KENDRIYA VIDYALAYA SANGATHAN

CHENNAI REGION

CLASS –XII

BIOLOGY

STUDY MATERIAL

2022-23

FORWARD

The student's study material is the product of an in house academic exercise undertaken by our subject teachers under the supervision of subject experts at different levels to provide the students a comprehensive learning support tool for the consolidation of your studies.

It consist of lesson concept maps, flow charts , pictorial representation of chapters , gist of lessons, competence based questions , MCQ questions , assertion and reasoning questions, case based questions, board previous years questions, practice papers and CBSE sample question papers.

The material has been developed keeping in mind the latest CBSE curriculum and question paper design. I hope this material will prove to be a good tool for quick revision and will serve the purpose of enhancing student's confidence level to help them perform better.

Planned study, hard work, good time management and sincerity will help the students to reach greater success.

BEST OF LUCK

Ms. T RUKMANI
Offg. Deputy Commissioner
KVS Chennai Region

A WORD TO MY DEAR STUDENTS

True education is about getting the best out of oneself —Mahatma Gandhi

I am delighted to release the Study Material in Biology for students, which is meticulously prepared by band of erudite Teachers of our coveted region. They have put in their experiences of classroom transactions in form of concise notes, Concept Map, compendium of questions, information tables and sets of ideal sample paper to give you all cutting edge. A good resource is best companion. It will definitely motivate you and guide you to bring best out of you.

I feel that the study material will prove equally helpful to Students and Teachers. It will cut down the preparation time for Teachers and will assist them to conduct timely assessment.

Wishing You success in Forthcoming exam & glittering career ahead.

Mr. P.I.T RAJA
Assistant Commissioner
KVS Chennai Region

ACKNOWLEDGEMENT

I, **Dr. M. Manickasamy, Principal K V IIT Chennai** extend my heartfelt thanks and gratitude to **Ms.T. RUKMANI, Offg. Deputy Commissioner, KVS Chennai Region** and **Mr. P.I.T RAJA, Assistant Commissioner, KVS Chennai Region** who have entrusted the preparation of student support material for class XII Biology.

I also extend my sincere gratitude to the Chennai region Biology teachers who have contributed to the making of student support material, which is useful for students community at different levels and also it will improve the performance the students concerned in forth coming board exams.

I also extend my sincere thanks to **Mr. C. Chellapandian, PGT Biology, KV Anna Nagar, Chennai** who brought the final shape for the study material with the team of teachers.

Last but not the least, I extend my in-depth gratitude to all my fellow colleagues, staff members whose contributions are inevitable to bring out this study support material.

THANK YOU ALL

Dr. M. Manickasamy
Principal
K V IIT
KVS Chennai Region

BIOLOGY STUDY MATERIAL

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CLASS 12 BIOLOGY (2022-23)

TIME : 3 HOURS **M.MARKS:70**

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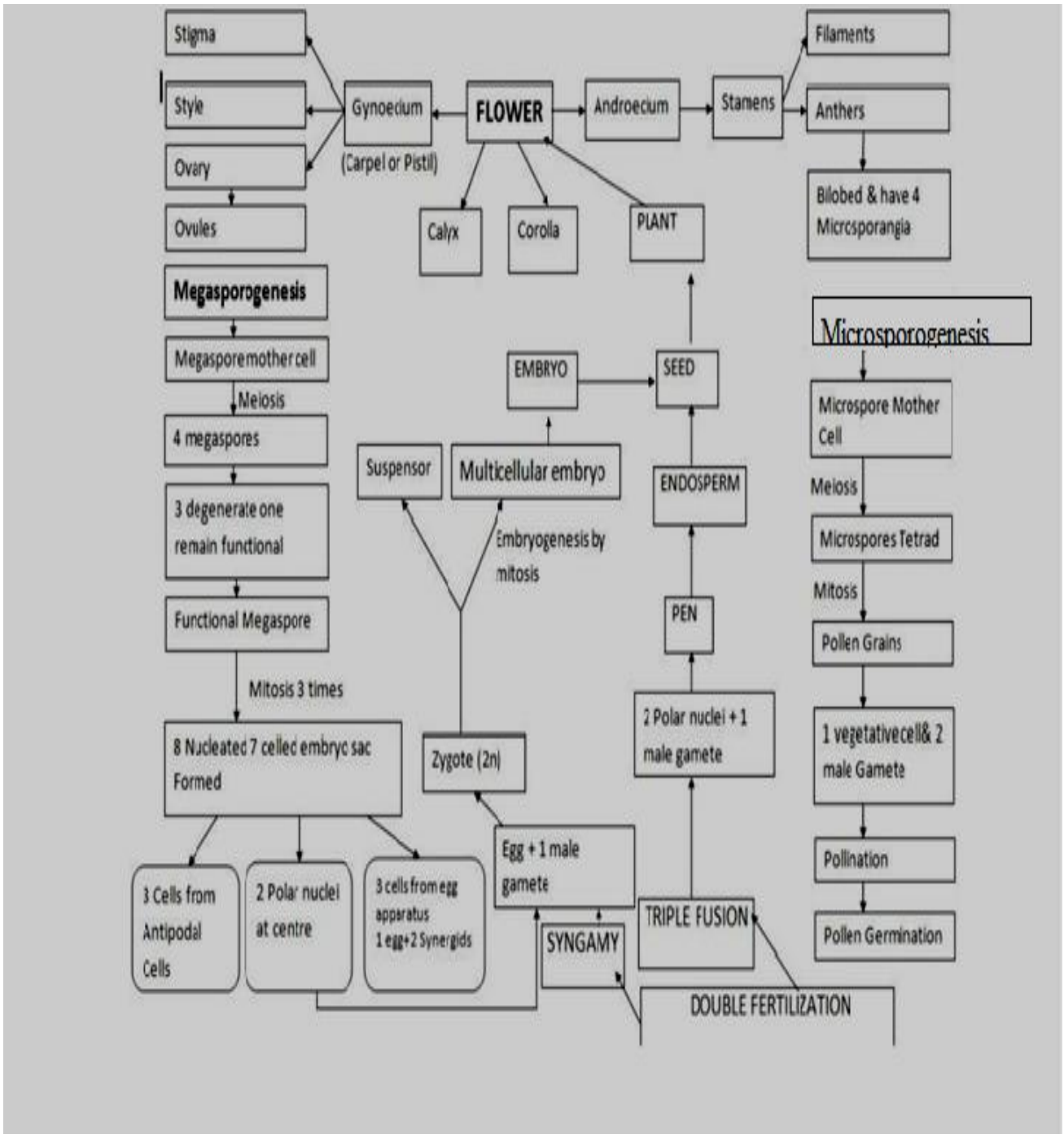
	TOTAL MARKS	70

CH -2 SEXUALREPRODUCTIONINFLOWERINGPLANTS

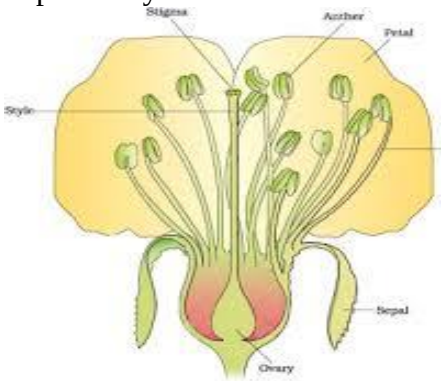
MIND MAP



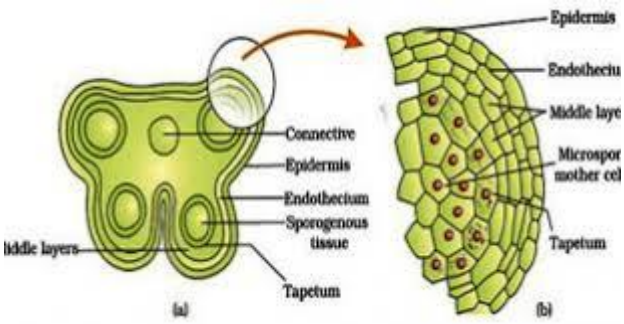
GIST OF THE LESSON

1. **PARTS OF FLOWER**

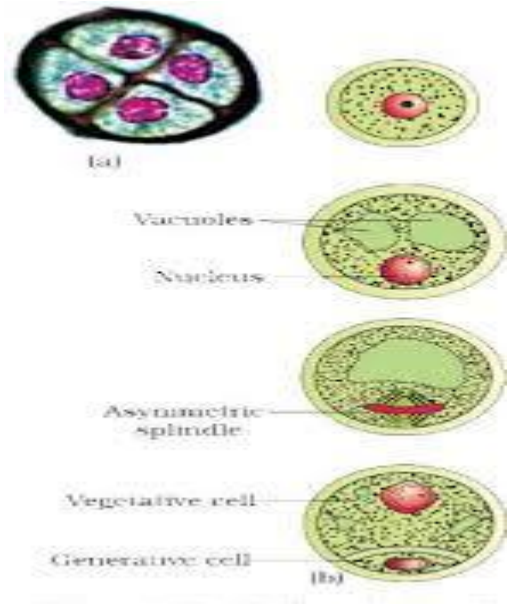
Sepals-Calyx Petals-Corolla Stamens-Androecium Pistil-Gynoecium



MICROSPOROGENESIS



DEVELOPMENT OF MICROSPORE INTO POLLEN GRAIN



1. STRUCTURE OF POLLEN GRAINS

Pollen grains are generally spherical measuring about 25-50 micrometres in diameter. It has a prominent two-layered wall. The hard outer layer called the exine is made up of sporopollenin which is one of the most resistant organic materials known. It can withstand high temperatures and strong acids and alkali. No enzyme that degrades sporopollenin is so far known. Pollen grain exine has prominent apertures called germ pores where sporopollenin is absent. Pollen grains are well preserved as fossils because of the presence of sporopollenin. The inner wall of the pollen grain is called the intine. It is a thin and continuous layer made up of cellulose and pectin. The cytoplasm of pollen grain is surrounded by a plasma membrane. When the pollen grain is mature it contains two cells, the vegetative cell and generative cell. The vegetative cell is bigger, has abundant food reserve and a large irregularly shaped nucleus. The generative cell is small and floats in the cytoplasm of the vegetative cell. It is spindle shaped with dense cytoplasm and a nucleus. In over 60 per cent of angiosperms, pollen grains are shed at this 2-celled stage. In the remaining species, the generative cell divides mitotically to give rise to the two male gametes before pollen grains are shed (3-celled stage).

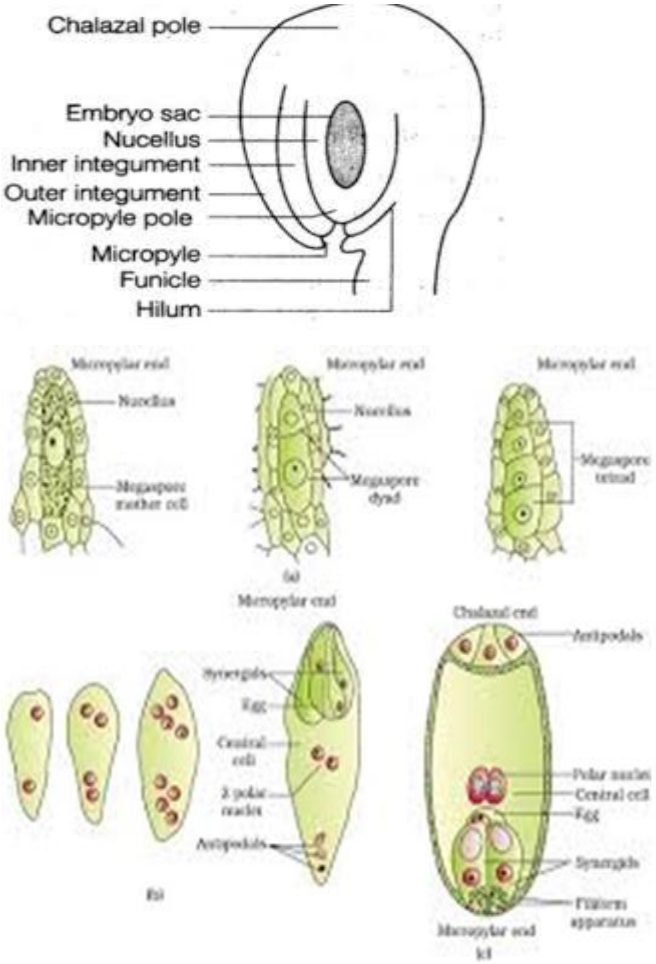
2. POLLINATION

Some plants such as Viola (common pansy), Oxalis, and Commelina produce two types of flowers – chasmogamous flowers which are similar to flowers of other species with exposed anthers and stigma, and cleistogamous flowers which do not open at all. In such flowers, the anthers and stigma lie close to each other. When anthers dehisce in the flower buds, pollen grains come in contact with the stigma to effect pollination. Thus, cleistogamous flowers are invariably autogamous as there is no chance of cross-pollen landing on the stigma. Cleistogamous flowers produce assured seed-set even in the absence of pollinators.

3. POLLINATION BY WATER

Pollination by water is quite rare in flowering plants and is limited to about 30 genera, mostly monocotyledons. As against this, you would recall that water is a regular mode of transport for the male gametes among the lower plant groups such as algae, bryophytes and pteridophytes. It is believed, particularly for some bryophytes and pteridophytes, that their distribution is limited because of the need for water for the transport of male gametes and fertilisation. Some examples of water pollinated plants are Vallisneria and Hydrilla which grow in fresh water and several marine sea-grasses such as Zostera. Not all aquatic plants use water for pollination. In a majority of aquatic plants such as water hyacinth and water lily, the flowers emerge above the level of water and are pollinated by insects or wind as in most of the land plantsPollen grains in many such species are long, ribbon like and they are carried passively inside the water; some of them reach the stigma and achieve pollination. In most of the water-pollinated species, pollen grains are protected from wetting by a mucilaginous covering.

STRUCTURE OF OVULE

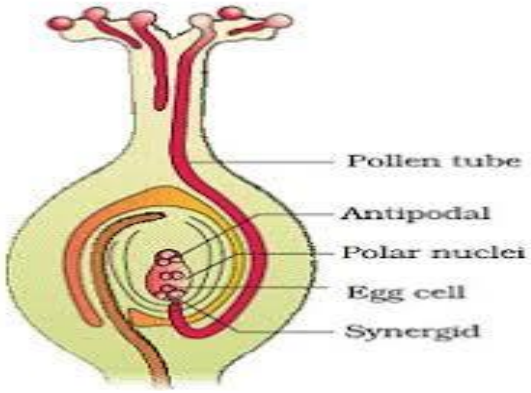


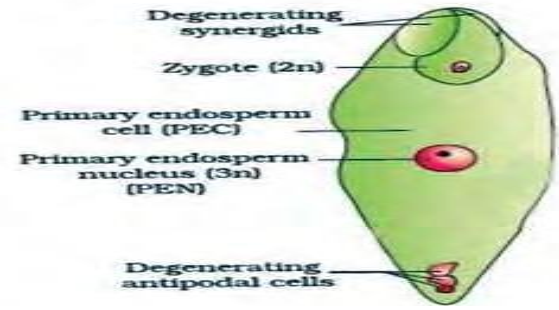
Megasporogenesis in flowering plants

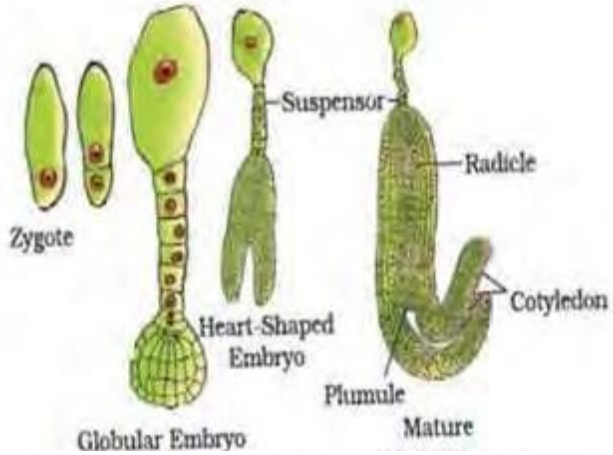
4. FERTILIZATION

As mentioned earlier, following compatible pollination, the pollen grain germinates on the stigma to produce a pollen tube through one of the germ pores. The contents of the pollen grain move into the Figure (a) Pollen grains germinating on the stigma; (b) Pollen tubes growing through the style; (c) L.S. of pistil showing path of pollen tube growth; (d) enlarged view of an egg apparatus showing entry of pollen tube into a synergid; (e) Discharge of male gametes into a synergid and the movements of the sperms, one into the egg and the other into the central cell. Pollen tube grows through the tissues of the stigma and style and reaches the ovary. You would recall that in some plants, pollen grains are shed at two-celled condition (a vegetative cell and a generative cell). In such plants, the generative cell divides and forms the two male gametes during the growth of pollen tube in the stigma. In plants which shed pollen in the three-celled condition, pollen tubes carry the two male gametes from the beginning. Pollen tube, after reaching the ovary, enters the ovule through the micro Pyle and then enters one of the synergids through the filiform apparatus. Many recent studies have shown that filiform apparatus present at the micropylar part of the

synergids guides the entry of pollen tube. All these events–from pollen deposition on the stigma until pollen tubes enter the ovule–are together referred to as pollen-pistil interaction. As pointed out earlier, pollen-pistil interaction is a dynamic process involving pollen recognition followed by promotion or inhibition of the pollen. The knowledge gained in this area would help the plant breeder in manipulating pollen-pistil interaction, even in incompatible pollinations, to get desired hybrids.

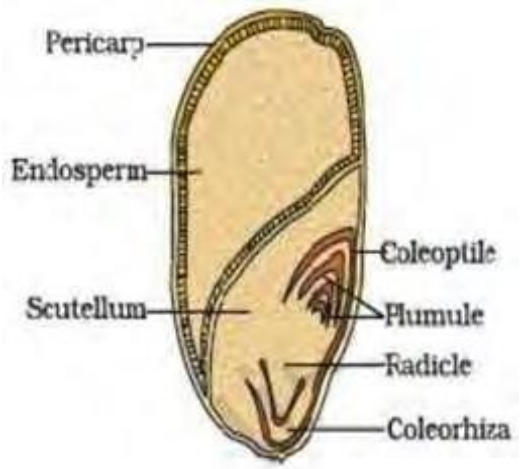






DEVELOPMENT OF DICOT EMBRYO

L S OF MONOCOT SEED



In most plants, by the time the fruit develops from the ovary, other floral parts degenerate and fall off. However, in a few species such as apple, strawberry, cashew, etc., the thalamus also contributes to fruit formation. Such fruits are called false fruits. Most fruits however develop only from the ovary and are called true fruits. Although in most of the species, fruits are the results of fertilisation, there are a few species in which fruits develop without fertilisation. Such fruits are called parthenocarpic fruits. Banana is one such example. Parthenocarpy can be induced through the application of growth hormones and such fruits are seedless. Seeds offer several advantages to angiosperms.

COMPETENCY BASED QUESTIONS

MCQ

Question 1. In a cereal grain, the single cotyledon of embryo is represented by

(a) coleoptile (b) coleorhiza (c) scutellum(d) hypocotyl

Ans--c

Question 2. In a typical complete, bisexual and hypogynous flower the arrangement of floral whorls on the thalamus from the outermost to the innermost is

(a) calyx, corolla, androecium and gynoecium (b) calyx, corolla, gynoecium and androecium c) gynoecium, androecium, corolla and calyx (d) androecium, gynoecium, corolla and calyx

Ans-a

Question 3. A dicotyledonous plant bears flowers but never produces fruits and seeds. The most probable cause for the above situation is

(a) plant is dioecious and bears only pistillate flowers

(b) plant is dioecious and bears both pistillate and staminate flowers

(c) plant is monoecious(d) plant is dioecious and bears only staminate flowers.

Ans-d

Question 4. In angiosperms, male gametes are formed by the division of

(a) microspore mother cell (b) microspore (c) generative cell (d) vegetative cell

Ans-a

Question 5. During microsporogenesis, meiosis occurs in

(a) endothecium (b) microspore mother cells (c) microspore tetrads (d) pollen grains.

Ans-b

Question 6. From among the sets of terms given below, identify those that are associated with the gynoecium

(a) Stigma, ovule, embryo sac, placenta (b) Thalamus, pistil, style, ovule

(c) Ovule, ovary, embryo sac, tapetum(d) Ovule, stamen, ovary, embryo sac

Ans-a

Question 7. Starting from the innermost part, the correct sequence of parts in an ovule are

(a) egg, nucellus, embryo sac, integument (b) egg, embryo sac, nucellus, integument

(c) embryosac, nucellus, integument, egg (d) egg, integument, embryo sac, nucellus

Ans. b

Question 8. From the statements given below choose the option that are true for a typical female gametophyte of a flowering plant

(i) It is 8-nucleate and 7-celled at maturity

ii) It is free-nuclear during the development

(iii) It is situated inside the integument but outside the nucellus

(iv) It has an egg apparatus situated at the chalazal end

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

Ans. c

Question 9. Autogamy can occur in a chasmogamous flower if

(a) pollen matures before maturity of ovule

(b) ovules mature before maturity of pollen

(c) both pollen and ovules mature simultaneously

(d) both anther and stigma are of equal lengths.

Ans. c

Question 10. Dioecy states

(a) unisexuality of a flower (b) bisexuality of a flower (c) bisexuality of a plant

(d) unisexuality of a plant

Ans.d

Question 11. Choose the correct statement from the following.

(a) Cleistogamous flowers always exhibit autogamy

(b) Chasmogamous flowers always exhibit geitonogamy

(c) Cleistogamous flowers exhibit both autogamy and geitonogamy

(d) Chasmogamous flowers never exhibit autogamy

Ans: a

Question 12. Which of the following structures are haploid in nature?

(a) nucellus and antipodals(b) Microspore and antipodals

(c) Egg cell and antipodals(d) Egg and central cell

Ans. c

Question 13. Filiform apparatus performs the function of

(a) opening the pollen tube (b) guiding the pollen tube to egg

(c) entry of pollen tube into synergids(d) prevents growth of more than one pollen tube

Ans.b

Question 14. Unisexuality of flowers prevent

(a) geitonogamy (b) autogamy (c) xenogamy(d) both geitonogamy and xenogamy

Ans. b

Question 15. A particular species of plant produces light, non-sticky pollen in large numbers and its stigmas are long and feathery. These modifications facilitate pollination by

(a) insects (b) water (c) wind (d) animals.

Ans. c

Assertion-Reason Questions

In the following questions (Q. No. 1-4) a statement of assertion followed by a statement of reason

is given. Choose the correct answer out of the following choices.

(a) Both assertion and reason are true, and reason is the correct explanation of the assertion.

(b) Both assertion and reason are true, but reason is not correct explanation of the assertion.

(c) Assertion is true but reason is False.

(d) Bath assertion and reason are false.

1. Assertion: Pollen grains are well-preserved as fossils.

Reason: Exine is made up of sporopollenin.

Ans. Both assertion and reason are true, and the reason is the correct explanation of the assertion.

2. Assertion: Banana is a parthenocarpic fruit.

Reason: Parthenocarpy is development of seeds without fertilization.

Ans. Assertion is true but reason is false.

3. Assertion: Apple is a false fruit.

Reason: The thalamus contributes to the formation of apple fruit along with ovary.

Ans. Both assertion and reason are true, and the reason is the correct explanation of the assertion.

4. Assertion: Pollen grains can germinate on the stigma of any species of plants.

Reason: Pollen grains represent the male gamete.

Ans. Both assertion and reason are false.

CASE STUDY BASED

Read the following and answer any four questions from (i) to (iv) given below: Double Fertilisation 8 After pollen germination in flowering plants, the pollen tube penetrates through the stigma and the tube grows through the style and reaches the ovary. Once it reaches the ovary, the tube penetrates it and reaches the micropyle of the ovule and enters into the embryo sac. Here, one of the two male nuclei fuse with the nucleus of the egg cell to form a zygote. This fusion of the male and female gametes is known as syngamy. The other male gamete fuses with the two polar nuclei located in the central cell to produce the triploid endosperm nucleus in a primary endosperm cell(PEC). This fusion of three nuclei is termed as triple fusion. Since two types of fusions, syngamy and triple fusion take place in an embryo sac, the phenomenon is termed double fertilization. The zygote develops into an embryo while PEC develops into the endosperm. The cells of endosperm tissue are filled with reserve food materials and are used for the nutrition of the developing embryo.

i. Name the diploid cell of the embryo sac.

a) Egg cell b) Ovary c) Ovule d) Central cell

Ans. d) Central cell.

ii. Double fertilization is a phenomenon found in

a) Bryophytes b) Pteridophytes c) Angiosperms d) All of the above.

Ans. c) Angiosperms.

iii. Atleast how many pollen grains are required to fertilise 10 ovules in a carpel?

a) 5 b) 10 c) 15 d) 20

Ans. b) 10

iv. The ploidy of a zygote formed as a result of syngamy is

a) Diploid b) Haploid c) Triploid d) None of the above.

Ans. a) Diploid.

CASE STUDY BASED(2)

Read the following and answer any four questions from (i) to (iv) given below: Pollinating agents The pollen-pistil interaction begins with pollination, followed by pollen adhesion to the stigma. After it adheres, it imbibes water and gets hydrated which initiates pollen tube germination. There are different agents of pollination like wind, insects, birds and water. Anemophilous flowers are pollinated by the agency of wind. These flowers are small and inconspicuous.. The pollen grains are very light, non-sticky and sometimes winged. Entomophilic flowers are pollinated by insects. These flowers are often attractive to look at with bright petals and are fragrant to attract the insect visitors to them. They often have broad stigmas or anthers to allow the insect to perch on it. Many of the insect-pollinated flowers also secrete nectar which attracts bees, butterflies or other similar insects to the flowers. The pollen grain surface of such flowers produce mucilaginous secretion. Hydrophilic flowers are pollinated by water. It is commonly found in algae, bryophytes, pteridophytes and some angiosperms. The pollen grains may have a mucilaginous covering to protect it from getting wet.

i. The pollinating agent of an inflorescence of small dull coloured flowers with well exposed stamens and large feathery stigma is

a. Water b. Wind c. Insects d. Birds.

Ans. b. Wind.

ii. An example of biotic agent for pollination is

a. Air b. Water c. Honey bee d. All of the above.

Ans. c. Honey bee.

iii. The pollen grains in the flowers are generally sticky that help them to

a. stick on to the body of the insects b. float on water

c. float in the air d. fall on the ground safely.

Ans. a. stick on to the body of the insects

iv. Which of the following statements seem to describe the water-pollinated submerged plants?

a. The flowers do not produce nectar. b. The flower petals are not brightly coloured.

c. The pollen grains have mucilaginous covering.

d. The female flowers have long stalk to reach the surface.

Ans. d. The female flowers have long stalk to reach the surface.

CASE STUDY BASED (3)

Read the following and answer any four questions from (i) to (iv) given below: Hybrid seeds created by crossing two varieties have superior qualities including high yield, pest resistance and climate tolerance and have been used by farmers for decades. In a breakthrough for farmers across the world, especially those from developing countries, scientists have discovered a way to clone hybrid seeds of rice. Hybrid seeds created by crossing two varieties have superior qualities including high yield, pest resistance and climate tolerance and have been used by farmers for decades. However, a major challenge with such crops so far has been that unlike other crops, their seeds do not produce plants with same qualities. So, farmers have had no option but to buy expensive hybrid seeds every year. Asexual reproduction through seeds, called Apomixis, is known to occur naturally in more than 400 species of wild plants, but not in crops. The embryos can develop directly from a diploid egg or the nucellus in the ovule without fertilisation. This mechanism of seed production allows a plant to clone itself through a seed, without fertilization and, thus prevents any loss of hybrid characters in plants. However, recreating these pathways in crop plants has been a challenge to science.

i. Which part of the flower form seeds?

a. Ovule b. Ovary c. Stigma d. Pollen grain

Ans. a. Ovule.

ii. There will be variations among the offsprings of a plant which undergoes____.

a. Asexual reproduction b. Sexual reproduction c. Apomixis d. All of the above.

Ans. b. Sexual reproduction.

iii. What is the ploidy of nucellus that undergoes apomixis?

a. Haploid b. Diploid c. Triploid d. None of the above.

Ans. b. Diploid.

iv. What are the problems with hybrid seeds?

a. Hybrids seeds has to be produced every year.

b. Seeds obtained from hybrid plants when grown, tend to segregate and loose the hybrid traits.

c. Cost factor d. All of the above.

Ans. d. All of the above.

BOARD BASED QUESTIONS

Very Short Answer Questions [1 mark]

1. Name the parts of an angiosperm flower in which development of male and female gametophyte takes place.

Ans. Male gametophyte- starts in the anther and later completed on the stigma.

Female gametophyte- inside the ovule.

2. What is meant by a dithecous anther?

Ans. A dithecous anther is the anther which is bilobed with two theca (sporangia) in each lobe.

3. How many microsporangium are present in an anther?

Ans. Four microsporangium

4. Name the first cell of the male gametophyte of angiosperms.

Ans. Microspore

5. What is exine and intine made up of respectively?

Ans. Exine: SporopolleninIntine: cellulose and pectin.

6. Name the two cells, a mature pollen grain has.

Ans. Vegetative cell and generative cell.

7. What is a micropyle in an ovule?

Ans. Micropyle is the opening left by the integuments at the tip of an ovule.

8. What does an embryo sac represent in an ovule?

Ans. Female gametophyte.

9. How many megaspore mother cells appear in the nucleus of an ovule?

Ans. Only one.

10. What is the total number of haploid nuclei formed in the embryo sac of an angiosperm? Ans. Eight haploid nuclei.

11. What do the tassels of a corn cob represent?

Ans. Styles and stigma.

12. What is meant by emasculation?

Ans. Emasculation is the process of removal of stamen/anthers before the pollen grains mature from a bisexual flower.

13. What technical term is given to the single cotyledon in the plants of grass family.

Ans. Scutellum.

14. Name two plants where remnants of nucellus persists in the seeds.

Ans. Beetroot, blackpepper.

15. What is perisperm?

Ans. The remnants of nucellus that persists in the seed is called perisperm.

Two marks

1. Name the four wall layers of a microsporangium.

Ans. The four wall layers of a microsporangium from outer to inner side are: -Epidermis, endothecium, middle layers and tapetum.

2. Name the innermost wall layer of a microsporangium. Mention its function.

Ans. Tapetum. -Its function is to nourish the developing pollen grains.

3. What are germ pores? What is their significance?

Ans. Germ pores are those regions on the surface of a pollen grain, where the exine(sporopollenin) is absent or is very thin. Significance: During pollen germination, the intine grows out through one of the germ pores to form the pollen tube.

4. Name the constituents of egg apparatus. Where is it located in the ovule?

Ans. Egg apparatus consists of an egg cell (or female gamete) and two synergids. -It is located at the micropylar end of the embryo sac in the ovule.

5. How is geitonogamy different from autogamy?

Ans. Geitonogamy refers to the transfer of pollen grains from the anther to the stigma of a different flower of the same plant. Whereas autogamy is the transfer of pollen grains from the anther to the stigma of the same flower.

6. What is triple fusion? Where does it take place?

Ans. Triple fusion is the process of fusion of three nuclei- two polar nuclei and a male gamete to produce a triploid primary endosperm nucleus (PEN). - It occurs in the central cell of the embryo sac.

7. What is apomixis and what is its importance?

Ans. Apomixis is the form of asexual reproduction that mimics sexual reproduction in which seeds are formed without fertilization. Importance: As there is no segregation of characters in the hybrid, so farmers can keep on using the hybrid seeds to raise new crop every year.

8. How is apomixis different from polyembryony?

Ans. When apomixis is a method of formation of seeds without fertilization, polyembryony is the occurrence of more than one embryo in a seed.

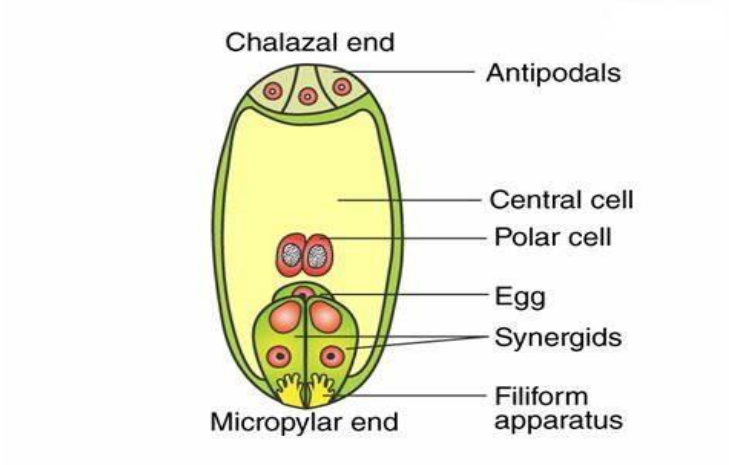
Short Answer Questions [3 marks]

1. How is a vegetative cell different from a generative cell?

Ans.

Vegetative cell	Generative cell
i. It is much larger than the generative cell. ii. It has abundant food reserves and a large irregular nucleus. iii. It does not divide any further.	i. It is much smaller and floats in the cytoplasm of vegetative cell. ii. It has dense cytoplasm and a prominent round nucleus. iii. It undergoes mitosis to form two male gametes.

2. Draw a labeled diagram of a mature embryo sac of an angiosperm. Ans.



3. What are chasmogamous flowers? How are they different from cleistogamous flowers?

Ans. Chasmogamous flowers are those bisexual flowers, which open at maturity and expose their stamens and stigmas; cross pollination can occur in them. Whereas cleistogamous flowers do not open at all; cross pollination cannot occur.

4. How is pollination effected in Vallisneria?

Ans. In Vallisneria, the female flowers reach the surface of water by the long stalk. The male flowers are released from the plant and float on the water surface; later they release the pollen grains. The pollen grains are passively carried by the water currents. Some of them reach the female flowers and their stigmas resulting pollination. The pollen grains are protected from getting wet by a mucilaginous coating on them.

5. Differentiate between albuminous and non-albuminous seeds.

Ans.

Albuminous seeds	Non-albuminous seeds
- These are the seeds in which the endosperm is present, as it is not completely used up by the developing embryo. - Eg., wheat, maize, sunflower.	- These are the seeds in which the endosperm is absent as it is completely used up by the developing embryo. - Eg., pea, groundnut.

5 MARKS QUESTION

1. List the different types of pollination depending upon the source of the pollen grain. What are the adaptations flowers possess to ensure self pollination?

Answers: Pollination can be classified into three different types based on the source of pollen grains. They are: i) Autogamy: It is defined as the transfer of pollen grains from the anther to the stigma of the same flower in the same plant. ii) Geitonogamy: It is defined as the transfer of pollen grains from the anther of one flower to the stigma of another flower on the same plant. iii) Xenogamy: It is defined as the transfer of pollen grains from the anther to the stigma of a different plant. Adaptationsi) The

pollen and stigma of a flower mature at the same time. ii) The anther and the stigma should be close to each other.

2. (a) What are outbreeding devices? (b) Continuous self-pollination results in inbreeding depression in plants. Describe four devices by which cross-pollination is encouraged in nature.

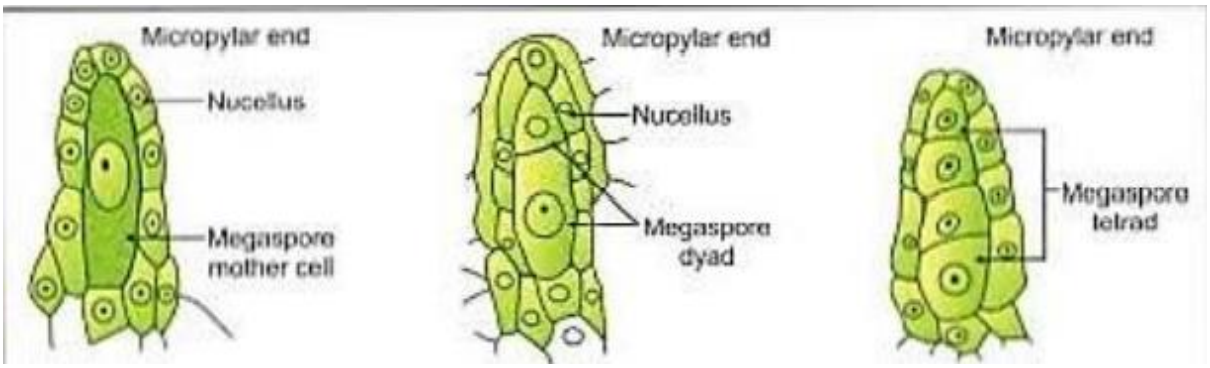
Ans. Outbreeding Devices are the mechanisms/processes that the plants adapt to prevent self-pollination and encourage cross-pollination. They are: i) Unisexuality: In this case, the plant bears either male or female flowers and is not bisexual. It is also called as Dioecism. ii) Dichogamy: In this mechanism, the stigma and anther mature at different times. iii) Self- incompatibility: It is a mechanism that prevents self-pollen from fertilizing the ovule either by not allowing the pollen grain to germinate or by retarding the growth of pollen tube. iv) Heterostyly: In some plants like the Oxalis, the stigma and the anthers are placed at different levels. This prevents the pollen from reaching the stigma and pollinating it.

3. Mention the similarity between autogamy and geitonogamy. List the advantages and disadvantages of self-pollination.

Ans. Similarity- In both the cases, pollen grains come from the same plant. So they are genetically similar. Advantages of self – pollination: i) In self- pollination, there is no diversity in the genes and therefore the purity of the race is maintained. ii) The plants do not depend on external factors for pollination and even smaller quantities of pollen grains produce have a good success rate in getting pollinated. iii) Self-pollination ensures that recessive characters are eliminated. Disadvantages of self-pollination: i) Since there is no mixing up of genes, there are no new characters or features that are introduced into the offspring. ii) Self- pollination is said to reduce the vigor and vitality of the race as there are no new features introduced. iii) Without new characters introduced, the resultant offspring's immunity to diseases reduces.

