed through the stomata present on the surfaces of the leaves. 3. Some of the excretory wastes gather in the vacuoles of the cell, which ultimately turn into gum and resin. These wastes are witnessed in old xylem tissues, which eventually droop or wither	**2**

	away. 4. Some of the excretory products of plants are stored in the form of latex and oil in the bark of trees. (Any 2 points)	
23.	1.Auxin is a plant hormone that is present at the tip of the shoot and roots of the plants. Auxin develops responses called tropisms that the growth of plants towards the light source. 2. More amount of auxin is present in the shaded part of the stem which grows longer and leads the stem to grow towards the light.	**2**
24.	1.Very easy to cultivate and grow 2. Many visible distinguishing characters such as height, flower type, seed color, seed coat etc. 3. Easy to obtain pure breed plant through self fertilization 4. Easy cross polination and fertilization	**2**
25.	Ohm's law states that at a constant temperature, the current passing through a conductor is directly proportional to the potential difference applied across it. $V \propto I$ V/I=Constant This **constant is called resistance R**. Resistance is the property of conductor which resists the flow of electric current through it. Therefore, $V/I = R$ (OR) $R_a = \rho L / A$ $R_b = \rho(3L / A/3) = 9\ R_a$ $R_c = \rho(L / 3/3A) = 1 / 9R_a$ Hence $R_b > R_a > R_c$ Resistivity of all three are same, because they are made of same material.	**1** **1** **½** **½** **½** **½**
26.	1.The zygote divides many times and forms embryo within the ovule. 2. The ovule develops a tough coat and is gradually converted into a seed. 3. The ovary develops into a fruit. 4. The petals, sepals, stamens, style and stigma shrivel and fall off.	**2**
	SECTION - C	
27.	a) Sodium Hydrogen Carbonate, $NaHCO_3$ b) $2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$ c) Used in Fire extinguisher.	**1** **1** **1**
28.	Decomposition reaction requiring heat is known as thermal decomposition , $CaCO_3 \rightarrow CaO + CO_2$. Decomposition reaction requiring light is known as photo chemical	**3**

	decomposition reaction , $2AgCl \rightarrow 2Ag + Cl_2$. Decomposition reaction which requires electricity is known as electro chemical decomposition reaction , $2H_2O \rightarrow H_2 + O_2$	
29.	 (OR) a)Enzyme trypsin: helps in the digestion of protein. (b) Enzyme lipase: helps in breaking down emulsified fats.. (c) Emulsification of fats and makes the food medium alkaline for the pancreatic enzymes to act on the food	**3**
30.	 	**3**
31.	1/F = 1/v - 1/u 1/F + 1 / u = 1/ v 1/12 +1/(-18) = 1/v 3-2 / 36= 1/ v 1/36= 1/v v = 36 cm	**3**

	m = v/ u m= height of image / height of object v/ u = height if image / height of object 36 / - 18 = height of image / 10 height of image = -20 cm Nature of image = Real and inverted	
32.	(a) Myopia (b) Concave Lens, f= -200 cm (c) Excessive curvature of eye lens, elongation of eye ball	**3**
33.	(a) (i) The incident ray, the refracted ray and the normal to the interface of two media at the point of incidence, all lie in the same plane. (ii) The ratio of sine of angle of incidence 'i' to the sine of angle of refraction 'r' is a constant. This constant value is called the refractive index of the second medium with respect to the first. (sin i) / (sin r) = constant (b) Bends towards the normal.	**3**
	SECTION - D	
34.	**(a)** $CH_3CH_2OH \rightarrow CH_3COOH$ (b) $CH_3CH_2OH \xrightarrow[\text{conc. } H_2SO_4]{443\ K} CH_2=CH_2 + H_2O$ (c) 2CH3CH2OH+Na→2CH3CH2ONa+H2↑ (d)C2H4+H2→ C2H6 (e) 2CH3COOH + Na2CO3→2CH3COONa + H2O + CO2 (OR) (a) Compound having same molecular formula but different structures. (Any 2 Isomers.) **Electron-dot structure:** (b)  (c)Tetra valency, Catenation	**5**

	(d) A mixture of ethyne and oxygen is used for welding as they both combine completely producing a clean flame**.**	
35.	(a)Mechanical barrier Surgical method Contraceptive pills (b) Bacteria – Gonorrhoea syphilis Virus - AIDS , Warts. (c) Provide nutrition to the sperm and fluidity for the movement. (OR) (a) (A)Polen, Male Germ cell (B)Stigma, receives polen (C) Pollen tube, transport male gamete (D) Female germ cell, which forms zygote **(b)** The process makes possible the production of seedless varieties such as banana, orange, rose, jasmine etc. 2) It helps in the preservation of useful parent characters in the next generation. 3) The method can be used for plants which can be easily grown in gardens due to their small size. (Any two point)	**5**
36.	a)Circuit diagram Derivation b)R = 20ohm	**1** **2** **2**
	SECTION - E	
37.	a) SOAP-It is made up sodium or potassium salts of long chain carboxylic acid. DETERGENT-It is made up of ammonium or sulphonate salt. b) Non biodegradable , water pollution c) Micelle formation (OR) **c**) The main cause of hardness of water is presence of Ca or Mg ions. When hard water containing these ions is treated with soap solution it reacts to form white crudy ppt known as scum.	**1** **1** **2**
38.	a) (ii)100 J b) (iii) third trophic level c) (i) act at every trophic level of the food chain d) (iii) energy is unidirectional and matter is repeatedly circulating (OR) (i)Decrease in energy at higher trophic levels	**4**
39.	a) Violet light b) (i) White light c) because of difference in speed of each colour inside the prism	**4**

	(OR) c) Label the angle of incidence, angle of refraction, angle of emergence and angle of deviation.	

KENDRIYA VIDYALAYA SANGATHAN,CHENNAI REGION
BLUEPRINT FOR SAMPLE PAPER 2 -MARCH 2023

Max. Marks: 80 **Time Allowed: 3 hours**

SCIENCE (086)

Class 10 Science Sample paper-2 Blue print

S.No	Chapter	MCQ (1M)	VSA (2M)	SA (3M)	LA (5M)	CASE STUDY (4M)	TOTAL Marks
1	Chemical Reactions and Equations	4	1	1	-	-	9M
2	Acids,Bases,and Salts	2	1	1	-	-	7M
3	Metals and Non-Metals	1	-	-	-	1	5M
4	Carbon and Its Compounds	1	-	-	1	-	6M
5	Life Processes	2	2	1	-	-	9M
6	Control and Coordination	1	1	-	-	-	3M
7	How Do Organisms Reproduce?	2	-	-	1	-	7M
8	Heredity and Evolution	2	-	-	-	1	6M
9	Light Reflection and Refraction	-	-	2	-	1	10 M
10	Human Eye and Colourful World	-	1	-	-	-	2M
11	Electricity	2	-	-	1	-	7M
12	Magnetic Effect of Electric Current	3	-	1	-	-	6M
13	Our Environment	-	-	1	-	-	3M
14	Total no of questions	20	6	7	3	3	39 (80M)

KENDRIYA VIDYALAYA SANGATHAN, CHENNAI REGION

Sample Question Paper -2 -2022-23

STD:X **SUB: SCIENCE (086)**

Max. Marks: 80 **Time Allowed: 3 hours**

General Instructions:

i. This question paper consists of 39 questions in 5 sections.

ii. All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.

iii. **Section A** consists of 20 objective type questions carrying 1 mark each.

iv. **Section B** consists of 6 Very Short questions carrying 02 marks each. Answers to these questions should in the range of 30 to 50 words.

v. **Section C** consists of 7 Short Answer type questions carrying 03 marks each. Answers to these questions should in the range of 50 to 80 words

vi. **Section D** consists of 3 Long Answer type questions carrying 05 marks each. Answer to these questions should be in the range of 80 to 120 words.

vii. **Section E** consists of 3 source-based/case-based units of assessment of 04 marks each with sub-parts.

SECTION-A

Select and write one most appropriate option out of the four options given for each question 1-20

1.What happens when copper rod is dipped in iron sulphate solution: - 1

(a)Copper displaces iron (b)Blue color of copper sulphate solution is obtained

(c)No reaction takes place (d)Reaction is exothermic

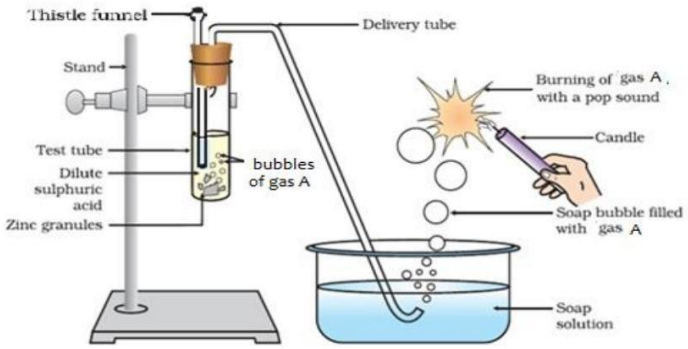
2.The following reaction is an example of a 1

$4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$

(i) displacement reaction (ii) combination reaction (iii) redox reaction(iv) neutralisation reaction

(a) (i) and (iv) (b) (ii) and (iii) (c) only (iii) (d) (iii) and (iv)

3.Identify gas A in the following experiment 1



a) Nitrogen b) Hydrogen c) Oxygen d) Carbon dioxide

4.Which of the following correctly represents a balanced chemical equation? 1

(a) $Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(s) + 4H_2(g)$ (b) $3Fe(s) + 4H2O(g) \rightarrow Fe_3O_4(s) + 4H_2(g)$

(c) $3Fe(s) + H_2O(g) \rightarrow Fe_3O_4(s) + H_2(g)$ (d) $3Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(s) + H_2(g)$