4. Describe megasporogenesis in an angiosperm.

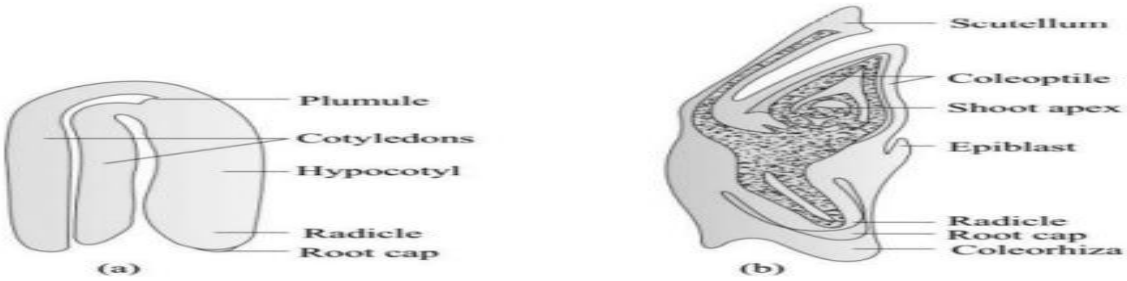
Ans. The process of formation of megaspores from the megaspore mother cell is called megasporogenesis. Ovules generally differentiate a single megaspore mother cell(MMC) in the micropylar region of the nucellus. The MMC undergoes meiotic division resulting in the formation of four megaspores.



5. How does a typical dicot embryo differ from a monocot embryo? Explain with the help of labeled diagram.

Ans.

Monocot embryo(Embryo of grass)	Dicot embryo
- There is a single cotyledon (scutellum). - The plumule is protected by coleoptile. - The radicle is protected by coleorhiza.	- There is a single cotyledon (scutellum). - The plumule is protected by coleoptile. - The radicle is protected by coleorhiza.

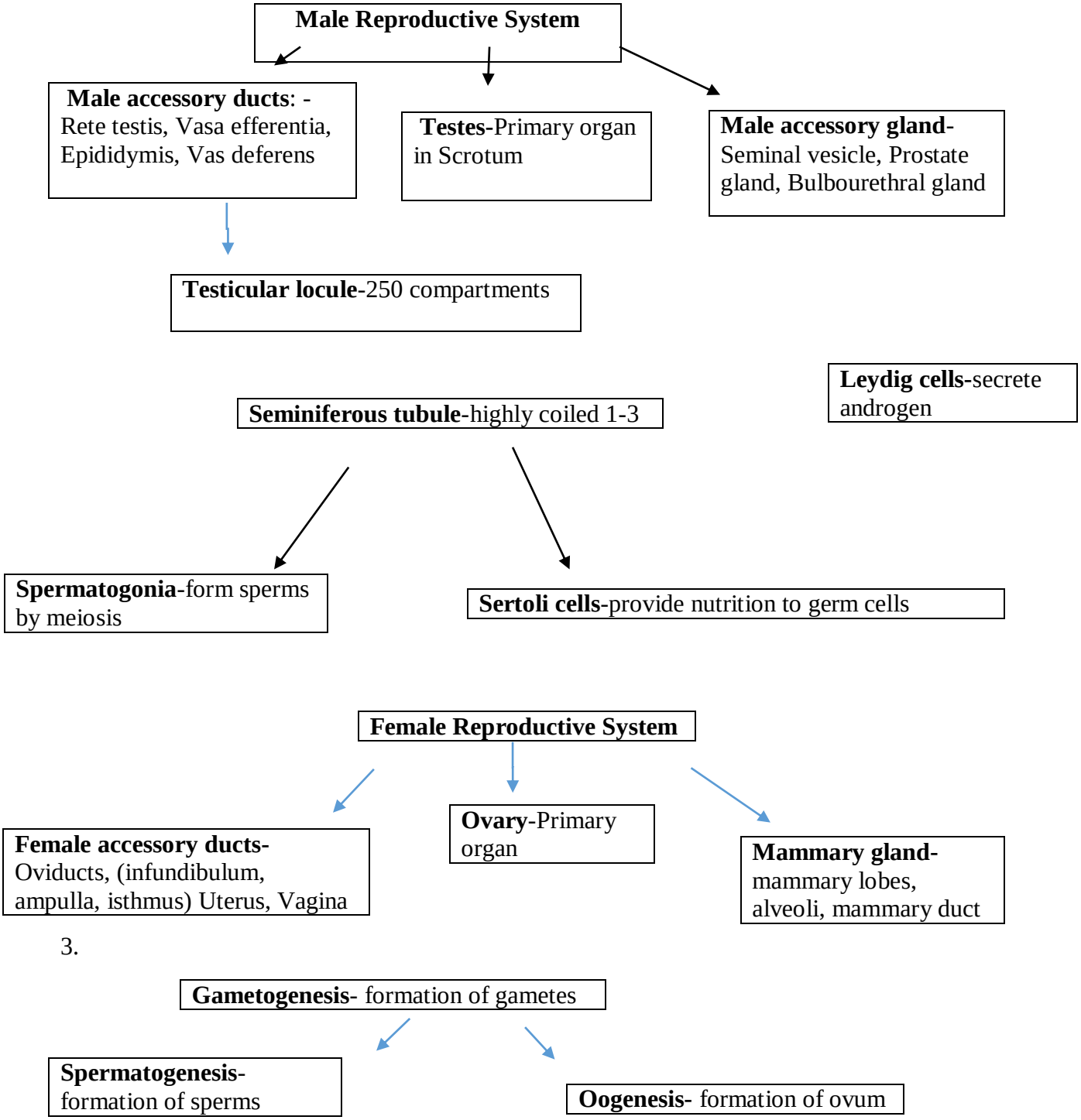


(a) A typical dicot embryo; (b) L. S. of an embryo of grass

CHAPTER 3: HUMAN REPRODUCTION

CONCEPT MAP

HUMAN REPRODUCTIVE SYSTEM



3.

Gist of the Lesson

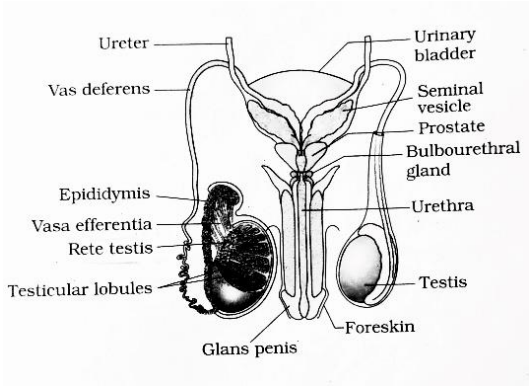
The male reproductive system of human is composed of a pair of testis, the male sex accessory ducts and the accessory glands and external genitalia.

Each testis has about 250 compartments called testicular lobules and each lobule contains1-3 highly coiled seminiferous tubules.

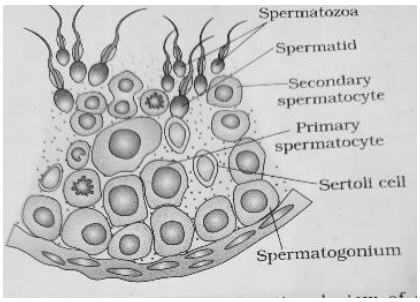
Each seminiferous tubule is lined inside by spermatogonia and Sertoli cells. The spermatogonia undergo meiotic divisions to form sperms, while Sertoli cells provide nutrition to the dividing cells.

The Leydig cells outside the seminiferous tubule synthesise and secrete testicular hormones called androgens.

Male Reproductive System



A seminiferous tubule (enlarged)



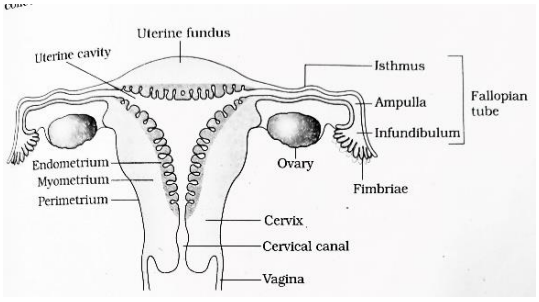
The female reproductive system of human is composed of a pair of ovaries, a pair of oviducts, a uterus, a vagina external genitalia and a pair of mammary glands.

The ovaries produce the female gamete (ovum) and some steroid hormones (ovarian hormones).

The oviducts, uterus and vagina are female accessory ducts.

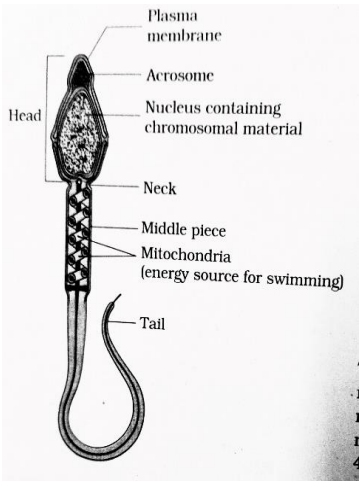
The uterus has 3 layers-perimetrium , myometrium and endometrium.

Female Reproductive System



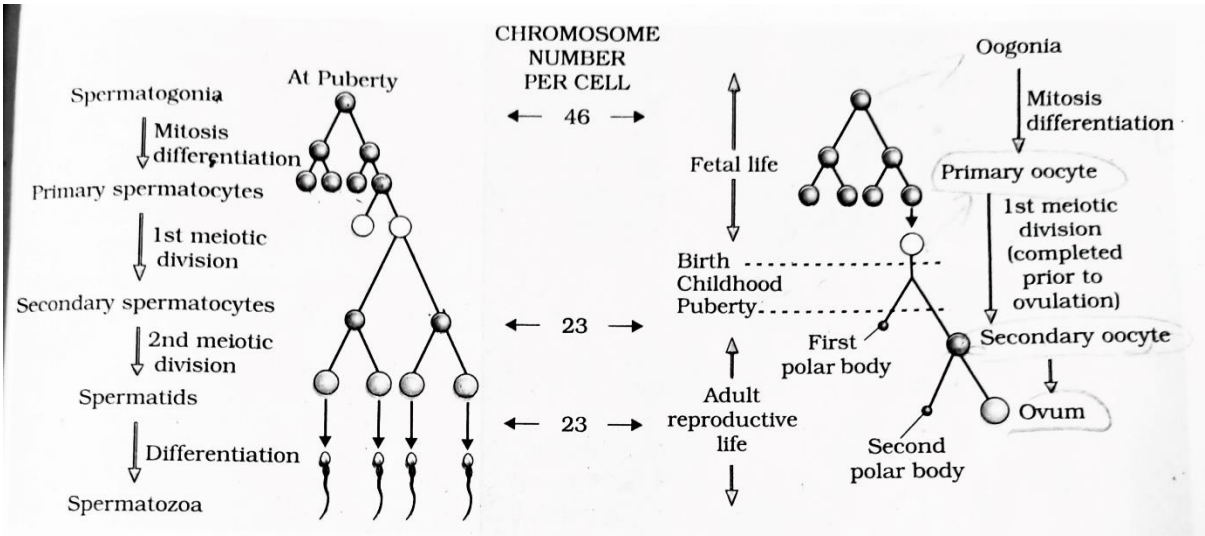
Spermatogenesis results in the formation of sperms. Human sperm is composed of a head, neck, a middle piece and a tail.

Structure of a sperm



The process of formation of mature female gametes is called oogenesis.

Schematic representation of (a) Spermatogenesis: (b) Oogenesis



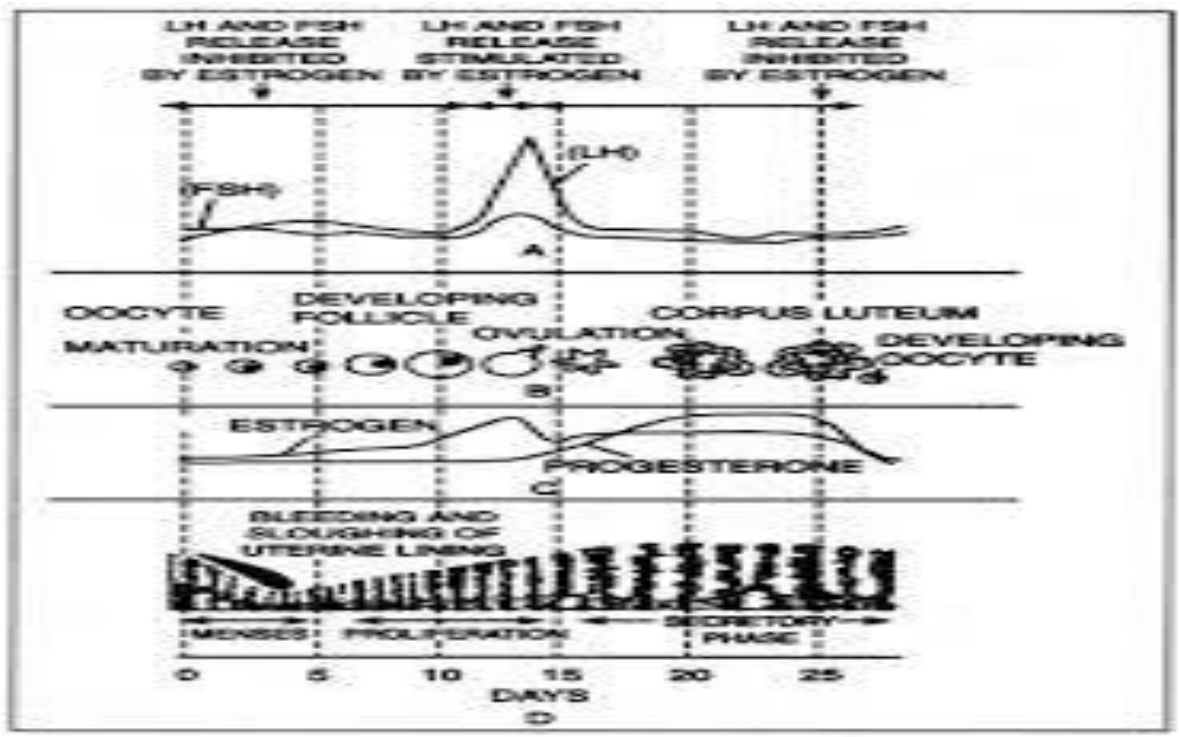
(a) (b)

The reproductive cycle of female primates is called menstrual cycle. The cyclical changes in the ovary and the uterus during menstrual cycle are induced by changes in the levels of pituitary and ovarian hormones.

Menstrual cycle starts with menstrual phase (3-5 days). The menstrual flow results due to breakdown of endometrial lining of the uterus and its blood vessels.

Follicular phase (proliferative phase), when the endometrium of the uterus regenerates through proliferation.

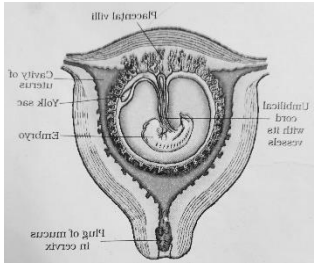
Luteal phase (Secretory phase) During luteal phase raptured Graafian follicle transform as corpus luteum.The corpus luteum secrete large amount of progesterone which is essential for maintenance of the endometrium. In absence of fertilisation Corpus luteum degenerates. This causes disintegrion of the endometrium leading to menstruation.



Fertilisation & Implantation: During copulation semen released into vagina-insemination.

Motile sperms pass through cervix-uterus-fallopian tube. At ampullary isthmic junction ovum and sperm meet. If they reach simultaneously fertilization occurs. Sperms contact with ovum ie, zona pellucida layer,bring changes in the plasmamembrane.This block the entry of additional sperms. Acrosome secretion helps sperm enter cytoplasm of ovum. Completion of meiosis II to form ahaploid ovum and 2nd polar body.Two nuclei of sperm and ovum fuse to form zygote. Mitosis starts ie, cleavage. Blastomeres formed with 8-16 cells form morula then blastocyst.

Pregnancy: After implantation finger like projections appear on trophoblast called chorionic villi which are surrounded by the uterine tissue and maternal blood. The chorionic villi and uterine tissue become interdigitated with each other and jointly form placenta.Placenta supply O_2 & nutrients and remove $CO_2$and metabolic waste from embryo



Diagrammatic sectional view ofThe human foetus within the uterus

Embryonic development:1st month-heart develops, 2nd month- limbs & digits, 3rd month,12 weeks(1st trimester)-most of the major organ system, 5th month-1st movement, appearance of hair 7 head,24 weeks (2nd trimester)- fine hairs covers the body,eye-lids separate &eye lashes formed. By 9th month -gestation period completed.

Parturition: The signals for parturition originate from the fully developed foetus and the placenta which induce mild contractions called foetus ejection reflex. This trigger release of oxytocin from pituitary.Oxytocin acts on uterine muscle causes stronger contractions, in turn stimulates further secretion of oxytoxin.

QUESTION BANK

MCQ

1. The cells which secretes male hormone, androgens.

(a) Sertoli cells (b) Leydig cells (c) Germ cells (d) Stem cells

Ans: Leydig cells

2. Finger like projection seen on the edges of infundibulum

(a) Ampulla (b) Isthmus (c) Fimbriae (d) Flagella

Ans:Fimbriae

3.After ovulation the raptured ovarian follicle shrinks and filled with cells to form

(a) Antrum (b) Zona pellucida (c) Graafian follicle (d) Corpus luteum

Ans:Corpus luteum

4.Antrum is the cavity of

(a) Primary follicle (b) Secondary follicle (c) Tertiary follicle (d)Graafian follicle

Ans: Graafian follicle

5.Before ovulation the secondary oocyte is covered by a membrane called

(a) Corona radiata (b) Zona pellucida (c) Fibrous adventitia (d) Mucous membrane

Ans: Zona pellucida

Assertion and Reason

1. Assertion: Primary spermatocytes of testes are haploid.

Reason: Primary spermatocytes are formed by meiosis-I in the spermatogonia.

a. Both assertion & Reason are true, and the reason is the correct explanation of the assertion.

b. Both assertion & Reason are true, and the reason is not the correct explanation of the assertion.

c. The assertion is true but the reason is false.

d. Both the assertion and the reason are false.

Ans: d. Both the assertion and the reason are false.

2. The increase in progesterone level exerts positive feedback on GnRH.

b. The rising level of progesterone stimulate production of FSH and LH.

Ans: . Both assertion & Reason are true, and the reason is the correct explanation of the assertion.

Short Answer Questions(2M)

1.Where are the Ley dig cells present? What is their role in reproduction?

Ans: Leydig cells are present in the region outside the seminiferous tubules called interstitial space.

2. Differentiate the structural changes in ovary during the follicular and luteal phase of the menstrual cycle.

Ans: During follicular phase, the primary follicles in the ovary grow to become a fully mature

Mature Graafian follicle and the endometrium of the uterus regenerate through proliferation. The secretion of LH and FSH increases during the follicular phase.During luteal phase raptured Graafian follicle transform as corpus luteum.The corpus luteum secrete large amount of progesterone which is essential for maintenance of the endometrium.

3.(a) Where do the signals for parturition originate from in humans?

(b) Why is it important to feed the newborn babies on colostrum?

Ans: a) From the fully developed foetus.

b) Contains several antibodies which is essential to develop resistance for the new-born babies.

4. Why are the human testes located outside the abdominal cavity? Name the pouch in which they are present.

Ans: Testis are located outside the abdominal cavity to maintain a low temperature of the testis which is necessary for spermatogenesis. Scrotum.

5.Write the location and function of the following in human testes a) Sertoli cells b) Leydig cells.

Ans: a) Location: linings inside the Seminiferous tubules. Functions: provide nutrition to the germcells

b) Location: Outside seminiferous tubules in interstitial cells.Functions: synthesise and secrete androgen.

Short Answer Questions (3M)

1. Describe the structure of a human sperm.

Ans: Human sperm is composed of a head, neck, a middle piece and a tail. A plasma membrane envelops the whole body of sperm. The sperm head contains an elongated haploid nucleus, the anterior portion of which is covered by a cap like structure, called acrosome. The acrosome is filled with enzymes that help fertilization of the ovum. The middle piece possesses numerous mitochondria, which produce energy for the movement of tail that facilitate sperm motility essential for fertilization.

2.(a) When and how placenta develop in human female?

(b) How is the placenta connected to the embryo?

(c) Placenta acts as an endocrine gland. Explain.

Ans: (a) Placenta develop after implantation. After implantation, finger like projections appear on the trophoblast called chorionic villi which are surrounded by the uterine tissue and maternal blood. The chorionic villi and uterine tissue become interdigitated with each other and jointly form placenta.

(b)The placenta is connected to embryo through an umbilical cord.

(c) The placenta acts as an endocrine tissue and secretes the following hormones:

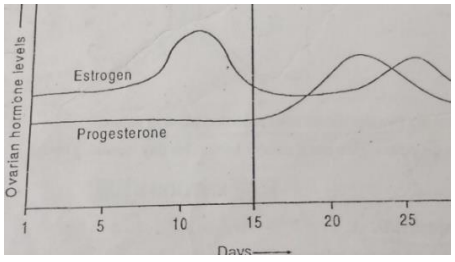
i) Human chorionic gonadotropin (hCG) ii) Human placental lactogen (hPL)

iii) Progestogens and iv) Estrogens.

3.Where does fertilization occur in humans?Explain the events that occur during this process.

Ans: Fertilisation occurs in ampullary region in fallopian tube. The sperms which come in contact with the pellucida layer of the ovum induces changes in the membrane. This blocks the entry of other sperms and ensures only one sperm fertilizes the ovum.The secretion of acrosome helps the sperm to enter the cytoplasm.Entry of sperm induces completion of second meiotic division forming ovum and 2nd polar body. The haploid nucleus of sperm and that of ovum fuses to form a diploidzygote.

4. Graph



Read the graph given above and correlate the uterine events that take place according to the hormonal levels on:

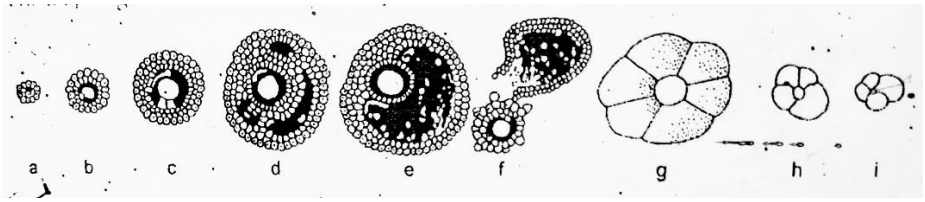
i) 6-15 days ii)16-25 days iii)26-28 days

Ans: i) It is follicular phase (proliferative phase), when the endometrium of the uterus regenerates, leading through proliferation.

ii) Luteal phase (Secretory phase)During luteal phase raptured Graafian follicle transform as corpus luteum.The corpus luteum secrete large amount of progesterone which is essential for maintenance of the endometrium.

iii) In absence of fertilisation Corpus luteum degenerates. This causes disintegration of the endometrium leading to menstruation.

5. The following is the illustration of the sequence of ovarian events 'a' to 'i' in a human life.



(a) Identify the figure that illustrates corpus luteum and name the pituitary hormone that influence its formation.

(b) Specify the endocrine function of corpus luteum. How does it influence the uterus?

(c) What is the difference between "d" and "e".

Ans: a) Corpus luteum is illustrated by 'g' and the hormone influencing its formation isluteinising hormone (LH)

b) Produces the hormone progesterone, causes proliferation of the endometrium which gets highly vascularized. It is essential for the implantation of the fertilized ovum and maintains the same during pregnancy.

c) "d" is the developing tertiary follicle and "e" is the Graafian follicle.

Case Based Question

1. Read the following and answer the questions given below:

Oogenesis is the process of formation of ovum in ovaries. It consists of three phases: multiplication,growth and maturation. Oogenesis is controlled by hormones GnRH,LH,FSH. GnRH secreted by the hypothalamus stimulates the anterior lobe of pituitary gland to secrete LH and FSH.

i. What is the function of hormone FSH?

a. It inhibits the formation of estrogen. b .It induces the release of secondary oocyte.

c. It stimulates the growth of Graafian follicle. d. causes ovulation.

Ans: c

ii. Which hormone induces the rupture of the mature Graafian follicle?

a. Follicle stimulating hormone b. Gonadotropin releasing hormone

c. Progesterone d.Luteinising hormone

Ans: d

iii. Identify the function(s) of LH.

a. Release of secondary oocyte from Graafian follicle. b. corpus luteum to secrete progesterone.

c. Stimulates estrogen formation. d. Promotes development of egg to form secondary oocyte

a. and b only b. b and c only c. c and d only d. b only

Ans: a

Long Answer Questions

1.Explain in detail the various developmental stages of the zygote until implantation with suitable diagrams.

Ans: When the zygote moves through the isthmus of the oviduct, the mitotic division is initiated and is called the cleavage towards the uterus to form 2,4,8,16 daughter cells called blastomeres. It is an embryo containing 8 to 16 blastomeres from morula. It continues to transform and divide into blastocysts as it further approaches the uterus. In blastocyst, the blastomeres are organized into an outer layer refrred to as the trophoblast and the inner cell mass, which is an inner collection of cell mass transforms into the embryo. After attachment, the cells of the uterus rapidly divide and covers up the entire blastocyst. This causes the blastocyst to implant in the endometrium of the uterus which leads to conception.

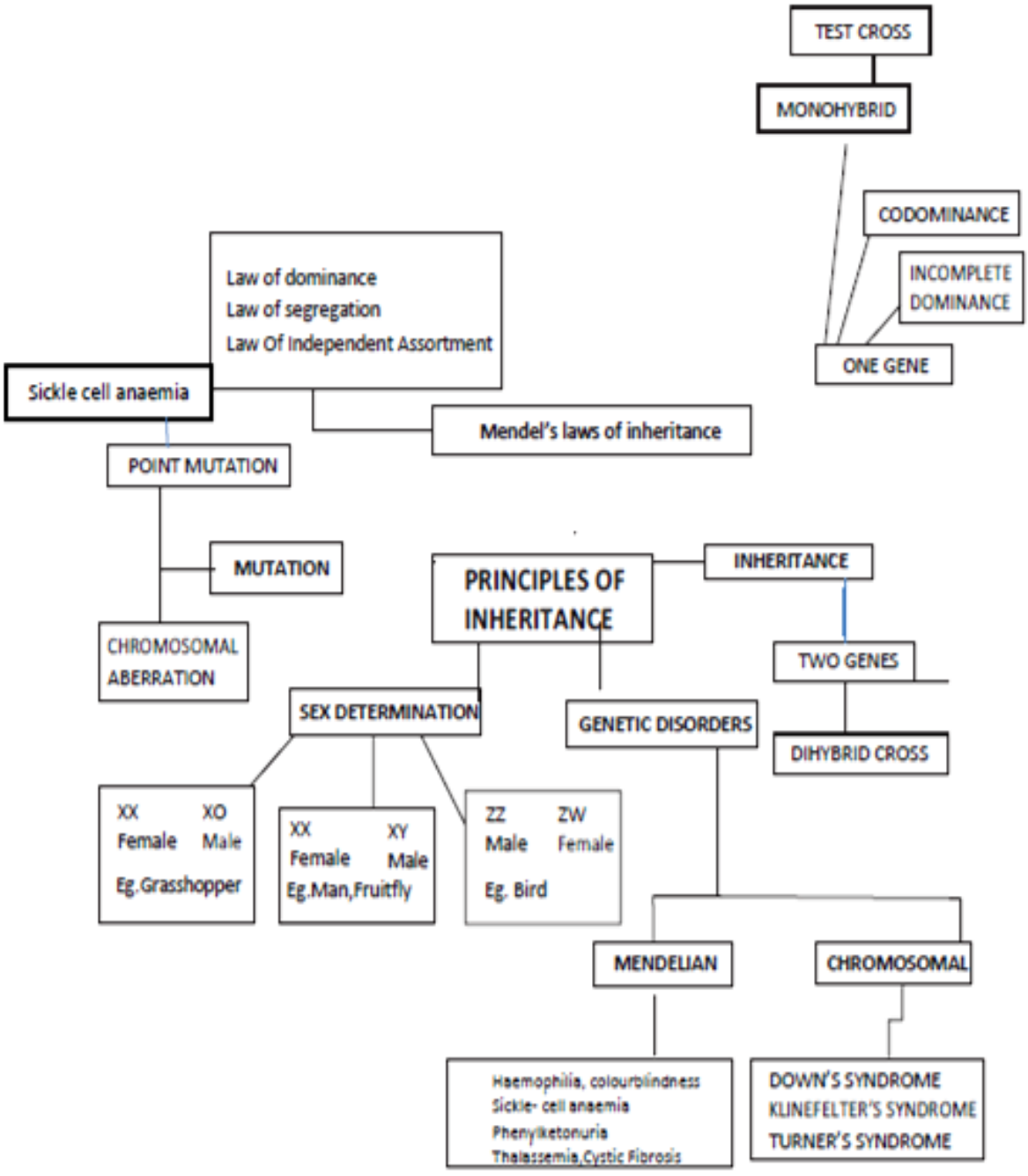
2. Explain in detail the difference between the meiotic division of oogenesis and spermatogenesis.

Ans: Spermatogenesis is the production process of sperm from the male germ cell whereas oogenesis is the production process of the eggs from the oogonia in females. Meiosis is different in spermatogenesis and oogenesis in the quantity of the end product. This unequal division is necessary to maintain the essential part of the cytoplasm. One minor part is detached as the polar body where a single daughter cell called the ovum is formed which is functional. But in spermatogenesis, four spermatids are produced which are functional and that later develops into spermatozoa.

Oogenesis	**Spermatogenesis**
Production of eggs from oogonia	Production of sperm from spermatogonia
Takes place inside the ovary in females	Takes place inside the testes in males
All except the last phase takes place inside the ovary	All phases occur inside the testis
Early stages observed during the fetal period. Rest stages observed between puberty and menopause	A continuous process that is initiated from puberty and lasts until death
Matured from germinal epithelium overlying	Developed from the germinal epithelial lining of the

the ovary	seminiferous tubules
Sertoli cells not found in germinal cell epithelium	Sertoli cells found in germinal cell epithelium
Few oogonia divide to produce eggs, one at a time	Spermatogonia are divided by meiosis to produce sperms
Lengthy growth phase in oogonia	The growth phase of spermatogonia is short
Generates non-motile gametes	Produces motile gametes
Primary oocyte divides to form a secondary oocyte and polar body during meiosis-I	During meiosis-I, primary spermatocyte divides to form two secondary spermatocytes

CHAPTER – 5 : PRINCIPLES OF INHERITANCE AND VARIATION
(CONCEPT MAP)



GIST OF CHAPTER

IMPORTANT TERMS

• **Allele:** Alternative forms of a gene. E.g. T (tall) and t (dwarf) are two alleles of a gene for the character height.

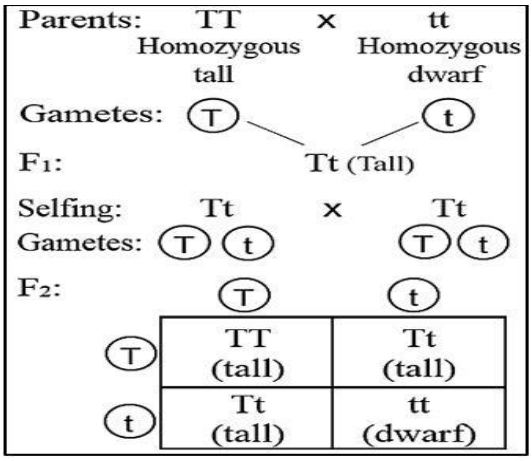
• **Homozygous:** The condition in which chromosome pair carries similar alleles of a gene. Also known as **pure line (True breeding).** E.g. TT, tt, YY, yy etc.

• **Heterozygous:** The condition in which chromosome pair carries dissimilar alleles of a gene. E.g. Tt, Yy etc.

➢ **Emasculation:** Removal of anthers of one plant to avoid self-pollination. This is female parent.

INHERITANCE OF ONE GENE

MONOHYBRID CROSS: A cross involving 2 plants differing in one character pair. E.g. Mendel crossed tall and dwarf pea plants to study the inheritance of one gene.



Monohybrid phenotypic ratio:

3 Tall: 1 Dwarf = **3:1**

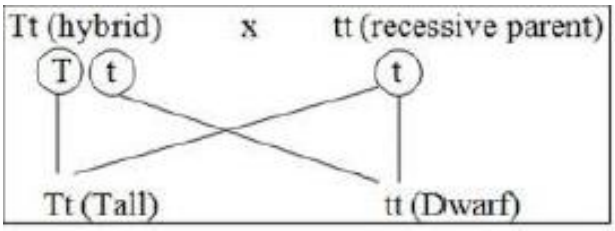
Monohybrid genotypic ratio:

1 Homozygous tall (TT) 2 Heterozygous tall (Tt) 1 Homozygous dwarf (tt) = **1:2:1**

BACK CROSS AND TEST CROSS

Backcross: Cross between a hybrid and its any parent.

Testcross: Crossing of an organism with dominant phenotype to a recessive individual. E.g.



Hence monohybrid test cross ratio= **1:1** Test cross is used **to find out the unknown genotype** of a character. E.g.

INHERITANCE OF TWO GENES Dihybrid cross:

It is a cross between two parents differing in 2 pairs of contrasting characters. E.g. Cross b/w pea plant with homozygous round shaped & yellow coloured seeds (RRYY) and wrinkled shaped & green coloured seeds (rryy).

Parents: RRYY X rryy

Gametes: (RY) (ry)

F_1: RrYy (Round yellow)

Selfing: RrYy X RrYy

Gametes: (RY) (Ry) (rY) (ry) (RY) (Ry) (rY) (ry)

F_2:

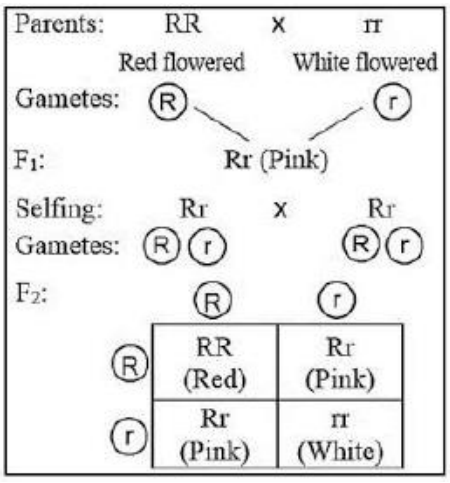
	(RY)	(Ry)	(rY)	(ry)
(RY)	RRYY *Ro. Yel*	RRYy *Ro. Yel*	RrYY *Ro. Yel*	RrYy *Ro. Yel*
(Ry)	RRYy *Ro. Yel*	RRyy *Ro. Gr*	RrYy *Ro. Yel*	Rryy *Ro. Gr*
(rY)	RrYY *Ro. Yel*	RrYy *Ro. Yel*	rrYY *Wri. Yel*	rrYy *Wri. Yel*
(ry)	RrYy *Ro. Yel*	Rryy *Ro. Gr*	rrYy *Wri. Yel*	rryy *Wri. Gr*

Dihybrid Phenotypic ratio:
9 Round yellow: 3 Round green: 3 Wrinkled yellow: 1 Wrinkled green = **9:3:3:1**

Mendel's 3rd Law: Law of Independent Assortment
It is based on the results of **dihybrid crosses.**

It states that **"When two pairs of traits are combined in a hybrid, segregation of one pair of characters is independent of the other pair of characters".**

1. INCOMPLETE DOMINANCE
It is an inheritance in which heterozygous offspring shows **intermediate character** b/w two parental characteristics.
E.g. Flower colour in **snapdragon (dog flower or *Antirrhinum* sp.)** and ***Mirabilis jalapa*(4'O clock plant**



Here, cross between homozygous **red & white** produces **pink** flowered plant. Thus phenotypic & genotypic ratios are same. **Phenotypic ratio= 1 Red: 2 Pink: 1 White (1:2:1) Genotypic ratio= 1 (RR): 2 (Rr): 1(rr)** This means that **R** was not completely dominant over **r.** Pea plants also show incomplete dominance in other traits.

2. CO-DOMINANCE – Eg. ABO blood grouping

When IA and IB are present together, they both express their own types of sugars. This is due to **co-dominance.**

3. MULTIPLE ALLELISM

It is the presence of **more than two alleles** of a gene to govern same character. E.g. ABO blood grouping (3 alleles: IA, IB &i). In an individual, only two alleles are present. Multiple alleles can be found only in a population.

4. POLYGENIC INHERITANCE

It is the inheritance in which some traits are controlled by several genes **(multiple genes).** E.g. human skin colour, human height etc

5. PLEIOTROPY

Here, a **single gene** exhibits **multiple phenotypic** expressions. Such a gene is called **pleiotropic gene.** In most cases, the mechanism of pleiotropy is the effect of a gene on metabolic pathways which contributes towards different phenotypes. E.g. Starch synthesis in pea, sickle cell anaemia, phenylketonuria etc.

CHROMOSOMAL THEORY OF INHERITANCE

Proposed by **Walter Sutton & Theodore Boveri.** They said that pairing & separation of a pair of chromosomes lead to segregation of a pair of factors they carried

Thomas Hunt Morgan proved chromosomal theory of inheritance using fruit flies (***Drosophila melanogaster***).

LINKAGE AND RECOMBINATION

Linkage is the physical association of two or more genes on a chromosome. They do not show independent assortment. **Recombination** is the generation of non-parental gene combinations. It occurs due to independent assortment or crossing over. **Morgan** carried out several dihybrid crosses in ***Drosophila*** to study sex-linked genes. E.g.

MECHANISM OF SEX DETERMINATION

1. **XX-XO mechanism:** Here, male is heterogametic, i.e. XO (Gametes with X and gametes without X) and female is homogametic, i.e. XX (all gametes are with X-chromosomes). E.g. Many insects such as grasshopper.

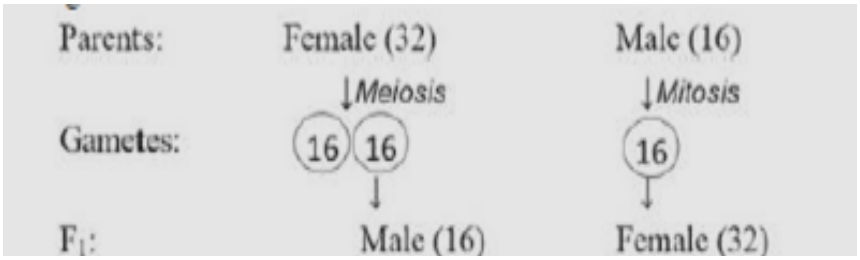
2. **XX-XY mechanism:** Male is heterogametic (X & Y) and female is homogametic (X only). E.g. Human &*Drosophila.*

3. **ZZ-ZW mechanism:** Male is homogametic (ZZ) and female is heterogametic (Z & W). E.g. Birds. **XX-XO & XX-XY mechanisms show male heterogamety.**

ZZ-ZW mechanism shows **female heterogamety.**

4.Sex determination in honeybee

.



MUTATION, PEDIGREE ANALYSIS

MUTATION

➢ **Point mutation:** The mutation due to change (substitution) in a single base pair of DNA. E.g. sickle cell anaemia.

➢ **Frame-shift mutation:** It is the deletion or insertion of base pairs resulting in the shifting of DNA sequences.
➢ **Physical mutagens:** UV radiation, α, β, γ rays, X-ray etc.
➢ **Chemical mutagens:** Mustard gas, phenol, formalin etc.

GENETIC DISORDERS

The disorders due to **change in genes or chromosomes.** 2 types: **Mendelian disorders & Chromosomal disorders.**

1. Mendelian Disorders

It is caused by **alteration or mutation in the single gene.** E.g.**Haemophilia, Colour blindness, Sickle-cell anaemia, Phenylketonuria, Thalassemia, Cystic fibrosis** etc..

Pedigree analysis of (A) Autosomal dominant trait (E.g. Myotonic dystrophy) (B) Autosomal recessive trait (E.g. Sickle-cell anaemia)

Haemophilia (Royal disease):

It is a **sex linked (X-linked) recessive** disease. In this, a protein involved in the blood clotting is affected. A simple cut results in **non-stop bleeding**

XX	Normal female
XX^h	Heterozygous female (carrier). She may transmit the disease to sons.
X^hX^h	Hemophilic female
XY	Normal male
X^hY	Hemophilic male

Colour blindness:

It is a **sex-linked (X-linked) recessive** disorder

Sickle-cell anaemia:

This is an **autosome linked recessive** disease. It can be transmitted from parents to the offspring when **both the partners are carrier (heterozygous)** for the gene. The disease is controlled by a pair of allele, **HbA**and **HbS.**

• Homozygous dominant (HbAHbA): normal
• Heterozygous (HbAHbS): carrier; sickle cell trait
• Homozygous recessive (HbSHbS): affected

The defect is caused by the substitution of **Glutamic acid (Glu)** by **Valine (Val)** at the **sixth position** of the **β-globin** chain of the haemoglobin (Hb).

Thalassemia:

An **autosome-linked recessive** blood disease.

EXAMPLES FOR CHROMOSOMAL DISORDERS

A. Down's syndrome:

It is the presence of an additional copy of chromosome number 21 **(trisomy of 21). Genetic constitution: 45 A + XX or 45 A + XY** (i.e. 47 chromosomes).

Features: The affected individual is short statured with small round head, furrowed tongue and partially open mouth

Palm is broad. Physical, psychomotor and mental development is retarded.

B. Klinefelter's Syndrome: It is the **presence of an additional copy of X-chromosome in male (trisomy). Genetic constitution: 44 A + XXY** (i.e. 47 chromosomes).

Features: Overall masculine development. However, the feminine development is also expressed. E.g. Development of breast (Gynaecomastia). Sterile

C. Turner's syndrome:

This is the **absence of one X chromosome in female (monosomy). Genetic constitution: 44 A + X0** (i.e. 45 chromosomes).

Features:-Such females are sterile as ovaries are rudimentary besides other features including
lack of other secondary sexual characters.

Q.no.	MCQS INCLUDING COMPETITIVE EXAM BASEDQUESTIONS	Ans
1	If one parent has blood group A and other parent has blood group B the off springs have which blood group a) A,B only b) O only c) B only d) A,B,AB,O	D
2	Which of the following possess Homogametic male? a) Plants b)Birds c) Insects d) Man	B
3	Tt mates with Tt. What will be characteristic of offspring? a) 75% recessive b) 50% recessive c) 25% recessive d) All dominant	B
4	In a monohybrid cross involving incomplete dominance, the phenotypic ratio equals the genotypic ratio in F2 generation. The ratio is a) 3:1 b) 1:2:1 c) 1:1:1:1 d) 9:7	B
5	The disorder caused due to the absence of one X-chromosome i. e. 45 with XO such females are sterile. Identify the syndrome a) Turner's syndrome b) Down's syndrome c) Klinefelter's syndrome d) Edward syndrome	A
6	It is an Autosomal disorder that is caused by the trisomy of 21st chromosome a) Turner's syndrome b) Edward syndrome c) Klinefelter's syndrome d) Down's syndrome	C
7	The classical example of point mutations a) Hemophilia b) Sickle cell anemia c) Phenylketonuria d) Cystic fibrosis	C
8	The Chromosome movement during meiosis has been worked out and noted that behavior of genes was parallel to the behavior of chromosomes a) Schledien b) Morgan c) Sturtevant d) Sutton and Boveri	A
9	Parents having genotype IA IB would show the blood group as AB. This is because of a) Pleiotrophy b) Co dominance c) Segregation d) Incomplete Dominance	C
10	Name the inborn error of metabolism that is inherited as an Autosomal recessive trait, The disease is characterized by the absence of phenylalanine hydroxylase in affected individual a) Thalassemia b) Phenyl ketonuria c) Sickle cell anemia d) Colour blindness	B
11	Which of the following Amino acid substitution is responsible for causing Sickle cell anemia?	C

	a) Valine is substituted by Glutamic acid in the globin chain at the sixth position b) Valine is substituted by Glutamic acid in the Beta-globin chain at the seventh position c) Glutamic acid is substituted by valine in the Globin chain at the sixth position d) Glutamic acid is substituted by Valine in the Beta-chain at the sixth position	
XII - CHAPTER-5 - ASSERTION – REASON TYPE QUESTIONS		
1	Assertion: The law of Independent Assortment can be studied by means of Dihybrid cross. Reason: The law of Independent assortment is applicable only to linkages. (a) Both assertion and reason are true, and reason is the correct explanation of assertion. (b) Both assertion and reason are true, but reason is not the correct explanation of assertion. (c) Assertion is true but reason is false. (d) Both assertion and reason are false.	C
2	Assertion: In Pigeon males are homogenetic and female are hetrogemetic. Reason: In pigeons, males have ZZ sex chromosomes, and females have ZW sex chromosomes. (a) Both assertion and reason are true, and reason is the correct explanation of assertion. (b) Both assertion and reason are true, but reason is not the correct explanation of assertion. (c) Assertion is true but reason is false. (d)Both assertion and reason are false.	A
3	Assertion: Down's syndrome is the genetic disorder caused due to the presence of additional copy of X chromosome. Reason: Both X chromosomes passes into single egg due to non-disjunction during oogenesis. (a) Both assertion and reason are true, and reason is the correct explanation of assertion. (b) Both assertion and reason are true, but reason is not the correct explanation of assertion. (c) Assertion is true but reason is false. (d) Both assertion and reason are false	A
4	Assertion: The persons with Klinefelter syndrome are sterile males. Reason: Klinefelter syndrome is due to trisomy. (a) Both assertion and reason are true, and reason is the correct explanation of assertion. (b) Both assertion and reason are true, but reason is not the correct explanation of assertion. (c) Assertion is true but reason is false. (d) Both assertion and reason are false.	B

5	Assertion: The Turner's syndrome is caused due to absence of one X or Y chromosome. Reason: Such individuals shows masculine as well as the feminine development (a) Both assertion and reason are true, and reason is the correct explanation of assertion. (b) Both assertion and reason are true, but reason is not the correct explanation of assertion. (c) Assertion is true but reason is false. (d) Both assertion and reason are false	D

	QUESTION ANSWER - 2- Marks-
1	Name a human genetic disorder due to the following : (a) An additional X-chromosome in a male (b) Deletion of one X-chromosome in a female Ans. a) Klinefelter's Syndrome b) Turner's Syndrome
2	(i) Why are grasshopper and Drosophila said to show male heterogamity? Explain. (ii) Explain female heterogamity with the help of an example. (i) Drosophila exhibit XY type of sex determination. Males produce two types of sperms, one having X chromosome and one having Y chromsome. Whereas females have only X type of chromosomes. Grasshoppers exhibit XO type of sex determination. Males produce two types of gametes, one with X chromosome and other with no chromosome. Thus, both show male heterogamety. (ii) Female heterogamety can be seen in female birds. In these, the females have one Z and one W chromosome whereas males have a pair of Z-chromosomes besides the autosomes.
3	Write the genotype of (i) an individual who is carrier of sickle cell anaemia gene but apparently unaffected, and (ii) an individual affected with the disease. Ans – (i) HbAHbS and (ii) HbSHbS Name the stage of cell division where segregation of an independent pair of chromosomes occurs. Ans – Anaphase-I of Meiosis-I.
4	A human being suffering from Down's Syndrome shows trisomy of 21st chromosome. Mention the cause of this chromosomal abnormality. Ans - Due to non-disjunction, 21st pair of chromosomes fail to separate during oogenesis. Therefore, the egg possesses 24 chromosomes instead of 23. When the egg fuses with a sperm, the zygote will have three copies of chromosome 21 causing trisomy.
5	Describe the mechanism of pattern of inheritance of ABO blood groups in humans. Ans – Human blood group is determined by glycoprotein/antigen A and glycoprotein/antigen B. The alleles are IA, IB and i. Hence, referred to as multiple allelism. The individual inherits any two of them as given below. IAIA, IAi - A group IBIB, IBi -B group IAIB -AB group ii - O group In the case of A, B and O groups, Law of dominance is the pattern of inheritance as IA and IB are dominant over i. In AB group both the alleles IA and IB express themselves. Thus, it is the case of co-dominance.
6	Garden pea plant produced axial white flowers. Another of the same species produced terminal violet flowers. Identify the dominant traits. Ans - Axial, violet flower.
7	Name the respective pattern of inheritance where F1 phenotype (a) does not resemble either of the two parents and is in between the two.

	(b) resembles only one of the two parents. Ans – (a) Incomplete dominance. (b) Dominance (law).
8	Why are human females rarely haemophilic? Explain. How do haemophilic patients suffer? Ans – Haemophilia is a sex-linked recessive disorder. The females haves XX chromosomes and the males have XY chromosomes. If one of the two X chromosomes is normal, she remains a carrier and not diseased. Females will haemophilic only when both the X chromosomes carry the haemophilia gene and this is possible only when the mother is a carrier and father ishaemophilic. Non-stop bleeding and no clotting.
9	With the help of one example, explain the phenomena of co-dominance and multiple allelism in human population. Ans – ABO blood group in human being is an example of multiple allelism and co-dominance. There are three alleles for the gene I, i.e., IA, IB, and i. When IA and IB are present together the blood group is AB. Both A and B blood groups are expressed. This is called condominance.
10	Write the scientific name of the fruit-fly. Why did Morgan prefer to work with fruit-flies for his experiments? State any three reasons. Ans – Drosophila melanogaster is the scientific name of fruit fly. Morgan preferred work with fruit flies because: (i) It is grown in simple synthetic medium. (ii) It completes the life cycle in only two weeks. (iii) Single mating produces many progeny. (iv) It exhibits dimorphism.
11	Drosophila has four pairs of chromosomes and Human has 23 pairs of chromosomes. How many linkage groups will each have? Ans :Drosophila - 4 linkage groups Human Being - 23 linkage groups
12	ZO-ZZ type mechanism occurs is honey bee for Sex-determination and the female Bee has 32 chromosomes. i) What is the number of chromosomes in male Bee? ii) Which cell division will the male perform for gametogenesis? Ans: i) 16 (Haploid) ii)Mitosis

	3 - Marks- questions and answers
1	Differentiate between Turner's syndrome and Down's syndrome.

TURNER'S SYNDROME	**DOWN'S SYNDROME**
(i) Absence of one X chromosome / 44+X0 X0 condition / monosomy of sex chromosome in females / 45 withX0	(i) Trisomy of 21st chromosome / Extra copy of 21st Chromosome = 1
(ii) Only females are affected	(ii) Both Male and female are affected
(iii) females sterile / ovary rudimentary / lack of secondary sexual character / short stature	(iii) short stature with small round head / furrowed tongue and partially open mouth / palm is broad with characteristic palm crease

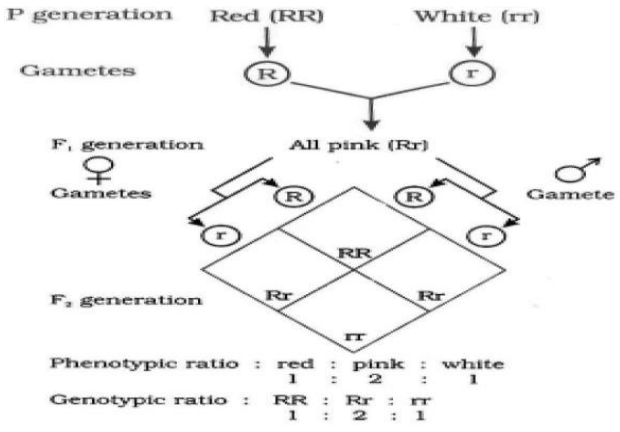
<table>
<tr><td>2</td><td>Both Haemophilia and Thalassemia are blood related disorders in humans. Write their causes and the difference between the two. Name the category of genetic disorder they both come under.
Ans –
<table>
<tr><th>Haemophilia</th><th>Thalassemia</th></tr>
<tr><td>Single protein involved in the clotting of blood is affected = ½</td><td>Defects in the synthesis of globin leading to formation of abnormal haemeoglobin = ½</td></tr>
<tr><td>Sex linked recessive disorder = ½</td><td>Autosomal recessive disorder= ½</td></tr>
<tr><td>Blood does not clot = ½</td><td>Results in anaemia = ½</td></tr>
</table>
Mendelian disorder.</td></tr>
<tr><td>3</td><td>(a) What is polygenic inheritance ? Explain with the help of a suitable example.
(b) How are pleiotropy and Mendelian pattern of inheritance different from polygenic pattern of inheritance ?
Ans - (a) Inheritance in which traits are controlled by three or more genes ,eg human skin colour / height , the inheritance depends upon the additive / cumulative effect of allelles , more the number of dominant allelles the expression of the trait will be more distinct / prominent , more the number of recessive allelles the trait will be diluted , if member of dominant and recessive allelles are equal the effect is intermediate.
(b) Single gene controls multiple phenotypic expression (Pleiotropy) , one gene controls one phenotypic expression (Mendelian).</td></tr>
<tr><td>4</td><td>Two independent monohybrid crosses were carried out involving a tall pea plant with a dwarf pea plant. In the first cross, the offspring population had equal number of tall and dwarf plants, whereas in the second cross it was different .Work out the crosses, and explain giving reasons for the difference in the offspring populations.
1st Cross
parental generation Tt × tt
gametes (T)(t) (t)(t)
F_1 - Tt : tt
1 : 1 (50 % Tall : 50% dwarf)
2nd Cross
parental generation TT × tt
gametes (T)(T) (t)(t)
F_1 - Tt : Tt
(Tall-100%)
Reason- In the first cross the tall parent plant is heterozygous for the trait , in second cross tall parent plant is homozygous for the trait.</td></tr>
<tr><td>5</td><td>(a) Why is haemophilia generally observed in human males? Explain the conditions under which a human female can be haemophilic.
(b) A pregnant human female was advised to undergo M.T.P. It was diagnosed by her doctor that the foetus she is carrying has developed from a zygote formed by an XX egg fertilised by Y-carrying sperms. Why was she advised to undergo M.T.P.?
Ans – (a) Haemophilia is caused due to the recessive gene on X-chromosome. Y has no allele for this. If a male is XhY, then he is haemophilic. If male inherits Xh from the mother, he will be haemophilic (with the genotype XhY).
If female inherits XhXh, one from the carrier mother and one from her haemophilic father, then she can be haemophilic.
(b) Embryo has (trisomy of sex chromosome) XXY karyotype or Klinefelter’s syndrome. She was advised to undergo MTP since the child will have the following problems:</td></tr>
</table>

	(i) male with feminine traits (ii) gynaecomastia (iii) underdeveloped testes (iv) sterile
6	Identify ‘a’,‘b’,‘c’,‘d’, ‘e’ and ‘f’ in the table given below:

No	ndrome	use	aracteristic of affected individuals	x Male/Female/Both
	wn’s	isomy of 21	(i) (ii)	
		XY	erall masculine development	
	rner’s	with XO	(i) (ii)	

Ans: (a) short stature/small round head/furrowed tongue/partially open mouth/mental development retarded.
(b) Both.
(c) Klinefelter’s syndrome.
(d) Male(sterile)
(e) (i) Sterile ovaries; (ii) Lack of secondary sexual characters
(f) Female.(sterile)

	5- Marks-Questions and answers
1	The F2 progeny of a monohybrid cross showed phenotypic and genotypic ratio as 1:2:1, unlike that of Mendel’s monohybrid F2 ratio. With the help of suitable example, work out a cross and explain how it is possible. Ans – Mirabilis jalapa / four O’ clock plant / Antirrhinum (majus)/ Snapdragon flower /dog flower. In heterozygous condition a single dominant gene is not sufficient to produce red colour, therefore it is a case of incomplete dominance.



2 (i) How does a Chromosomal disorder differ from a Mendelian disorder?
(ii) Name any two chromosomal aberration associated disorders.
(iii) List the characteristics of the disorders mentioned above that help in their diagnosis.
Ans
(i)

S. No.	Mendelian Disorder	Chromosomal Disorder
(i)	This disorder is mainly due to alteration or mutation in the single gene.	This disorder is caused due to absence or excess or abnormal arrangement of one or more chromosomes.
(ii)	This follows Mendel's principles of inheritance.	This does not follow Mendel's principles of inheritance.
(iii)	This may be recessive or dominant in nature	This is always dominant in nature.
(iv)	For example, haemophilia, sickle-cell anaemia.	For example, Turner's syndrome.

ii) Two chromosomal aberration-associated disorders are Down's syndrome and Klinefelter's syndrome.
(iii) (a) Down's syndrome: The individuals have overall masculine development but theyexpress feminine development like development of breast, i.e., gynaecomastia. They are sterile.
(b) Klinefelter's syndrome: The females are sterile as ovaries are rudimentary. Other secondary sexual characters are also lacking.

3 Write the symptoms of haemophilia and sickle-cell anaemia in humans. Explain how the inheritance pattern of the two diseases differs from each other.
Ans - Symptoms of Haemophilia.
(i) Patient continues to bleed even on a minor cut as the patient does not possess natural phenomenon of blood clotting.
Symptoms of Sickle-cell Anaemia.
(i) HbS behaves as normal haemoglobin except under oxygen stress where erythrocytes lose their circular shape and become sickle-shaped. As a result, the cells cannot pass through narrow capillaries. Blood capillaries are clogged and thus affects blood supply to different organs
Differences between Haemophilia and Sickle-cell Anaemia.

	Haemophilia	Sickle-cell Anaemia
(i)	It is a sex-linked recessive disorder.	It is an autosomal linked recessive trait.
(ii)	The gene for haemophilia is located on X-chromosome.	The disease is controlled by a single pair of allele Hb^A and Hb^S.
(iii)	More males suffer from haemophilia than females because in males single gene for the defect is able to express. Females suffer from this disease only in homozygous condition, *i.e.*, X^cX^c.	Only the homozygous individuals for Hb^S, *i.e.*, Hb^SHb^S show the discased phenotype.
(iv)	The defective alleles produce non-functional protein which later form a non-functional cascade of protein involving in blood clotting.	Due to point mutation Glutamic acid (Glu) is replaced by Valine (Val) at sixth positions of beta globin chain of haemoglobin molecule.

4	(a) A true breeding homozygous pea plant with green pods and axial flowers as dominant characters, is crossed with a recessive homozygous pea plant with yellow pods and terminal flowers. Work out the cross up to F2 generation giving the phenotypic ratios of F1 and F2 generation respectively. (b) State the Mendelian principle which can be derived from such a cross and not from monohybrid cross.

(a) **Parents** Green axis GGAA × Yellow terminal ggaa

Gametes GA, Ga

F_1 generation GgAa × GgAa—(Hybrid) green axial

Selfing

F_2 generation

	GA	Ga	gA	ga
GA	GGAA Green axial	GGAa Green axial	GgAA Green axial	GgAa Green axial
Ga	GGAa Green axial	GGaa Green terminal	GgAa Green axial	Ggaa Green terminal
gA	GgAA Green axial	GgAa Green axial	ggAA Yellow axial	ggAa Yellow axial
ga	GgAa Green axial	Ggaa Green terminal	ggAa Yellow axial	ggaa Yellow terminal

Phenotypic ratio Green axial : Green terminal : Yellow axial : Yellow terminal

9 : 3 : 3 : 1

(b) From the above cross law of independent assortment can be derived which states that when two pairs of traits are combined in a hybrid, segregation of one pair of character is independent of the other pair of characters.

COMPETANCY BASED QUESTIONS & ANSWERS

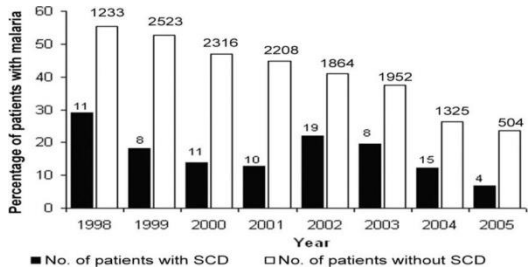
1 *Read the following and answer the questions from 1(i) to 1(v) given below:*

Sickle cell anemia is a genetic disorder where the body produces an abnormalhemoglobincalledhemoglobinS.Redbloodcellsarenormallyflexiblean dround, but when the hemoglobin is defective, blood cells take on a "sickle" orcrescentshape.Sicklecellanemiaiscausedbymutationsinagenecalled HBB.

It is an inherited blood disorder that occurs if both the maternal and paternal copies of the HBB gene are defective. In other words, if an individual receives just one copy of the defective HBB gene, either from mother or father, then the individual has no sickle cell anemia but has what is called "sickle cell trait". People with sickle cell trait usually do not have any symptoms or problems but they can pass the mutated gene onto their children. There are three inheritance scenarios that can lead to a child having sickle cell anemia:

- Both parents have sickle cell trait
- One parent has sickle cell anemia and the other has sickle cell trait

Both parents have sickle cell anemia

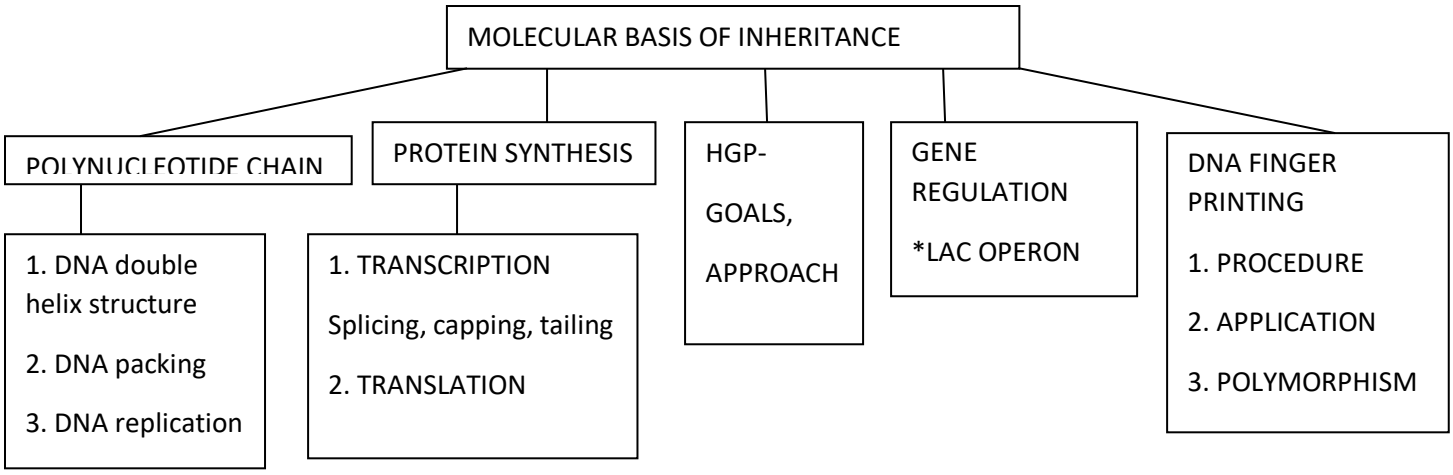
i.	Sickle cell anemia is a/an_____disease. a. X-linked b. autosomal dominant c. autosomal recessive d.Y-linked	C
ii.	If both parents have sickle cell trait, then there is_____of the child having sickle cell trait. a. 25%risk b.50%risk c. 75%risk d. Norisk	A
iii.	If one parent has sickle cell anemia and the other has sickle cell trait, there is that their chidren will have sickle cell anemia and__will have sickle cell trait. a. 25%risk,75% risk b. 50%risk,50% risk c. 75%risk,25%risk d. Norisk	B
	 The following statements are drawn as conclusions from the above data(Kenya). (i) Patients with SCD (Sickle Cell Disease) are less likely to be infected with malaria. (ii) Patients with SCD(Sickle Cell Disease) are more likely to be infected with malaria. (iii) Over the years the percent age of people infected with malaria has been decreasing. (iv) Year 2000 saw the largest percentage difference between malaria patients with and without SCD. Choose from below the correct alternative. (i) only I is true (ii) I and IV are true (iii) III and II are true (iv) I and III are true Ans: (i)	
2	Read the following and answer any four questions 15(i) to 15(v)given below: Morgan worked with the tiny fruit flies, which were found very suitable for such studies. They could be grown on simple synthetic medium in the laboratory. They complete their life cycle in about two weeks, and single mating could produce a large number of progeny flies. Male and female flies are easily distinguishable. Also it has many types of hereditary variations that can be seen with low power microscopes. i) Lack of independent assortment of two genes A and B in fruit fly Drosophila is due to a) Recombination b) Linkage c) Crossing over d) Repulsion	

	ii) Test cross in plants or in Drosophila involves crossing a) Between two genotypes with recessive trait b) Between two F1 hybrids c) The F 1 hybrid with a double recessive genotype d) Between two genotypes with dominant trait iii) Chromosomal theory of inheritance was proposed by- _____ a) Sutton in 1902 b) Boveri in 1902 c) Correns in 1909 d) Sutton and Boveri in 1902 iv) What is the number of linkage groups in the Drosophila? a) Two b) Four c) Eight d) None of the above v) **Assertion**: *Drosophila melanogaster* is widely used in genetic research **Reason:** *Drosophila melanogaster* is a readily available insect. a) Both assertion and reason are true and reason is the correct explanation of assertion b) Both assertion and reason are true but reason is not the correct explanation of assertion c) Assertion is true but reason is false d) Both assertion and reason are false	
3	A true breeding line is one that, having undergone continuous self-pollination, shows the stable trait inheritance and expression for several generations. In a typical test cross an organism (pea plants here) showing a dominant phenotype (and whose genotype is to be determined) is crossed with the recessive parent instead of self-crossing. ,it was found that sometimes the F1 had a phenotype that did not resemble either of the two parents and was in between the two. The inheritance of flower colour in the dog flower (snapdragon ns the information to express a particular trait. In a diploid organism, there are two copies of each gene, i.e., as a pair of alleles. Now, these two alleles need not always be identical, as in a heterozygote. But, in the case of co-dominance the F1 generation resembles both parents. ABO blood groups are controlled by the gene I. The gene (I) has three alleles IA , I B and i. The alleles I A and I B produce a slightly different form of the sugar while allele i does not produce any sugar. Because humans are diploid organisms, each person possesses any two of the three I gene alleles. I A and I B are completely dominant over i, in other words when IA and ia represent only IA expresses	
	1.A true breeding plant is produced by a) Emasulation b) Autogamy c)Xenogamy d)All of these	B
	2.The genotype of a true breeding red flowered plant is a)Rr)rr c) RR d)rR	C
	3.Blood group in humans is an example of a) multiple gene effect b) Cumulative gene effect c) Multiple allelism d) pleiotropy	C
	4.AB blood group shows a) incomplete dominance b) Pleiotropy c) Codominance d) polygenic effect	C
	5.Which among the following plants show incomplete dominance? a) Hibiscus b)Snapdragon c)Ixora d)Viola	B

CHAPTER -6

MOLECULAR BASIS OF INHERITANCE

CONCEPT MAP



GIST OF THE LESSON

1. A polynucleotide chain

A nitrogenous base is linked to pentose sugar with N-glycosidic linkage to form to form a nucleoside. When phosphate group is linked 5'-OH of a nucleoside through phosphoester linkage nucleotide is formed.Two nucleotides are linked through 3'-5' phosphodiester linkage to form dinucleotide. More nucleotide joins together to form polynucleotide

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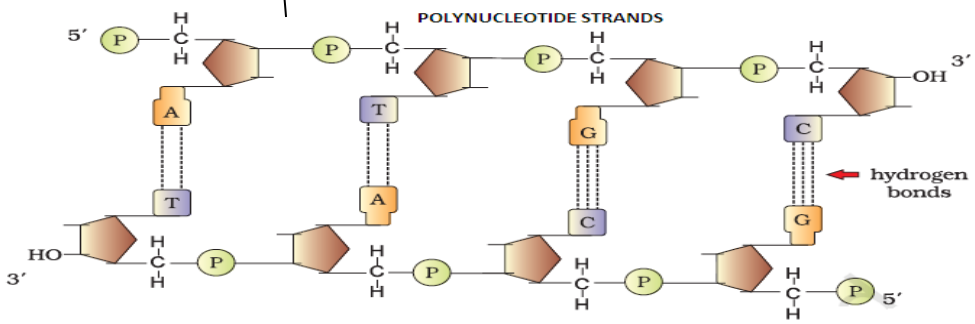


2. Double Helix Model for Structure of DNA

(a) DNA is made of two polynucleotide chains in which backbone is made and bases projected inside it. up of sugar-phosphate

(b) Two chains have anti-parallel polarity. i.e 5'--------3' and other with 3'--------5'.

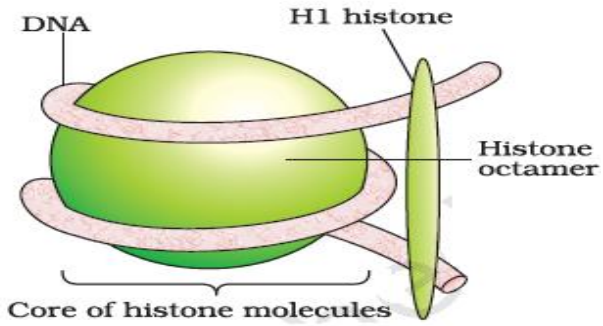
(c) The bases in two strands are paired through H-bonds. Adenine and Thymine forms double bond and Guanine and Cytosine forms triple hydrogen bonds.

(d) Two chains are coiled in right handed fashion. The pitch of helix is 3.4 nm and roughly 10 bp in each turn.

(e) The plane of one base pair stacks over the other in double helix to confer stability. Francis Crick proposed the Central dogma in molecular biology, which states that the genetic information flows from DNA-> RNA-> Protein.

3.Packaging of DNA helix

In prokaryotes, negatively charged DNA is combined with some positively charged proteins called nucleoids.In eukaryotes, positively charged protein organized to form 8 molecules unit called histone octomer. Negatively charged DNA is wrapped around the histone octomer to form nucleosome.. Histones are rich in the basic amino acid residues lysines and arginines. Both the amino acid residues carry positive charges in their side chains.Single nucleosome contains about 200 base pairs.Chromatin is the repeating unit of nucleosome.In nucleus, some region of chromatin are loosely packed (and stains light) and are referred to as euchromatin. The chromatin that is more densely packed and stains dark are called as Heterochromatin. Euchromatin is transcriptionally active chromatin, whereas, heterochromatin is inactive.

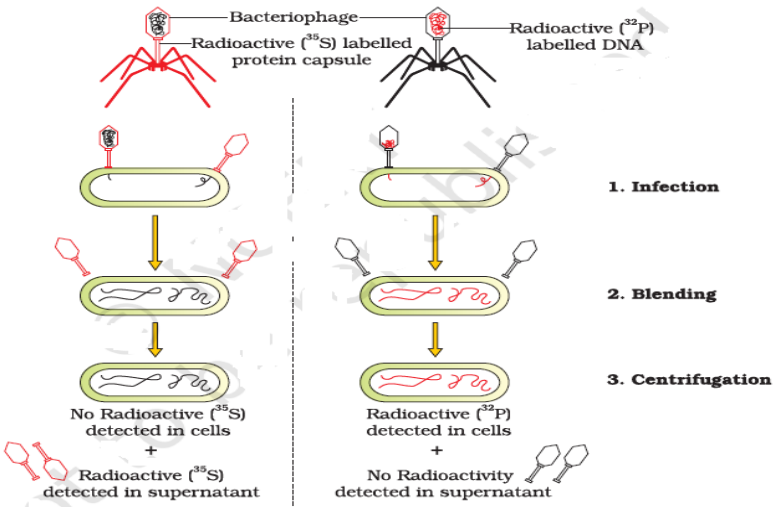


4. Transforming Principle

Frederick Griffith in 1928 conducted experiment on bacteria Streptococcus pneumoniae (bacterium responsible for pneumonia). There are two types of strain of this bacteria, some produce smooth shiny colonies (S) and others produce rough colonies (R). Mice infected with the S strain (virulent) die from pneumonia infection but mice infected with the R strain do not develop pneumonia.. This must be due to the transfer of the genetic material.

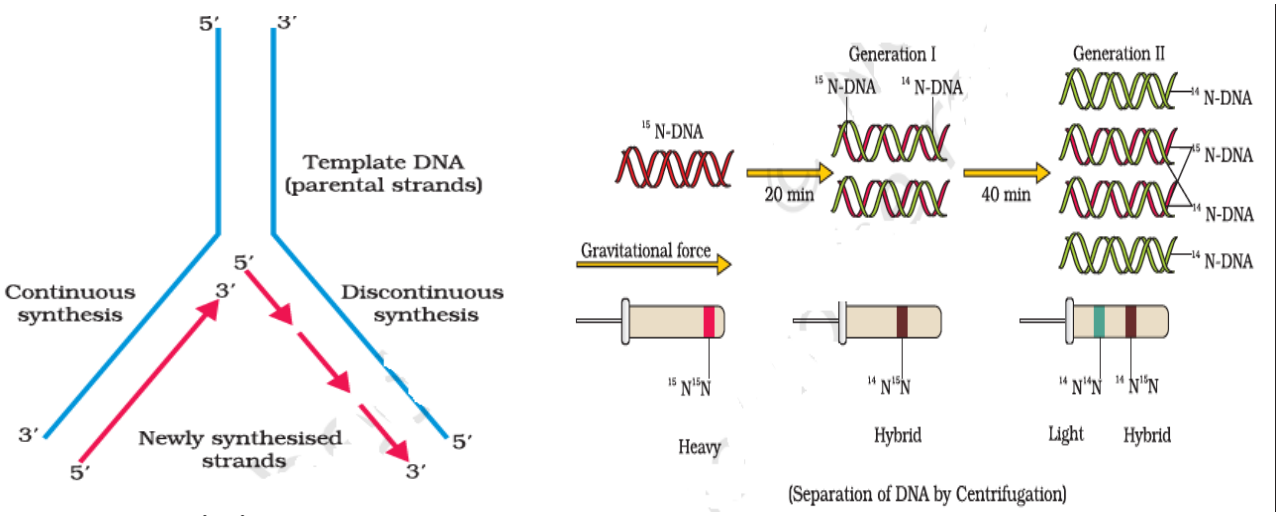
Biochemical Characterisation of Transforming Principle: Oswald Avery, Colin MacLeod and McCarty worked out to determine the biochemical nature of transforming principle of Griffith and discovered that ,DNA is the genetic material

5. Experimental proof that DNA is the genetic material : Alfred Hershey and Martha Chase (1952) worked with virus that infect bacteria called bacteriophages. His experiment shows that pro c material.



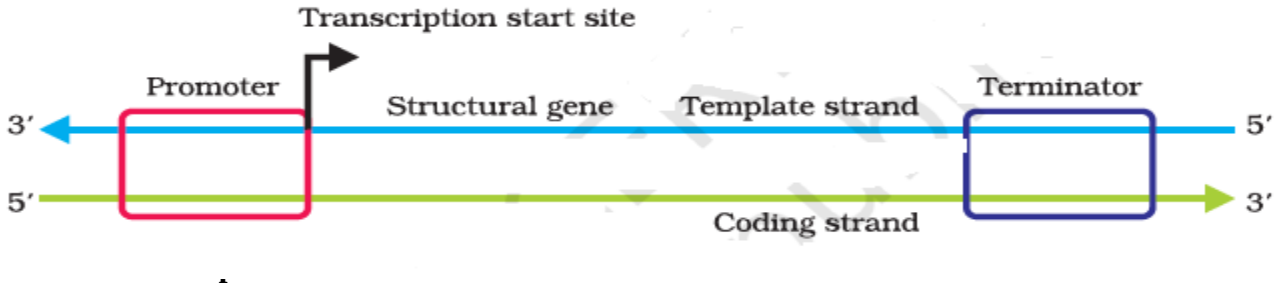
6. Replication of DNA

Watson and Crick suggested that two strands of DNA separate from each other and act as template for synthesis of new complementary strands.After the completion of replication each DNA molecule would have one parental and one newly synthesised strand, this method is called semi-conservative replication. Messelson and stahl's shows experimentalevidence of semiconservative replication.



7. Transcription

It is the process of copying genetic information from one strand of DNA into RNA. In transcription only one segment of DNA and only one strand is copied in RNA.Transcription of DNA includes a promoter, the structural gene and a terminator. The strands that has polarity 3'→5 act as template and called template strand and other strand is called coding strand. Promoter is located at 5' end and that bind the enzyme RNA polymerase to start transcription. Sigma factor (o) also help in initation of transcription.The terminator is located at 3'end of coding strand and usually defines the end of transcription where rho (p) factor will bind to terminate transcription. RHO factor help in termination of transcription.

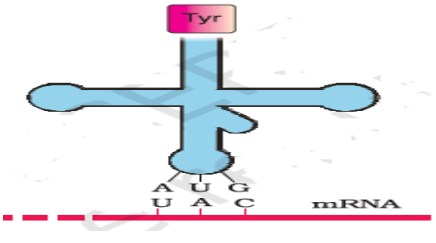


Translation is the process of polymerisation of amino acids to form a polypeptide. Amino acids are joined by peptide bonds. It involved following steps:

(a) Charging of t-RNA. (b) Formation of peptide bonds between two charged tRNA.

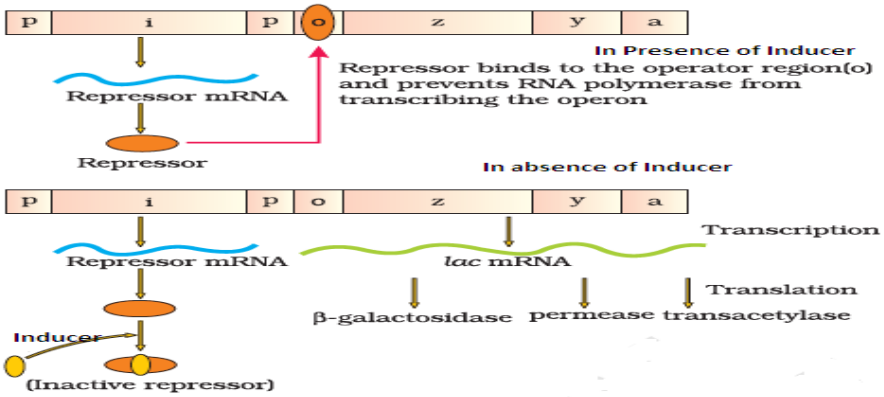
The start codon is AUG. For initiation ribosome binds to mRNA at the start codon. Ribosomes moves from codon to codon along mRNA for elongation of protein chain.