5.Which of the following elements will form an acidic oxide? 1

(a) An element with atomic number 7 (b) An element with atomic number 3

(c) An element with atomic number 12 (d) An element with atomic number 19

6.If a few drops of a concentrated acid accidentally spills over the hand of a student, what should be done? 1

(a) Wash the hand with saline solution

(b) Wash the hand immediately with plenty of water and apply a paste of sodium hydrogen carbonate

c)After washing with plenty of water, apply solution of sodium hydroxide on the hand

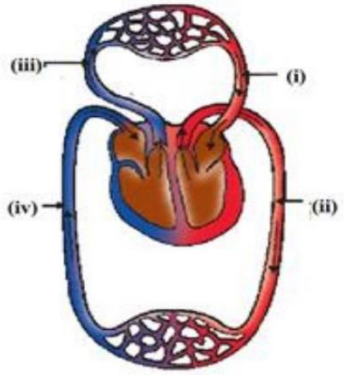
d)neutralise the acid with a strong alkali

7.Which of the following belongs to homologous series of alkynes? 1

C_6H_6, C_2H_6, C_2H_4, C_3H_4

(a) C_6H_6 (b) C_2H_6 (c) C_2H_4 (d) C_3H_4

8.The figure given below shows a schematic plan of blood circulation in humans with labels (i) to (iv). Identify the correct label with its functions? 1



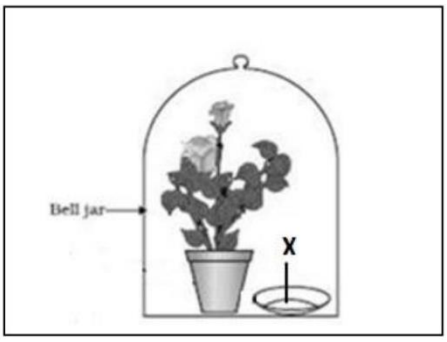
a) (i) Pulmonary vein - takes impure blood from body part.

b) (ii) Pulmonary artery - takes blood from lung to heart.

c) (iii) Aorta - takes blood from body to body parts.

d) (iv) Vena cava takes - blood from body parts to right auricle.

9.Observe the experimental setup shown below. Name the chemical indicated as 'X' that can absorb the gas which is evolved as a byproduct of respiration. 1



(a) NaOH (b) KOH (c) $Ca(OH)_2$ (d) KCO_3

10.Two pea plants one with round green seeds (RRyy) and another with wrinkled yellow (r r YY) seeds produce F1 progeny that have round, yellow (RrYy) seeds. When F1 plants are selfed, the F2 progeny will have new combination of characters. Choose the new combination from the following: 1

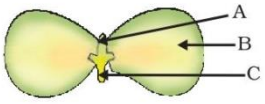
(i) Round, yellow (ii) Round, green (iii) Wrinkled, yellow (iv) Wrinkled, green

(a) (i) and (ii) (b) (i) and (iv) (c) (ii) and (iii) (d) (i) and (iii)

11.Electrical impulse travels in a neuron from 1

(a) Dendrite axon → axonal end → cell body
(b) Cell body → dendrite → axon → axonal end
(c) Dendrite → cell body → axon → axonal end
(d) Axonal end → axon → cell body → dendrite

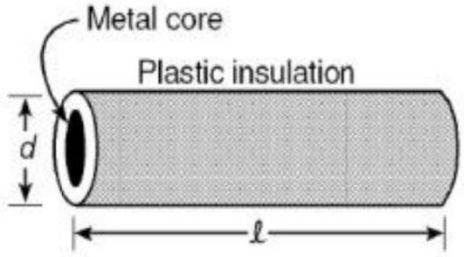
12.In given below figure, the parts A, B and C are sequentially 1



(a) cotyledon, plumule and radicle (b) plumule, radicle and cotyledon
(c) plumule, cotyledon and radicle (d) radicle, cotyledon and plumule.

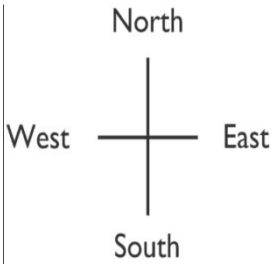
13.A complete circuit is left on for several minutes, causing the connecting copper wire to become hot. As the temperature of the wire increases, the electrical resistance of the wire 1
(a) decreases. (b) remains the same. (c) increases. (d) increases for some time and then decreases.

14



.
Plastic insulation surrounds a wire having diameter d and length l as shown above. A decrease in the resistance of the wire would be produced by an increase in the 1
(a) length l of the wire (b) diameter d of the wire (c) temperature of the wire
(d) thickness of the plastic insulation

15.A constant current flows in a horizontal wire in the plane of the paper from east to west as shown in the figure. The direction of magnetic field at a point will be North to south



1W←—----------E
(current flow direction)

(a) directly above the wire (b) directly below the wire
(c)at a point located in the plane of the paper
(d)at a point located in the plane of the paper, on the south side of the wire.

16.The strength of magnetic field inside a long current carrying straight solenoid is 1
(a) more at the ends than at the centre
(b) minimum in the middle
(c) same at all points
(d) found to increase from one end to the other

Q. no 17 to 20 are Assertion - Reasoning based questions.

These consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the
appropriate option given below:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true and R is not the correct explanation of A
(c) A is true but R is false
(d) A is False but R is true

17.Assertion (A): Decomposition of vegetable matter into compost is an example of exothermic reactions. 1
Reason (R): Exothermic reactions are those reactions in which heat is evolved.

18.Assertion: The sex of a child is determined by the mother. 1
Reason: Humans have two types of sex chromosomes: XX and XY.

19.Assertion: Amphibians can tolerate mixing of oxygenated and deoxygenated blood. 1
Reason: Amphibians are animals with two chambered heart

20.Assertion(A): The strength of the magnetic field produced at the centre of a current carrying circular coil increases on increasing the number of turns of the circular coil. 1
Reason (R): Magnetic field strength is directly proportional to the number of turns of the circular coil.

SECTION B

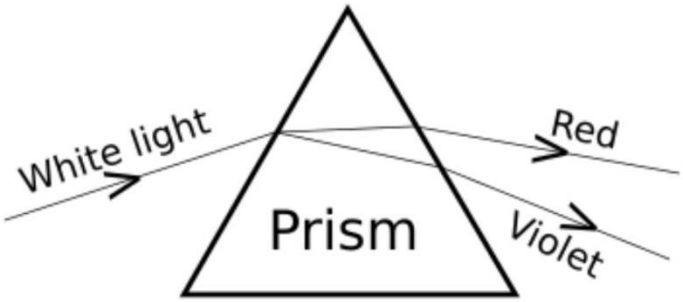
Q.no 21 to 26 are very short answers questions

21.A compound 'X' of calcium is used to immobilize fractured bone and it is obtained by heating another compound "Y" of calcium 2
(i) Name the compound 'X' and give its chemical formula.
(ii)Name the compound 'Y' and give one use of it other than its use to make 'X'
You are provided with 90 mL of distilled water and 10 mL of concentrated sulphuric acid to prepare dilute sulphuric acid.
(i) What is the correct way of preparing dilute sulphuric acid? Give reason.

22.A squirrel is in a scary situation. Its body has to prepare for either fighting or running away. State the immediate changes that take place in its body so that the squirrel is able to either fight or run. 2

23.Bile juice does not have any digestive enzyme but still plays a significant role in the process of digestion. Justify the statement. 2

24.State the events occurring during the process of photosynthesis. Is it essential that these steps take place one after the other immediately? 2



25.

A student observes the above phenomenon in the lab as a white light passes through a prism. Among many other colours, he observed the position of the two colours Red and Violet 2

What is the phenomenon called? What is the reason for the violet light to bend more than the red light?

OR

How will you use two identical prisms so that a narrow beam of white light incident on one prism emerges out of the second prism as white light? Draw the diagram.

26.Plastic cups were used to serve tea in trains in early days- these could be returned to the vendors, cleaned and reused. Later, Kulhads were used instead of plastic cups. Now, paper cups are used for serving tea. What are the reasons for the shift from Plastic to Kulhads and then finally to paper cups? 2

SECTION C

Q.no 27 to 33 are short answer questions

27.(i) Write two observations when lead nitrate is heated in a test tube. 3

(ii) Name the type of reaction.

(iii) Write a balanced chemical equation to represent the above reaction.

28.A metal carbonate X on reacting with an acid gives a gas which when passed through a solution Y gives the carbonate back. On the other hand, when a gas G that is obtained at the anode during electrolysis of brine is passed on dry Y, it gives a compound Z, used for disinfecting drinking water. Identity X, Y, G and Z. 3

29.Givereasons:

(i)Ventricles have thicker muscular walls than atria.

(ii)Rate of breathing in aquatic organisms is much faster than that in terrestrial organisms.

OR

(i)Draw a flow chart showing the three different pathways involved in the breakdown of glucose in different organisms.

(ii) What is reserve food in plants and animals?

30.It is desired to obtain an erect image of an object, using concave mirror of focal length of 12 cm.3M

(i) What should be the range of the object distance in the above case?

(ii) Will the image be smaller or larger than the object? Draw a ray diagram to show the formation of image in this case.

(iii) Where will the image of this object be, if it is placed 24 cm in front of the mirror?

31.(i)A doctor has prescribed a corrective lens of power +1.5 D. Find the focal length of the lens. What type of lens is this?

(ii)A girl was playing with a thin beam of light from a laser torch by directing it from different directions on a convex lens held vertically. She was surprised to see that in a particular direction, the beam of light continues to move along the same direction after passing through the lens. State the reason for her observation. Draw a ray diagram to support your answer. 3

32.Draw magnetic field in a circular loop. Explain why magnetic field lines never intersect each other.

OR

(i)Define alternating current

(ii)Explain why alternating current is preferred over direct current for transmission over long distances.

(iii) Alternating current has a frequency of 50 Hz. What is meant by this statement? How many times does it change its direction in one second?

33.Gas A, found in the upper layers of the atmosphere, is a deadly poison but is essential for all living beings. The amount of this gas started declining sharply in the 1980s. 3

a. Identify Gas A. How is it formed at higher levels of the atmosphere?

b. Why is it essential for all living beings? State the cause for the depletion of this gas.

SECTION D

Q.no.34 to 36 are Long answer questions

34.An organic compound 'A' is an essential constituent of wine and beer. Oxidation of 'A' yields an organic acid 'B' which is present in vinegar. Name the compounds 'A' and 'B' and write their structural formulae. What happens when 'A' and 'B' react in the presence of an acid catalyst? Write the chemical equation for the reaction. 5

OR

Elements forming ionic compounds attain noble gas electronic configuration by either gaining or losing electrons from their valence shells.

(i) Explain giving reason why carbon cannot attain such a configuration in this manner to form its compounds.

(ii)Name the type of bonds formed in ionic compounds and in the compounds formed by carbon.

(iii)Also explain with reason why carbon compounds are generally poor conductors of electricity.

(iv) Why does carbon form a large number of compounds?

35.List any four methods of contraception used by humans. How does their use have a direct effect on the health and prosperity of a family? 5

OR

(i)Why is DNA copying an essential part of the process of reproduction?

(ii) What are the advantages of sexual reproduction over asexual reproduction?

What is placenta? Explain its functions.

36 Find out(i)If the current flowing is 0.3A and an voltage of 220 V is given to an electric bulb then find the power of the bulb? 5

(ii)What is the potential difference of the resistor if the heater is generating 200J of heat per second due to 7-ohm resistance?

(i)What is equivalent resistance of the resistors 6-ohm, 12-ohm, 24 ohm and 3 ohms if connected in series and parallel combination.

SECTION D

Q.no.37 to 39 are case - based / data - based questions with 2 to 3 sub-parts. Internal choice is provided in one of these sub-parts

37. Krishna and Gargi went for a summer camp in a remote village. There they visited many ancient temples. One day they noticed that a lady is cleaning old vessels that had become dull in appearance. They had a discussion with that lady and Gargi noticed that the lady uses tamarind solution to clean the tarnished copper vessels. While moving to store room for old utensils they noticed many rusted iron vessels and utensils dumped there and in one of the store rooms of the temple, Krishna noticed many Aluminium vessels kept aside and they are not polished or painted. They had a mutual discussion over a related article, they read in a Science Magazine

'Corrosion resistant coatings protect metal components against degradation due to moisture, salt spray, oxidation or exposure to a variety of environmental or industrial chemicals. Anti-corrosion coatings allow for added protection of metal surfaces and acts as a barrier to inhibit the contact between chemical compounds or corrosive materials. In addition to corrosion prevention, many of the coatings also provide a bonus of abrasion resistance, non-stick performance and chemical protection. 4M

(i) Gargi noticed green patches over the tarnished copper vessels that are kept in store room. What are these green patches?

(a)Mixture of copper hydroxide and copper carbonate

(b)Mixture of copper sulphate and copper carbonate
(c)Copper hydroxide
(d)None of the above

(ii) Why aluminium objects do not require painting or polishing even though it is very reactive?

(iii)Is it advisable to use sour substances in cleaning tarnished copper vessels? What is your answer? Explain your answer.

OR

(iii)What is corrosion? Name two methods to prevent corrosion.

38.Pooja has green eyes while her parents and brother have black eyes. Pooja's husband Ravi has black eyes while his mother has green eyes and father has black eyes. 4

(a) On the basis of the above given information, is the green eye colour a dominant or recessive trait? Justify your answer.

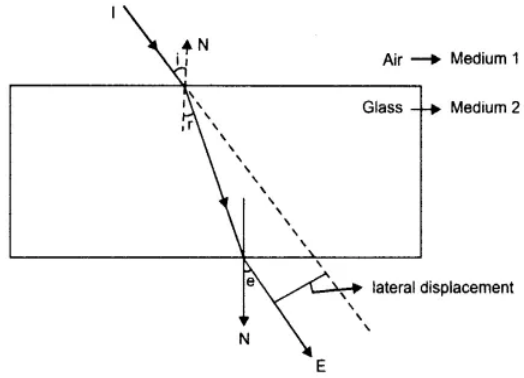
(b) What is the possible genetic makeup of Pooja's brother's eye colour?

(c) What is the probability that the offspring of Pooja and Ravi will have green eyes? Also, show the inheritance of eye colour in the offspring with the help of a suitable cross.

OR

(d) 50% of the offspring of Pooja's brother are green eyed. With help of cross show how this is possible.

39. A group of students are tracing the path of light through glass slab. They observe shifting of light after refraction from glass slab. Now answer the following questions: -



. 4

(i)What is lateral displacement?

(ii) Lateral displacement depends on:

(a) angle of incidence (b) angle of refraction (c) thickness of glass slab (d) angle of emergence.

(iii)The relation between ∠i, ∠r and n (refractive index) is:

(a) n = sin i/sin r (b) n = sin r/sin I (c) n sin i = n sin r (d) sin i = n sin r

(iv)The incident ray and the emergent ray in the glass slab are:

(a) always parallel (b) converging always (c) sometimes parallel (d) sometimes diverging.

OR

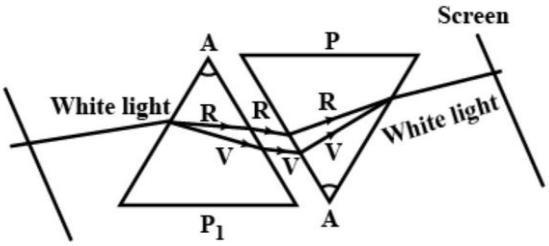
When ray of light travels from air to glass slab its wavelength:

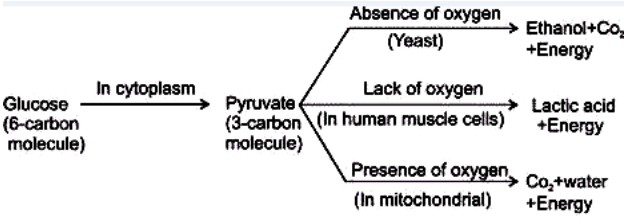
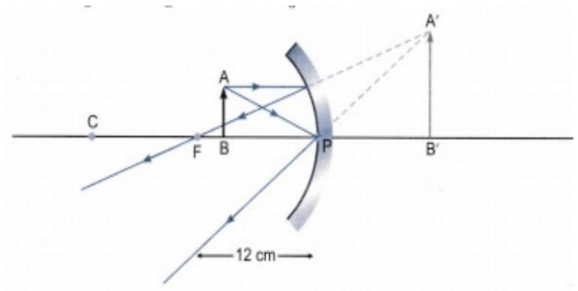
(a) increases (b) no change (c) decreases (d) depends on glass slab thickness.

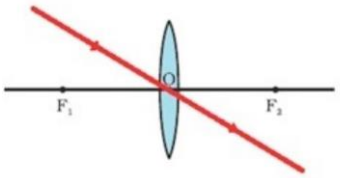
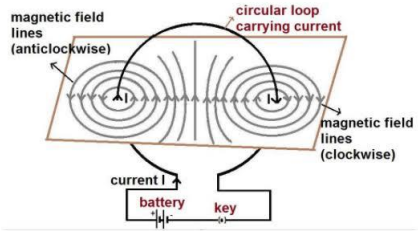
SCIENCE (086) SAMPLE PAPER -2
CLASS X
MARKING SCHEME (2022-23)

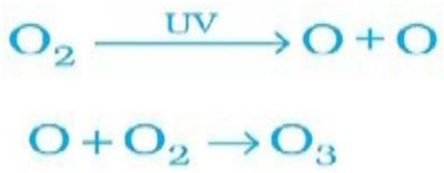
Q.No	Answers	Marks
	Section A	
1	(c)No reaction takes place	1
2	(c) (iii)	1
3	b) Hydrogen	1
4	b) $3Fe(s) + 4H2O(g) \rightarrow Fe_3O_4 (s) + 4H_2(g)$	1
5	(a) An element with atomic number 7	1
6	b)Wash the hand immediately with plenty of water and apply a paste of sodium hydrogen carbonate	1
7	(c) C_2H_4	1
8	d) (iv) Vena cava takes - blood from body parts to right auricle.	1
9	(b) KOH	1
10	(b) (i) and (iv)	1
11	(c) Dendrite → cell body → axon → axonal end	1
12	(c) plumule, cotyledon and radicle	1
13	(c) increases	1
14	(b) diameter d of the wire	1
15	b)directly below the wire	1
16	(c) same at all points	1
17	(a) Both A and R are true and R is the correct explanation of A	1
18	(d) A is False but R is true	1