At the end release factors binds to the stop codon, terminating the translation and release of polypeptide form ribosome.



9. Regulation of Gene Expression: The Lac Operon

Lac operon consists of one regulatory gene (i) and three structural genes (y,z and a). Gene i code for the repressor of the lac operon.The 'z' gene code for the enzyme beta-galactosidase, that is responsible for hydrolysis of disaccharide, lactose into monomeric units, galactose and glucose..Gene 'y' code for the enzyme permease, which increases permeability of the cell.While, Gene a codes for the enzyme transacetylaseLactose is the substrate for enzyme beta-galactosidase and it regulates switching on and off of the operon,



10. Human Genome Project:

Human Genome Project (HGP) was launched in 1990 to find out the complete DNA sequence of human genome using genetic engineering technique and bioinformatics to isolate and clone the DNA segment for determining DNA sequence.

Goals of HCP are : To identify all the genes (20,000 to 25,000) in human DNA.Determine the sequence of the 3 billion chemical base pairs that make up human DNA.Store this information in data base. Improve tools for data analysis. Find out possibilities of transfer of technology developed during HGP to industry. Two approaches are EST and,sequence annotation

11. DNA Fingerprinting :

DNA fingerprinting is a very quick way to compare the DNA sequence of any two individual. It includes identifying differences in some specific region in DNA sequence called as repetitive DNA because in this region, a small stretch of DNA is repeated many times.The technique of fingerprinting was developed by Alec Jeffrey.Used in forensic science to identify the crime and in paternal testing.

OBJECTIVE TYPE QUESTIONS

1. In a DNA strand the nucleotides are linked together by
a)glycosidic bonds b)phosphodiester bonds c)peptide bonds d)hydorgen bonds.
Answer: (b) phosphodiester bonds

2. The net electric charge on DNA and histones is
a) both positive b)both negative c)negative and positive, respectively d)zero.
Answer: (c) negative and positive, respectively

3. Control of gene expression takes place at the level of
a)DNA-replication b)transcription c)translation d)none of the above.
Answer: (b) transcription

4. Which was the last human chromosome to be completely sequenced ?
a) Chromosome 1 b)Chromosome 11 c)Chromosome 21 d)Chromosome X
Answer: (a) Chromosome 1

5. If the sequence of nitrogen bases of the coding strand of DNA in a transcription unit is:
5'– ATG ATG – 3', the sequence of bases in its RNA transcript would be
(a)5' – AUG AUG – 3'(b)5' – UACUU A – 3'(c)5' – CAU CAU – 3'
(d)5' – GUAGUA – 3'.
Answer: (d) 5' – GUAGUA – 3'.

6. If the base sequence of a codon in mRNA is 5' – AUG – 3′ the sequence of tRNA pairing with it must be
a)5' – UAC – 3' b)5' – CAU – 3' c)5'-AUG – 3' d)5' – GUA – 3'
Answer: (b) 5' – CAU – 3'

7. The amino acid attaches to the tRNA at its
a)5'- end b)3' – end c)anti codon site d)DHUloop.
Answer: (b) 3' – end

8. To initiate translation, the m RNA first bind to
(a) the small ribosomal subunit b)the large ribosomal subunit
(b) the whole ribosome d)no such specificity exists.
Answer: (a) the small ribosomal subunit

9. In E. colt, the lac operon gets switched on when
a)lactose is present and it binds to the repressor b)repressor binds to operator
c)RNA polymerase binds to the operator d)lactose is present and it binds to RNA polymerase.
Answer: (a) lactose is present and it binds to the repressor

ASSERTION AND REASONING

Read the **Assertion** and **Reason** carefully to mark the correct option out of the options given below:
(a)If both the **Assertion** and the **Reason** are true and the **Reason** is a correct explanation of the**Assertion**.
(b) If both the **Assertion** and **Reason** are true but the **Reason** is not a correct explanation of *the**Assertion***.
(c)Ifthe **Assertion** istruebutthe **Reason** isfalse.
(d)If both the **Assertion** and **Reason** are false

1. Assertion: DNA is considered to be better genetic material than RNA for most organisms
Reason: 2'OH group present in DNA makes it labile and less reactive
Ans: Option C

2. Assertion: Replication and transcription occurs in Nucleus but translation occurs in cytoplasm.
Reason: mRNA transferred from nucleus to cytoplasm where ribosomes and amino acids areavailable for protein synthesis
Ans: Option A

3. Assertion: Synthesis of daughter or new strand occurs continuously along the parent 3'---5'strand
Reason: DNA polymerase can polymerase nucleotides in 3'--5' direction on 5'--3'strand
Ans: Option C

4..Assertion: a very low level expression of lac operon has to be present in the cell always
Reason: In Lac operon, lactose when added enters the cells by the action of enzyme permease
Ans: Option A

5..Assertion: The DNA strand having polarity 3'-5' replicated continuously whereas the strandwith polarity 5'- 3; replicated discontinuously.
Reason: The DNA polymerase catalyses the polymerisation only in one direction
Ans: Option A

6. Assertion: VNTRs are used as probes for hybridisation in DNA Fingerprinting.
Reason: DNA fingerprinting is based on the principle of Polymorphism in DNA sequences
Ans: Option A

7.Assertion: Viruses having RNA genome have shorter life span and mutate faster.
Reason: RNA is unstable and thus mutates faster
Ans: Option A

8.Assertion: The genetic code is degenerate.
Reason: Most amino acids are coded by more than one codon.
Ans: Option A

9..Assertion: Viruses having shorter life span, mutate and evolve faster.
Reason: Viruses have generally RNA genome.
Ans. Option A

COMPETENCY BASED QUESTION AND ANSWERS

1. Control of gene expression takes place at the level of:
(a) DNA replication (b) Transcription (c) Translation (d) None of these
Ans. (b) Transcription

2. Select the option(a:direction RNA synthesis, b:direction of reading of template strand)
(a)_5'..... 3', 3' ..... 5'
(b) 3' ..... 5', 5'…….5'
(c) 5'..... 3', 5' ..... 3'
(d) 3' …..... 5', 3' ..... 5'
Ans. (a) 5' ..... 3', 3'…….5'

3.State a functional difference between the following codons – (a) AUG and UAA
(b) Specific and Degenerate
Ans – (a) AUG – Start codon and UAA – Stop codon. (b) Specific - Each codon codes for a specific amino acid. Degenerate – More than one codon code for the same amino acid.

4. Although a prokaryotic cell has no defined nucleus , yet DNA is not scattered throughout the cell. Explain.
Ans – DNA is negatively charged , positively charged proteins , hold it in places , in large loops (in a region termed as nucleiod)

5. Mention the contribution of genetic maps in human genome project
Ans – Sequencing of genes, DNA fingerprinting, tracing human history, chromosomal location for disease associated sequences.

CASE BASED QUESTIONS

1.Read the following passage and answer the following questions
DNA replication is a complex multi-step process that requires enzymes, protein factors and metal ions. DNA replication in eukaryotes occurs in the nucleus during the S phase of the cell cycle. It is semi discontinuous in eukaryotes. In prokaryotes replication takes place in the cytoplasm. DNA replication in bacteria occurs prior to fission. Nucleoid or viral chromosome is a single molecule of nucleic acid, it may be linear or circular. Nucleic acid in a virus is either DNA or RNA but never both.

1. In Viral DNA how many origin of replication are present?
a) Single b) Two c) Multiple d) None
Ans: a) Single
2. Select the main enzyme involved in DNA replication.
a) DNA ligase b) Helicase c) DNA dependant DNA polymerase d) Topoisomerase
Ans: c) DNA dependant DNA polymerase
3. Read the given statement and select the option that correctly fill in the blanks. Enzyme ----------(i) acts over the ori site and unwind the two strands of DNA by destroying -------(ii) bonds
a) (i)Helicase, (ii)glycosidic b) (i)Helicase (ii) Hydrogen
c) (i)Unwindase (ii) glycosidic d) (i) helicase (ii) phosphodiester
Ans: b) (i)Helicase (ii) Hydrogen

4. DNA strand build-up of Okazaki fragments is called
a) lagging strand b) leading strand c) complementary strand d) parental strand
Ans: a) lagging strand

2) DNA fingerprinting is a technique of determining nucleotide sequences of certain areas of DNA which are unique to each individual. Each person has a unique DNA finger print. Each fingerprint is the same for every cell, tissue and organ of a person. DNA fingerprinting is the basis of paternity testing in case of disputes.

1. The technique developed to identify a person with the help of DNA restriction analysis is known as
a) DNA profiling b) RFLP c) DNA finger printing d) Both (a) and (b)
Ans: c) DNA finger printing

2. For DNA finger printing, DNA is obtained from
a) Blood b) Hair root cells c) Semen d) All of the above
Ans: d) All of the above
3. During DNA finger printing radioactive probes
a) Hybridise with DNA sample to form double stranded structure
b) Degrade the DNA c) Create positive charge on DNA d) Cut the DNA sample at various sites
Ans: a) Hybridise with DNA sample to form double stranded structure
4. In India DNA finger printing technique was developed by
a) Dr Lalji Singh b) Alec Jeffreys c) Dr Khorana d) None of the above
Ans: a) Dr Lalji Singh

3.Read the following passage and answer the questions given below:
The process of translation requires transfer of genetic information from a polymer of nucleotides to synthesise a polymer of amino acids. The relationship between the sequence of amino acids in a polypeptide and nucleotide sequence of DNA or mRNA is called genetic code. George Gamow suggested that in order to code for all the 20 amino acids, code should be made up of three nucleotides.
1. What is a codon?
a) A length of DNA which codes for a particular protein
b) A part of the tRNA molecule to which specific amino acid is attached
c) A part of the tRNA molecule which recognises the triplet code on the messenger RNA
d) A part of the messenger RNA molecule that has sequence of bases coding for an amino acid
Ans: d)
2. Three consecutive bases in the DNA molecule provide the code for each amino acid in a protein molecule. What is the maximum number of different triplet that could occur?
a) 16 b) 20 c) 24 d) 64
Ans: d)
3. Identify the stop codon among the following
a) UCG b) AUG c) UAA d) UGG
Ans: c)
4. Listed below are some amino acids and their corresponding mRNA triplets. Phenyl alanine-UUU, Lysine-AAG, Arginine-CGA,
Alanine-GCA . Which DNA sequence would be needed to produce
the following polypeptide sequence? Alanine-Arginine-Lysine-Phenyl
alanine
a) CGT GCT TTC AAA b) CGT GCT TTC TTT
c) CGU GCU UUC AAA d) CGU GCU UUC TTT
Ans: d)
5. A polypeptide is made using synthetic mRNA molecules as shown.
Synthetic mRNA used is UUUAAAUUUAAA. The polypeptide
produced is Phenyl alanine-lysine-phenyl alanine-lysine. What are the
DNA segment codes for amino acids phenyl alanine and lysine?
a) Phenyl alanine -AAA , Lysine-UUU b) Phenyl alanine-AAA , Lysine- TTT
c) Phenyl alanine- GGG , Lysine- CCC d) Phenyl alanine- TTT , Lysine- GGG
Ans: b)

PREVIOUS YEAR CBSE QUESTIONS

ONE MARK QUESTIONS

1.Name the enzyme involved in the continuous replication of DNA strand. Mention the polarity of the template strand.

Ans – DNA polymerase is involved in continuous replication of DNA strand. The polarity of .′5→′template strand is 3

2. Mention the contribution of genetic maps in human genome project.

Ans – Sequencing of genes, DNA fingerprinting, tracing human history, chromosomal location for disease associated sequences

3. Explain the two factors responsible for conferring stability to double helix structure of DNA.
Ans – Factors responsible for conferring stability to double helix structure are presence of hydrogen-bonds, the plane of one base pair stacks over the other, complementarily presence of thymine in place of uracil.

4. What is a cistron ?
Ans **–** A segment of DNA , Coding for a polypeptide

5. Name the stage in the cell cycle where DNA replication occurs
Ans: S phase / synthetic phase (of interphase)

6.Why is DNA replication said to be semiconservative?

Ans: During DNA replication in the two newly synthesised daughter DNA one strand is parental (conserved) and the other is newly synthesized.

7.Write the dual purpose served by Deoxyribonucleoside triphosphates in polymerisation.
Ans - Acts as a substrate , provide energy (from the terminal two phosphates)

TWO MARK QUESTIONS

1.Mention the role of ribosomes in peptide-bond formation. How does ATP facilitate it?

Ans - There are two sites in the large subunit of the ribosome, for subsequent amino acids to bind to and thus, be close enough to each other for the formation of a peptide bond. The ribosome also acts as a catalyst for the formation of peptide bond 23S rRNA in bacteria is a ribozyme. Amino acids become activated by binding with its aminoacyl–tRNAsynthetase in the presence of ATP.

2. How are the structural genes activated in the lac operon in E. coli?
Ans – Lactose acts as the inducer that binds with repressor protein and frees the operator gene. RNA polymerase freely moves over the structural genes, transcribing lac mRNA, which in turn produces the enzymes responsible for the digestion of lactose.

3. Explain the significance of satellite DNA in DNA fingerprinting technique.
Ans – (i) They do not code for any proteins ,
(ii) They form large part of the human genome ,
(iii) They show high degree of polymorphism / Specific to each individual.

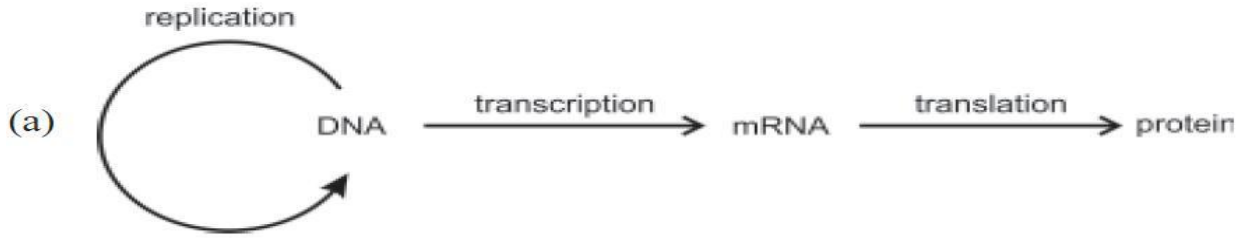
4. (a) List the two methodologies which were involved in human genome project. Mention how they were used.

(b) Expand 'YAC' and mention what was it used for.
Ans – **(a)** Expressed Sequence Tags **,**Identifying all the genes that are expressed as RNA. Sequence Annotation **,**sequencing the whole set of genome coding or non coding sequences and later assigning different region with functions.
(b) Yeast Artificial Chromosome , used as cloning vectors (cloning / amplification)

5. (a) Expand VNTR and describe its role in DNA fingerprinting.
(b) List any two applications of DNA fingerprinting technique.
Ans – **(a)** VNTR - Variable Number of Tandem Repeat(s) - used as a probe (because of its high degree of polymorphism)
(b) Forensic science / criminal investigation (any point related to forensic science) / determine population and genetic diversities / paternity testing / maternity testing / study of evolutionary biology (Any two)

6. Name the types of cells and the process by which hnRNA is fromed. Describe the processing mechanism it undergoes before it becomes functional.
Ans – Cells are eukaryotic and Process is called as Translation.
-• hnRNA undergoes **capping** at 5' end (methyl guanosine triphosphate) and **tailing** at 3' end (with poly A tail)
• Further **Splicing** is carried out , where the non- coding sequences called introns are removed, and coding sequences called exons are joined together in a defined manner.

7. State the 'Central dogma' as proposed by Francis Crick. Are there any exceptions to it ? Support your answer with a reason and an example



Yes , in some viruses flow of information is in reverse direction / reverse transcription. e.g. Any Retrovirus / HIV

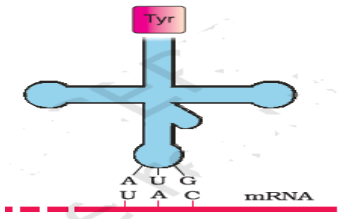
THREE MARK QUESTIONS

1)(i) Name the enzyme that catalyses the transcription of hnRNA. (ii) Why does the hnRNA need to undergo changes? List the changes that hnRNA undergoes and where in the cell such changes take place.

Ans – (i) RNA polymerase II. (ii) hnRNA has non-functional introns in between the functional exons. To remove these, it undergoes changes. The changes that hnRNA undergoes include capping, i.e., methyl guanosine triphosphate is added to 5′ end; tailing in which poly A tail is added at 3′ end; and splicing by which introns are removed and exons are joined.

2.(a) Name the scientist who called tRNA an adaptor molecule. (b) Draw a clover leaf structure of tRNA showing the following: (i) Tyrosine attached to its amino acid site. (ii) Anticodon for this amino acid in its correct site (codon for tyrosine is UAC). (c) What does the actual structure of tRNA look like?

Ans – (a) Francis Crick (b)



(c) The actual structure of tRNA looks like inverted L

3. Answer the following questions based on Meselson and Stahl's experiment (a) Write the name of the chemical substance used as a source of nitrogen in the experiment by them. (b) Why did the scientists synthesise the light and the heavy DNA molecules in the organism used in the experiment? (c) How did the scientists make it possible to distinguish the heavy DNA molecule from the light DNA molecule? Explain. (d) Write the conclusion the scientists arrived at after completing the experiment.

Ans – (a) Ammonium chloride (NH4Cl). (b) To check if DNA replication was semi-conservative. (c) The heavy and light DNA molecules were distinguished by centrifugation in a cesium chloride density gradient. (d) The scientists concluded that DNA replicates semi-conservatively

4. In a maternity clinic, for some reasons the authorities are not able to hand over the two newborns to their respective real parents. Name and describe the technique that you would suggest to sort out the matter.
Ans – The technique is DNA fingerprinting. It includes the following steps:
(*i*) DNA is isolated and extracted from the cell or tissue by centrifugation.
(*ii*) DNA is digested into small fragments with restriction endonucleases.
(*iii*) DNA fragments are separated by agarose gel electrophoresis and Southern blotting.
(*iv*) Labelled VNTR probes are now added for hybridisation.
(*v*) The hybridised DNA fragments are detected by autoradiography.

5. (a) Write the specific features of the genetic code AUG.
(b) Genetic codes can be universal and degenerate. Write about them, giving one example of each.
(c) Explain aminoacylation of the tRNA.
Ans – (*a*) AUG is the starting codon and codes for methionine.
(*b*) The genetic code is universal, *i.e.*, a particular codon codes for the same amino acid in all organisms. For example, UUU codes for phenylalanine in all organisms. Some amino acids are coded by more than one codon, hence the code is degenerate. For example, UUU and UUC both code for phenylalanine.
(*c*) Amino acids become activated by binding with aminoacyl *t*RNAsynthetase enzyme in the presence of ATP. These activated amino acids are then linked to their cognate tRNA to form aminoacylated*t-RNA*

6.Use of heavy isotope of nitrogen by Meselson and Stahl demonstrated semiconservative mode of replication of a DNA molecule." Explain how did they arrive at this conclusion. Ans – Grown E.coli in 15NH4Cl for many generations to get 15N incorporated into DNA , then the cells are transferred into 14NH4Cl , The extracted DNA are centrifuged in CsCl and measured to get their densities , DNA extracted from the culture after one generation (20 minutes) , showed intermediate hybrid density , DNA extracted after two generations (40 minutes) showed light DNA and hybrid DNA.

FIVE MARK QUESTIONS

1.In a series of experiments with Streptococcus and mice F. Griffith concluded that Rstrain bacteria had been transformed. Explain.

Ans – F. Griffith (1928), conducted an experiment with Streptococcus pneumoniae (bacterium causing pneumonia). He observed two strains of this bacterium, one forming a smooth shiny colony (S-type) with capsule, while other forming rough colonies (R-type) without capsule. When live S-type cells were injected into the mice, mice died due to pneumonia. When live R-type cells were injected into the mice, mice survived. When heat killed S-type cells were injected into the mice, mice survived and there was no symptoms of pnuemonia. When heat killed S-type cell were mixed with live R-type cells and injected into the mice, the mice died due to unexpected symptoms of pneumonia. He concluded that heat killed S-type bacteria caused a transformation of the R-type bacteria into S-type bacteria.

2.How did Alfred Hershey and Martha Chase arrive at the conclusion that DNA is the genetic material?

Ans – Hershey and Chase conducted their experiment on bacteriophage and proved that DNA is the genetic material. (i) They grew some bacteriophage virus on a medium that contained radioactive phosphorus (P32) and some in another medium with radioactive sulphur (S35) respectively. (ii) Viruses grown in the presence of radioactive phosphorus (P32) contained radioactive DNA. (iii) Similar viruses grown in presence of radioactive sulphur (S35) contained radioactive protein. (iv) Both the radioactive viruses was allowed to infect E. coli separately. (v) Soon after infection the bacterial cells were gently agitated in blender to remove viral coats from the bacteria. (vi) The culture was also centrifuged to separate the viral particle from the bacterial cell. (vii) It was observed that only radioactive P32 was found associated with the bacterial cell and S 35 was only in the surrounding medium and not in the bacterial cell. (viii) The result clearly indicates that only DNA and not protein coat entered the bacterial cell and this proves that DNA is the genetic material that is passed from virus to bacteria and not protein.

5. Explain the process of transcription in prokaryotes. How is the process different in eukaryotes?

Ans – **Initiation** - DNA dependent RNA polymerase associates with the Initiation factor/□□□factor, and binds to the promotor site of DNA thus initiates transcription.

Elongation - The RNA polymerase using nucleoside triphosphates, polymerises in a template dependent fashion in 5' to 3' direction, following the rule of complimentarity.

Termination - at the terminator region the enzyme associates with the rho □□□□and both the enzymes and the newly formed/nascent RNA fall off from the DNA.

Difference-

(i) There are 3 different types of RNA polymerases in the nucleus of eukaryotes (polymerizing the three different types of RNA molecules) but only 1 in prokaryotes

(ii) Primary transcripts (hnRNA/precussor mRNA) undergoes splicing capping and tailing to give rise to functional RNA/mRNA (that moves out of the nucleus) this processing is absent in prokaryotes.

6. (a) Absence of lactose in the culture medium affects the expression of a Lac-operon in *E. coli.* Why and how ? Explain.

(b) Write any two ways in which the gene expression is regulated in eukaryotes.

Ans – **(a)** • Lactose acts as inducer thus absence of lactose switches off the operon

• Repressor protein produced by regulatory gene (i-gene) is free (in the absence of inducer) ,

• Repressor protein binds with the operator gene (o-gene) ,

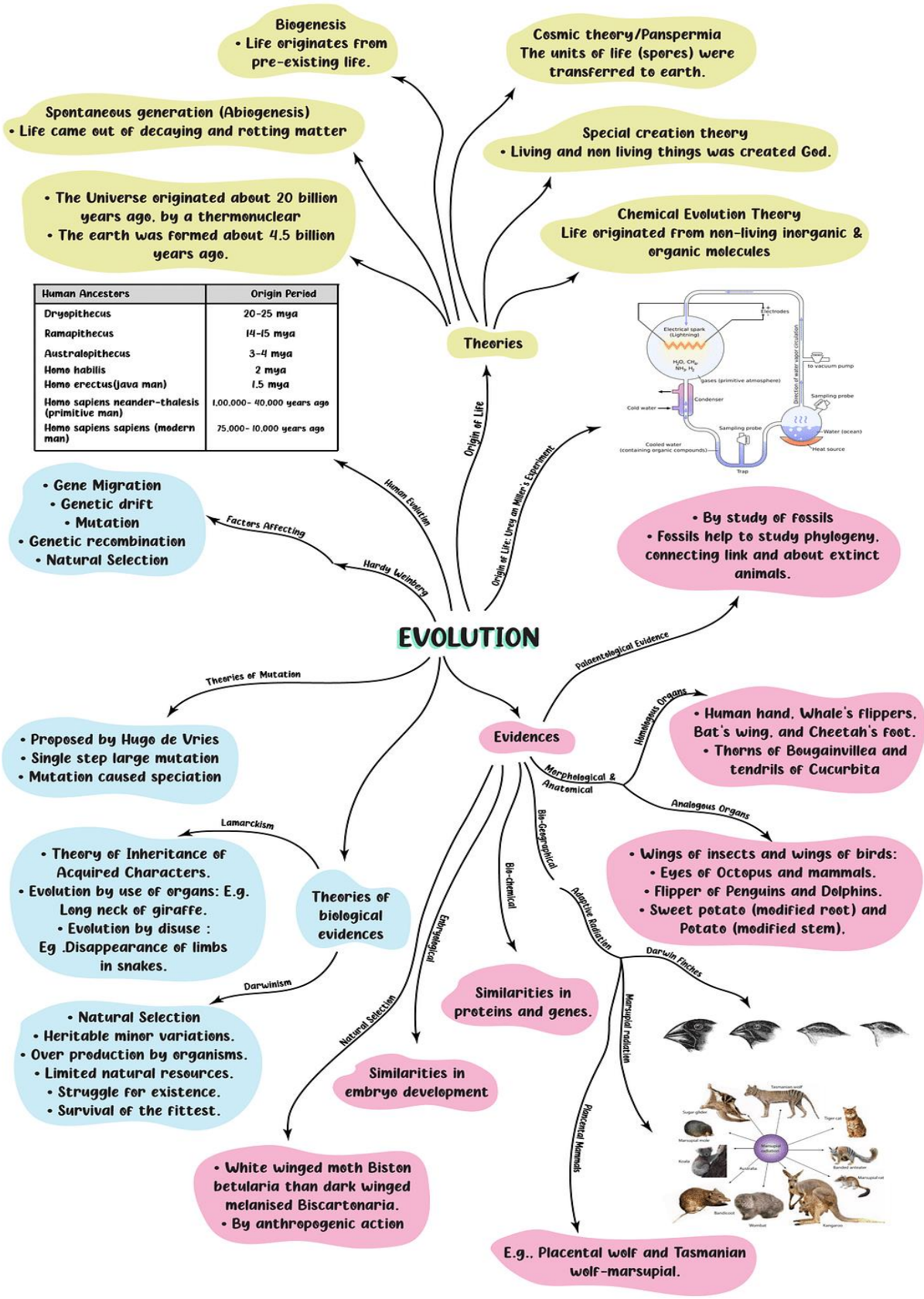
• Preventing RNA polymerase to transcribe the structural gene and operon is switched off

(b) • Transcriptional level (formation of primary transcripts)

• Processing level (regulation of splicing)
• Transport of messengar RNA from nucleus to the cytoplasm
• Translational level

CHAPTER 7 EVOLUTION

(I). MIND MAP



(II). GIST OF THE LESSON

ORIGIN OF LIFE (Big Bang Theory)

The single huge explosion resulted in the origin of the universe about 20 billion years ago. The earth was formed about 4.5 billion years ago. There was no atmosphere on early earth. Water vapor, CH_4, CO_2& NH_3 released from molten mass covered the surface. The UV rays from the sun broke up water into Hydrogen and Oxygen and the lighter H_2 escaped. Oxygen is combined with ammonia and methane to form water, CO_2, etc. The ozone layer was formed. As it cooled, the water vapour fell as rain and form oceans. Life appeared four billion years back.

THEORIES OF ORIGIN OF LIFE

1.Theory of spontaneous generation (Abiogenesis)- It states that life came out of decaying and rotting matter like straw, mud, etc.

2.Theory of biogenesis -Proposed by Louis Pasteur. He demonstrated that life comes only from pre-existing life.

3.Theory of Panspermia- It states that the units of life (spores) were transferred to different planets including earth.

4.Theory of special creation- It states that living things were created by some supernatural power.

5.Theory of chemical evolution- Proposed by Oparin & Haldane. It states that the first form of life originated from non-living inorganic & organic molecules.

Harold Urey & Stanley Miller Experiment They experimentally proved the theory of chemical evolution. They created a condition like that of primitive earth (i.e. high temperature, volcanic storms, reducing atmosphere with CH_4, NH_3, H_2O, H_2, etc). When an electric discharge is produced in a closed flask containing CH_4, NH_3, H_2, and water vapor, at 800^0 C biomolecules (amino acids) like present-day were formed.

EVIDENCES FOR EVOLUTION

1.Fossils: Fossils are remnants of life forms found in rocks (earth crust). The study of fossils is known as Palaeontology. Fossils provide evidence for phylogeny (evolutionary history or race history). E.g., Horse evolution, Used to study the connecting link between two groups of organisms (E.g. Archaeopteryx), to study extinct animals (E.g. Dinosaurs), to study geological periods by analysing fossils in different sedimentary rock layers.

2.Morphological & Anatomical evidences

a. Homologous organs -These organs have similar structures and origins but different functions. The origin of homologous organs is due to Divergent evolution. Homology indicates common ancestry. The human hand, Whale's flippers Bat's wing & Cheetah's foot humerus, radius, ulna, carpals, metacarpals & phalanges Thorns of Bougainvillea and tendrils of Cucurbita.

b. Analogous organs- These organs have similar functions but different structures & origins. The origin of analogous organs is due to Convergent evolution. It is the evolution by which unrelated species become more similar to survive and adapt to similar environmental conditions. Wings of insects and birds Eyes of Octopus and mammals Flipper of Penguins and Dolphins. The trachea of insects and lungs of vertebratessweet potato & Potato

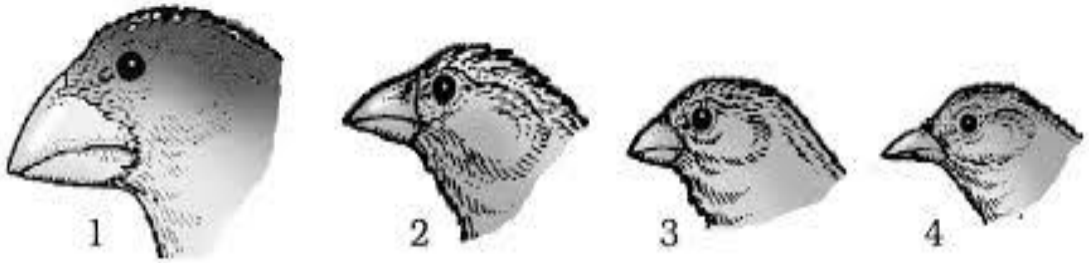
3. Embryological evidences

Proposed by Ernst Haeckel. He observed that all vertebrate embryos have some common features that are absent in adults. For E.g., all vertebrate embryos develop vestigial gill slits just behind the head. But it is functional only in fish and not found in other adult vertebrates.

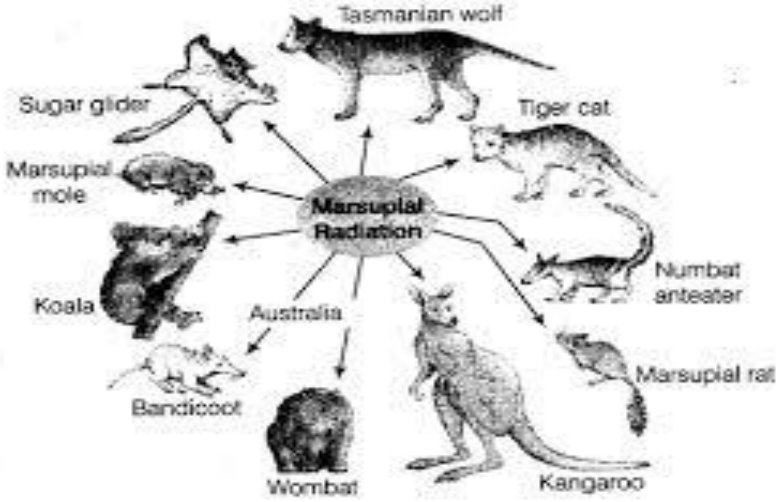
4. Biochemical evidence- Organisms show similarities in proteins, genes, other biomolecules & metabolism. It indicates common ancestry.

Adaptive radiation -This is the evolution of different species from an ancestor in a geographical area starting from a point. It is a type of divergent evolution. E.g., Darwin's finches in Galapagos Islands, Australian marsupials (Marsupial radiation), Placental mammals in Australia When more than one adaptive radiation appears in an isolated geographical area, it results in convergent evolution. E.g., Australian Marsupials and Placental mammals

Darwin Finches- He observed many varieties of finches on the same island. All varieties of finches had evolved from original seed-eating finches. here was alternation in beaks enabling some to become insectivorous and some vegetarian.



Variety of beaks of finches that Darwin found in Galapagos Island



Evolution by Natural Selection

In England, before industrialization, white bodied peppered moths were prevalent when compared to the black bodies ones due to better camouflage they had on clean trees. Once industrialization started, the trees accumulated soot from the pollution hence the white moths were clearly spotted against the dark background and were easily eaten by birds. Now, the black bodies moths got a survival advantage since they could not be easily spotted against dark backgrounds by birds and were not easily eaten by them. This made the black bodies moths to be naturally selected and they increased in numbers. This is a perfect example of natural selection put forth by Darwin.

Anthropogenic evolution-Excess use of pesticides, herbicides has resulted in selection of resistant varieties in a much lesser time scale.

Lamarckism (Theory of Inheritance of Acquired characters)

It is proposed by Lamarck. It states that the evolution of life forms occurred by the inheritance of acquired characters. Acquired characters are developed by the use & disuse of organs.

Evolution by use of organs – The long neck of a giraffe

Evolution by disuse- Disappearance of limbs in snakes

Darwinism (Theory of Natural selection)

- Proposed by Charles Darwin.
- It was based on observations during a sea voyage isailingsail ship called H.M.S. Beagle.
- Alfred Wallace (who worked in the Malay Archipelago) had also come to similar conclusions.
- Work of Thomas Malthus on populations influenced Darwin.
- Darwinism is based on 2 key concepts: Branching descent and Natural selection Natural selection is based on the following facts:
- Heritable minor variations
- Limited natural resources
- Struggle for existence
- Survival of the fittest

MUTATION

- Hugo de Vries proposed the Mutation Theory of evolution.
- He conducted experiments evening primrose

HARDY-WEINBERG PRINCIPLE

- It states that allele frequencies in a population are stable and are constant from generation to generation in the absence of disturbing factors.
- the allelic frequency in a population will remain constant from one generation to the next in the absence of disturbing factors. Hardy Weinberg equilibrium equation
- Sum total of all the allelic frequencies = 1

$p2 + 2pq + q2 = 1$

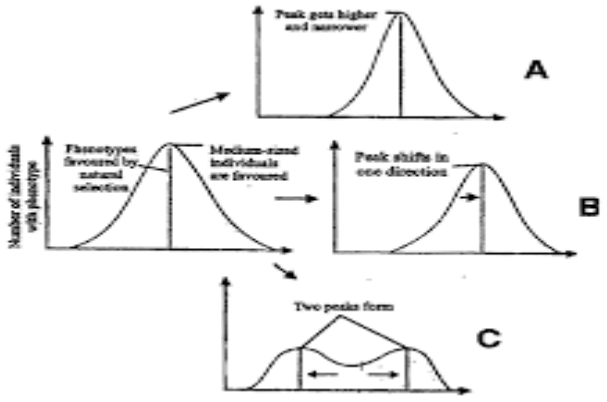
Factors affecting Hardy-Weinberg equilibrium - Gene migration, Genetic drift, Mutation, Genetic recombination, Natural selection.

Types of Natural selection:

A. Stabilizing selection- More individuals acquire mean character value.

B. Directional selection- Individuals of one extreme are more favoured.

C.Disruptive selection- It breaks a homogenous population into many different forms. Individuals of both extremes are more favoured.



ORIGIN AND EVOLUTION OF MAN

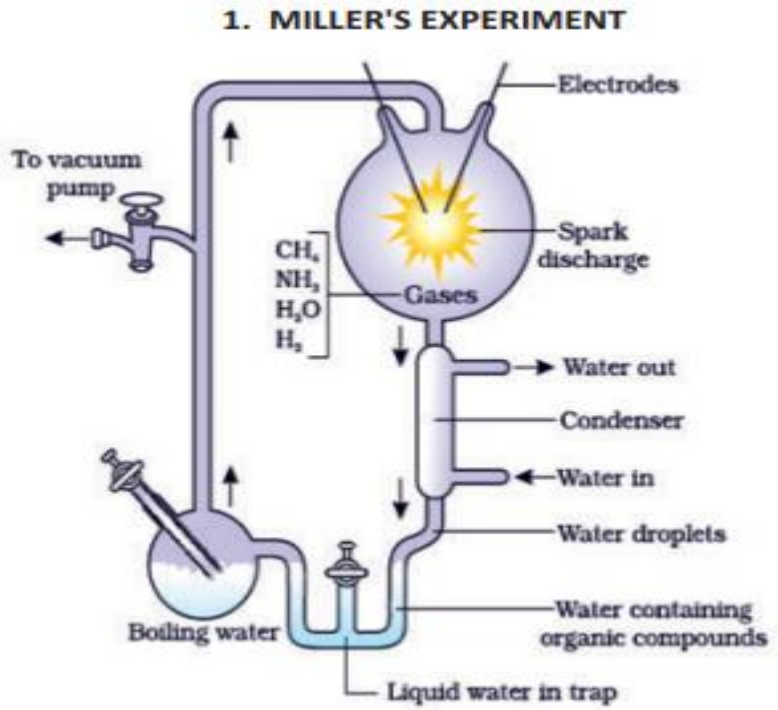
1. Dryopithecus and Ramapithecus- About 15 mya, primates called Dryopithecus and Ramapithecus were existing. They were hairy and walked like gorillas and chimpanzees. Ramapithecus was more man-like while Dryopithecus was more ape-like.

2.Australopithecines -About two mya Australopithecines probably lived in East African grasslands. They hunted with stone weapons, essentially ate the fruit.

3.Homo habilis- Brain capacities - 650-800cc. They probably did not eat meat.

4.Homo erectus -About 1.5 mya, Homo erectus arose. Brain capacity- 900cc. Homo erectus probably ate meat.
5.Neanderthal man- Brain size- 1400cc They used hides to protect their body and buried their dead. 6.**Homo sapiens**- or modern man Arose in Africa During the ice age between 75,000-10,000 years ago, Homo sapiens arose.
Pre-historic cave art developed about 18,000 years ago. Evidence -Bhimbetka rock shelter in Raisen district of Madhya Pradesh. Agriculture came around 10,000 years back and human settlements started.