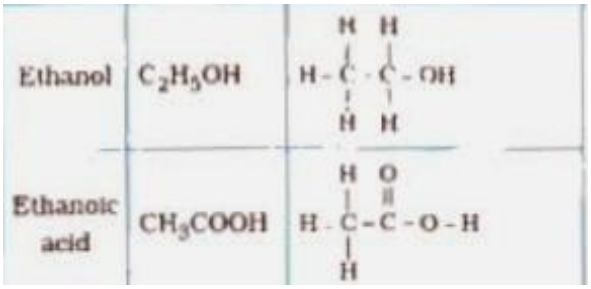
19	(c) A is true but R is false	1
20	(a) Both A and R are true and R is the correct explanation of A	1
	Section B	
21	(i) Plaster of Paris -CaSO4 (1/2 +1/2 M) (ii) Gypsum(1/2 m) Any one use like –used in cement industry(1/2m) OR (i) Add 10 mL of concentrated sulphuric acid slowly to 90 mL of water with constant stirring.(1M) Dilution of acid is a highly exothermic process. If water is added to concentrated sulphuric acid, heat generated causes the mixture to splash leading to burns and the glass container can break.(1M)	2M
22	When squirrel is in a scary situation then its nervous system stimulates the adrenal glands to secrete more adrenaline hormone into blood.(1M) This adrenaline hormone increases heartbeat, breathing rate, blood flow into muscle. All these actions of adrenaline hormone produces a lot of energy in squirrel's body. In this way, squirrel prepares itself for fighting or running away action. (1M)	2M
23	Bile juice makes the acidic food coming from the stomach alkaline for the action of pancreatic enzymes(1M) Bile salts break the large globules of fat in the intestine to smaller globules increasing the efficiency of enzyme action. This is similar to the emulsifying action of soaps on dirt(1M)	2M
24	1Absorption of light energy by chlorophyll.(0.5M) 2 Conversion of light energy to chemical energy and splitting of water molecules into hydrogen and oxygen.(1M) 3 Reduction of carbon dioxide to carbohydrates.(0.5)	2M

25	The phenomenon is called dispersion.(1M) Speed of Violet Light inside the prism is slowest and that of Red is highest. Hence, deviation of Violet Light is maximum and that of Red is minimum(1M) OR Angle of deflections of the two prisms need to be equal and opposite. While the first prism splits the light in the seven colours due to different angles of deflection, the second prism combines the spectrum along a single ray and the colours again combine to give white light as the emergent light.(1M)  diagram(1M)	2M
26	Use of Plastic cups raised the concern towards hygiene thus they were replaced by disposable plastic cups.(1M) Plastic cups are non-biodegradable and harm the environment friendly.They were thus replaced by Kulhads.(1M) Making Kulhad made of clay on a large scale resulted in the loss of top fertile soil.(1M) so, disposable paper cups are used	3M
	Section-C	
27	(i) It turns yellow due to formation of lead oxide(0.5M) and Reddish brown fumes evolve.(0.5M) (ii) Thermal decomposition reaction.(1M) heat (iii) $2Pb(NO_3)_2$---------> $2PbO + 4NO_2 + O_2$(1M)	3M
28	X-calcium carbonate(0.5M) Y-calcium hydroxide(1M) G-chlorine(1M) Z-bleaching powder(0.5)	3M

29	(i)Since ventricles have to pump blood into various organs with high pressure, they have thicker walls than atria.(1M) (iii)Air contains about 21% of oxygen while water has less than 1% oxygen in dissolved state.(1M) Oxygen diffuses through water at a much slower rate as compared to air.(1M) OR  **(Break down of glucose by various pathways)** flow chart (2M) plants-starch, animals-glycogen (1M)	3M
30	(i) Range of distance should be 0 cm to < 12 cm. (ii) The image will larger than the object.(0.5M)  (1.5M) (iii) Image will be at 24cm in front of the mirror or the image is formed at C(1M)	3M

31	(i) f=1/P =1/+1.5D =+10/15 m=+0.6667m(1M) Covex or converging lens(0.5M) (ii) The girl must have directed the ray of light along the direction of the optical centre of the lens because the ray of light passes straight through the optical centre of the lens.(0.5)M)  OR Ray diagram(1M)	3M
32	 (i) Diagram (2M) (ii)Two magnetic field lines can never intersect each other because if they do there will be two directions of the field at the same point, which is impossible.(1M) OR (i)An electric current whose magnitude changes with time and direction reverses periodically is called alternating current.(1M) (ii)A.C. can be transmitted to distant places without much loss of electric power than D.C. That is why A.C. is preferred over D.C. for transmission of current over a long distances.(1M) (iii)The frequency of household supply of A.C. in India is 50 Hz. This means, A.C. completes 50 cycles in one second. Thus, A.C. changes direction 2 × 50 = 100 times in one second.(1M)	3M

33	Ozone (O_3).(0.5M)  Equation (1M) Ozone shields the surface of the earth / protects living organisms from ultraviolet (UV) radiation released by the sun.(0.5M) Chlorofluorocarbons (CFCs) which are used as refrigerants / in fire extinguishers lead to depletion of ozone layer.(1M)	3M
Section -D		

34	The available information suggests that the compound 'A' is ethanol and the compound 'B' formed by the oxidation of 'A' is ethanoic acid. Their structural formulae are :(1M)  structure (2M) When 'A' and 'B' react in the presence of an acid like cone. H2SO4, the compound is ethyl ethanoate (ester) with a pleasant smell. $C_2H_5\boxed{OH} + CH_3COO\boxed{H} \xrightarrow{\text{conc. } H_2SO_4}$ Alcohol Carboxylic acid $CH_3COOC_2H_5 + H_2O$ Ester (ethyl ethanoate) equation and compounds name (2M) OR (i)a If carbon forms ionic bonds by gaining four electrons to attain a noble gas configuration then it would be difficult for six protons in the nucleus to hold ten electrons.(1M (i)b. If carbon forms ionic bonds by loss of four electrons then it would require a lot of energy to remove these electrons from outermost shell.(1M) (ii)type of bonds formed in ionic compounds are called electrovalent bonds and the type of bonds formed in carbon compounds are called covalent bonds.(1M) (iii)Covalent compounds are generally poor conductors ol electricity because they do not have tree electrons or ions.(1M) (iv) Because of catenation and tetravalency(1M)	5M

35	Barrier method- These are physical devices to prevent the entry of sperm in the female, e.g., condoms.(1M) Chemical method – It involves the use of oral pills that check ovulation. These are mainly hormonal preparations and contain estrogen and progesterone.(1M) Intrauterine contraceptive device-These devices are implemented into uterus, e.g., copper – T, to prevent fertilisation.(1M) Surgical methods : These methods involves removal of a small jJortion of vas deferens in males or fallopian tube in females to prevent fertilisation.(1M) Contraception prevents frequent pregnancies and sexually transmitted diseases thus supports good health and prosperity of a family.(1M) OR DNA copying is an essential part of the process of reproduction as it results in passing of nearly same genetic information from parents to the offsprings(1M) Variation occurs only during the sexual reproduction. Variations are necessary for evolution and to increase chances of survival in changed environmental conditions.(1M) Placenta is an intimate connection between fetus and uterine wall of the mother to exchange the materials. It is a disc shaped structure embedded in the uterine wall. It contains villi on embryo's side and blood spaces towards mothers side. Blood spaces surround villi.(2M) Through placenta nutrients and other useful substances enter into foetus from mother's blood. Waste products like urea and carbon dioxide are expelled into mother's blood from foetus.(1M)	5M

36	(i)P = VI = 220*0.3= 66 J/s Thus, power of the bulb is 66J/s or 66 W.(1M) (ii)We know that, according to Joule's law of heating, H= I^2Rt (0.5M) I^2 = H/Rt = 200/7*1 = 28.57 And I = 5.34 A (0.5M) Now, potential difference across the resistor is given by, V= IR = 5.34*7= 37.41 V(1M) (iv)Re= 6 + 12 + 24 + 3 = 45 ohm(1M) 1/Re = 1/6 + 1/12 + 1/24 + 1/3 1/ Re = 4 + 2 + 1 + 8 = 15 Thus, 1/Re = 15 And hence, Re = 1/15 = 0.066 ohm.(1M)	5M
	Section -E	
37	(i)(a)Mixture of copper hydroxide and copper carbonate(1M) (ii)Aluminium react with oxygen to form an inert layer of aluminium oxides, The inert layer protect metal from further corrosion(1M) (iii)Yes, sour substances contain acids. The green substance on tarnished copper vessels (mixture of copper hydroxide and copper carbonate) is basic in nature. When acid react with base neutralisation reaction occurs(2M) (OR) (iii)Reaction of metals with environment to form stable metal oxide .(1M) Anodising, painting ,applying grease, electroplating galvanising (any two)(1M)	4M

<table>
<tr>
<td>38</td>
<td>a. Yes, green eye colour is recessive (0.5M)
as it will express only in homozygous condition(0.5M)
b. BB, Bb(1M)
c. bb*Bb (0.5M)
<table>
<tr><td></td><td>B</td><td>b</td></tr>
<tr><td>b</td><td>Bb</td><td>bb</td></tr>
<tr><td>b</td><td>Bb</td><td>bb</td></tr>
</table>
Genetic cross(1M)
50% of the offsprings can have green eye colour (0.5M)

OR
c,Brother is heterozygous(Bb) and wife is green(bb) - Wife bb*Bb brother(1M)
<table>
<tr><td></td><td>B</td><td>b</td></tr>
<tr><td>b</td><td>Bb</td><td>bb</td></tr>
<tr><td>b</td><td>Bb</td><td>bb</td></tr>
</table>
50% of the offsprings can have green eye colour as per the cross shown.(1M)</td>
<td>4M</td>
</tr>
<tr>
<td>39</td>
<td>(i)The perpendicular distance between the incident ray and the emergent ray(1M)
(ii)(c) thickness of glass slab(1M)
(iii)(a) n = sin i/sin r(1M)
(iv)(a) always parallel(1M)
OR
(iv)(c) decreases(1M)</td>
<td>4M</td>
</tr>
</table>