(III). DIAGRAMS



(IV). COMPETENCY BASED QUESTIONS
MCQ

1.The theory of spontaneous generation stated that
(a) life arose from living forms only (b) life can arise from both living and non-living
(c) life can arise from non-living things only (d) life arises spontaneously, neither from living nor from the non-living.
Answer: (c) life can arise from non-living things only
2.Animal husbandry and plant breeding programmes are the examples of
(a) reverse evolution (b) artificial selection (c) mutation (d) natural selection.
Answer: (d) natural selection.
3.Palaentological evidences for evolution refer to the
(a) development of embryo (b) homologous organs (c) fossils (d) analogous organs.
Answer: (c) fossils
4.The bones of forelimbs of whale, bat, cheeah and man are similar in structure, because
(a) one organism has given rise to another (b) they share a common ancestor

(c) they perform the same function. (d) the have biochemical similarities.
Answer: (b) they share a common ancestor
5.Analogous organs arise due to
(a) divergent evolution (b) artificial selection (c) genetic drift (d) convergent evolution.
Answer: (d) convergent evolution.
6. $(p+q)^2 = p^2 + 2pq + q^2 = 1$ represents an equation used in
(a) population genetics (b) Mendelian genetics (c) biometrics (d) molecular genetics.
Answer: (a) population genetics
7.Appearance of antibiotic-resistant bacteria is an example of
(a) adaptive radiation (b) transduction (c) pre-existing variation in the population (d) divergent evolution.
Answer: (c) pre-existing variation in the population
8.Which type of selection is industrial melanism observed in moth, Bistonbetularia?
(a) Stabilising (b) Directional (c) Disruptive (d) Artificial
Answer: (b) Directional
9.Which of the following is an example for link species ?
(a) Lobe fish (b) Dodo bird (c) Seaweed (d) Chimpanzee
Answer: (a) Lobe fish
10.The earliest geological time period among the following is _____
(a) Cambrian (b) Permian (c) Jurassic (d) Quaternary
Answer. (a) Cambrian

ASSERTION & REASONING

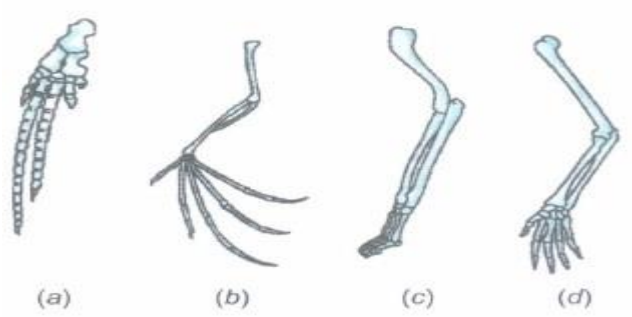
Directions: In the following questions, a statement of assertion is followed by a statement of reason.
Mark the correct choice as:
(a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
(c) If Assertion is true but Reason is false.
(d) If both Assertion and Reason are false.

1. **Assertion:** According to big-bang hypothesis about 20 billion years ago universe was a big ball of only neutrons.
Reason: Movement of these particles is known to generate tremendous heat which caused explosion due to temperature and pressure changes.
Answer: (a)
2.**Assertion:** Milky way is the galaxy in the universe.
Reason: Our Earth is part of milky way.
Answer: (d)
3**.Assertion**: Darwin's finches show a variety of beaks suited for eating large seeds, flying insects and cactus seeds.
Reason: Ancestral seed-eating stock of Darwin's finches radiated out from South America main land to different geographical areas of the Galapagos Islands, where they found competitor-free new habitats.
Answer: (a)
4.**Assertion**: Primitive atmosphere was of reducing type.
Reason: First hydrogen atoms combined with all oxygen.
Answer: (a)

5.**Assertion**: Evolution is not occurring at present.
Reason: Evolution is a very quick process.
Answer (d)

CASE BASED QUESTIONS

1.

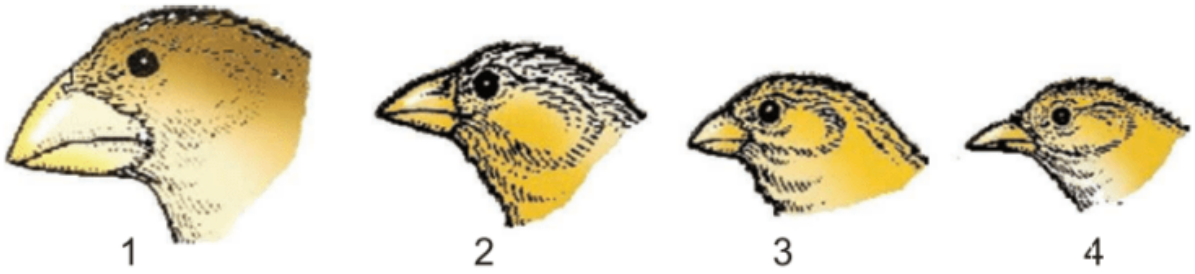


The forelimbs of four vertebrates are shown in the diagram shown above.
(a) What type of evolution is exhibited by the similarity among these organs in those organisms?
(b) What are such organs known as?
(c) What do they indicate?

Answer.

a. Divergent evolution
b. Homologous organs
c. Common anscestry

2. Darwin found the varieties of finches that in travelled to Galapagos Islands and observed variations in them.



(i) What role does an individual organism play as per Darwin's theory of natural selection?
(ii) How did Darwin explain the existence of different varieties of finches on Galapagos Islands?
(iii) What is "fitness of an individual" according to Darwin?
Answer
(i) An individual organism passes on the variations, mutations and adaptations from one generation to another.
(ii) Darwin explained it as the process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography (habitats), called adaptive radiation.
(iii) According to Darwin, "fitness of an individual" is the ability of an organism to survive and pass on its genes to future generations.

(V). PREVIOUS YEARS BOARD EXAM QUESTIONS

ONE-MARK QUESTIONS

1.State the two principal outcomes of the experiments conducted by Louis Pasteur on origin of life. (Delhi 2019)

Answer:

Louis Pasteur's experiments demonstrated that life comes only from pre-existing life. He showed that in swan-neck pre-sterilised flasks, life did not evolve from 'killed yeast' while in another flask open to air, new living organisms arose from 'killed yeast.'

2. State two postulates of Oparin and Haldane's theory with reference to the origin of life. (All India 2017)

Answer:

Oparin and Haldane proposed the following postulates with reference to origin of life.

The first form of life came from pre-existing non-living organic molecules.

The conditions on earth favouring chemical evolution were high temperature, volcanic storms and reducing atmosphere.

3. Name the type of evolution that has resulted in the development of structures like wings of butterfly and bird. What are such structures called? (Delhi 2014C)

Answer:

Convergent evolution has resulted in the development of structures like wings of butterfly and birds. Such structures are called analogous organs.

4. Write the hypothetical proposals put forth by Oparin and Haldane. (Foreign 2015)

Answer:

Oparin and Haldane proposed the theory of chemical evolution. According to them, life originated from pre-existing non-living organic molecules and the formation of life was preceded by chemical evolution.

5. Write the term used for resemblance of varieties of placental mammals to corresponding marsupials in Australia. (Delhi 2013C)

Answer:

Adaptive radiation occurring through parallel evolution results in the resemblance of placental mammals to marsupials in Australia.

6.Identify the examples of convergent evolution from the following

(i) Flippers of penguins and dolphins

(ii) Eyes of Octopus and mammals

(iii) Vertebrate brains (Delhi 2013)

Answer:

(i) and (ii) are the examples of analogous organs representing convergent evolution.

Vertebrate brains are the example of divergent evolution.

7. Identify the examples of homologous structures from the following

(i) Vertebrate hearts

(ii) Thorns in Bougainvillea and tendrils of Cucurbita.

(iii) Food storage organs in sweet potato and potato. (Delhi 2013)

Answer:

Homologous organs are derived through divergent evolution thus, indicating common ancestry.

8. State the significance of the study of fossils in evolution. (Delhi 2012)

Answer:

Fossils help us to know the morphological details of the organisms that were present in the past and relate them to the organisms of the present for better understanding the process of evolution. We can also trace the time at which the particular organism existed.

9. State the significance of biochemical similarities among diverse organisms in evolution. (Delhi 2012)

Answer:

Similarities in biochemicals such as DNA, help in deriving the line of evolution. Organisms with more similar DNA sequences are considered close relatives that might have evolved from the same ancestor.

10. Name the scientist who disproved spontaneous generation theory.

Answer:

Louis Pasteur

TWO MARK QUESTIONS

1.Divergent evolution leads to homologous structures. Explain with the help of an example. (All India 2011C)

Answer:

Divergent evolution is a process, where the same structure develops along different directions in different organisms due to adaptations to different needs. Divergent evolution leads to the development of homologous structures, as they all have similar anatomical structure and origin, but perform different functions.

(i) Explain adaptive radiation with the help of suitable example.

(ii) Cite an example where more than one adaptive radiation has occurred in an isolated geographical area.

2. Name the type of evolution your example depicts and state why is it so named? (All India 2014)

Answer:

(i) The process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas or habitat is called adaptive radiation, e.g. alterations in beaks of finches on Galapagos Islands.Tasmanian wolf (marsupial) and placental wolf (placental
mammals).

3.List the two main propositions of Oparin and Haldane. (All India 2013)

Answer:

Two main propositions of Oparin and Haldane were

The primitive atmosphere was reducing, i.e., free oxygen was absent.

There was high temperature, high methane, ammonia and hydrogen gas in the atmosphere.

4.Describe the experiment that helped Louis Pasteur to dismiss the theory of spontaneous generation of life. (Delhi 2016C)

Answer:

Theory of spontaneous generation states that the life originate;! from dead, decaying or rolling matters like storm, dead animals, etc.

Louis Pasteur rejected the theory of spontaneous generation and demonstrated that life had evoived from pre-existing life. In his experiment, he kept killed yeast cells in presterilised flask and in another flask open into air. The life did not evolved in the former, but new living organisms evolved in the another flask.

5.Write the probable differences in eating habits of Homo habilis and Homo erectus. (Foreign 2016)

Answer:

The probable differences in eating habit of Homo habilis and Homo erectus are as follows

Homo habilis They did not eat meat.

Homo erectus They probably ate meat.

THREE MARK QUESTIONS

1.State a reason for the increased population of dark coloured moths coinciding with the loss of lichens (on tree bark) during industrialisation period in England. (Delhi 2015)

Answer:

The increase in dark population of moths was due to industrial melanism.
After industrialisation, dark-winged moths became more than white-winged moths. This is because tree trunks covered by lichens became dark due to the air pollution during industrialisation. White-winged moths fail to camouflage and thus, decreased in number, whereas dark-winged moths were able to escape predation.

2.When does a species become founder to cause founder effect? (Foreign 2010).

Answer:

Founders effect occurs due to the change in allele frequency of a population. When the change in the allele frequency is very different in the new sample of population, so that they become a different species. The original drifted population becomes founder and the effect is called founder effect.

3.How would the gene flow or genetic drift affect the population in which either of them happen to take place ? (Delhi 2019)

Answer:

If gene flow or genetic drift takes place in a population, the effect would be
Gene flow/Gene migration Due to migration, new genes or alleles are added to the population and are lost from the old population thus, changing the frequencies of alleles in both populations. When migration occurs multiple times it is termed as gene flow.
Genetic drift Changes occurring in allele frequencies by chance is called genetic drift. Due to changes in allele frequency in new population, some different species are formed. This is called founder effect and the original population is called founder.

4.With the help of an algebraic equation, how did Hardy-Weinberg explain that in a given population the frequency of occurrence of alleles of a gene is supposed to remain the same through generations? (2018)

Answer:

Hardy-Weinberg's principle states that allele frequencies in a population are stable. They remain constant from generation to generation. The gene pool also remains constant. This is called genetic equilibrium.
Thus, according to this principle, the sum total of all the allelic frequencies in a population is always 1. Suppose in a diploid individual, p and q represent the frequency of allele A and allele a, respectively. The probability that an allele A with a frequency of P appears on both the chromosomes of a diploid organism in the p^2. Similarly of aa is q^2, of Aa is 2pq. Hence, $p^2 + 2pq + q^2 = 1$. The difference measured in the expected values of frequencies, indicates the extent of evolutionary change.

5.Mention the evolutionary significance of the following organisms:
(i) Shrews
(ii) Lobefins
(iii) Homo habilis

Answer:

The evolutionary significance of the given organisms are as follows
(i) Shrews They are the first mammals. These were long tailed, insectivorous, squirrel-like organisms. They gave rise to primitive primates. For example, leones and tarsiers at the beginning of the Palaeocene era.
(ii) Lobefins They are the first amphibians. Modem day frogs and salamanders have evolved from them.

(iii) Homo habilis The first human-like primates who lived in Africa about 2 million years ago. They had brain capacity of 700 cc. They are also called as handy man as they were first and the most skilful tool makers.

(VI). COMPETITIVE EXAM QUESTIONS

1. **The force that initiates evolution is _____**

a) Variation b) Extinction c) Adaptation d) Mutation

Answer: a

2. **_____ is a vestigial organ**

a) Intestinal villi b. Papillae c.Vermiform appendix d. None of the above

Answer: c

3. **The experiment that simulated conditions thought to be present on the early earth**

a) Hershey–Chase experiment b) Miller–Urey experiment

c) Geiger–Marsden experiment d) Schiehallion experiment

Answer: b

4. **Example of a homologous organ**

a) The arm of a human, wing of a bird b) Wing of an insect, wing of a bird

c) Leg of a dog, leg of a spider d) None of the above
Answer: a

5. **Primordial soup is a set of hypothetical conditions on ancient earth first proposed by_____**

a. Dmitri Ivanovsky b. Alexander Oparin c. Dmitry Anuchin d. Nikolay Shasky

Answer: a

6. **Which condition can be explained by Lamarckism?**
   a. How giraffes got their long neck c. How humans lost their tail
   b. How humans became bipedal d. All of the above

Answer: a

7. **Observation of species on _____ heavily inspired Darwin's theory of evolution.**

a. Ilha da Quemada Grande b. Guatemala c. Faroe Islands d. Galapagos Islands

Answer: d

8. **_____ was considered as a missing link between reptiles and birds.**
   a. Archaeopteryx b. Pteranodon c. Avimimus d. Caudipteryx

Answer: a

9. **The oldest mineral discovered so far was _____, which dates back to 4.4 billion years.**
   a. Iron b.Zircon c. Cadmium d. Silicon

Answer: a

10. **Pigeon, platypus and panda are _____**
    a. Homeothermic b. Poikilothermic c. Hyperthermic d. None of the above

Answer: a

11. **The last common ancestor of humans is**
    a. Pan troglodytes b. Homo Neanderthal c. Lemuroidea d. Dromaeosaurus

Answer: b

12. **An example of convergent evolution is**

a. Wing of Hawkmoths, the wing of hawks

b. Teeth of domestic dog, teeth of a wolf

c. Wings of Geospiza magnirostris, wings of Geospiza fortis

d. None of the above

Answer: a

13. **On the Origin of Species was written by _____**

a) Charles Darwin b) Ludmila Kuprianova c) Mikhail A. Fedonkin d) None of the above

Answer: a

14. **When did dinosaurs die off?**

a) 105.1 million years ago b. 65.5 million years ago c. 75.5 million years ago.

d) None of the above

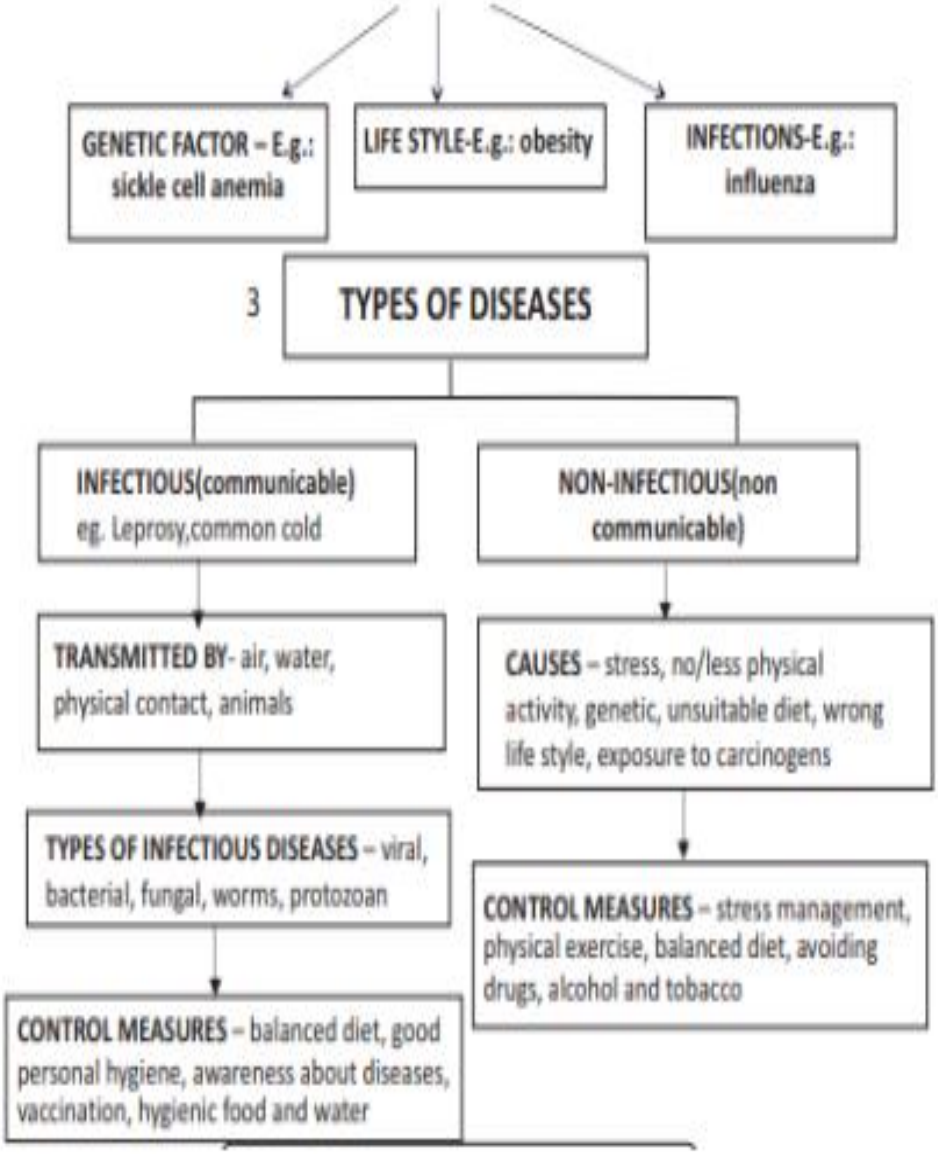
Answer: a

Assertion: Organic compounds first evolved in earth required for origin of life were protein and nucleic acid.
Reason: All life forms were in water environment only. [AIIMS 2016]
Answer: (b) Organic compounds that first evolved in earth which required for origin of life were protein and nucleic acid. All life forms were in aquatic environment only.
Assertion: The earliest organisms that appeared on the earth were non-green and presumably anaerobes.
Reason: The first autotrophic organisms were the chemoautotrophs that never released oxygen. [AIIMS 2006]
Answer: (b)

HUMAN HEALTH AND DISEASES

1 HEALTH (Physical, mental, social well being)

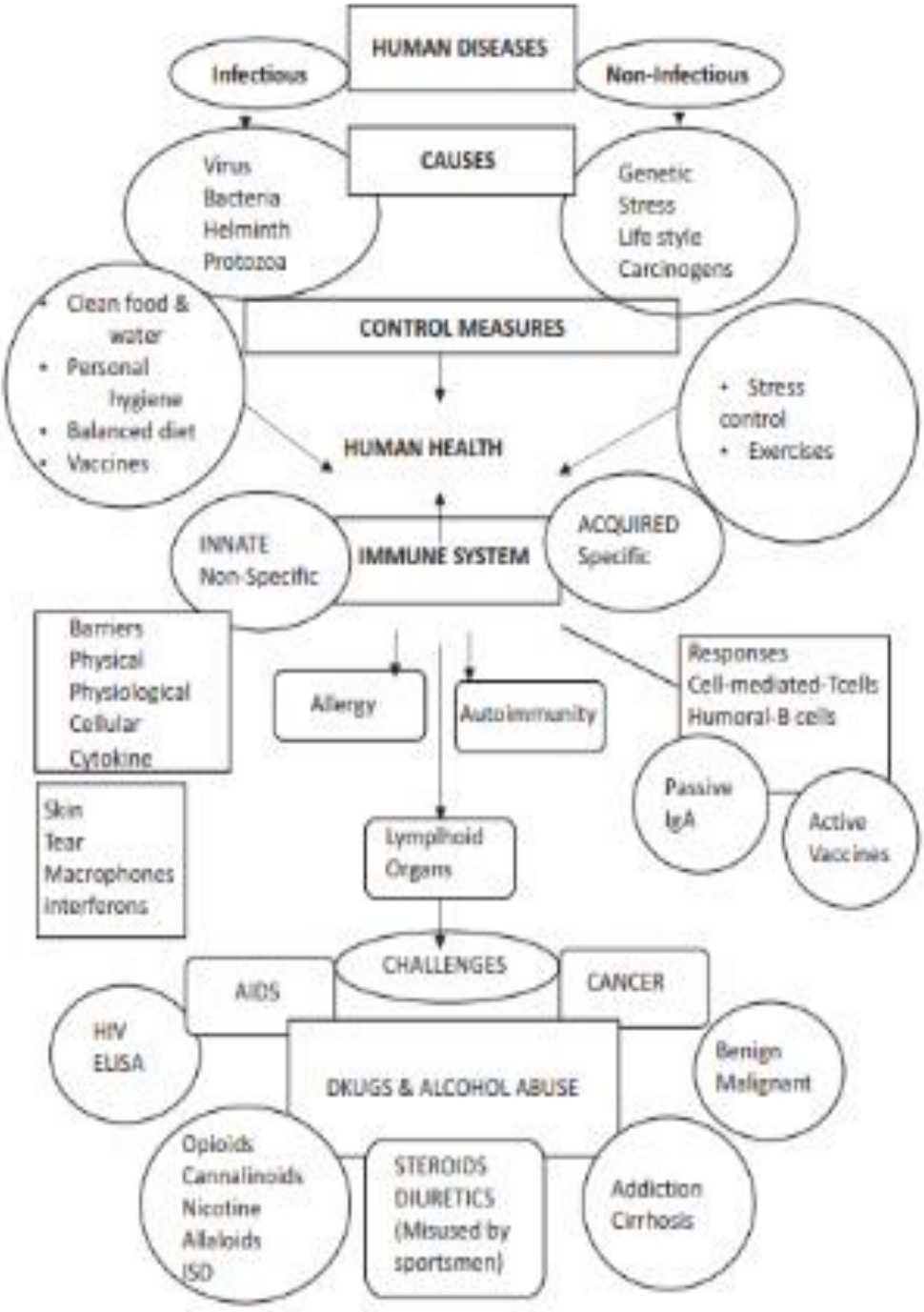
2. FACTORS AFFECTING HEALTH



CHAPTER 8

HUMAN HEALTH AND DISEASES

(CONCEPT MAP)



IMPORTANT POINTS OF THE LESSON

The state of complete physical, mental and social well beings is called health. Health simply does not means disease-free condition or physical fitness. Health is affected by-
a. Genetic disorders – the defect which child inherits from it parents.
b. Infection from microbes or other organisms.
c. Lifestyle- includes food and water we take, exercise and rest.

Good health can be maintained by

- Balanced diet.
- Personal hygiene
- Regular exercise
- Awareness about the disease and their effect
- Immunization against the infectious disease
- Proper disposal of wastage
- Control of vectors
- Maintenance of hygienic food and water

Disease – Diseases can be broadly grouped into infectious and non-infectious.

a) Infectious disease -Diseases which are easily transmitted from one person to another, are called infectious diseases e.g AIDS, common cold, malaria, tuberculosis etc

b) Non-infectious disease – Diseases which cannot transmitted from one person to another, are called non- infectious diseases e.g cancer, hypertension, diabetes etc.

Common Diseases in Humans:

- The disease-causing microorganisms like bacteria, virus, fungus, protozoa, helminthes are called pathogen.
- The pathogen can enter the body by various means and multiply and interfere with normal vital activities resulting in morphological and functional damage.

Name of disease /test	**Causal organisms**	**Symptoms**	**Effects**
Typhoid / Widal test	Salmonella typhi	Sustained high fever, weakness, stomach pain,	Intestinal perforations and death may occur in severe cases
Pneumonia	Streptococcus pneumoniae and Haemophilus influenzae	Fever, chills, cough and headache.	Alveoli get filled with fluid leading to severe problems in respiration.

Common cold	Rhino viruses	Nasal congestion and discharge, sore throat, cough and headache.	Infect the nose and respiratory passage.
Malaria	Plasmodium (P. vivax, P. malaria and P. falciparum)	The chill and high fever recurring 3 to 4 days.	Parasite multiply within lever cells and then attack the RBCs.
Amoebiasis or Amoebic dysentery	Entamoeba histolytica	Constipation, abdominal pain, cramps, stool with mucous and blood clot.	Infect the large intestine.
Ascariasis	Ascaris (Helminthes)	Internal bleeding, muscular pain, fever, anemia etc.	Healthy person get infected through water, vegetable etc.
Elephantiasis or filariasis	Wuchereria (W. bancrofti and W. malayi)	Inflammation in the lower limb and genital organs.	Lymphatic vessels of lower limbs get blocked.
Ring worms	Microsporum, Trichophyton and Epidermophyton	Appearance of dry, scaly lesions on various part of body.	Infects the skin, nail and scalp.

Life cycle of plasmodium : Plasmodium enters the human body as small sporozoites through the bite of infected female anopheles mosquito and multiplies within the lever cells. Later attacks the RBCs resulting the rapture with release of toxic substance, haemozoin, which is responsible for high fever and chill recurring every three to four days.

Malarial parasite requires two hosts, human and anopheles mosquito to complete their life cycle. Female anopheles is vector of this disease to human beings.

Immunity – the ability of host cells to fight the disease causing microorganism due to immune system is called immunity. There are two types of immunity-

Innate immunity – non-specific types of defence presents at the time of birth and provide different kinds of barriers to the entry of foreign agents into the body. it consists of four types of barrier-

a. Physical barrier- skin, mucus coating of epithelium lining the respiratory, gastrointestinal and urogenital tract.

b. Physiological barrier- acid in stomach and saliva in mouth.

c. Cellular barrier- leucocytes, neutrophils, monocytes.

d. Cytokine barriers- virus infected cells secretes protein called interferon.

Acquired Immunity- pathogen specific defence characterised by memory. When our body encounters a pathogen first time produces a response called primary response of low intensity. Subsequent encounter by same pathogen produce highly intensified response called secondary response or anamnestic response due to memory of first encounter.

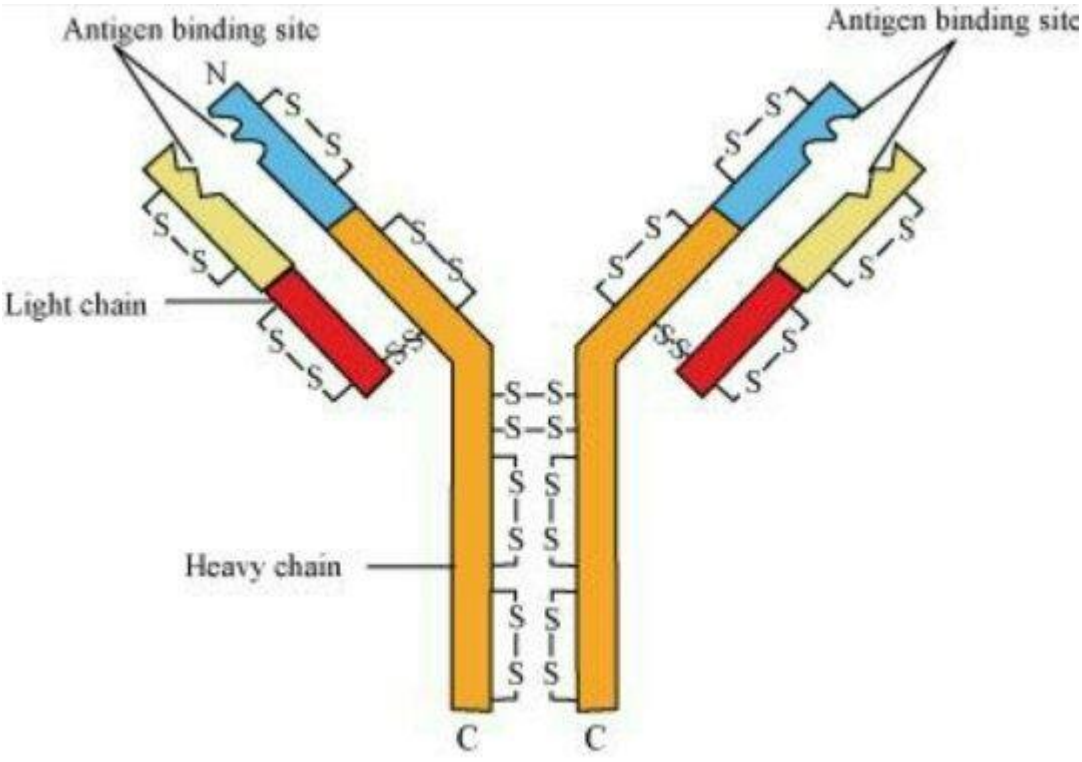
Primary and secondary responses are carried out with the help of B-lymphocytes and T-lymphocytes. B-lymphocytes produce army of protein called antibodies each having two light and two heavy chains.

It involves two types of lymphocytes –

- B lymphocytes: Show humoral immune response (HI)
- T lymphocytes: Show cell mediated immunity (CMI)

Structure of an Antibody:

- The antibodies are protein molecules called immunoglobulins and are of various types like IgA, IgM, IgE, IgG.
- Each antibody molecule consists of four polypeptide chains, two are long called heavy chains and other two are short called light chains. Both are arranged in the shape of 'Y', hence an antibody is represented as H2L2.



Structure of an antibody molecule

On the basis of production of antibodies, immunity can be further categorised as –

- Active immunity: Body produces its own antibodies against antigens
- Passive immunity: Readymade antibody is transferred from one individual to another
- Colostrum (contains antibodies IgA) is an example of passive immunity provided by the mother to her child.

Different types of antibodies produce in blood include IgA, IgM, IgEete. They are called humoral immune response due to presence in blood.

Human immune system can distinguish between self and foreign molecules or foreign bodies. Sometimes, due to genetic or unknown reasons, the body attack self-cells. This results in damage to the body and called auto-immune disease. Rheumatoid arthritis is due to this effect

Allergies – the exaggerated response of immune system to certain antigens present in the environment is called allergy. The substance to which such immune response is produced is called allergens. The antibodies produced due to these are IgE types. Allergy is due to secretion of chemicals like histamine and serotonin from the mast cells.

Immune system in the body- the human immune system includes lymphoid organs, tissue, cells and soluble molecules like antibodies.

Lymphoid organs are the organs where origin and maturation and proliferation of lymphocytes occur. Primary lymphoid organs include bone marrow and thymus.

After maturation lymphocytes migrate to secondary lymphoid organ like spleen, lymph nodes, tonsils, peyer's patches of small intestine and appendix. They provide the sites for interaction lymphocyte with antigens.

There is lymphoid tissue also located within the lining of respiratory, digestive and urogenital tract called mucosal associated lymphoid tissue (MALT). It constitute 50% of lymphoid tissues in human body.

How does vaccination help?

- Vaccines are nothing but inactivated pathogens.
- These inactivated pathogens when introduced in the body produce a primary immune response and antibodies are produced against the pathogen.
- Memory B and T-cells are produced.
- Now when the pathogen again attacks the person, memory B and T-cells generate a massive immune response and the pathogen is killed.

AIDS (Acquired Immuno Deficiency Syndrome) was first reported in 1981. It is caused by HIV (human Immuno deficiency virus), a retrovirus. Transmission of HIV virus occurs by-

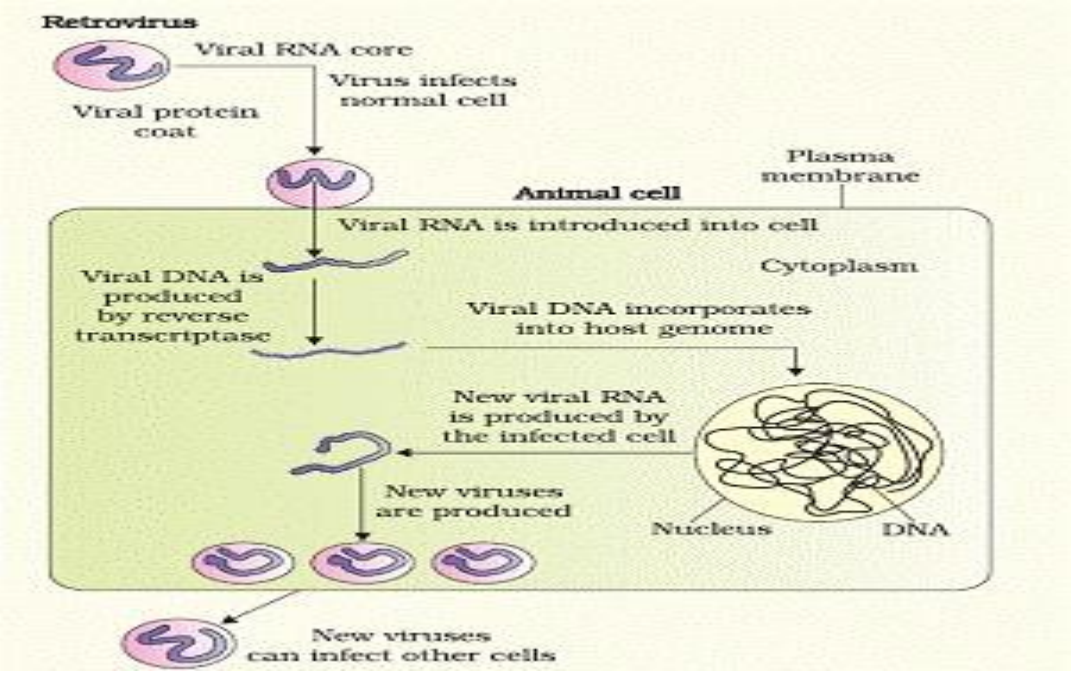
a. Sexual contact with infected person

b. Transfusion of contaminated blood and blood products

c. Sharing infected needles as in intravenous drug abusers

d. Infected mother to her child through placenta.

Replication of retrovirus in Macropahges.



AIDS/HIV does not spread by physical contact. It spread only through body fluids. There is always time lag between infection and appearance of symptoms that may vary from 5-10 years.

Diagnostic test for AIDS is ELISA (enzyme-linked Immuno-sorbent assay). The treatment of this disease with anti-retroviral drug is partially effective and just prolonged the life but not prevents the death.

CHIKUNGUNYA

Symptoms

- Most people infected with chikungunya virus will develop some symptoms.
- Symptoms usually begin 3–7 days after an infected mosquito bites you.
- The most common symptoms are fever and joint pain.
- Other symptoms may include headache, muscle pain, joint swelling, or rash.
- Death from chikungunya is rare.
- Most patients feel better within a week. However, joint pain can be severe and disabling and may persist for months.
- People at risk for more severe disease include newborns infected around the time of birth, older adults (≥65 years), and people with medical conditions such as high blood pressure, diabetes, or heart disease.

- Once a person has been infected, he or she is likely to be protected from future infections.

Diagnosis

- See your healthcare provider if you have visited an area where chikungunya is found and have symptoms described above. Tell your healthcare provider when and where you traveled.
- Your healthcare provider might order blood tests to look for chikungunya or other similar viruses like dengue and Zika.

Treatment

- There is currently no vaccine to prevent or medicine to treat chikungunya.
- Treat the symptoms:
    - Get plenty of rest.
    - Drink fluids to prevent dehydration.
    - Take medicine such as acetaminophen (Tylenol®) or paracetamol to reduce fever and pain.
    - Do not take aspirin and other non-steroidal anti-inflammatory drugs (NSAIDS) until dengue can be ruled out to reduce the risk of bleeding.
    - If you are taking medicine for another medical condition, talk to your healthcare provider before taking additional medication.
- If you have chikungunya, prevent mosquito bites for the first week of your illness.
    - During the first week of illness, chikungunya virus can be found in the blood. The virus can be passed from an infected person to a mosquito through mosquito bites.
    - An infected mosquito can then spread the virus to other people.

DENGUE

- Dengue is a viral infection transmitted to humans through the bite of infected mosquitoes. The primary vectors that transmit the disease are Aedes aegypti mosquitoes and, to a lesser extent, Ae. albopictus.
- The virus responsible for causing dengue, is called dengue virus (DENV). There are four DENV serotypes and it is possible to be infected four times.
- Severe dengue is a leading cause of serious illness and death in some Asian and Latin American countries. It requires management by medical professionals.
- There is no specific treatment for dengue/severe dengue. Early detection of disease progression associated with severe dengue, and access to proper medical care lowers fatality rates of severe dengue to below 1%.

- Dengue is found in tropical and sub-tropical climates worldwide, mostly in urban and semi-urban areas.
- The global incidence of dengue has grown dramatically with about half of the world's population now at risk. Although an estimated 100-400 million infections occur each year, over 80% are generally mild and asymptomatic.
- Dengue prevention and control depends on effective vector control measures. Sustained community involvement can improve vector control efforts substantially.
- While many DENV infections produce only mild illness, DENV can cause an acute flu-like illness. Occasionally this develops into a potentially lethal complication, called severe dengue.

Cancer is one of the most dreaded diseases of human beings and is a major cause of death all over the world. Normal cells show a property called contact inhibition by virtue of which contact with other cells inhibit their uncontrolled growth. Cancer cells lost this property.

Cancerous cells continue to divide giving rise to masses of cells called tumors. There are two kind so tumors-

(a) Benign tumors

(b) Malignant tumors

Causes of cancer – cancerous neoplastic cell may be induced by physical, chemical and biological agents called carcinogens. Cancer causing viruses called oncogenic virus have gene called viral oncogenes. Several genes called cellular oncogenes (c-onc) or proto oncogenes have been identified in normal cells which, when activated under certain conditions, could lead to oncogenic transformation of the cells.

Cancer detection and diagnosis-cancer detection is based on biopsy and histopathological study of the tissues, blood and bone marrow test for increased cell counts. Radiography, CT (computed tomography), MRI (magnetic resonance imaging) are very useful to cancers of internal organs.

Treatment of Cancer-

1. Surgical – cancerous tissues are surgically removed.
2. Radiotherapy – tumor cells are irradiated lethally by radiation.
3. Chemotherapy – drugs are used to kill cancerous cells, but shows side effects like hair loss, anemia, etc.
4. Immunotherapy – patients are given with alpha-interferon which activate their immune system and help in destroying the tumor

Drugs and Alcohol Abuse

Commonly abused drugs include opioids, cannabinoids and coca alkaloids obtained from flowering plants and a few from fungi.

Opioids are the drugs which bind to specific opioids receptors present in our central nervous system and gastrointestinal tract. Heroin commonly called smack is chemically diacetylmorphine which is a white, odourless, bitter crystalline compound. It is extracted from the latex of poppy plant (Papaversomniferum).Generally taken by snorting and injection, heroin is a depressant and slows down body functions.

Cannabinoids are a group of chemicals which interact with cannabinoid receptors present in the brain. Natural cannabinoids are obtained from the inflorescence of the plant cannabis sativa. They include marijuana, hashish, charas and gangja. They generally taken by inhalation and oral ingestion, these are known for their effects on cardiovascular system of the body.

Coca alkaloid or cocaine is obtained from coca plant Erythroxylum coca, native to South America. It interferes with the transport of the neuro-transmitter dopamine. Cocaine, commonly called coke or crack is usually snorted. It has a potent stimulating action on central nervous system, producing a sense of euphoria and increased energy.

Adolescence and Drug abuse

- Adolescence is the period during which the child becomes matured.
- It is between 12 – 18 years of age.

Causes of drug abuse –

- Curiosity
- Adventure
- Excitement
- Experimentation
- Stress or pressure to excel in examination

Effects of drug/alcohol abuse –

- Reckless behaviour
- Malicious mischief
- Violence
- Drop in academic performance
- Depression, isolation, aggressiveness, etc.

Dependence is the tendency of the body to manifest a characteristic and unpleasant withdrawal syndrome if regular dose of drug/alcohol is abruptly discontinued that includes anxiety, shakiness, nausea and sweating.

Prevention avoid undue peer pressure, education & counselling, seeking helps from parents and peers, seeking professional and medical help etc

Effects of Alcohol/ Drug Abuse

- Immediate effect − Vandalism, violence, and reckless behaviour
- Drop in academic performance, lack of interest in personal hygiene, rebellious behaviour, and change in eating and sleeping patterns, weight and appetite fluctuations
- Mental, psychological, and financial loss not only to the user, but also to his family
- Those who take drugs intravenously have a high risk of acquiring deadly diseases such as AIDS and hepatitis B.
- Damage to nervous system and liver (cirrhosis)
- Use of anabolic steroids by sportsperson have adverse effects:
    - In females − Increase of masculinity, aggressiveness, depression, abnormal menstrual cycle, facial hair growth, enlargement of clitoris, and deepening of voice
    - In males − Acne, aggressiveness, depression, reduction in size of testicles, decreased sperm production, enlargement of prostate gland, breast enlargement, premature baldness
- Ultimately, prolonged use of alcohol/drugs leads to coma and death.

Preventing Alcohol/ Drug Abuse

- It is better to prevent the inclination of an individual towards alcohol/ drugs right from adolescence. Some of the ways of prevention are:
    - Avoid peer pressure − Understand the unique personality and capabilities of a child
    - Education and counselling − A child must be taught to accept success and failure equally. Especially during adolescence, he must be inclined towards constructive activities such as music, yoga, sports, reading based on his interest.
    - Help from parents and peers − This includes proper guidance, advice, and trust to overcome problems such as stress and guilt.
    - Identifying danger signals − If any sign of symptom of alcohol / drug abuse is seen in the adolescent by family or friends, then it should not be ignored because prevention is better than cure.
- Seeking medical help − Psychologists and rehabilitation programs surely help an addict. Medical help should be sought to prevent further damage.

OBJECTIVE QUESTIONS

1. Immuno suppressants such as _____ prevent transplanted organs from being rejected in recipients.

(i) Thrombin (ii) Cyclosporine (iii) Aspirin (iv) None of the above

ANS: (ii)

2. Both B & T lymphocytes are produced in the bone marrow; however, only the T lymphocytes travel to the _____ and mature there.

(i) Spleen (ii) Thymus (iii) Pituitary gland (iv) Adrenal gland .

ANS: (ii)

3. The _____ is at its largest in children, but with the onset of puberty, it eventually shrinks and gets replaced by fat.

(i) Thymus (ii) Hypothalamus (iii) Parathyroid gland (iv) None of the above

ANS: (i)

4. Ascaris lumbricoides is a species of parasitic roundworm that lives in _____.

(i) Humans (ii) Grasshoppers (iii) Pigs (iv) None of the above

ANS: (i)

5. Which of the following diseases has been eradicated?

(i) Smallpox (ii) Rinderpest (iii) Polio (iv)All of the above

ANS: (iv)

ASSERTION AND REASON BASED MCQ

Directions: In the following questions, a statement of assertion is followed by a statement of reason.

Mark the correct choice as:

(a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

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

(d) If both Assertion and Reason are false.

Q.1. Assertion: Streptococcus pneumoniae and Haemophilus influenzae are responsible for causing infectious diseases in human beings.

Reason: A healthy person acquires the infection by inhailing the droplets/aerosols released by an infected person.

Ans: b

Q.2. Assertion : Paroxysms are regular and daily in Quotidian malaria.

Reason : Recurrence of fever is after 48 hours if the infection is caused by Plasmodium malariae.

Ans: d

Q.3. Assertion: There is no chance of malaria to a man on the bite of male Anopheles mosquito.

Reason: It carries a non-virulant strain of Plasmodium.

Ans: c

Q.4. Assertion : Plasmodium vivax is responsible for malaria.

Reason : Malaria is caused by polluted water.

Ans: b

5. Assertion : Escherichia coli, Shigella sp. and Salmonella sp. are all responsible for diarrhoeal diseases.

Reason : Dehydration is common to all types of diarrhoeal diseases and adequate supply of fluids and electrolytes should be ensured.

Ans: b

CASE STUDY BASED MCQ

Read the following and answer any four questions from (i) to (v) given below:

Priya was 4 years old when she contracted chicken pox. It took her around 15 days to recover completely. Now Priya is 5 years old so her mother got her vaccinated few days back for DPT (5th dose) as per immunisation program. Recently she was playing with her friend in the park when her friend accidently fell on iron pipe and badly bruised her knee. She was taken to the hospital where doctor gave her ATS injection and painkillers. Based on the above information, answer the following questions.

(i) Select the correct statement.

(a) Priya has developed natural active immunity against chicken pox.

(b) Priya has developed artificial active immunity against DPT.

(c) Priyas friend has developed artificial passive immunity against tetanus.

(d) All of these

Ans: d

(ii) Which of the following do you think is an example of natural passive immunity?

(a) Administration of AGS (anti gas gangrene serum) in a person

(b) Transfer of IgA antibodies from mother to baby through mother's milk

(c) A person recovered from viral infection (d) A child vaccinated for polio

Ans: b

(iii) Which of the following is true for active immunity?

(a) It provides immediate relief. (b) It is temporary, not long lasting.

(c) It has no side effects (d) None of these

Ans: c

(iv) Select the incorrect match.

(a) Passive immunity - IgG antibodies crossing placental barrier to reach fetus

(b) Active immunity - Vaccination against corona virus

(c) Active immunity - Administration of antidiphtheria serum in patient

(d) Passive immunity - Fetus having mother's milk

Ans: c

(v) Assertion: A person recovered from measles develops an active immunity against this infection.

Reason: In active immunity, person's own cells develop antibodies in response to infection.

(a) Both assertion and reason are true and reason is the correct explanation of assertion.

(b) Both assertion and reason are true but reason is not the correct explanation of assertion.

(c) Assertion is true but reason is false.

(d) Both assertion and reason are false.

Ans: c

ONE MARK QUESTIONS

1.Why is secondary immune response more intense than the primary immune response in humans?

Ans. Since, the secondary immune response is based on the memory of primary response,i.e. first encounter with antigen. The second generated immune response is more fast having higher affinity for antigen, and therefore more intense than primary immune response.

2.Name any two types of cells that act as 'cellular barriers' to provide innate immunity in humans.

Ans. Certain type of leucocytes (such as PMNL- neutrophils, monocytes) and natural killer cells are two types of cells that act as 'cellular barriers' to provide innate immunity in humans

3.Name the two intermediate hosts on which the human liver fluke depends to complete its life cycle so as to facilitate parasitisation of its primary host

Ans. The human liver fluke requires two intermediate hosts, i.e. freshwater snail and fish to complete their life cycle and facilitate parasitisation of its primary host

4.How does haemozoin affect the human body when released in blood during malarial infection?

Ans. The release of toxic haemozoin by the ruptured RBCs during malarial infection accounts for recurrence of high fever and chill every 3-4 days.

5.What is an autoimmune disease? Give an example.

Ans. The abnormal response of an immune system in which it fails to recognise 'self and 'non-self' and start destroying its own cells and molecules is called autoimmune disease. Rheumatoid is an example of autoimmune disease which destroys articular cartilage and fusing bones

SHORT ANSWER TYPE QUESTIONS (2 MARKS)

1.List the symptoms of ascariasis. How does a healthy person acquire this infection?
Ans. The symptoms of ascariasis, caused by roundworm include internal bleeding, muscular pain, fever, anaemia and blockage of intestinal passage A healthy person accquires this infection through consumption of water, vegetables or fruits contaminated with eggs of parasite Ascaris

2.Name an allergen and write the response of human body when exposed to it
Ans. The allergen can be pollen grains, spores or dust particles.
When the allergens are inhaled or enter body system, they stimulate body to produce IgE antibodies and trriger an anti-allergic reaction. The chemical such as histamine and serotonin are released from mast cells, in respons to allergen, thereby causing dilation of blood vessels. The other symptoms of allergy, i.e. sneezing, watery eyes, running nose, etc

3.How does a vaccine for a particular disease immunise the human body against that disease?
or
Why is a person with cuts and bruises following an accident administered tetanus antitoxin? Give reasons.
Ans. During vaccination for a particular disease, an antigen or antigenic protein or pathogen which is in inactive form is introduced into the body which induces mild immuneresponse. The vaccine generates antibodies that neutralises the toxin/pathogen and produces memory B or T-cells, which recognise the pathogen in the subsequent encounters and produce antibodies.
or
Tetanus is a disease caused by Mycobacterium tetani. A person with cuts and bruises following an accident is administered tetanus antitoxin because this toxin contains antibody against the pathogen. This inactivates the pathogen (called passive immunity).

4.A patient showed symptoms of sustained high fever, stomach pain and constipation, but no blood clot in stools. Name the disease and its pathogen. Write the diagnostic test for the disease. How does the disease get transmitted?
Ans. Typhoid is the disease that show symptoms, i.e. high fever, stomach pain and constipation.
Its causative agent is Salmonella typhi. Widal test is used for its diagnosis.Typhoid is transmitted through contaminated food and water

5.(i) Highlight the role of thymus as a lymphoid organs.
(ii) Name the cells that are released from the above mentioned gland. Mention how they help in immunity?
Ans.(i)Thymus is a primary lymphoid organ of the immune system. Maturation of lymphocytes occur in it. T-cells produced in the bone marrow get mature in thymus and are released from here.
(ii) T-cells are released from thymus, upon maturation. They themselves do not produce antibodies, but help B-cells to produce them. They are also responsible for Cell Mediated Immune (CMI) response.

SHORT ANSWER TYPE (II) 3 Marks Questions

1. Community service department of your school plans a visit to a slum near the school with an objective educate the slum dwellers with respect to health and hygiene.
(i)Why is there a need to organise such visits?
(ii)Write the steps you will highlight, as a member of this department, in your interactions with them to enable them to lead a healthy life.
Ans. (i) Slums are generally unauthorised and encroached colonies with no public facilities and organisation. Due to lack of education, cleanliness and other facilities and the poor living standard in terms of health, hygiene and nutrition such people are always at risk of acquiring infections. Therefore, there is a need to organise visits to slums so as to educate and crate awareness among them regarding the importance of hygiene.
(ii) The points to be highlighted while interacting with the slum people may be.

- Importance of cleanliness and hygiene of body as well as surroundings.
- Awareness and prevention of infectious diseases.
- Use of public facilities, i.e. toiletries.
- Consumption of properly cooked and hygienic food and water.
- Administration of vaccines to newborn children so as to prevent diseases.

2.(i) Name and explain going reason, the type of immunity provided to the newborn by the colostrum and vaccinations
(ii)Name the type of antibody a) present in colostrums b) produced in response to allergens in human body.

Ans.(i) The immunity provided to the newborn by colostrum and vaccinations is called passive immunity. This is because both in colostrum and vaccines the antibodies conferred are not produced by own body but are rather transferred passively to recipient's body. Such as IgA antibodies pass across the placenta or through milk (colostrum) to infants and provides passive immunity against infection.
(ii) The type of antibody present in a) colostrum is IgA. b) response to allergens in human body is IgE

3. (i)Name the causative organisms for the following diseases.
(a)Elephantiases (b)Ringworm (c)Amoebiasis
(ii) How can public hygiene help control such diseases?
Ans.(i)The causative agent or organism for following diseases are:

(a) Elephantiasis is caused by Wuchereria bancrofti and W. malayi. These affect lower limbs and genital organs.
(b) Ringworm is caused by Microsporum, Trychophyton and Epidermophyton. They affect the skin, nails and scalp.
(c) Entamoeba histolytica is a protozoan parasite in the large intestine of human, which causes amoebiasis (amoebic dysentery).
(ii) Maintenance of public hygiene such as:

- keeping body and surroundings clean.
- consumption of clean drinking water, fruits and vegetables, etc.
- regular cleaning and disinfection of tanks and other water reservoirs, etc.
- All the above measures help controlproper disposal of waste and excreta.the increase in vectors of infectious diseases and their breeding places. Thus, there would be reduced chances of transmission of infectious diseases.

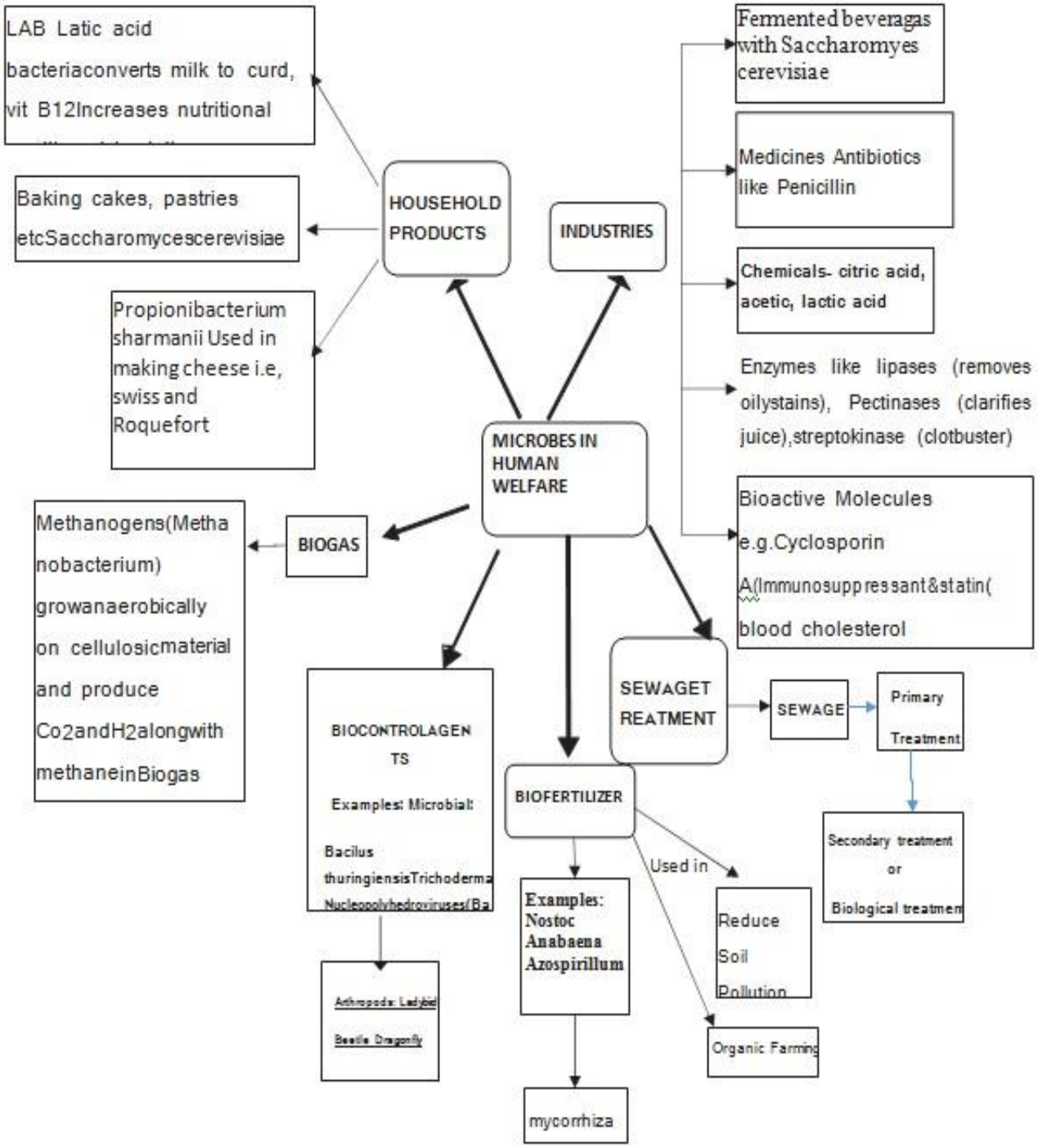
4.Trace the events occur in human body to cause immunodeficiency, when HIV gains entry into the body.
Ans. The HIV virus attacks the macrophages cells in human body.
(i) RNA is replicated to form viral DNA by the enzyme reverse transcriptase.
(ii) Viral DNA now gets incorporated into the host cell's DNA and directs the infected cells to produce viruses.
(iii) Macrophages continue to produce virus particles and function as HIV factories.
(iv) The virus particles enter helper T-lymphocytes in the blood, where they continue to replicate and produce viral progenies.
(v)The number of helper T-lymphocytes progressively decreases in the body of the infected person.
(vi) With the decrease in number of T-cells, the immunity also decreases. The person is unable to produce any immune response even against common bacteria like Mycobacterium, parasites like Toxoplasma, viruses and fungi.

LONG ANSWER QUESTIONS (5 Marks)

1.Explain the process of replication of a retrovirus after it gains ' entry into the human body.
Ans. The HIV virus attacks the macrophages cells in human body.
(i) RNA is replicated to form viral DNA by the enzyme reverse transcriptase.
(ii) Viral DNA now gets incorporated into the host cell's DNA and directs the infected cells to produce viruses.
(iii) Macrophages continue to produce virus particles and function as HIV factories.
(iv) The virus particles enter helper T-lymphocytes in the blood, where they continue to replicate and produce viral progenies.
(v)The number of helper T-lymphocytes progressively decreases in the body of the infected person.
(vi) With the decrease in number of T-cells, the immunity also decreases. The person is unable to produce any immune response even against common bacteria like Mycobacterium, parasites like Toxoplasma, viruses and fungi.

2.(i) Cancer is one of the most dreaded diseases. Explain 'contact inhibition' and 'metastasis' with respect to disease.
(ii)Name the group of genes that have been identified in normal cells that could lead to cancer. How do these genes cause cancer?
(iii)Name any two techniques that are useful in detecting cancers of internal organs.
(iv)Why are cancer patients are given a-interferon as part of the treatment?
Ans.(i)'Contact inhibition' is the property exhibited by normal cells. It prevents their uncontrolled proliferation when they are in contact with other neighbouring cells. But cancerous cells seem to have lost this property and continue to divide despite being in contact with other cells, which leads to masses of cells called tumours.'Metastasis' is the property exhibited by malignant tumours which grows rapidly, invades, neighbouring tissues and is capable of reaching distant sites through blood and lymph thus, spreading malignant tumours to other organs or parts of body.
These two properties make 'cancer' one of the dreaded diseases.
(ii) The group of genes called oncogenes or proto-oncogenes in normal cells could lead to cancer.
These genes are present in inactivated or suppressed form. Some factors, i.e. physical, chemical or biological called carcinogens are capable of activating these oncogenes and thus transforming normal cells into cancerous one.
The two techniques useful jn detecting cancers of internal organs, are CT (Computed Tomography) and MR1 (Magnetic Resonance Imaging).
(iv) As tumour cells are capable of avoiding recognition and destruction by immune system, the cancer patients are given a-interferons which are biological response modifiers. It helps activate the immune system and destroy tumours.

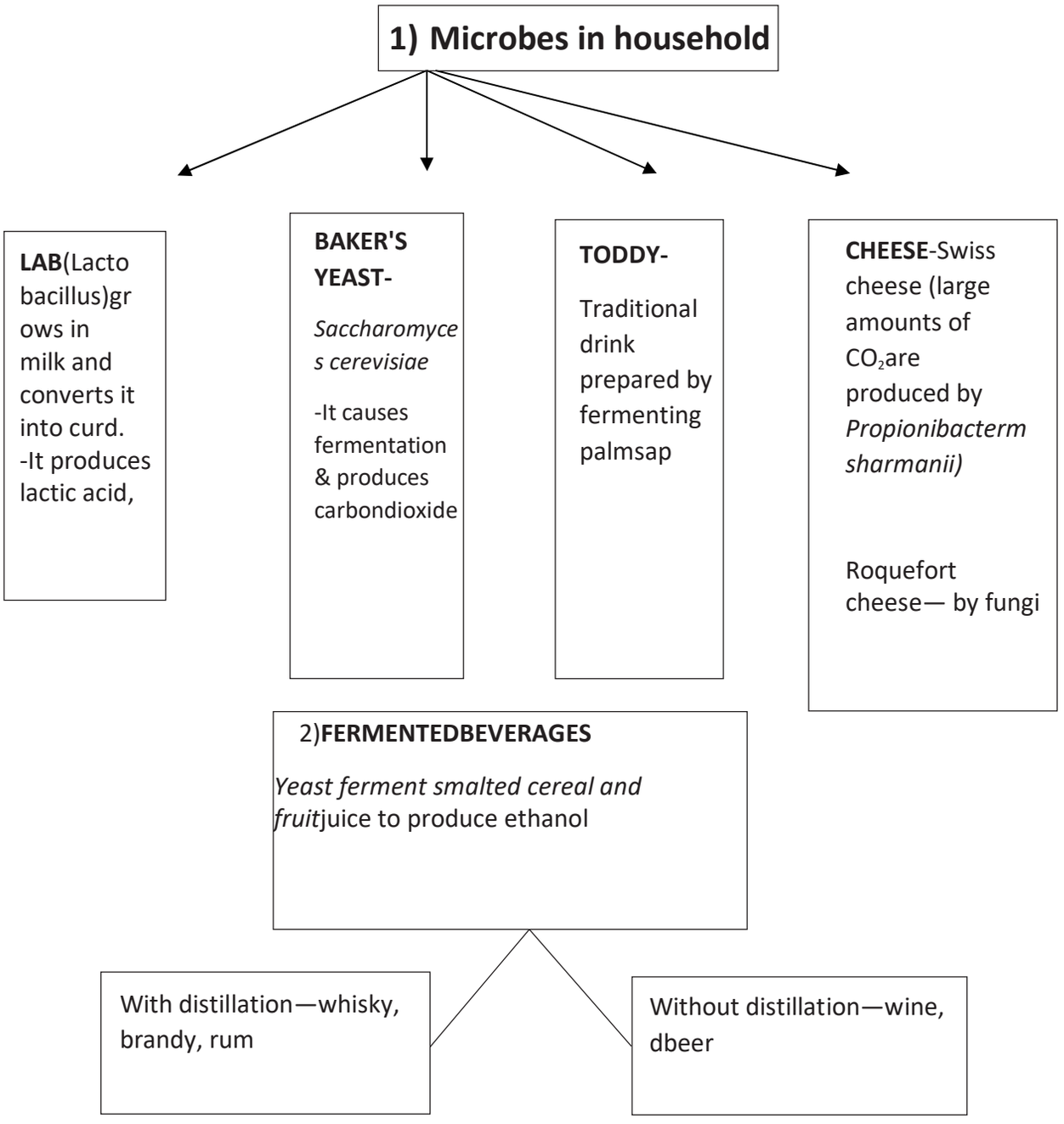
CHAPTER:10 MICROBESIN HUMANWELFAR
(CONCEPTMAP)



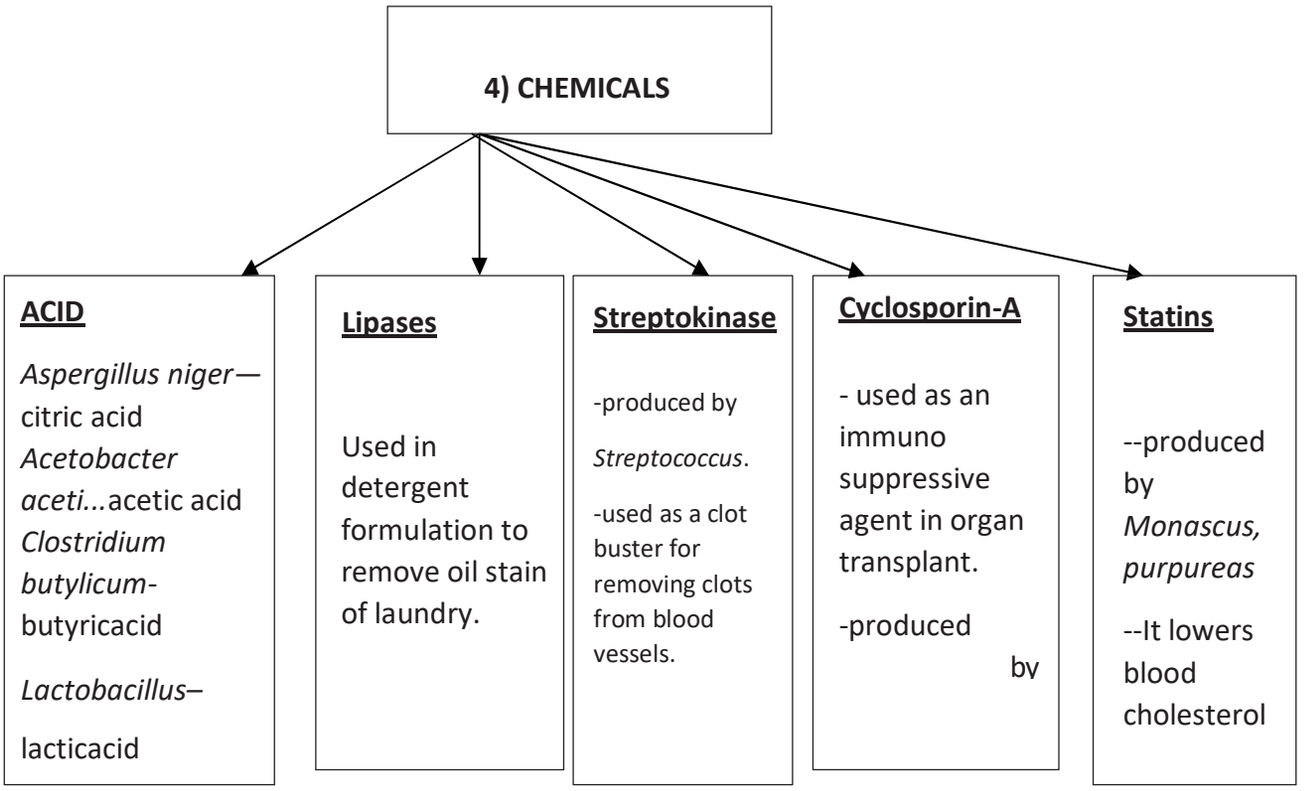
(KEYPOINTS)

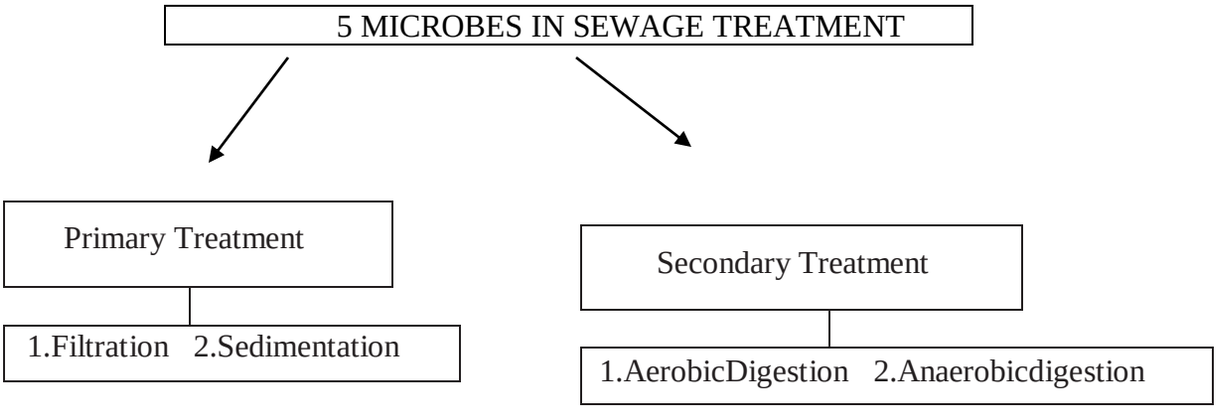
S.No.	Term	Explanation
1	BOD	Biochemical Oxygen Demand
2	GAP	Ganga Action Plan
3	YAP	Yamuna Action Plan
4	KVIC	Khadiand Village Industries Commission
5	LAB	Lactic Acid Bacteria
6	Baculo virus	Pathogens that attack insects and other arthropods
7	Effluent	The product of primary treatment of sewage.
8	Fermentors	A very large vessel where microbes are grown on an industrial scale.
9	Flocs	Mass of mesh like structure formed by Bacteria and fungi.
10	Prions.	The proteinaceous infectious agent.
11	Methanogens-	Bacteria producing methane.
12	STPs	Sewage Treatment Plants
13	IARI	Indian Agricultural Research Institute
14	IPM	Integrated Pest Management

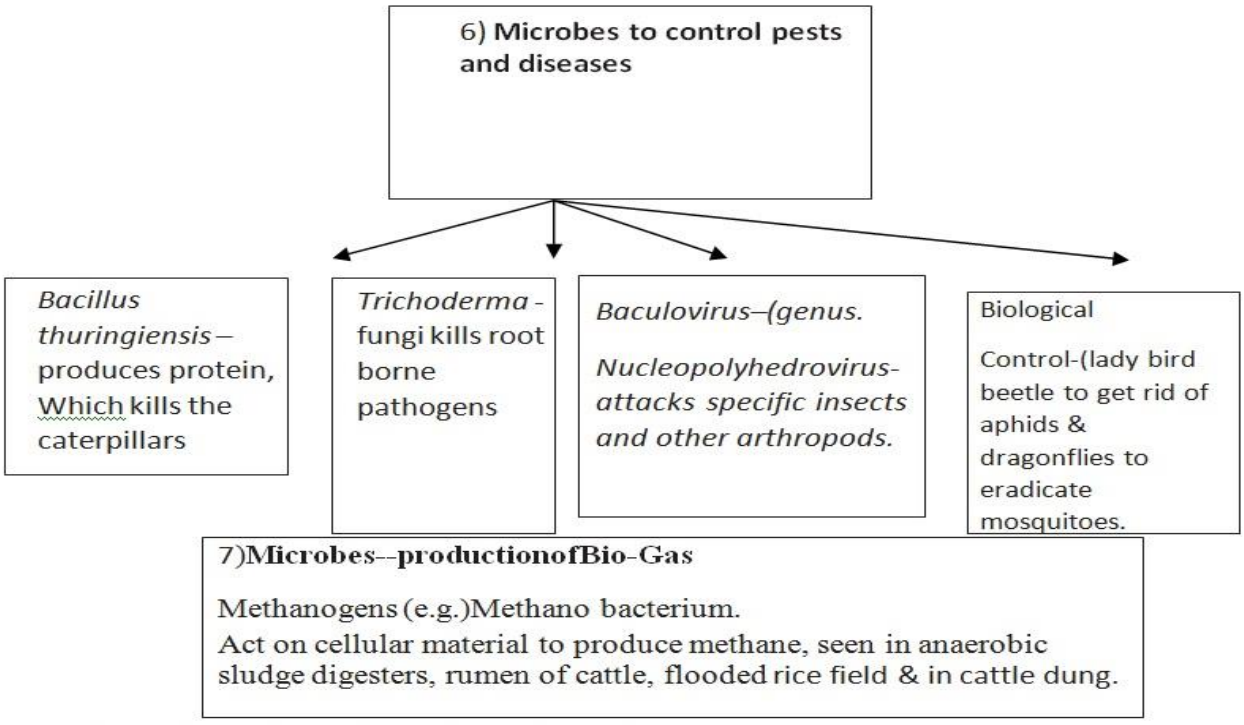
(FLOWCHART)

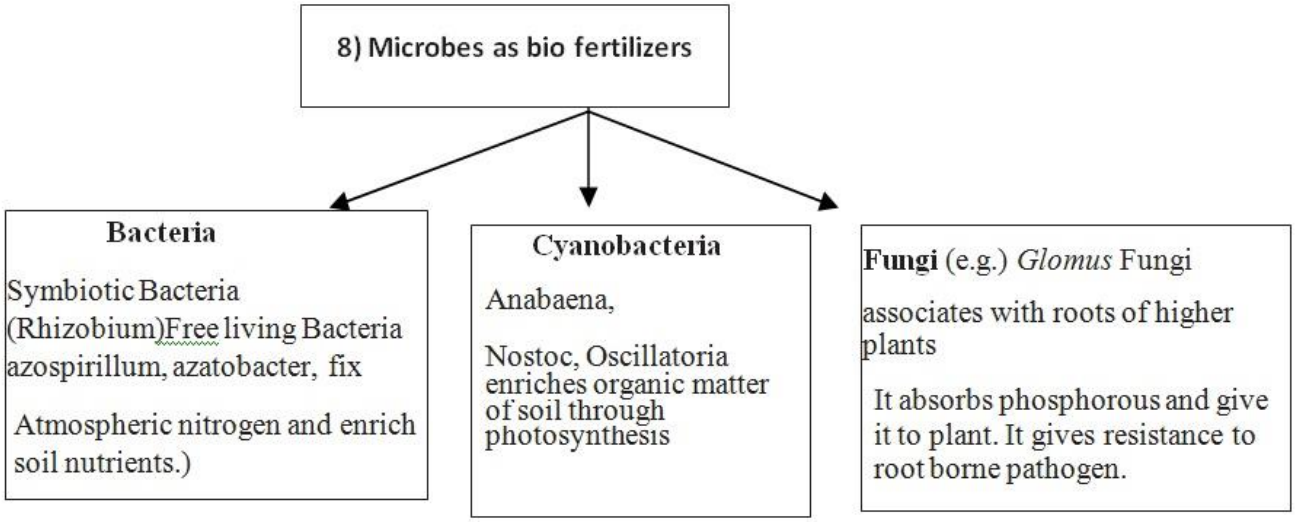

1) Microbes in household
LAB(Lacto bacillus)grows in milk and converts it into curd.
-It produces lactic acid,
BAKER'S YEAST-
Saccharomyces cerevisiae
-It causes fermentation & produces carbondioxide
TODDY-
Traditional drink prepared by fermenting palmsap
CHEESE-Swiss cheese (large amounts of $CO_2$are produced by Propionibacterm sharmanii)
Roquefort cheese— by fungi
2)FERMENTEDBEVERAGES
Yeast ferment smalted cereal and fruitjuice to produce ethanol
With distillation—whisky, brandy, rum
Without distillation—wine, dbeer

3) **ANTIBIOTICS (Penicillin -**It is produced by *Penicillium notatum)*






6) Microbes to control pests and diseases
Bacillus thuringiensis – produces protein, Which kills the caterpillars
Trichoderma - fungi kills root borne pathogens
Baculovirus–(genus. Nucleopolyhedrovirus- attacks specific insects and other arthropods.
Biological Control-(lady bird beetle to get rid of aphids & dragonflies to eradicate mosquitoes.
7)Microbes--productionofBio-Gas
Methanogens (e.g.)Methano bacterium.
Act on cellular material to produce methane, seen in anaerobic sludge digesters, rumen of cattle, flooded rice field & in cattle dung.


8) Microbes as bio fertilizers
Bacteria
Symbiotic Bacteria (Rhizobium)Free living Bacteria azospirillum, azatobacter, fix
Atmospheric nitrogen and enrich soil nutrients.)
Cyanobacteria
Anabaena,
Nostoc, Oscillatoria enriches organic matter of soil through photosynthesis
Fungi (e.g.) Glomus Fungi
associates with roots of higher plants
It absorbs phosphorous and give it to plant. It gives resistance to root borne pathogen.

COMPETENCY BASED QUESTIONS
Assertion and Reason type questions

In the following question, a statement of assertion(A) followed by statement of reason(R) is given.

Choose the correct answer out of the following choices.

A. Both Assertion and Reason are true and thereason is the correct explanationof the assertion.

B. Both Assertion and Reason are true but thereason is not the correct explanation of the assertion.

C. Assertion is true but Reason is false.

D. Assertion is false and Reason is true.

1. A- Propionibacterium sharmani produces large holes in swiss cheese.
R-the large holes in swiss cheese is due to the absorption of CO_2 by the bacterium.
And: D

2. A.-LAB play beneficial role in checking disease diseasecausing microbes in our stomach.

R- Curd improves its nutritional quality by increasing VIT B12.

And: B

3.A-Adino virus causes respiratory infections.

R-All Adinovirus genomes are linear , double stranded DNA molecule & affect the respiratory pssage..

And: A

4. A- The bacterium Azospirillum is a bio fertilizer .

R- Azospirillum increases the phosphorous content in the soil.

And: C

5. A. Methanogen in an anaerobic bacteria.

R- Large amount of methane CO2& H2 are produced from cellulosic material in the presence of oxygen.