S.No	Chapter	MCQ (1M)	VSA (2M)	SA (3M)	LA (5M)	CASE STUDY (4M)	TOTAL Marks
1	Chemical Reactions and Equations	4	1	1	-	-	9M
2	Acids,Bases,and Salts	2	1	1	-	-	7M
3	Metals and Non-Metals	1	-	-	-	1	5M
4	Carbon and Its Compounds	1	-	-	1	-	6M
5	Life Processes	2	2	1	-	-	9M
6	Control and Coordination	1	1	-	-	-	3M
7	How Do Organisms Reproduce?	2	-	-	1	-	7M
8	Heredity and Evolution	2	-	-	-	1	6M
9	Light Reflection and Refraction	-	-	2	-	1	10 M
10	Human Eye and Colourful World	-	1	-	-	-	2M
11	Electricity	2	-	-	1	-	7M
12	Magnetic Effect of Electric Current	3	-	1	-	-	6M
13	Our Environment	-	-	1	-	-	3M
14	Total no of questions	20	6	7	3	3	39 (80M)

KENDRIYA VIDYALAYA SANGATHAN, CHENNAI REGION
Sample Question Paper -3 -2022-23

STD:X **SUB: SCIENCE (086)**
Max. Marks: 80 **Time Allowed: 3 hours**
General Instructions:

i. This question paper consists of 39 questions in 5 sections.
ii. All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.
iii. Section A consists of 20 objective-type questions carrying 1 mark each.
iv. Section B consists of 6 Very Short questions carrying 02 marks each. Answers to these questions should be in the range of 30 to 50 words.
v. Section C consists of 7 Short Answer type questions carrying 03 marks each. Answers to these questions should be in the range of 50 to 80 words
vi. Section D consists of 3 Long Answer type questions carrying 05 marks each. Answers to these questions should be in the range of 80 to 120 words.
vii. Section E consists of 3 source-based/case-based units of assessment of 04 marks each with sub-parts.

SECTION - A

Select and write one most appropriate option out of the four options given for each of the questions 1 – 20

1.A student notices that her silver jewellery turned dull and had a gray-black film over it after wearing for a few months. What results in the change in colour of the silver metal?
(1)
(a) dust deposits over the jewellery which changes its colour
(b) the jewellery comes in contact with air, moisture, and acids and corrodes
(c) the polish over the jewellery was removed after wearing for a few months
(d) silver breaks due to wear and tear and turns its colour changes due to rusting

2. An oxide of element P is added to an acid where it forms salt and water. The table shows the possible value of pH and the type of element before the reaction.
(1)

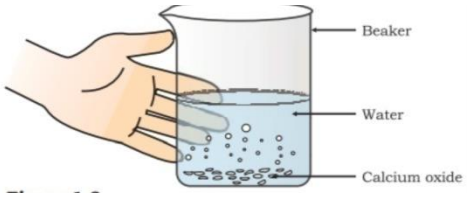
	pH	Type of Element
A	Less than 7	Metal
B	Less than 7	Non-metal
C	Greater than 7	Metal
D	Greater than 7	Non-metal

Which option is correct?

(a) A (b) B (c) C (d) D

3. Solid calcium oxide reacts vigorously with water to form calcium hydroxide accompanied by liberation of heat. This process is called slaking of lime. Calcium hydroxide dissolves in water to form its solution called lime water. Which among the following is (are) true about slaking of lime and the solution formed?

(1)



(i) It is an endothermic reaction. (ii) It is an exothermic reaction.

(iii) The pH of the resulting solution will be more than 7.

(iv) The pH of the resulting solution will be less than 7

(a) (i) and (ii) (b) (ii) and (iii) (c) (i) and (iv) (d) (iii) and (iv)

4. When solid sodium hydrogen carbonate is added to an organic liquid that is used as a food preservative, brisk effervescence is noted. The gas that gives rise to brisk effervescence is

(1)

(a)Carbon dioxide (b)Hydrogen (c) Oxygen (d) Nitrogen

5. A dilute ferrous sulphate solution was gradually added to the beaker containing acidified permanganate solution. The light purple colour of the solution fades and finally disappears. Which of the following is the correct explanation for the observation?

(1)

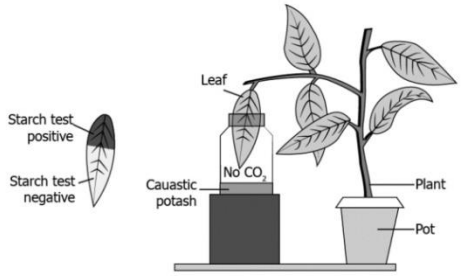
(a) $KMnO_4$ is an oxidising agent, it oxidises $FeSO_4$.

(b) $FeSO_4$ acts as an oxidising agent and oxidises $KMnO_4$.

(c) The colour disappears due to dilution; no reaction is involved.

(d) $KMnO_4$ is an unstable compound and decomposes in presence of $FeSO_4$to a colorless compound

6. A student sets up an experiment to study the photosynthesis in plants. The student destarched a potted plant by keeping it in a dark room for 3 days. Half of the portion of de starched leaf was placed in a bottle containing caustic potash (absorbs CO_2) as shown.



The student then places the plant in light and tests the leaf after 5 hours for the presence of starch. The portions inside the bottle shows negative starch test by reflecting no change in colour when react with iodine, however, other upper portions of the leaf gave positive starch test showing blue-black colour with iodine. What can be evaluated from this experiment?

(1)

(a) carbon dioxide is directly linked with the colour of leaf

(b) carbon dioxide is necessary for preparing carbohydrate
(c) lack of carbon dioxide increases amount of starch in plant
(d) lack of carbon dioxide slows the process of photosynthesis

7. The table lists the process which explains how pure metals are obtained from impure samples by electrolytic refining.
(1)

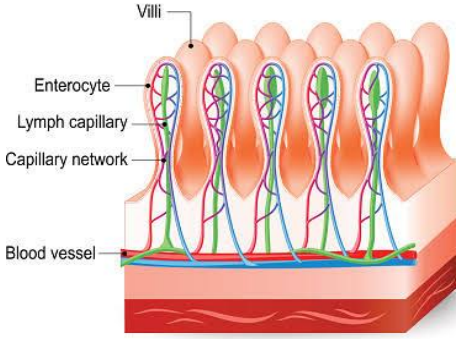
1. Keep impure metal at anode and pure metal at cathode.
2. Pass current in the electrolytic solution.
3. Insoluble impurities settle in the bottom of the anode as anode mud.
4. Pure metal from anode dissolves in the solution and pure metal from solution deposits on the cathode.

Which option arranges the steps in the appropriate order?
(a) 2-1-3-4 (b) 1-2-4-3 (c) 3-1-4-2 (d) 4-2-3-2

8. A Mendalian experiment consisted of breeding tall pea plants bearing violet flowers with short pea plants bearing white flowers. The progeny all bore violet flowers, but almost half of them were short. This suggests that the genetic make-up of the tall parent can be depicted as
(1)

(a) TTWW (b) TTww (c) TtWW (d) TtWw

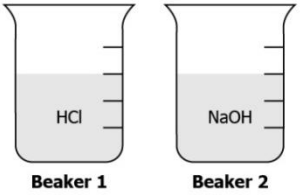
9. The image shows a cross section of small intestine.



What will be the likely happen if the number of villi increases in the intestine?
(1)

(a) Increase in the absorption of food
(b) Fast elimination of waste from the body
(c) Increase in absorption of water in the small intestine
(d) Fast breakdown of larger food particles into smaller ones

10. A student placed 10 mL HCl and NaOH in two separate beakers as shown.



In beaker 1, 4 mL of NaOH is added whereas in beaker 2, 4 mL of HCl is added. The student notes the possible change in pH in both solutions.

(1)

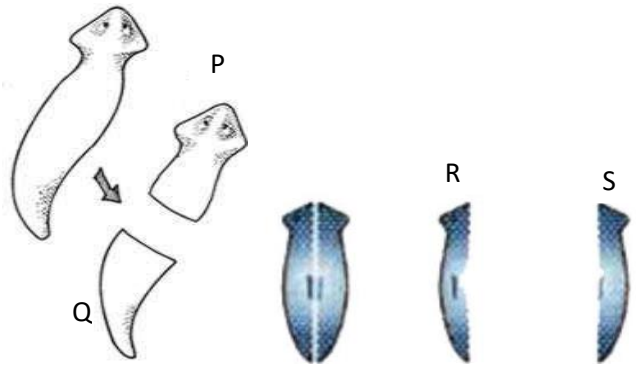
	Change in pH (Beaker 1)	Change in pH (Beaker 2)
A	increase	increase
B	reduce	increase
C	increase	reduce
D	reduce	reduce

Which change in pH is correct?

a) A b) B c) C d) D

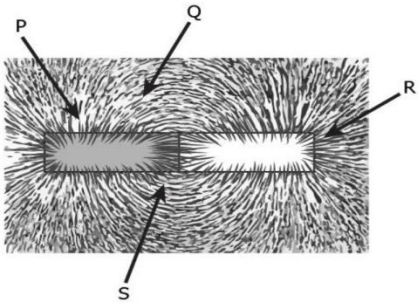
11. A Planaria worm is cut horizontally in the middle into two halves P and Q such that the part P contains the whole head of the worm. Another Planaria worm is cut vertically into two halvesR and S in such a way that both the cut pieces R and S contain half head each. Which of the cut pieces of the two Planaria worms could regenerate to form the complete respective worms?

(1)



(a) Only P (b) Only R and S (c) P, Rand S (d) P, Q, R and S

12. A student places some iron fillings around a magnet. The iron fillings arrange themselves as shown in image.



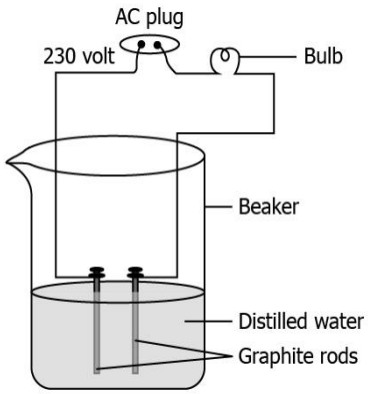
The student labeled four different regions around the magnet. Where would be the magnetic be the strongest?