And: B

6. A- Cyclosporin A in an immunosuppressant.

R- Immunosuppressant is used to prevent transplant rejection

And: A

MULTIPLE CHOICE QUESTIONS

1. which of the following pair is not a of bio fertilizers

A.Nostoc& anabaena B. Rhizobium &nostoc C)Oscillatoria& anabaena D) Asospirillum& retrovirus

And: D

2. Which of the following is used to reduce blood cholesterol lowering agent?

A)Cyclosporin A B) Statin C) pectinase D) lactic acid

Ans B

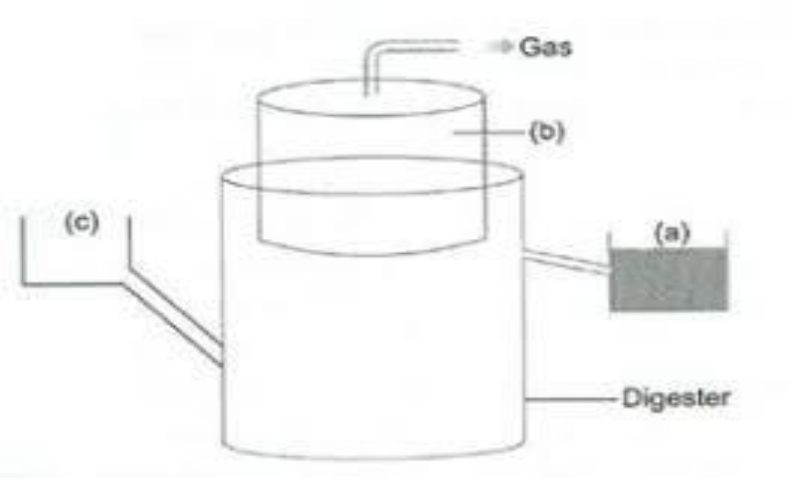
3. The large holes in Swiss Cheese are due to the production of large amount of

A) Oxygen B) Carbon di dioxide C) ethanol D) methane

Ans B

Case based question.

1. The diagram given below is that a typical biogas plant .Carefully understand the diagram and answer the questions.



1 The floating nature of (b) is due to

a) Microbial activity b) greenhouse effect c) biological oxygen demand d) bio active molecules

ans _A) Microbial activity

2. What are the main products of anaerobic digestion ?

Ans.Methane & carbon dioxide

3. The group of organism that act to produce bio gas is

   A) methanogen B) bio active moleculle

   C) bio controle agent D)bio pesticide

   ans A Methanogen

4. Under which condition the organisms be most active & effective

A) Aerobic B) Anaerobic C) biological activity D)more slurry

Ans B) Anaerobic

OR

The label a & c in the diagram is ----------& ---------- respectively

A) Sludge loader &dung,water B)Gas holder &Aerobic

C)Dung& gas holder D)Gas holder & sledge holde

Ans A

CBSE PREVIOUS YEARQUESTIONS
1MARK

1. How does a small amount of curd added to fresh milk convert it into curd?
Mention a nutritional quality that gets added to the curd.

Ans. A large number of lactic acid bacteria are found in small amount of curd which multiply and convert the milk into curd by producing the lactic acid.

The nutritional quality improves by increasing Vitamin B12

2. Why is secondary treatment of water in sewage treatment plant called biological treatment?

Ans . In this treatment Organic wastes of sewage water are decomposed by certain microorganisms in presence of water.

3. An antibiotic called Wonder Drug was used to treat the wounded soldiers of America during World War-II. Name the drug and the scientist who discovered it.

Ans. Penicillin,AlexanderFleming

4. You have observed that fruit juice in bottles bought from the market is clearer as compared to those made at home. Give reason.

Ans. Bottle juices are clarified by the use of pectinase and proteases

5. Alexander Fleming discovered. Penicillin, but its full potential as an effective antibiotic was established by other scientists. Name the two scientists.

Ans . Ernest chain and Howard Flore

2 MARKS

1. Name two alcoholic drinks produced in each of the following ways.

(i) by distillation and (ii)withoutdistillation

Ans. i) Whisky, brandy, rum- bydistillation

ii)Wine, beer- without distillation

2. Lactic Acid Bacteria (LAB) is commonly used in the conversion of milk into curd.
Mention any two other functions of LAB that are useful to humans.

Ans. i) LAB in human intestine synthesizes Vitamin B12.

ii) LAB in human stomach checks the growth of harmful microbes

3. How do mycorrhizae function as biofertilisers?Explainwithexample.

Ans. Mycorrhia are fungi associated with roots of plants .they absorbs water & minerals like

phosphorous from the soil & provide them to the plant

4. Cyanobacteria (Nostoc,Anabaena) are used as biofertilisers in certain crop fields. Name such one crop. Also, mention the names of two other microorganisms which perform the same function.

Ans. Paddy (RiceCrop),Rhizobium and Azotobacter

5. Which Ministry of Govt.of India had initiated Ganga Action Plan and Yamuna Action Plan? What are the objectives of these plans?

Ans: The Ministry of Environment and Forests. The objective of Ganga Action Plan and Yamuna Action Plan is to save these rivers from pollution. It was proposed to build a large number of sewage treatment plants. So that only treated sewage may be discharged into these rivers.

3 MARKS

1. Fill in the blanks spaces a,b,c,d,e, and f given in the following table

S.No.	***NameofOrganism***	***CommercialProduct***	***Application***
1	*Penicillium notatum*	Penicillin	(a)
2	(b)	Lactic acid	Making Curd
3	*Streptococcus*	Clotbuster enzyme	(c)
4	Trichoderma polysporum	(d)	Immuno Suppressive agent
5	*Saccharomyces cerevisiae*	Ethanol	(e)

(a) To kill disease causing bacteria

(b) Lactobacillus

(c) Remove clots from blood vessels

(d) Cyclosporin A

(e) Beverage

(f) *Propioni bacterium sharmanii*

2. What is biochemical oxygen demand (BOD) test?At what stage of sewage treatment this test is performed? BOD level of three samples of water labelled as A, B and C are 30 mg/ L, 10mg/Land500mg/L respectively. Which sample of water is most polluted?

Ans. The BOD test measures the rate of uptake of oxygen by microorganisms in a sample of water. Biological treatment or Secondary treatment. Sample C is most polluted because it has highest BOD level among the three samples of Water.

3.What are bio fertilisers?A farmer is advised to add a culture of bacterium in the soil before sowing the crop. Name the bacterium in the culture. How is this bacterium useful to the crop?
Ans. Biofertilisers are organisms that enrich the nutrient quality of the soil.
Azotobacter/Azospirillum (free living) This bacterium fixes atmospheric nitrogen into organic forms, which is used by the plants as nutrient.

14.What are statins? Name the micro organism that produces this substance. How is it medically important?

Ans. Statins are cholesterol reducing agents. They are produced by *Monascuspurpureus* (Yeast) They act by Competitively inhibiting theenzymesresponsibleforsynthesisofcholesterolandareusedasbloodcholesterolloweringagents.

4.a)How does activated sludge get produced during sewage treatment?
b) Explain how this sludge is used in biogas production.
Ans: a)when BOD of sewage water is reduced, the effluent passes to settling tank where, bacterial flocs are allowed to sediment and this sediment is activated sludge=1/2x3
b) The major part of sludge is pumped into anaerobic sludge digester, here other anaerobic bacteria digest the flocs, during this digestion biogas is produced.

5. Why are some molecules called bioactive molecules? Give two examples of such molecules?
Ans:-Microbes/bacteria fungus are used in their production = I
e.g. Citric acid - acetic acid
Butyric acid - lactic acid
Ethanol - lipase
Streptokinase - cyclosporine A(Any two)=1 = 1 =2

6**.** a-Which one of the following is the baker's yeast used in fermentation?
i) SaccharumBarberi
ii). Saccharomyces Cerevisiae
iii) Sonalika
Ans:-ii. ***Saccharomyces Cerevisiae***

b Many members of the genus Glomus form mycorrhiza.

i) What are called mycorrhizae?
Ans:-i) Fungal associations with roots of higher plants.
ii) What are the other benefits shown by the plants having such association other than increase in plant growth and development?
Ans:-ii)Resistance to root borne pathogens ,tolerance to salinity and drought

5 MARK

1 . How does primary sludge differ from activated sludge? What type of changes in the sludge is carried out in anaerobic sludge digester? Give the composition of biogas produced in the waste treatment plant.

Ans. Primary sludge is all solids like soil, small pebbles that settle down in settling tank during primary treatment of sewage.

Activated sludge is the sediment of bacterial, flocs, in settling tank during biological treatment.

Flocs are masses of bacteria held together by slime and fungal filaments.

A part of activated sluge is used as inoculum in aeration tank and remaining is passed into a large tank called anaerobic sluge digester. In this tank, other kind of bacteria which grow an aerobically, digest the bacteria, fungi and biomass in the sludge. Biogas that produced in Sewage treatment plant is a mixture of methane, hydrogen and Carbon dioxide.

Ch.11 BIOTECHNOLOGY: PRINCIPLES AND PROCESSESS

CONCEPT MAP

I Principles of Biotechnology:

Genetic Engineering

rDNA (gene cloning and gene transfer)

origin of replication

II Tools of rDNA technology:

- Restriction enzyme
- Polymerase enzyme
- Ligase
- Vectors
- Host organism

III Process of rDNA technology:

- Isolation
- Cutting of DNA
- Amplication of gene by PCR
- Insertion of Recombinant DNA
- Obtaining foreign gene product
- Downstream processing.

GIST OF THE CHAPTER:-

I Principles of Biotechnology

II Tools of rDNA technology

III Process of rDNAtechnologY

IMPORTANT TOPICS

Two core techniques that enabled birth of modern biotechnology:-

1) Genetic Engineering
2) Maintenance of Sterile condition

Plasmid:-

1) Autonomously replicating circular extra chromosomal DNA.
2) First plasmid used from *Salmonellatyphimurium*.
3) Stanley and Boyer isolated antibiotic resistance gene.
4) Plasmid acts as vector.

Convention for naming Restriction enzyme:-

2) Specific name

1) Genus name — **ECORI** — 4) Roman number (order of isolation)

3) Strain

1) First letter of the genus name: Escherichia

2) Specific name of the bacteria: Coli

3) Name of the strain

4) Roman number-order of isolation

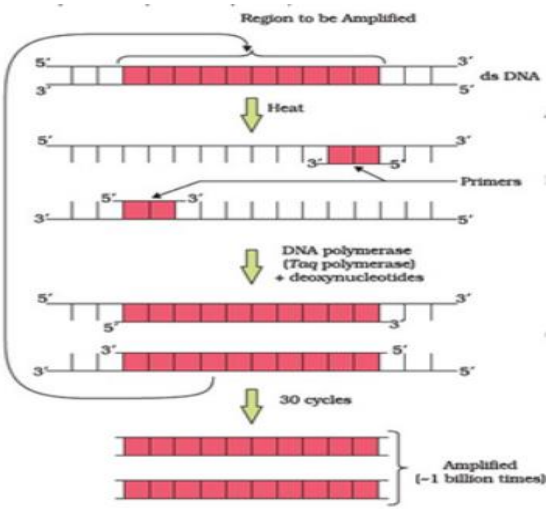
Cloning vectors:-

1) ORIGIN OF REPLICATION:
   - Specific sequence of the DNA where replication starts.
   - The foreign (alien) DNA can be linked to this sequence for replication.
2) SELECTABLE MARKER:
   - Presence of antibiotic resistance gene in the plasmid helps in selecting transformants and non transformants.
   - Example- ampicillin, tetracyclin.

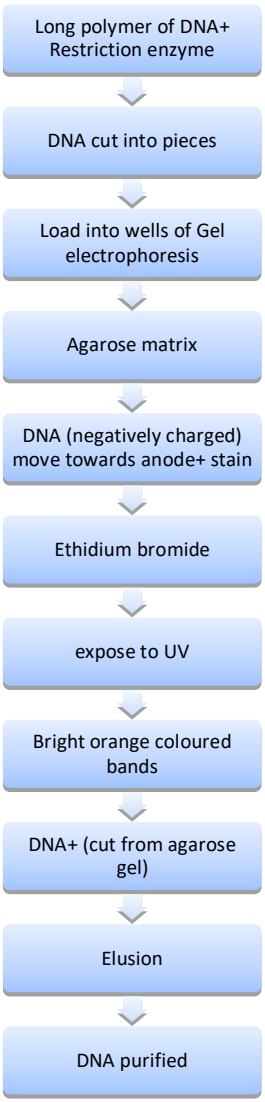
3) CLONING SITE:
    - Recognition sites, where alien DNA can ligate with the plasmid.
    - Example- antibiotic resistance gene-a cloning site.
4) INSERTIONAL INACTIVATION:
    - Alternate selectable marker.
    - Easy to distinguish between recombinant and non- recombinant.

Cloning vectors:-

5) ORIGIN OF REPLICATION:
    - Specific sequence of the DNA where replication starts.
    - The foreign (alien) DNA can be linked to this sequence for replication.
6) SELECTABLE MARKER:
    - Presence of antibiotic resistance gene in the plasmid helps in selecting transformants and non transformants.
    - Example- ampicillin, tetracyclin.
7) CLONING SITE:
    - Recognition sites, where alien DNA can ligate with the plasmid.
    - Example- antibiotic resistance gene-a cloning site.
8) INSERTIONAL INACTIVATION:
    - Alternate selectable marker.
    - Easy to distinguish between recombinant and non- recombinant.
    - **Polymerase Chain Reaction (PCR)**



Separation and Isolation of DNA fragments:-



Chromogenic substances

βgalactosidase

↓

Blue colour colonies

↓

Non recombinant

rDNA-inserted in the coding sequence of β galactosidase

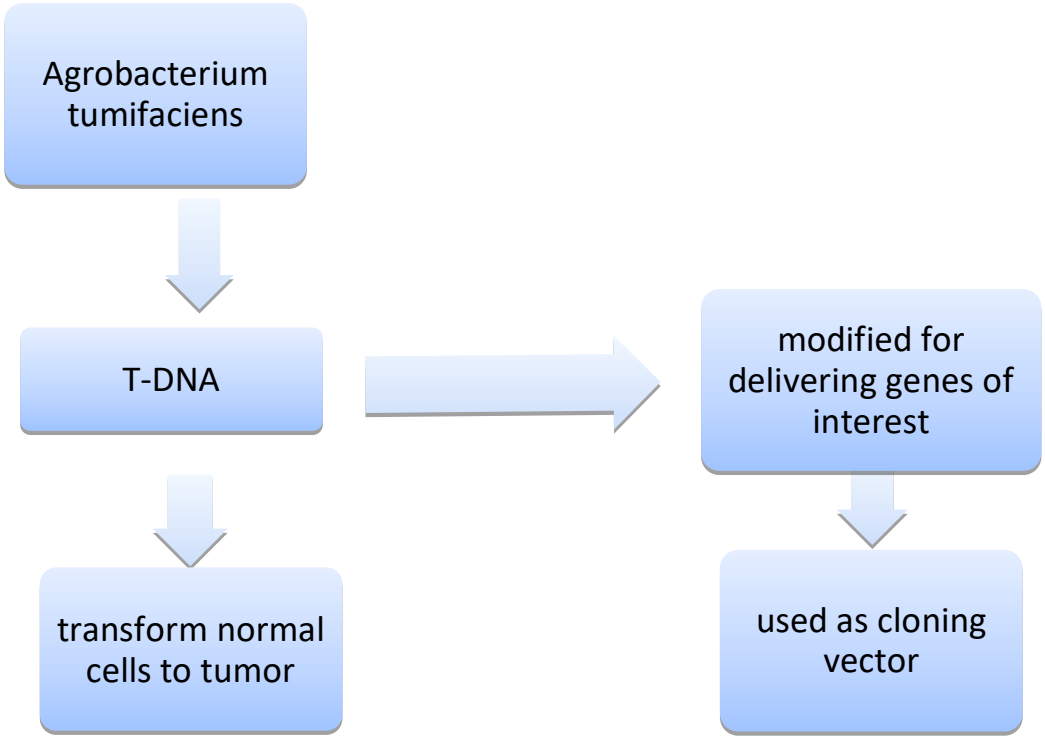
↓

No blue colour colonies

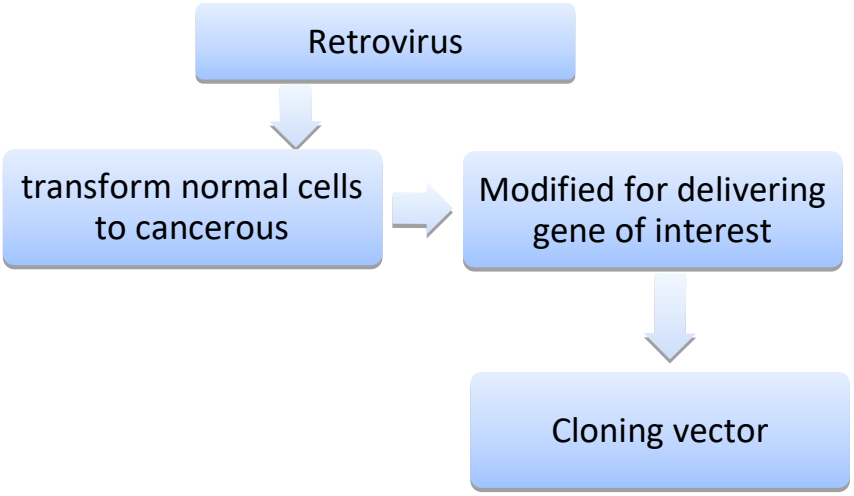
↓

Recombinant

Vectors for cloning genes in plants:-



Vectors for cloning genes in animal:-



Competent Host:-

1) To force bacteria to take up the plasmid treat with divalent cation-calcium

   Place on ice

   Incubate (heat shock) 42C

   Place on ice

   Bacteria takes up the rDNA

2) Micro injection: rDNA-directly injected into animal cell.
3) Gene gun/Biolistic: rDNA coated with gold or tungsten is bombarded into plant cell.

Isolation:-

ORGANISM	ENZYME
Bacteria	Lysozyme
Plant cell	Cellulose
Fungus	Chitinase

Amplification of gene by PCR:-

(PCR- Polymerase Chain Reaction)

1) DENATURATION- Heat the DNA, dsDNA separates.
2) ANNEALING- Adding primers (oligonucleotides).
3) EXTENSION- Taq polymerase (from Thermusaquaticus) is a thermo stable DNA polymerase helps in DNA amplification.

Bioreactors (to produce in large scale):-

1) Simple stirred tank bioreactor.
2) Sparged stirred tank bioreactor.

Downstream Processing:-

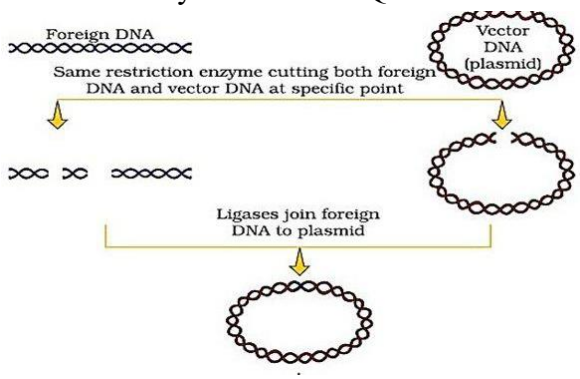
Separation and purification of Biosynthetic product.

OBJECTIVE QUESTIONS

1) A biotechnologist wanted to create a colony of E.coli possessing the plasmid pBR322, sensitive to Tetracycline. Which one of the following restriction sites would he use to ligate a foreign DNA?
   (a) Sal I (b) Hind III (c) Pvu I (d) EcoRI
   Ans (a)Sal I

2) 'Restriction' in Restriction enzyme refers to:
   (a) Cleaving of phosphodiester bond in DNA by the enzyme.
   (b) Prevention of the multiplication of bacteriophage in bacteria.
   (c) All of the above.
   (d) Cutting of DNA at specific position only.
   Ans (d) Cutting of DNA at specific position only.

3) An antibiotic resistance gene in a vector usually helps in the selection of:
   (a) Competent cells (b) Recombinant cells (c) Transformed cells (d) None of the above
   Ans. (c) Transformed cells.
4) Name the enzymes 'P' and 'Q' that are involved in the processes given below:



   (a) Enzyme P-Exonuclease and Enzyme Q-Permease.
   (b) Enzyme P-Exonuclease and Enzyme Q-Ligase.
   (c) Enzyme P-Endonuclease and Enzyme Q- Permease.
   (d) Enzyme P-Restriction endonuclease and Enzyme Q-Ligase.
   Ans(d) Enzyme P-Restriction endonuclease and Enzyme Q-Ligase

5) The process of separation and purification of expressed protein before marketing is called:
   (a) Downstream processing (b) Upstream processing (c) Post production processing (d) Bio processing
   Ans (a) Downstream processing
6) The correct order of step in polymerase chain reaction (PCR) is:
   (a) Extension, Denaturation, Annealing
   (b) Denaturation, Extension, Annealing
   (c) Denaturation, Annealing, Extension
   (d) Annealing, Extension, Denaturation
   Ans (c) Denaturation, Annealing, Extension
7) Which of the following steps are catalysed by Taq polymerase in a PCR reaction?
   (a) Extension of primer end on the template DNA.
   (b) Annealing of primers to template DNA.
   (c) Denaturation of template DNA.
   (d) All of the above.
   Ans (a) Extension of primer end on the template DNA
8) Which of the following statements does not hold true for restriction enzyme?

(a) It recognises a palindromic nucleotide sequence.
(b) It produces the same kind of sticky ends in different DNA molecules.
(c) It is an endonuclease. (d) It is isolated from viruses.

Ans (d) It is isolated from viruses

9) Which of the following bacteria is not a source of restriction endonuclease?
(a) Haemophilus influenza (b) Escherichia coli (c) Agrobacterium tumifaciens (d) Bacillus amyloli

Ans(c) Agrobacterium tumifaciens

10) What is the criterion for DNA fragments movement on agarose gel during gel electrophoresis?
(a) The larger the fragment size, farther it moves.
(b) The smaller the fragment size, farther it moves.
(c) Positively charged fragment move to farther end.
(d) Negatively charged fragment do not move.

Ans (b) The smaller the fragment size, farther it moves.

ASSERTION AND REASON BASED MCQs

Directions: In the following questions a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(A) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(B) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(C) Assertion (A) is true but reason (R) is false.
(D) Assertion (A) is false nut reason (R) is true.

1) **Assertion (A):**EcoRI is restriction endonuclease enzyme.
Reason (R): Exonuclease removes nucleotides from the ends of DNA.
Ans B
2) **Assertion (A):** Any fragment of DNA, when linked to the ori region, can be initiated to replicate.
Reason (R): Ori is a genetic sequence that acts as the initiation site for replication of DNA.
Ans A
3) **Assertion (A):**E.coli having pBR322 with DNA insert at BamH I site cannot grow in medium containing tetracycline.
Reason (R): Recognition site for BamH I is present in ter^R region of pBR322.
Ans A
4) **Assertion (A):** It is essential to have few cloning sites in cloning vector.
Reason (R): It helps in identifying and eliminating non-transformants and selectively permitting the growth of the transformation.
Ans B
5) **Assertion (A):** DNA is positively charged molecule.
Reason (R): DNA moves towards the positive electrode (anode).

Ans D

CASE STUDY BASED MCQs

Read the following text and answer the following questions on the basis of the same:

The term "Biotechnology" refers to the use of living organisms or their products to modify human health and their human environment. For example, 'test tube' programmes, synthesis of a gene or correcting a defective gene are all part of the biotechnology. The basis of the modern biotechnology is genetic engineering and maintenance of sterile conditions. Genetic engineering is the techniques that alter the chemistry of genetic material i.e., DNA and RNA, then this genetic material is introduced into host organisms, which alter the phenotype of the host organism.

1) Discovery of------- molecule made genetic engineering possible.
   (a) Restriction exonuclease (b) Restriction endonuclease (c) Ribozyme (d) DNA polymerase
   Ans b.
2) The recognition sequence of the first restriction enzyme isolated was------ base pair long.
   (a) Four (b) Five (c) Six (d) Two
   Ans c.
3) The specific DNA sequence where EcoRI cuts is:
   (a) GATTCG (b) GAATTC (c) GTTCAA (d) TTCCAA
   Ans b
4) The cutting of DNA at specific locations became possible with the discovery of:
   (a) Ligases (b) Restriction enzyme (c) Probes (d) Selectable marker
   Ans b
5) DNA fragments are:
   (a) Positively charged (b) Negatively charged (c) Neutral (d) Either positively or negatively charged depending on their size
   Ans b

VERY SHORT ANSWER TYPE QUESTIONS

1) Mention the role of Restriction enzymes in Recombinant DNA technology.

Ans. To cut DNA at specific sites/Molecular scissors (DNA)

2) Name two enzymes that are essential for constructing a recombinant DNA.

Ans. Restriction enzymes/ polymerase enzymes/ ligase

3) Why do DNA fragments move towards the anode during gel electrophoresis?

Ans. DNA fragments are negatively-charged

4) How the introduction of an alien DNA into plant host cell is achieved?

Ans. Introduction of an alien DNA into the plant host cell is achieved by using a gene gun, coated with gold or tungsten particles.

5) By using which vector, the nematode specific genes were introduced into the tobacco host plant.

Ans. By using Agrobacterium, the nematode specific genes were introduced into the tobacco host plant.

SHORT ANSWER TYPE [I] QUESTIONS (2 marks)

1) Why do prokaryotes (bacteria) have restriction enzymes but not eukaryotes?

Ans. To restrict the growth of bacteriophages—eukaryotes have other defence mechanisms.

2) A recombinant DNA is formed when sticky ends of vector DNA and foreign DNA join. Explain how the sticky ends are formed and get joined.

Ans. Restriction enzyme cuts the strands of DNA—the palindromic sequence—DNA ligase.

3) Why and how can bacteria be made 'competent'?

Ans. DNA is a hydrophilic molecule—treated with divalent cations (example: calcium).

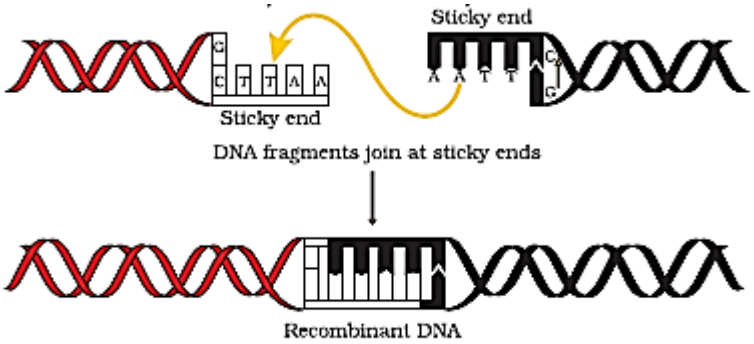
4) Name the source of the DNA-polymerase used in PCR technique. Mention why it is used?

Ans. Taq polymerase—thermo stable enzyme.

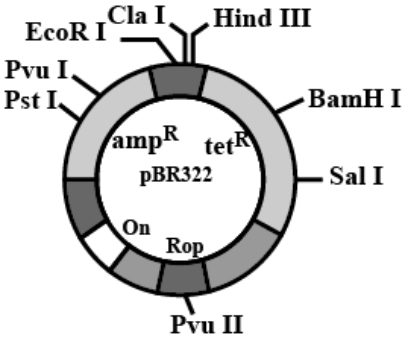
SHORT ANSWER TYPE [II] QUESTIONS (3 marks)

1) Draw the vector DNA segment and foreign DNA segment after the action of EcoRI and label the sticky ends produced.

Ans.



2) (i) Name the organism in which the vector shown is inserted to get the copies of the desired gene.
(ii) Mention the area labelled in the vector responsible for controlling the copy number of the interested gene.
(iii) Name and explain the role of a selectable marker in the vector shown.



Ans. (i) Escherichia coli

(ii) Ori

(iii) amp^R and tet^R—the recombinant plasmid will lose tetracycline resistance—helps in identifying the recombinants from the non-recombinants.

3) Describe the process of gene amplification for rDNA technology experiments.

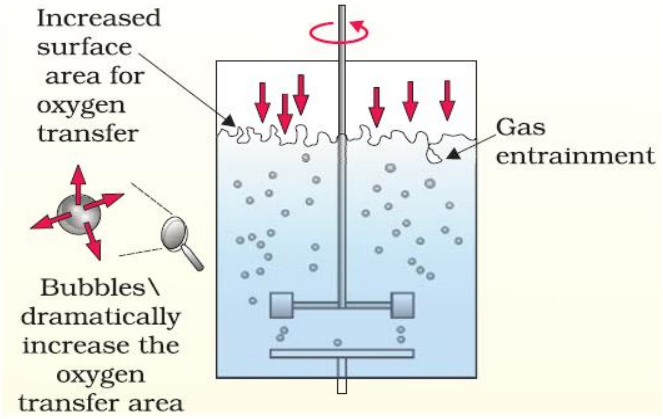
Ans. (PCR- Polymerase Chain Reaction)

1) <u>DENATURATION</u>- Heat the DNA, dsDNA separates.
2) <u>ANNEALING</u>- Adding primers (oligonucleotides).
3) <u>EXTENSION</u>- Taq polymerase (from Thermusaquaticus) is a thermo stable DNA polymerase helps in DNA amplification.

LONG ANSWER QUESTIONS (5 marks)

1) What is a bioreactor? Draw a labelled diagram of a sparged stirred-tank bioreactor. Explain its functioning.

Ans. Bioreactors (to produce in large scale)—the bioreactor has an agitator system, an oxygen delivery system and a foam control system, a temperature control system, pH control system and sampling ports.



Sparged stirred-tank bioreactor through which sterile air bubbles are sparged

2) (a) Why are engineered vectors preferred?
(b)A vector is engineered with three features, which facilitate its cloning within the host cell. List the three features and explain each one of them.

Ans. (a) (i) Engineered vectors help easy linking of foreign DNA.

(ii) They facilitate selection of recombinants from non-recombinants.

(b)Features of cloning vectors:

ORIGIN OF REPLICATION:

- Specific sequence of the DNA where replication starts.
- The foreign (alien) DNA can be linked to this sequence for replication.

SELECTABLE MARKER:

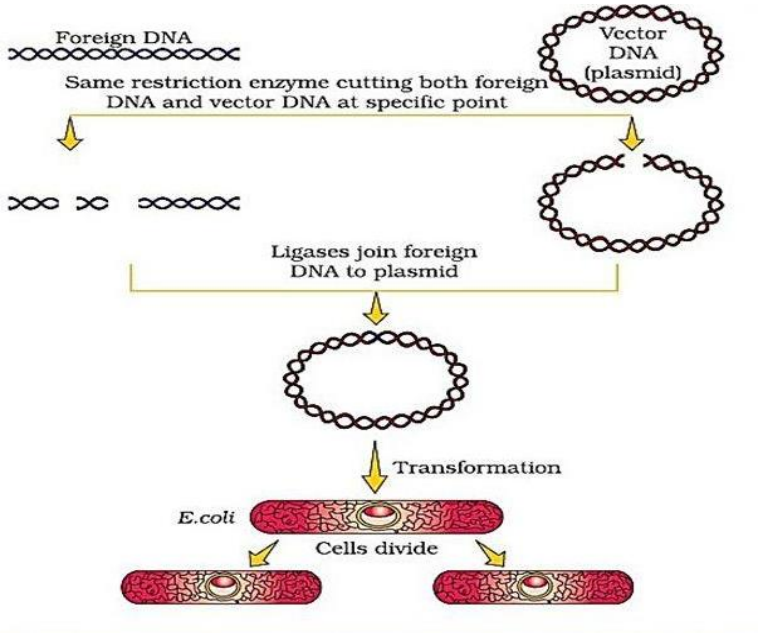
- Presence of antibiotic resistance gene in the plasmid helps in selecting transformants and non transformants.
- Example- ampicillin, tetracyclin.

CLONING SITE:

- Recognition sites, where alien DNA can ligate with the plasmid.
- Example- antibiotic resistance gene-a cloning site.

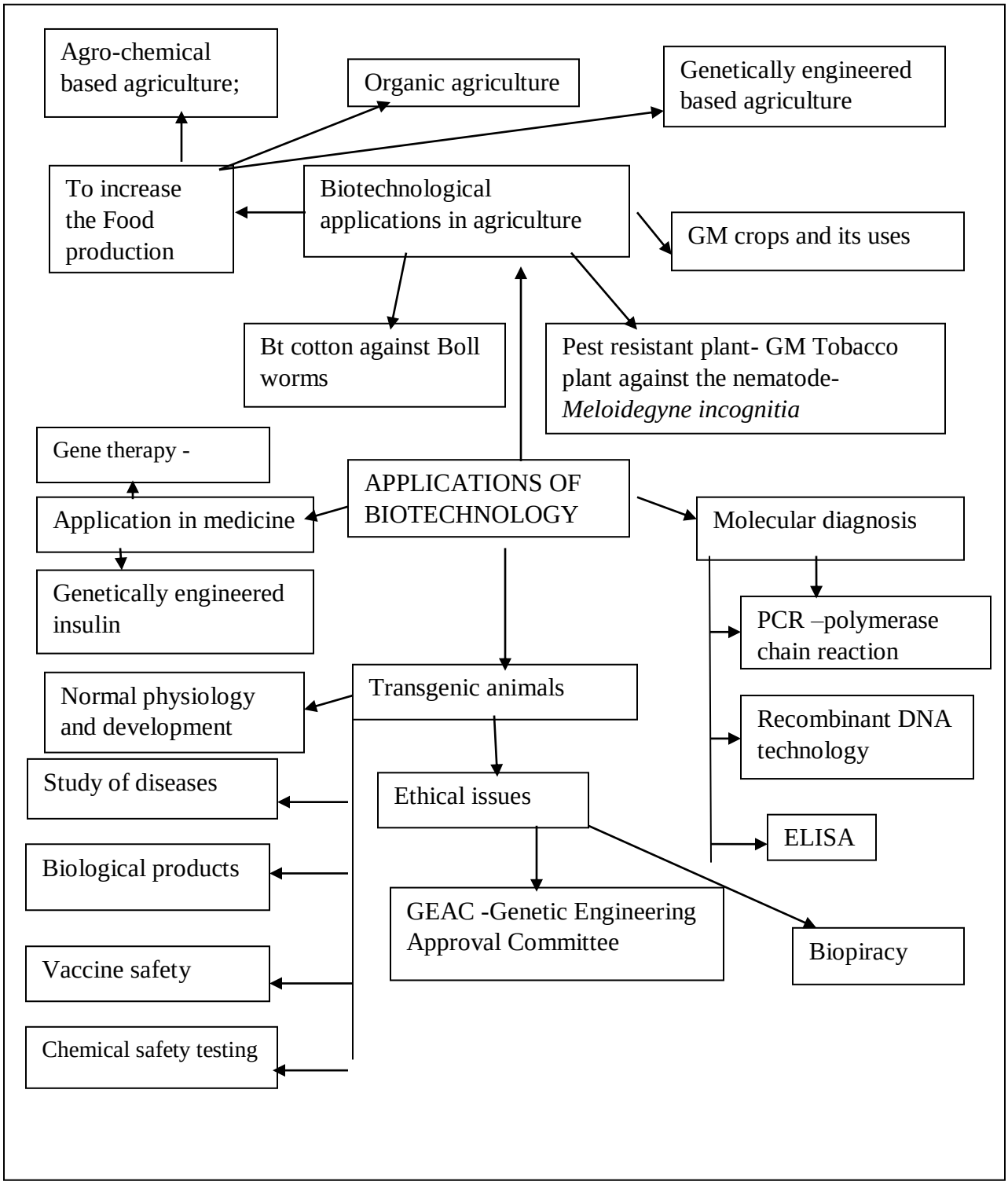
IMPORTANT DIAGRAMS:

Recombinant DNA technology



CHAPTER: 12. BIOTECHNOLOGY & ITS APPLICATIONS

CONCEPT MAP



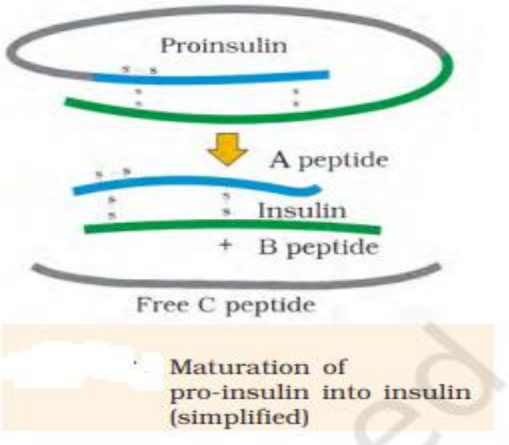
Gist of the Chapter

Three critical research areas of biotechnology – i) providing best catalyst in the form of improved organism –microbe /enzyme.
ii. Creating optimal conditions through engineering for a catalyst to act,
(iii) Downstream processing technologies to purify the protein/organic compound.