(1)

(a) P (b) Q (c) R (d) S

13. A student makes an arrangement to test the electrical conductivity of distilled water as shown.

(1)



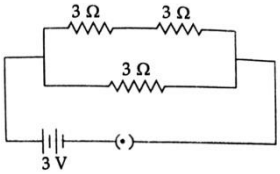
The student observes that the bulb does not glow. What could be the reason the bulb does not glow?

a) the bulb needs DC source to glow (b) the water never conducts electricity

c) the graphite is bad conductor of electricity (d) the distilled water does not have ions present in it

14. Three resistors of 3 ohm each are connected to a battery of 3 V as shown. The current drawn from the battery is:

(1)



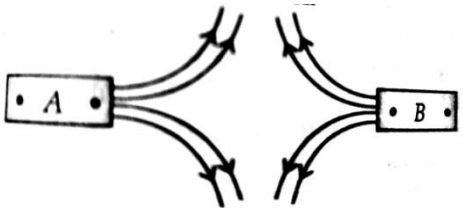
a) 2A b) 2.5A c) 1A d) 1.5A

15. When we touch the leaves of a touch-me-not plant, they begin to fold up and droop. What is the nature of movement in this case?

(1)

a. Tropic movements b. Thigmotropism c. Chemotropism d. Nastic movements

16. Magnetic field lines of two bar magnets A and B are as shown below. Name the poles of the magnets facing each other.
(1)



a) Both A and B are South Pole b) Both A and B are North Pole
c) A- North Pole B- South pole d) A- South Pole B- North pole

Q. no 17 to 20 are Assertion - Reasoning based questions. These consist of two statements – Assertion (A) and Reason (R). Answer these questions by selecting the appropriate option given below: (a) Both A and R are true and R is the correct explanation of A (b) Both A and R are true and R is not the correct explanation of A (c) A is true but R is false (d) A is False but R is true

17. **Assertion (A)** : If blood group of both mother and father is O then the blood group of children will also be O.
Reason (R) : Blood group in humans is determined by many alleles of a gene viz. I^A, I^B, I^0.
(1)
18. **Assertion (A)** : The fuse is placed in series with the device.
Reason (R) : Fuse consists of a piece of wire made of a metal or an alloy of appropriate melting point.

(1)
19. **Assertion (A):** Rings of cartilage are present in the throat,
Reason (R) : These ensure that the air-passage does not collapse
(1)

20. **Assertion(A)**: A compass needle is placed near a current carrying wire. The deflection of the compass needle decreases when the magnitude of an electric current in the wire is increased.
Reason (R) : Strength of a magnetic field at a point near the conductor increases on increasing the current.
(1)

SECTION – B

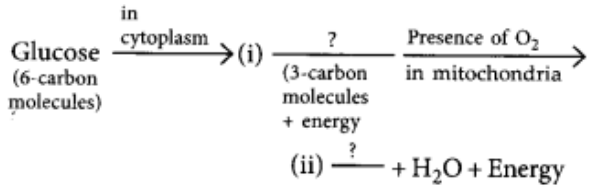
Q. no. 21 to 26 are very short answer questions.

21. (a) Rate of breathing in aquatic organisms is much faster than that in terrestrial organisms. Give reasons.

(1)

(b) Complete the following pathway showing the breakdown of glucose.

(1)



22. Zinc is the metal which lies in the middle of the activity series. This metal is extracted from its sulphide ore. Outline the steps involved in the process of extraction of zinc metal with the help of balanced chemical equation for each step.

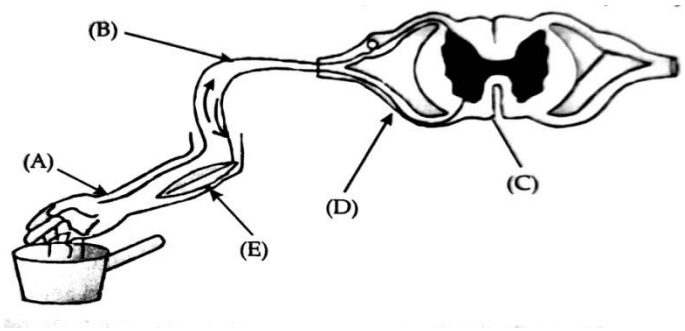
(2)

23. In the given diagram of reflex arc:

(2)

(i) Name the parts labeled A and C

(ii) Write the functions of B and E.



24. (i) Why do ventricles have thicker, muscular walls than atria?

(2)

(ii) Stomata remain closed in desert plants during day time.' How do they do photosynthesis?

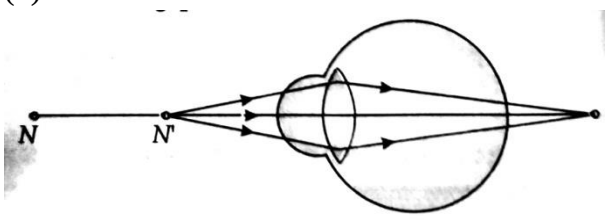
OR

What are the methods used by plants to get rid of excretory products?

(2)

25. Study the diagram given below and answer the following questions:

(2)



(i) List two causes of the defect.

(ii) Draw a ray diagram for the correction of the above defect using an appropriate lens.

OR

Explain with the help of a diagram the reason why the sun is visible to us about 2 minutes before the actual sun-rise and about 2 minutes after the actual sunset.

(2)

26. Your mother always thought that fruit juices are very healthy for everyone. One day she readsin the newspaper that some brands of fruit juices in the market have been found to contain certain level of pesticides in them. She got worried as pesticides are injurious to our health.
It is said that when these harmful pesticides enter our body as well as in the bodies of other organisms they get accumulated and beyond at limit may cause harm and damage our organs. Name the phenomenon and write about it.
(2)

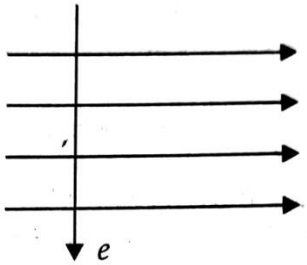
SECTION – C

Q.no. 27 to 33 are short answer questions

27. Write balanced chemical equations for the following statements:
(3)
(i) Excess of carbon dioxide gas is passed through lime water.
(ii) Dilute sulphuric acid reacts with sodium carbonate
(iii) Egg shells are dropped in hydrochloric acid.
28. What is cinnabar? How is a metal extracted from cinnabar? Explain briefly.
(3)

OR

(i) Explain the formation of ionic compound CaO by transfer of electrons. Atomic number of calcium and oxygen are 20 and 8 respectively.
(ii) Name the constituent metals of bronze.
29. Draw a diagram of human excretory system and label the following:
(3)
(i) part in which urine is produced
(ii) part which stores the urine
(iii) part which connects (i) and (ii)
(iv) part from which urine is passed out.
30.a) An electron enters a magnetic field at right angles to it as shown in figure. What will be thedirection of force acting on the electron? State the rule which gives direction of force on electron.



b) If instead of electron, a neutron enters a field, what will be its direction of motion? Give reason for your answer.
(3)

OR

How does the strength of the magnetic field at the centre of a current carrying circular coil depend on the
(3)

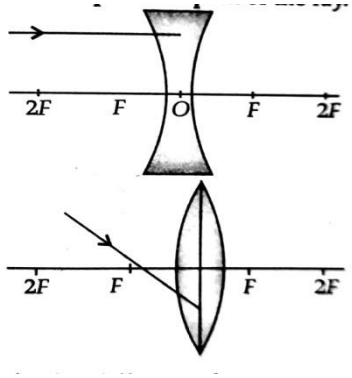
(i) Radius of the coil,

(ii) Number of turns in the coil, and

(iii) Strength of the current flowing in the coil

31.(i) The refractive index of diamond is 2.42. What is the meaning of this statement?
(3)

(ii) Redraw the diagram given below in your answer book and complete the path of the ray.



32. What will happen if we kill all the organisms in one tropic level? Explain with a help of an example.

(3)

33. The image of an object formed by a lens is of magnification-1. If the distance between the object and its image is 60 m, what is the focal length of the lens? If the object is moved 20 cm towards the lens, where would the image be formed? State reason and also draw a ray diagram in support of your answer. (3)

SECTION - D

Q.no. 34 to 36 are long answer questions

34. i) An organic compound 'P' is a constituent of wine. P on reacting with acidified $K_2Cr_2O_7$, forms another compound 'Q'. When a piece of sodium is added to 'Q' a gas 'R' evolves which burns with a pop sounds. Identify P, Q and R and write the chemical equations of the reactions involved.
ii) List two uses of esters.
(5)

OR

Carbon has the unique property to form bonds with other atoms of carbon.
(5)

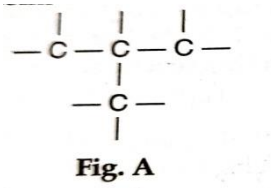


Fig. A

I) Name the characteristic property of carbon as depicted in figure A.
ii) Give reason for this unique property of carbon
iii) What is isomerism? Draw the isomers of butane.

35. (a) Draw a sectional view of human female reproductive system and label the part where
(5)

(i) Eggs develop. (ii) Fertilization take place.

(iii) Fertilized egg gets implanted.

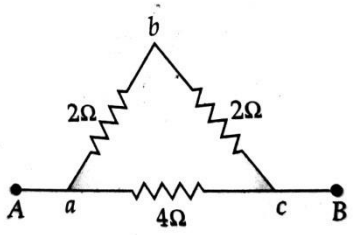
(b) Describe, in brief, the changes the uterus undergoes:

(i) To receive the zygote. (ii) If zygote is not formed.

36. a) With the help of a circuit diagram prove that when a number of resistors are connected in parallel, the reciprocal of equivalent resistance of the combination isequal to the sum of the reciprocals of the individual resistances of the resistors.

b) Find the resistance between A and B in the following network.

(5)



OR

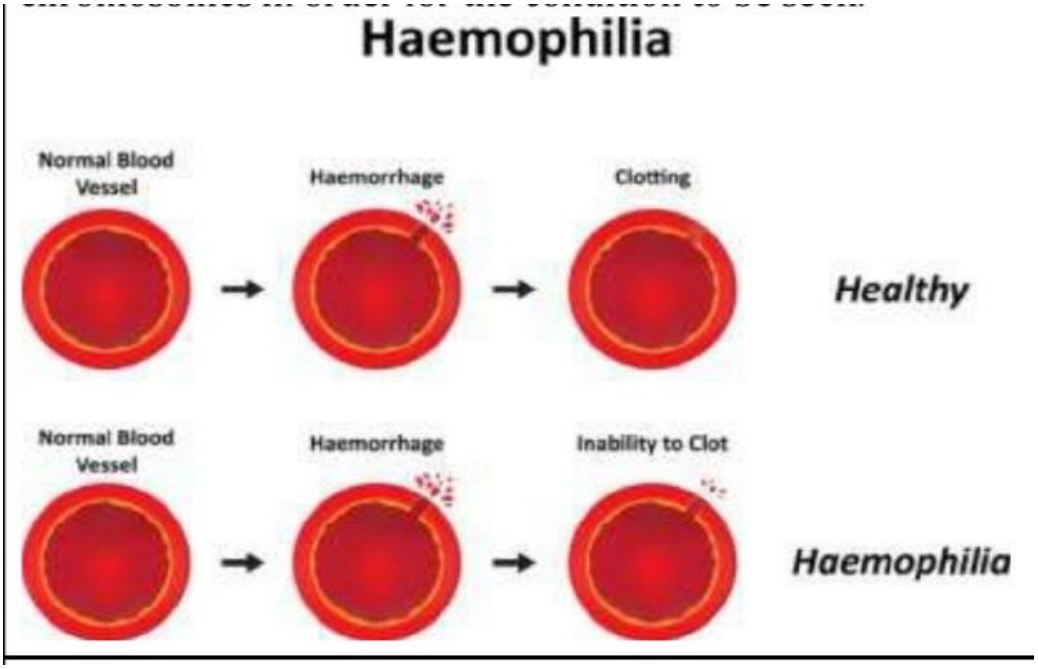
a) Why the elements of electric heating devices such as bread-toasters and electric iron are made of an alloy rather than of a pure metal.

b) Two lamps, one rated 100 W at 220 V and the other 200 W at 220V are connected (i) in series and (ii) in parallel to electric main supply of 220 V. Find the current drawn in each case.

SECTION - E

Q.no. 37 to 39 are case-based/data-based questions with 2 to 3 short sub-parts. Internal choice is provided in one of these sub-parts.

37. Haemophilia is an X-linked disorder characterized by the inability to properly form blood clots. Until recently, haemophilia was untreatable, and only a few haemophiliacs survived to reproductive age because any small cut or internal haemorrhaging after even a minor bruise was fatal. Women haemophiliacs are rare because they will be a carrier of recessive carrier gene.



I) Is it an acquired or an inherited trait?

(1)

ii) What are the problems associated with Haemophilia?

(1)

iii) Can the offspring be born with hemophilia if father is healthy and mother is a carrier of hemophilia? Justify

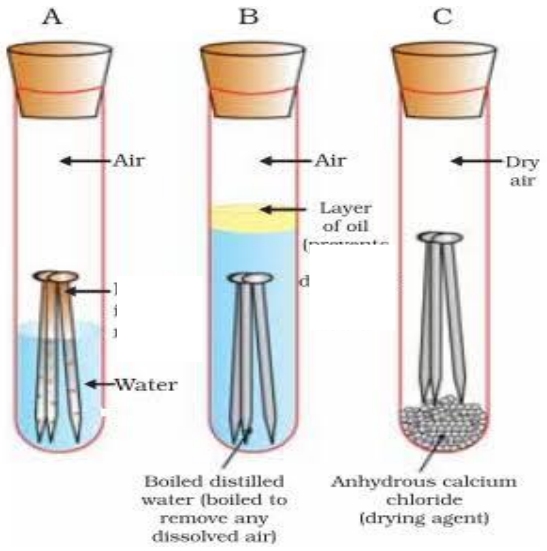
(2)

OR

iii)Who has highest probability of acquiring Haemophilia? Give reasons to support your answer. (2)

38. Corrosion is one of the most common phenomena that we observe in our daily lives. You must have noticed that some objects made of iron are covered with an orange or reddish-brown coloured layer at some point in time. The formation of this layer is the result of a chemical process known as rusting, which is a form of corrosion.

i) In which of the following case rusting of iron is possible? Why? (2)



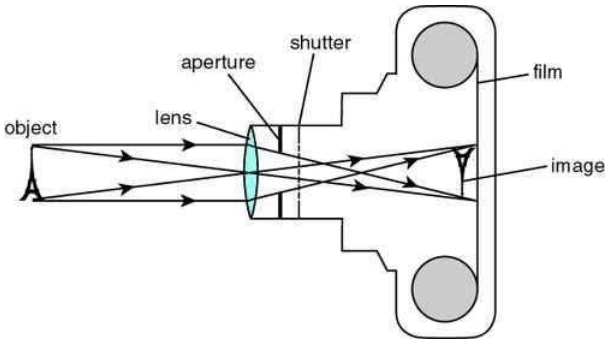
ii) Give reason (2)

Silver articles become black after some time when exposed to air. What is the name of that black coating?

(OR)

How does galvanization help in preventing corrosion? (2)

39.



i) What is the nature of lens used in a camera? (1)

ii) What is the nature of image formed? (1)

iii) A tree, which is 200m away from the pinhole, produces an image of height 1cm, in a pinhole camera of width 20cm. Find the height of the tree.

(2)

(OR)

How is our eye able to function like a camera? (2)

KENDRIYA VIDYALAYASANGATHAN, CHENNAI REGION

MARKING SCHEME

SAMPLE PAPER 3

Max. Marks: 80 **Time Allowed: 3 hours**

SCIENCE (086)

SECTION – A

1. b
2. c
3.b
4. a
5. a
6. b
7. b
8. c
9. a
10. c
11. d
12. c
13. d
14. d
15. d
16. b
17. b
18. b
19. a
20. d

SECTION – B

21.a. Amount of dissolved oxygen is less in water compared to air (1)
b. Pyruvate (1/2) , Carbon di oxide (1/2)

22. Roasting(1/2)
$2ZnS + 3O_2 \text{ ---> } 2ZnO + 2SO_2$ (1/2)
Reduction(1/2)
$ZnO + C \text{ --> } Zn + CO$ (1/2)

23. i)A – Receptor(1/2)
C- Spinal cord(1/2)
ii) B- Receives impulse(1/2)
E - Responds to stimuli(1/2)

24.i) Needs to send blood to all parts of the body(1/2),
to withstand high pressure (1/2)
ii) Forms intermediate during night by taking Carbon di oxide(1/2) .
Does photosynthesis during day(1/2)

Or

a) Gums and resins any 4 each (1/2) marks

b) Water by transpiration

c) Waste products stored in vacuoles or in leaf

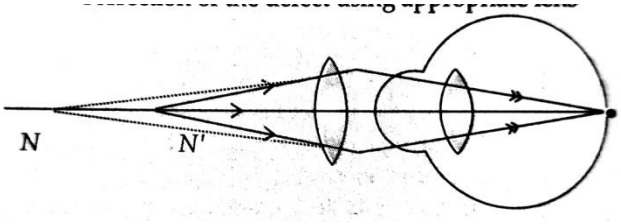
d) oxygen, a product of photosynthesis

e) Shedding of leaf or bark

25.i) Two causes

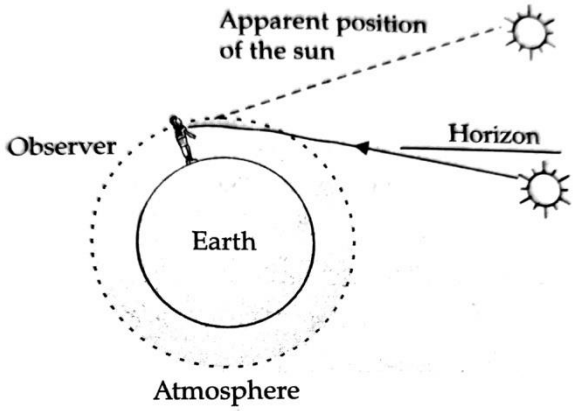
- The focal length of the eye lens is too long (1/2)
- The eyeball has become too small (1/2)

ii)



(1)

Or



(1)

When the Sun is slightly below the horizon, its light moves from less dense air to more dense air and gets refracted towards the normal. Because of this atmospheric refraction, the Sun appears to be above the horizon when it is actually slightly below the horizon. It is also due to atmospheric refraction that we can still see the Sun for about two minutes even after it has set below the horizon. (1/2 +1/2)

26.Biomagnification (1/2)

Biological magnification or bio-magnification is the accumulation of chemicals in the individuals of higher tropic level. (1/2)

Chemicals are non-biodegradable and their concentration increases at each tropic level. (1/2)

Humans, being at the top of food chain, also get higher concentration of these harmful chemicals resulting into various health problems. (1/2)

SECTION – C

27.i) $CaCO_3(s) + H_2O(l) + CO_2(g) \rightarrow Ca(HCO_3)_2\ (aq)$ (1)

(ii) $Na_2CO_3(s) + H_2SO_4(dil) \rightarrow Na_2SO_4(aq) + H_2O(l) + CO_2(g)$ (1)

(iii) $CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$(1)

28. Cinnabar is an ore of Mercury (1)

Since it is less reactive metal on heating produces HgO and on further heatingpure Hg is obtained. (1)

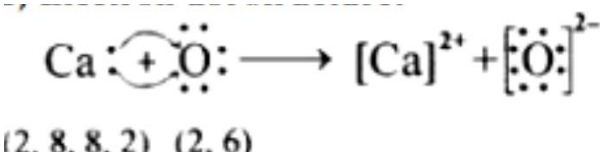
$2HgS + 3 O_2$ ----> $2 HgO + 2SO_2$ (1/2)

$2 HgO$ ------> $2 Hg + O_2$ (1/2)

Or

i) Ca--> $Ca^{2+} + 2e^-$ (1/2)

$O + 2e^-$---> O^{2-} (1/2)

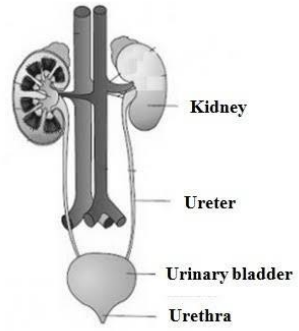


(1/2) +(1/2)

ii) Bronze - Cu, Sn (1/2) +(1/2))

29.Diagram (1)

Correct Labelling (1/2) x 4 = 2



30. a) Electron will move in a direction perpendicular to the plane of paper and into it. (1/2)

Flemings Left Hand Rule: Stretch the first three fingers of the left hand mutually perpendicular to each other such that the forefinger points the direction of magnetic field, the middle finger points the direction of current, then the thumb will indicate the direction of force experienced by the conductor. (1 1/2)

b) Neutron will continue to move in same direction because no force will act on it since it carries no charge. (1)

Or

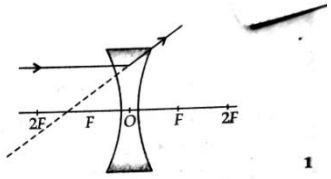
(I) Inversely proportional; more radius less, strong magnetic field. (1)

(ii) Directly proportional; more turns more, strong magnetic field. (1)

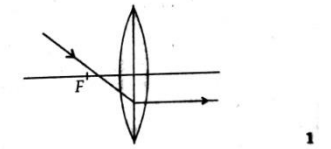
(iii) Directly proportional; more strength of current, more strong magnetic field. (1)

31. i) ratio of speed of light in air and speed of light in diamond is 2.42(1)

ii)



1

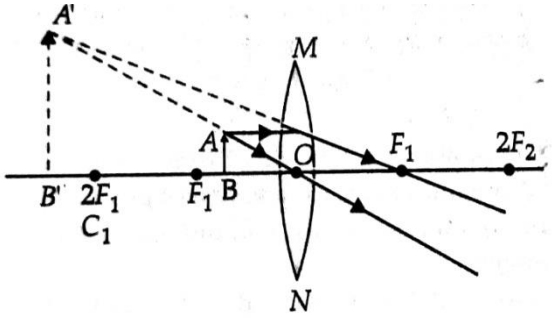


1

32.Lower tropic level's population will increase (1)
Instability (1)

For example, if we remove deer (second trophic level) from a food chain, the population of carnivores will deplete while the primary producer, that is, grass and plants will show high growth. (1)

33.Image with magnification -1 means image is inverted and of the same size.
Therefore, object is at 2F and the image is also at 2F on the other side of the lens. (1/2)
f=15cm (1/2)



(1)

u is less than the focal length, and the image would be virtual, erect and will form on the same side as the object. (1)

SECTION – D

34. i) P - Ethanol, Q- Ethanoic acid, R- Hydrogen (1/2+1/2+1/2)

$$CH_3CH_2OH \xrightarrow{\text{Acidified } K_2Cr_2O_7} CH_3COOH \quad ½$$

$$2CH_3COOH + 2Na \longrightarrow 2CH_3COONa + H_2 \quad 1$$

ii)Any two uses (1+1)

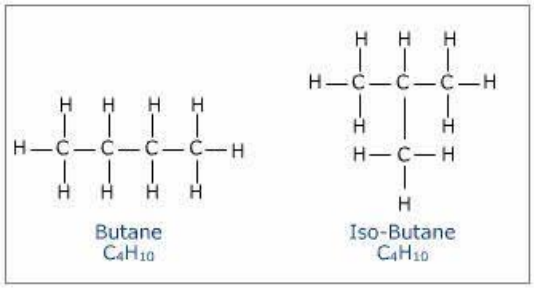
a. Esters are used in food as flavours and fragrances
b. In making of soaps.
c. Esters are used as solvents.
d. Esters are used in medicines.
e. Esters are used as emulsifying agents.

Or

I) Catenation (1)
ii) Catenation,Tetravalency (1+1)

iii) Isomerism (1)

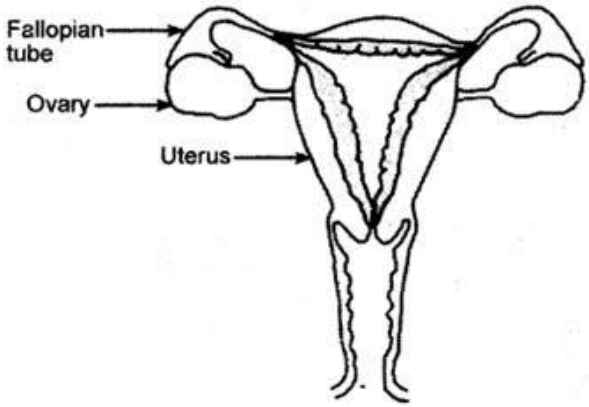
Correct isomers of butane (1/2+1/2)



35.

a) Diagram (1 1/2)

correct labeling (1/2+1/2+1/2)

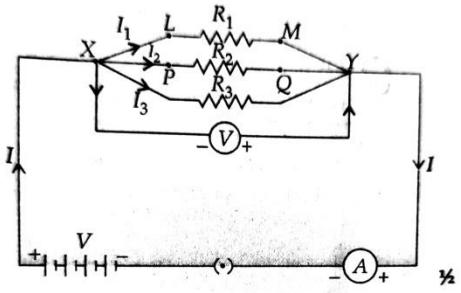


b) i) inner lining of uterus becomes thick (1/2)

Supplied with blood to nourish embryo(1/2)

ii)Menstruation (1)

36.a) Derivationwithdiagram(3)



½

It is observed that the total current I, is equal to the sum of the separate currents through each branch of the combination.

$I = I_1 + I2 + I3$ (1/2)

$I = V/Rp$ (1/2)

On applying Ohm's law to each resistor, we have

$I_1 = V/R_1$; $I_2 = V/R_2$; $I_3 = V/R_3$ (1/2)

From eqns., we have

$V/Rp = V/R_1 + V/R_2 + V/R_3$ (1/2)

$1/Rp = 1/R_1 + 1/R_2 + 1/R_3$ (1/2)

b)$R_s = R_1 + R_2$(1/2),

Rs = 2+2

Rs = 4ohm (1/2)

$1/R_p = 1/R_1 + 1/R_2$ (1/2)

1/Rp = 1/4+1/4

R=2ohm(1/2)

Or

a) Highresistivity(1),
High meltingpoint(1)

b)

$$R_1 = \frac{V^2}{P_1} = \frac{220 \times 220}{100} = 484\ \Omega \quad (\frac{1}{2})$$

$$R_2 = \frac{V^2}{P_2} = \frac{220 \times 220}{200} = 242\ \Omega \quad (\frac{1}{2})$$

In series :

$$R_s = R_1 + R_2 = 484 + 242 = 726\ \Omega \quad (\frac{1}{2})$$

$$\therefore \quad I_s = \frac{V}{R_s} = \frac{220}{726} = \frac{10}{33}\ A = 0.30\ A \quad (\frac{1}{2})$$

In parallel :

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$= \frac{1}{484} + \frac{1}{242}$$

$$R_p = \frac{484}{3}\ \Omega \quad (\frac{1}{2})$$

$$I_p = \frac{V}{R_p} = \frac{220 \times 3}{484}$$

$$= \frac{30}{22}\ A = 1.36\ A. \quad (\frac{1}{2}) \quad 3$$

SECTION – E

37. i) Inherited trait (1)

ii) No clotting of blood (1)

iii) No (1)

The child will be carrier Or a healthy child as mother has two X chromosomes with recessive allele of Haemophilia (1)

Or

Male (1/2)

As they have only 1 X chromosome(1/2)

While female has 2 X chromosome. Since it is a recessive allele Haemophilia is suppressed by dominant allele(1)

38. i) A(1)

It contains both air and water(1)

ii) Silver reacts with sulphur in air (1)

Silver sulphide (1)

Or

It is the process of adding a layer of zinc to the outer surface of a metal, namely steel or iron. (1)

Even if zinc coating is removed it protects the metal against rusting (1)

39. i) Converging lens (1)

ii) real , diminished and inverted (1/2+1/2)

iii) u=200m

v=20cm=0.2m

Image height, hi =1cm=0.01m

hi = v×ho/u (1)

$\Longrightarrow$0.01= 0.2×h o)/200

$\Longrightarrow$ho =(200×0.01)/ 0.2 =10m

Hence the height of the tree is 10m. (1)

Or

The iris works like a shutter in a camera. (1/2)

Eye lens converges the light ray (1/2)

Retina acts like a screen (1/2)

Pupil controls the light entering the eye (1/2)