- Biotechnological applications in Agriculture
  1. Genetically Modified Organisms (GMO) –
     i)made crops more tolerant to abiotic stresses (cold, drought, salt, heat). (ii) reduced reliance on chemical pesticides (pest-resistant crops). (iii) helped to reduce post harvest losses. (iv) increased efficiency of mineral usage by plants (this prevents early exhaustion of fertility of soil). (v) enhanced nutritional value of food, e.g., golden rice, i.e., Vitamin 'A' enriched rice.
  2. Bt Cotton - Bt toxin gene is introduced in cotton plants, The gene produces crystals of insecticidal protein which is inactive protoxin,when the boll worm eats the protoxin the alkaline pH of the gut activates it, activated protoxin binds to the midgut epithelial cells, creates pores/causes swelling/causes lysis/kill the worm
     Pest Resistant Plants -Using *Agrobacterium* vector nematode specific genes are introduced into the host plant. The introduction of DNA such that it produces both sense and anti sense RNAs. These two are complimentary to each other formed a double stranded RNA (dsRNA). This silences the mRNA of the nematode and prevents its translation into protein. So nematode cannot survive in the roots of plants. Thus plant is protected from the parasite.
- Biotechnological applications in Medicine-

1. G enetically engineered insulin:

Eli Lilly used rDNA technique ,prepared two DNA sequences corresponding to A and B chain of insulin,introduced them in plasmids of E.coli, insulin chains are produced separately, extracted and combined by creating disulphide bonds(assembled mature molecule of insulin), (the prohormone produced in the human body has an extra stretch of C peptide)

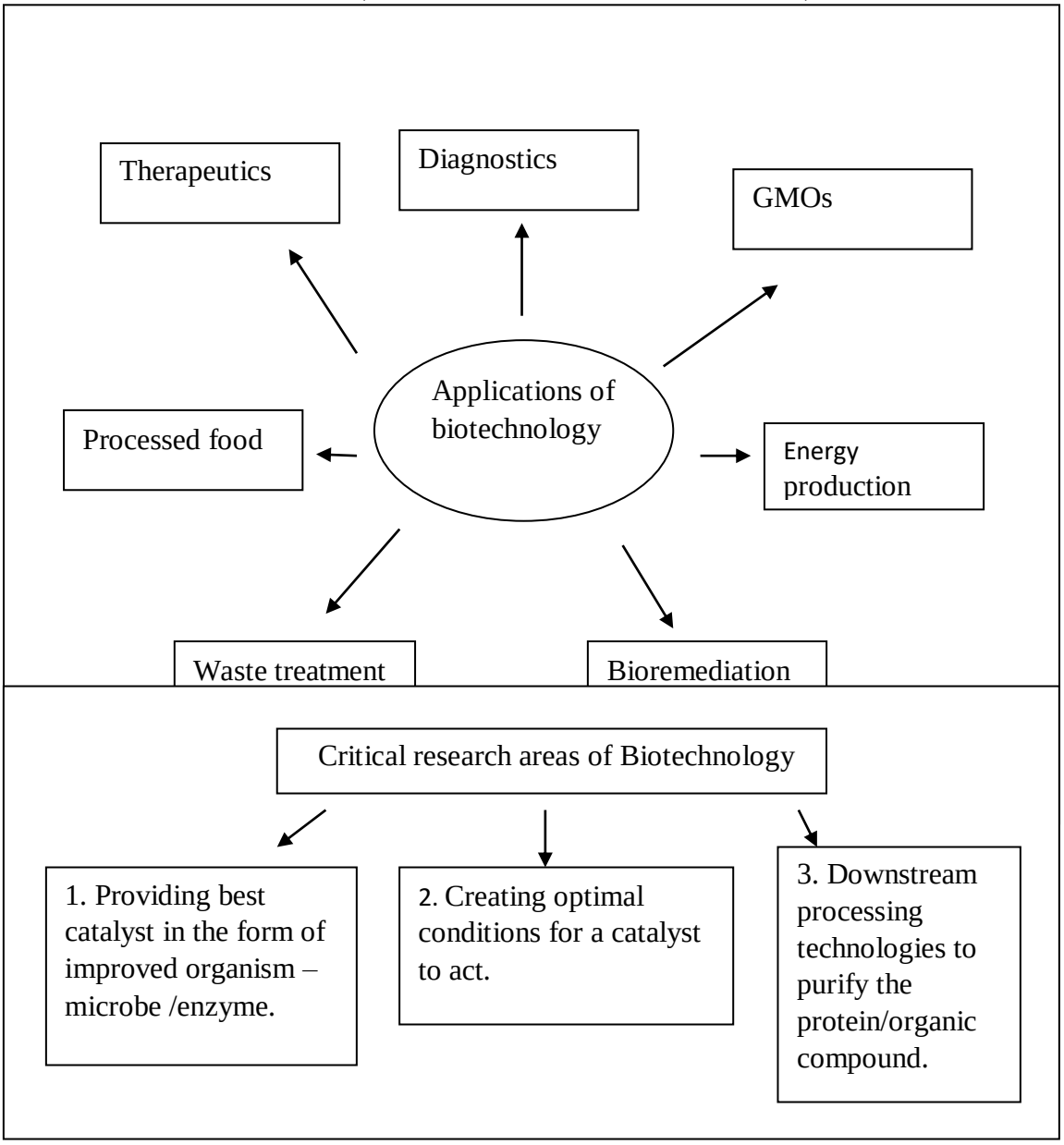


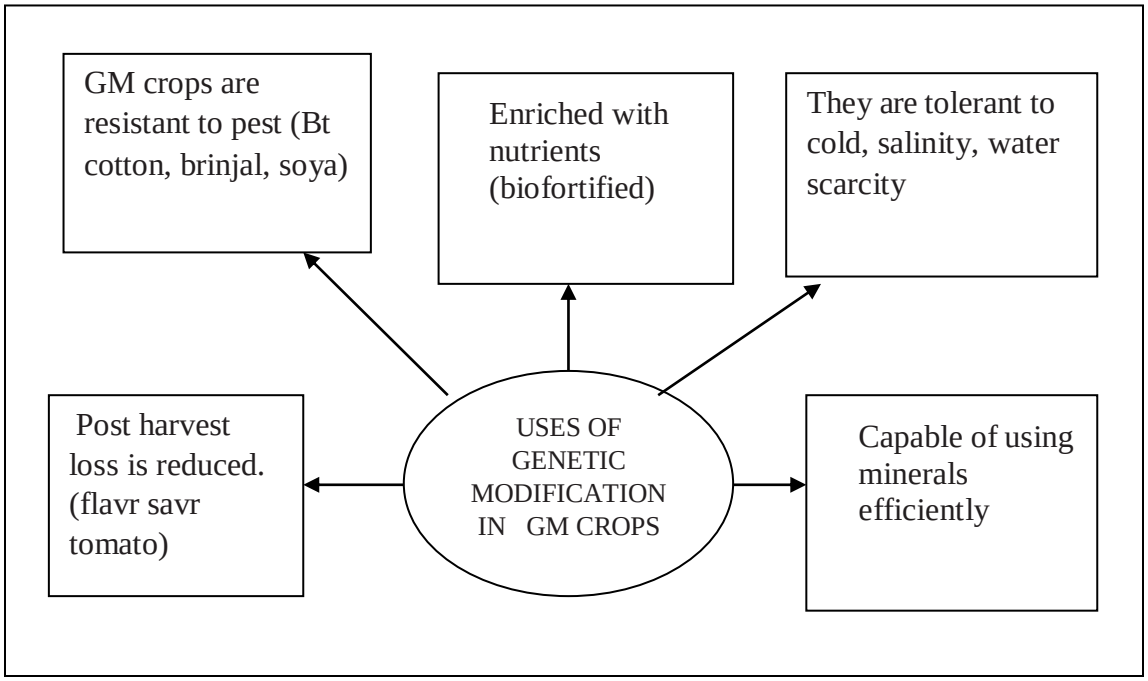
3. **Gene Therapy** – lymphocytes from the blood of the patient are grown in a culture outside the body. A functional ADA cDNA (using a retroviral vector) is then introduced into these lymphocytes, which are subsequently returned to the patient. – Patient requires periodic infusion. It can be cured when done in early embryonic stage.
4. **Molecular diagnosis:** Recombinant DNA technology, Polymerase Chain Reaction

(PCR) and Enzyme Linked Immuno-sorbent Assay (ELISA) - early diagnosis of diseases.

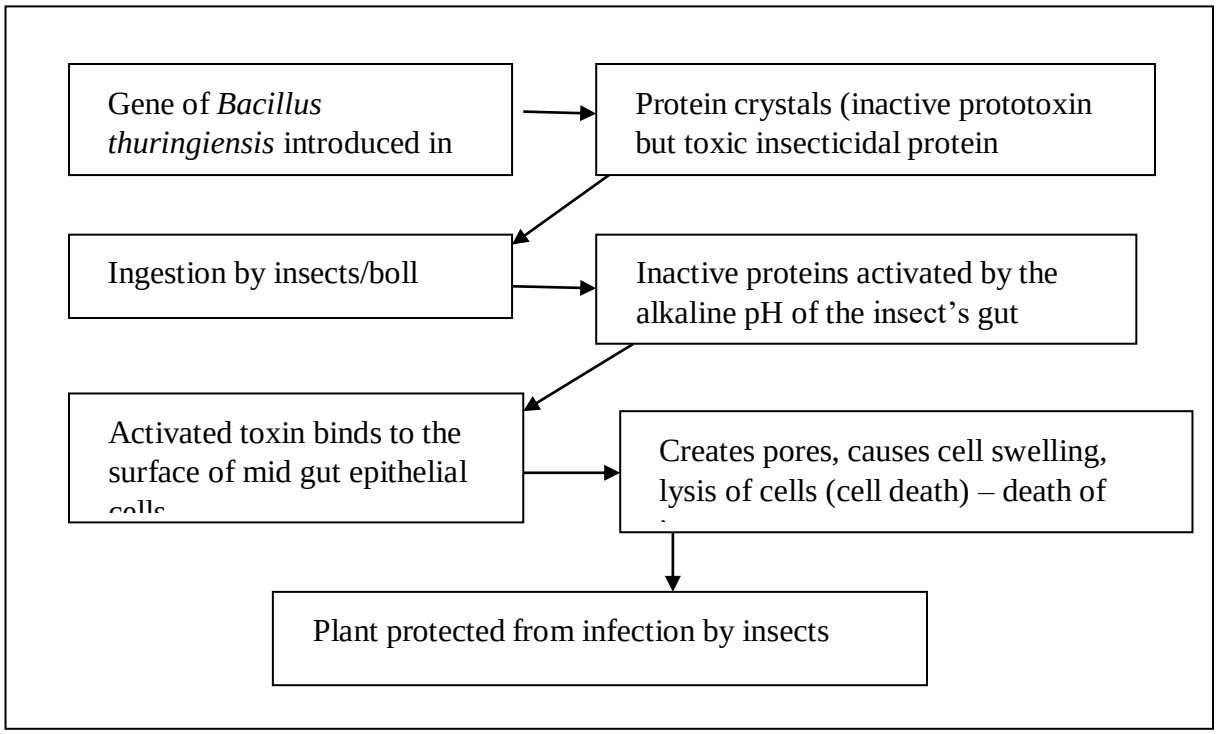
- TRANSGENIC ANIMALS: Normal physiology and development:
  Study of disease, Biological products, Vaccine safety, Chemical safety testing:
- ETHICAL ISSUES – GEAC (Genetic Engineering Approval Committee), l makes decisions regarding the validity of GM research and the safety of introducing GM-organisms for public services.
- BIOPIRACY- The use of bio-resources by multinational companies and other organisations without proper authorisation from the countries and people concerned without compensatory payment.

(FLOW CHART/ CONCEPT MAP)

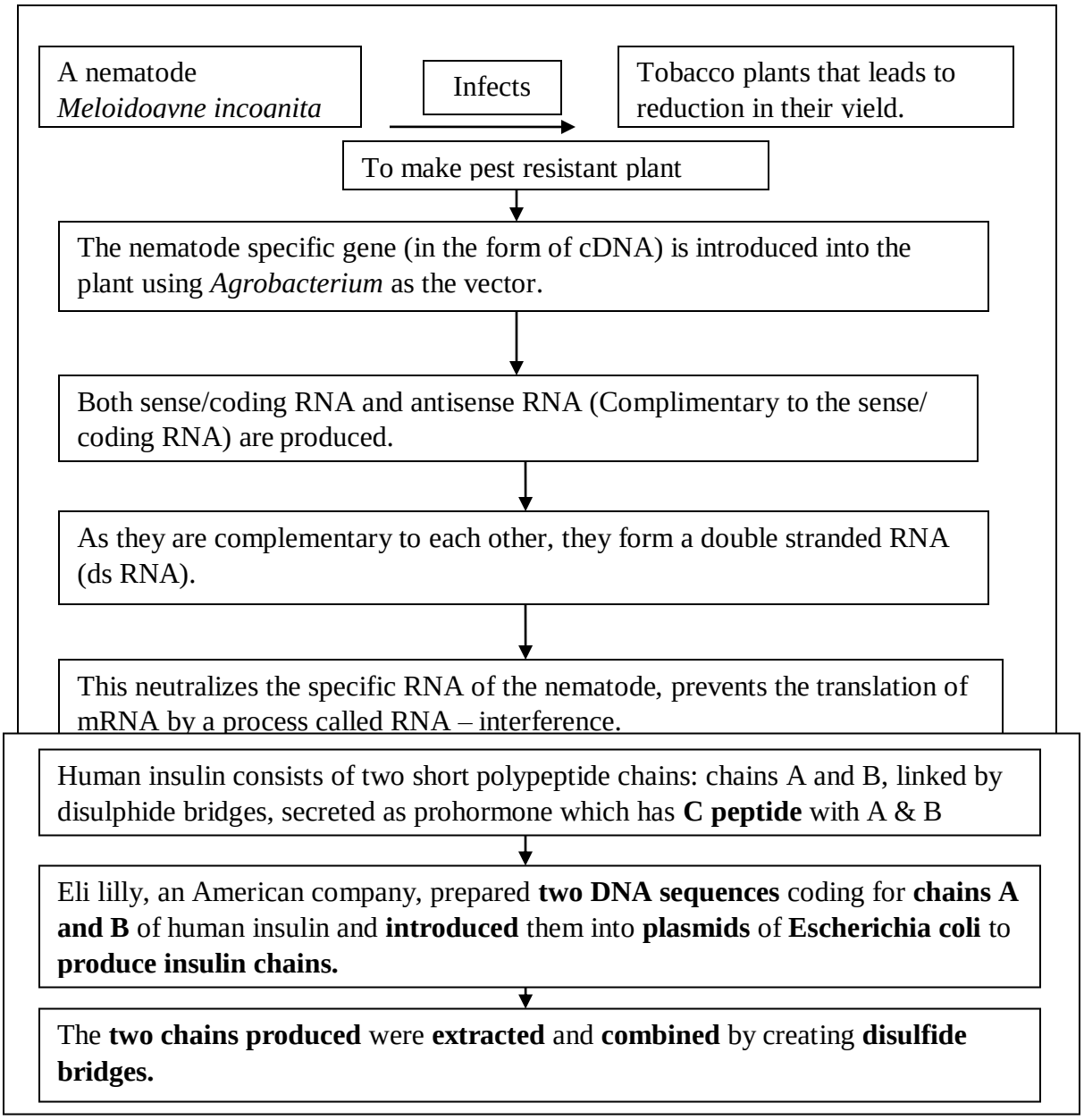




Bt cotton plants



Pest resistant plant - *Meloidegyne incognitia* (pest) resistant Tobacco plant.



Human insulin consists of two short polypeptide chains: chains A and B, linked by disulphide bridges, secreted as prohormone which has **C peptide** with A & B

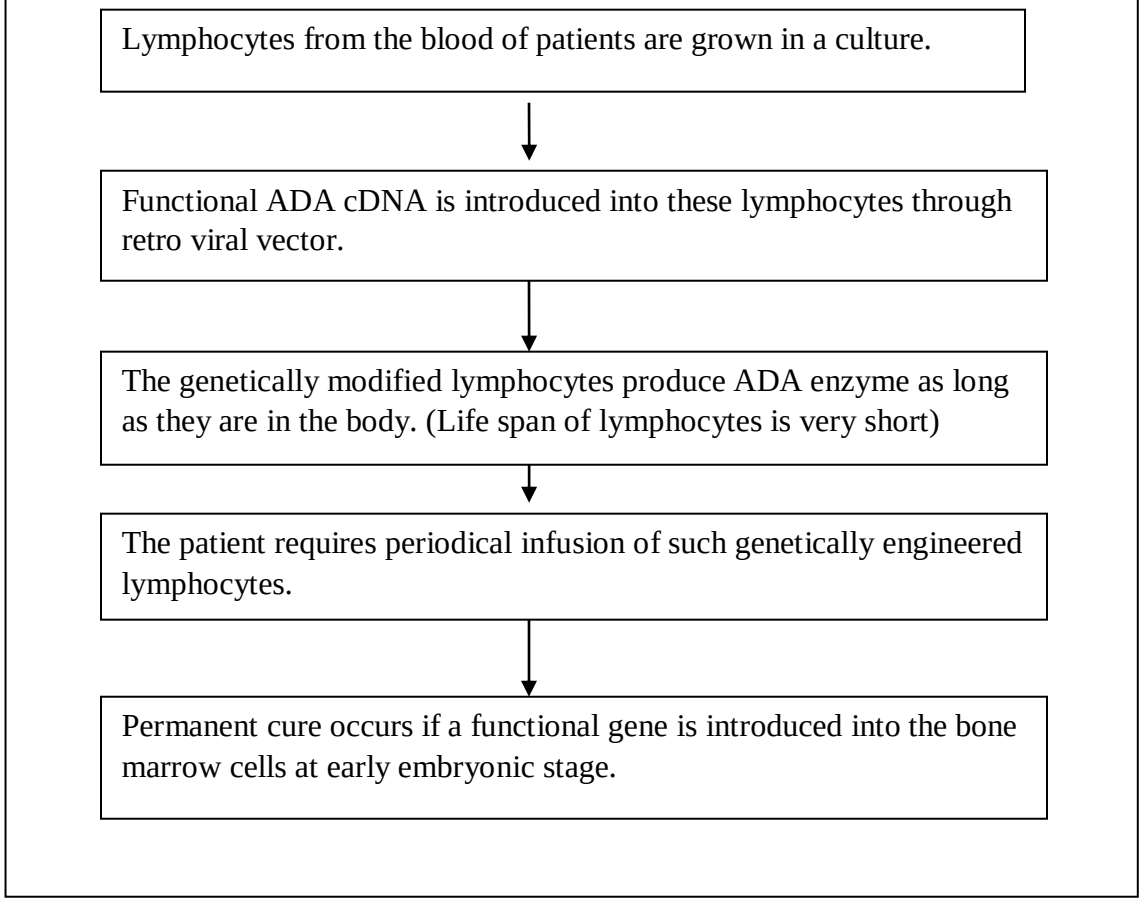
Eli lilly, an American company, prepared **two DNA sequences** coding for **chains A and B** of human insulin and **introduced** them into **plasmids** of **Escherichia coli** to **produce insulin chains.**

The **two chains produced** were **extracted** and **combined** by creating **disulfide bridges.**

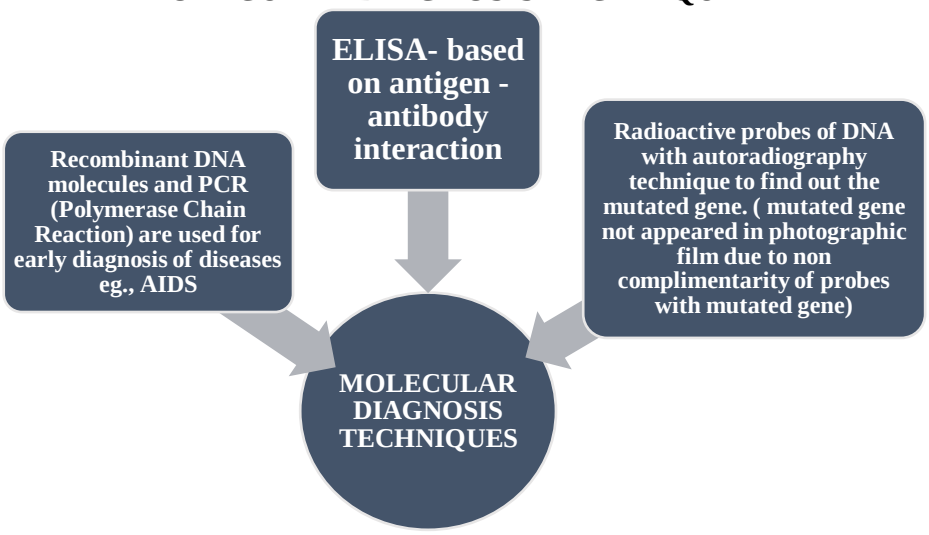
GENE THERAPY

A normal gene is introduced into the individual or embryo to replace the defective mutant allele of the gene that causes hereditary disease.

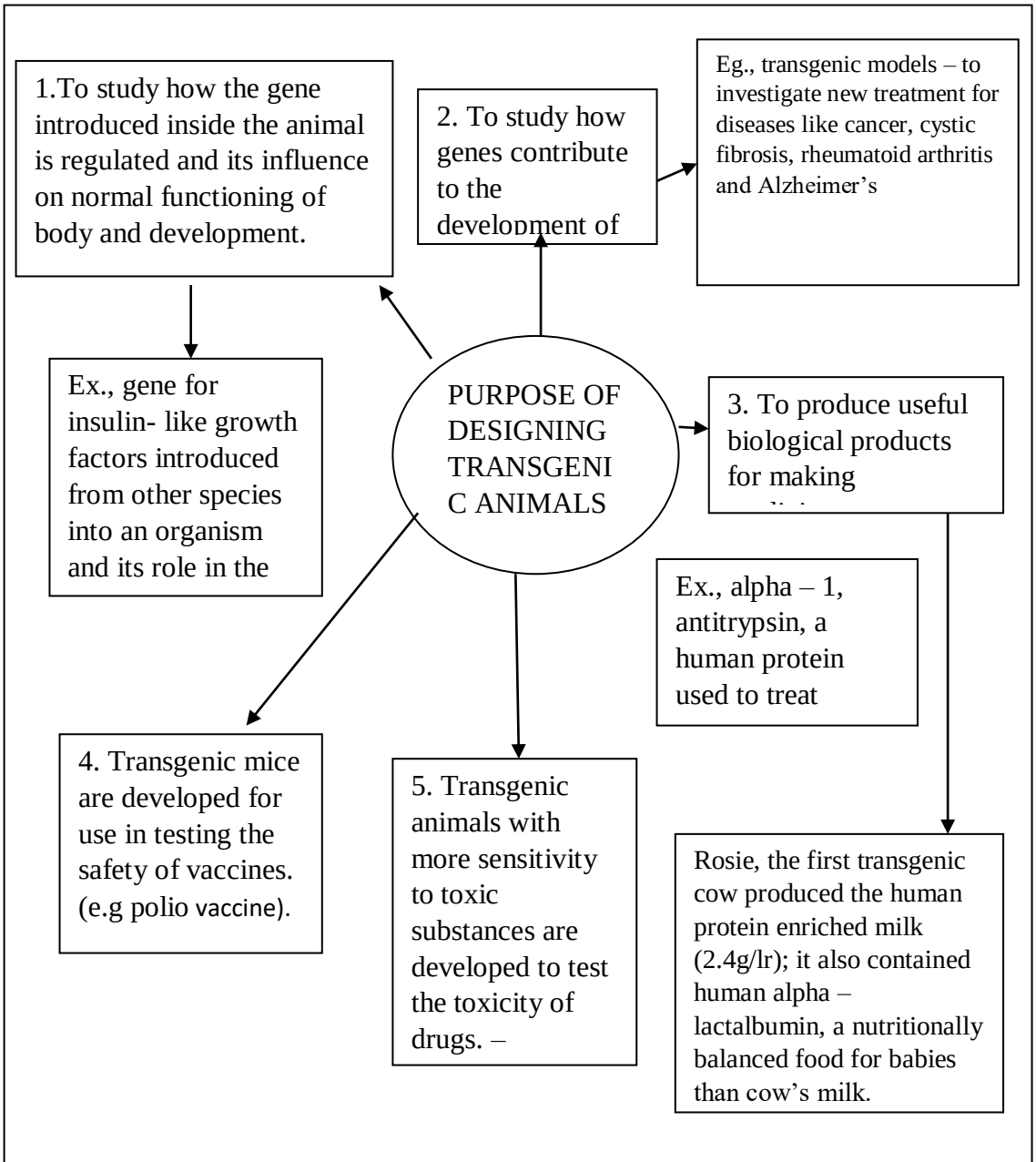
Viruses which attack the host and introduce their genetic material into host are used as vectors to introduce the normal genes.



MOLECULAR DIAGNOSIS TECHNIQUE



TRANSGENIC ANIMALS



Competency Based Questions

MCQs :

1.	Toxin of Bacillus thuringiensis is activated in the intestine of boll worm by: a. Acidic pH of stomach . b.High temperature c. Alkaline pH of gut d. Mechanical action in the insect gut ans: C	1
2.	Gene can be silenced through the use of: a. RNAi only b. antisense RNA only c. both RNAi and antisense RNA d. none of the above ans: C	1
3.	The disease for which first clinical gene therapy was done is: a. AIDS b. Cancer c. Cystic fibrosis d. SCID (Severe Combined Immuno Deficiency resulting from deficiency of ADA) ans: D	1
4.	The product α -1 antitrypsin produced by transgenic animal is: a. An antacid b. An enzyme c. Used to treat arthritis d. Used to treat emphysema ans: D	1
5.	A protoxin produced by *Bacillus thuringiensis* does not kill the bacterium. Because it is: a. A primitive toxin b. A denatured toxin c. destroyed inside the microbe d. An Inactive toxin ans: D	1
6.	Pick out the vector from the following? a. *Trichoderma harzianum b. Meloidogyne incognita c. Penicillium expansum d. Agrobacterium tumifaciens* ans: D	1
7.	The two polypeptides of human insulin are linked together by a .Hydrogen bonds b. Disulphide bridges c. Covalent bonds d. Phosphodiester bonds ans: B	1
8.	Golden rice is a genetically modified crop plant where the incorporated gene is meant for the biosynthesis of a. Vitamin B b. Vitamin C c. omega3 d. Vitamin A ans:D	1
9.	Human insulin is being commercially produced from a transgenic species of : a. *Rhizobium b. Mycobacterium c. Saccharomyces d. Escherichia* ans: D	1
10.	Production of a human protein in bacteria by genetic engineering is possible because a. Bacterial cell can carry out the RNA splicing reactions b. The human chromosome can replicate in bacterial cell c. The mechanism of gene regulation is identical in humans and bacteria d. The genetic code is universal ans: D	1

11. Given below are four genes and the organisms/cells/plant which could be killed / inactivated by the genes. Find out the correct match. 1

S.NO	Vector/Gene	S.NO	Mode of action
a)	cryIIAb	i)	lymphocytes
b)	nematode-specific genes	ii)	corn borer
c)	cryIAb	iii)	cotton bollworms
d)	ADA cDNA	iv)	Tobacco plant

a) a -ii b-i c-iii d-iv
b) a-iv b-iii c-ii d-i
c) a-iii b-iv c-ii d-i
d) a- i b-ii c-iii d-iv

ans: C

ASSERTION- REASON

12. Assertion: "Cry" proteins are named so because they are crystal proteins. 1
Reason: "Cry" proteins are solubilised in acidic environment of insect midgut and then release toxic core fragments after proteolytic action.
(a) Both assertion and reason are true, and reason is the correct explanation of assertion.
(b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.
ans: C

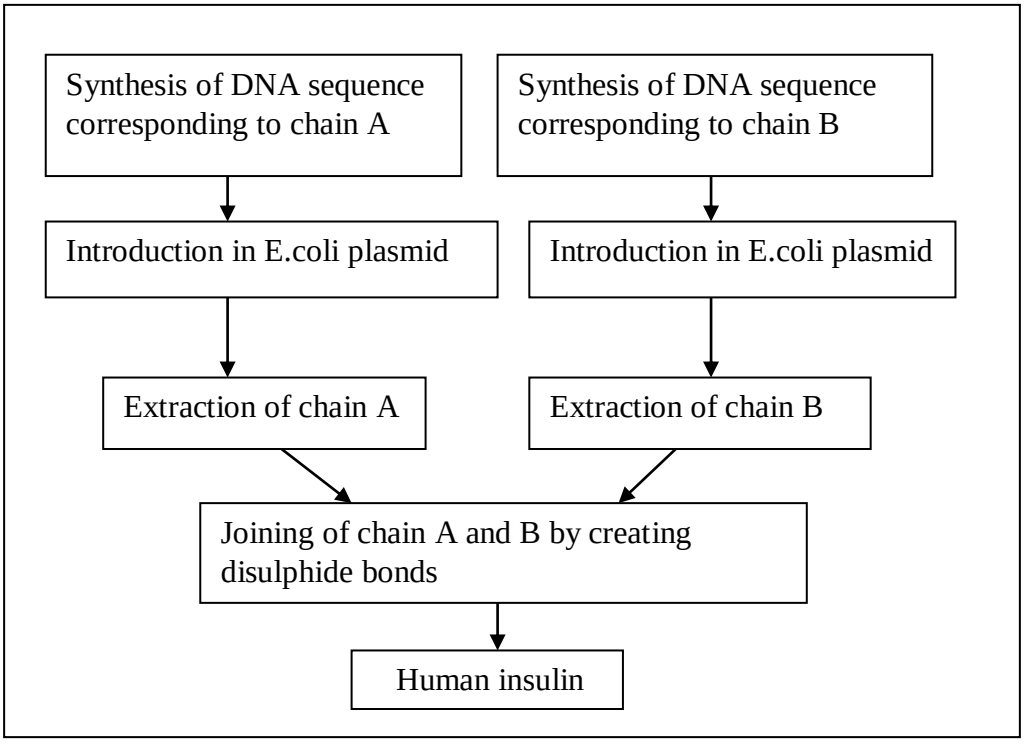
13. Assertion: The RNAi can be brought out in an organism by insertion of gene encoding complementary RNA only. 1
Reason: There are no methods by which in vitro synthesized complementary RNA can be inserted in an organism to induce RNAi (RNA interference).
(a) Both assertion and reason are true, and reason is the correct explanation of assertion.
(b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.
ans: D

14. Assertion: Indian Parliament passed the Indian Patent Bill 1
Reason: To prevent unauthorized exploitation of bio resources and traditional knowledge.
(a) Both assertion and reason are true, and reason is the correct explanation of assertion.
(b) Both assertion and reason are true, but reason is not the correct explanation of assertion.
(c) Assertion is true but reason is false.
(d) Both assertion and reason are false.
Ans: A

15. Assertion: DNA sequences corresponding to Human insulin can be produced in bacterial cells using biotechnology. 1

	Reason: To produce human insulin the A, B and C polypeptides of the human insulin are produced separately in the bacterial cells, extracted and combined by creating disulphide bonds. (a) Both assertion and reason are true, and reason is the correct explanation of assertion. (b) Both assertion and reason are true, but reason is not the correct explanation of assertion. (c) Assertion is true but reason is false. (d) Both assertion and reason are false. Ans: C	
16.	Assertion: ADA gene therapy was done at first to treat immune disorder due to ADA deficiency. Reason: The gene ADA cDNA was delivered into the patient's cells using retroviral vector. (a) Both assertion and reason are true, and reason is the correct explanation of assertion. (b) Both assertion and reason are true, but reason is not the correct explanation of assertion. (c) Assertion is true but reason is false. (d) Both assertion and reason are false. Ans: A	1
17.	Assertion: Organisations like GEAC are necessary to monitor GM researches and to test the safety of introducing GM organisms for public services. Reason: GM researches can have unpredictable results which even can be disastrous when genetically modified organisms are introduced into the ecosystem. (a) Both assertion and reason are true, and reason is the correct explanation of assertion. (b) Both assertion and reason are true, but reason is not the correct explanation of assertion. (c) Assertion is true but reason is false. (d) Both assertion and reason are false. Ans: B	1
18.	Why do children treated by enzyme-replacement therapy for adenosine deaminase deficiency need periodic infusion of that enzyme? Ans: This therapy does not cure the disease completely=1 The enzyme functions as long as it is present in the body as it cannot be synthesized due to the absence of ADA gene.=1	2
19.	You have developed a GM organism which government organisation will approach you to obtain clearance for its mass production? Why is such a body necessary? Give two reasons. ANS:GEAC, It may give undesirable effects, so the validity and safety has to be checked.	2
20.	Suggest any two possible treatments that can be given to a patient exhibiting adenosine deaminase deficiency. Ans: 1)enzymes replacement therapy (in which functional ADA is injected) 2) bone marrow transplantation 3) gene therapy/ culturing the lymphocytes followed by introduction of functional	2

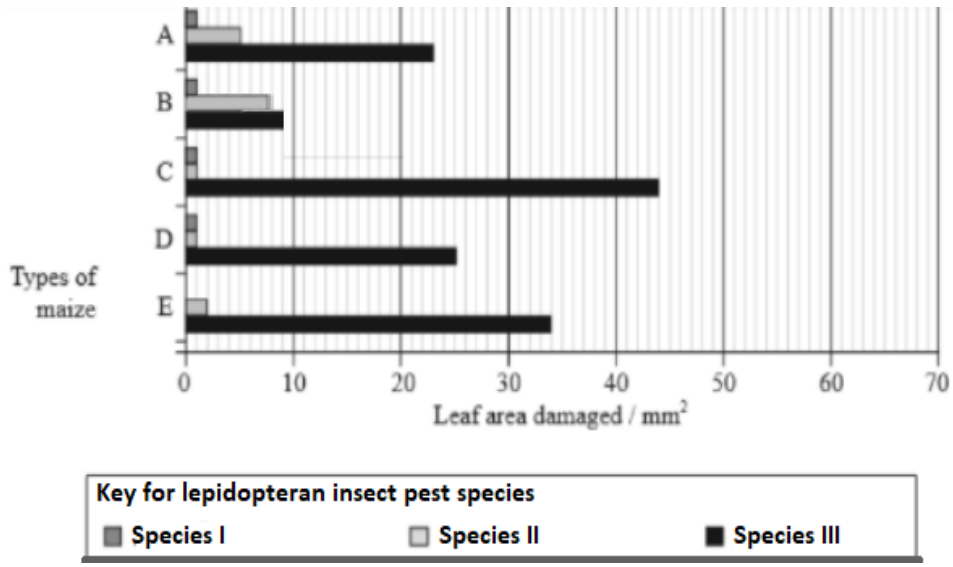
	ADAcDNA into it & returning it into the patient's body. (any two) =1+1	
21.	a) Mention the cause and body system affected by ADA deficiency in humans. b) Name the vector used for transferring ADA-DNA into the recipient cells in humans. Name the recipient cells. Ans: a)defective gene in producing ADA, immune system is affected =1/2+1/2 b)a retroviral vector is used, recipient cells are lymphocytes = ½+1/2	2
22.	How 'Rosie' is considered different from a normal cow? Explain. Ans: Rosie is a transgenic cow=1 Rosie produced human enriched milk, containing human alpha lactalbumin=1/2+1/2=1	2
23.	Transgenic animals are proved to be beneficial. Mention their role in: (a) Production of biological products (b) Chemical safety testing **(**Rosie – transgenic cow) produced human protein / alpha lactalbumin enriched milk, alpha -1 antitrypsin used to treat emphysema.1/2+1/2 (Toxicity testing) – more sensitive to toxic substances, results obtained in less time. 1/2+1/2	2
24.	In developing and under developed countries, an unauthorised exploitation of bio resources is done. What is it known as? Is that to be prevented? State why and how. Ans: Biopiracy, yes to be prevented=1 By developing laws to obtain proper authorisation/pay compensatory benefits=1	2
25.	Why is proinsulin so called ?How is insulin different from it? Ans: Proinsulin is an inactive form of insulin , containing an extra stretch called 'C' peptide , insulin is made up of only 2 short poly peptide chains 'A' and 'B' linked by disulphide bridges , is functional = ½*4	
26.	a) Tobacco plants are damaged severely when infested with *Meloidegyne incognitia*. Name and explain the strategy that is adapted to stop this infestation. b) Name the vector used for introducing the nematode specific gene in tobacco plant. Ans: a) Nematode specific gene introduced into host plant, produced ds RNA, RNAi initiated, specific mRNA of the nematode silenced and parasite dies. =1/2x4=2 b)*Agrobacterium tumefaciens* =1	3
27.	Insects belonging to the orders such as lepidoptera (tobacco budworm, armyworm), coleoptera (beetles) usually damage the crops and reduce their yield. This is avoided by introducing pest resistant gene in the crops. a) Name the insect pest that is killed by the products of cry IAc gene. b) Explain how the gene makes the plant resistant to the insect pest. Ans: Boll worm=1 The gene produces crystals of insecticidal protein which is inactive protoxin,when the boll worm eats the protoxin the alkaline pH of the gut activates it, activated protoxin binds to the midgut epithelial cells, creates pores/causes swelling/causes lysis/kill the worm=1/2x4	3
28.	How did an American company, Eli Lilly use the knowledge of r-DNA technology to produce human insulin? Ans: Two chains of DNA sequence corresponding to A&B chains of human	3

	insulin prepared, introduced them into plasmids of *E.coli* to produce separate A& B chains, A& B chains extracted combined by creating disulphide bonds= 1x3	
29.	Recombinant DNA technology is of great importance in the field of medicine. With the help of a flow chart, show how this technology has been used in preparing genetically engineered human insulin. Ans:  1+1/2+1/2+1/2+1/2=3	3
30.	Although "green revolution" has almost tripled the food grain production, yet it is not enough to feed the growing population. This problem can be overcome by the use of genetically modified crops. i) What are GM crops? ii) Mention any four ways in which GM crops have been useful. i)GM crops- crops developed through genetic modification, tailor made. (1+4) ii) 1.Made crops tolerant to abiotic stresses (cold, drought, heat, salt) 2. Reduced reliance on chemical pesticides. 3. Helped to reduce post harvest losses 4. Increased efficiency of mineral usage. 5. Enhanced nutritional value of food, e,g., vitamin A enriched rice. (any four)	5
31.	(Questions from sample papers - CBSE) Insects in the Lepidopteran group lay eggs on maize crops. The larvae on hatching feed on maize leaf and tender cob. In order to arrest the spread of three such Lepidopteran pests, Bt maize crops were introduced in an experimental field. A study was carried out to see which of the three species of lepidopteran pests	5

was most susceptible to Bt genes and its product.

The lepidopteran pests were allowed to feed on the same Bt-maize crops grown on5 fields (A-E).

The graph below shows the leaf area damaged by these three pests after feeding on maize leaves for five days.



Insect gut pH was recorded as 10, 8 and 6 respectively for Species I, II and IIIrespectively.

(a) Evaluate the efficacy of the Bt crop on the feeding habits of the three species of stem borer and suggest which species is least susceptible to Bt toxin.

(b) Which species is most susceptible to Bt-maize, explain why?

(c) Using the given information, suggest why similar effect was not seen in the three insect species?

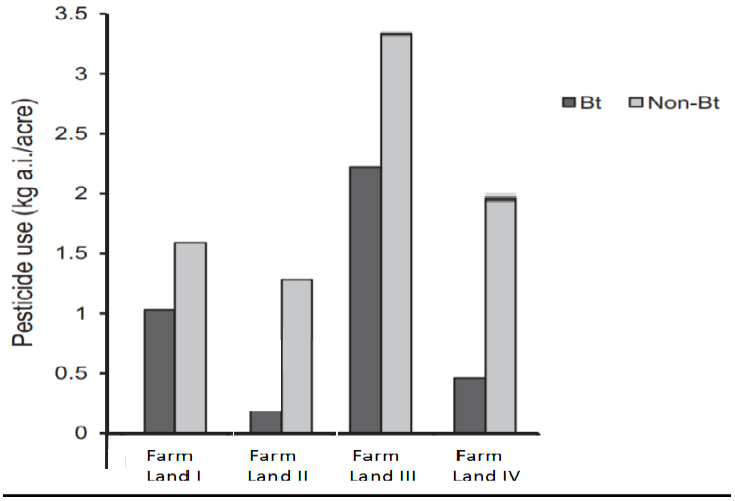
Ans:

(a) Species III is least susceptible (1 Mark)

(b) Bt toxin **protoxins are converted into an active form in the gut** which solubilises the toxin crystals.The **activated toxin binds to the surface of midgut epithelial cells** and **create pores** that **cause cell swelling and lysis** and eventually cause death of the insect (2 Marks)

a) Insect **species I and II have alkaline gut pH** which **solubilises the insecticidal protein crystals of protoxin and makes it active**. Species **III has an acidic** and the **protoxin continues to remain inan inactive form** doing no harm to insect species III (2 Marks)

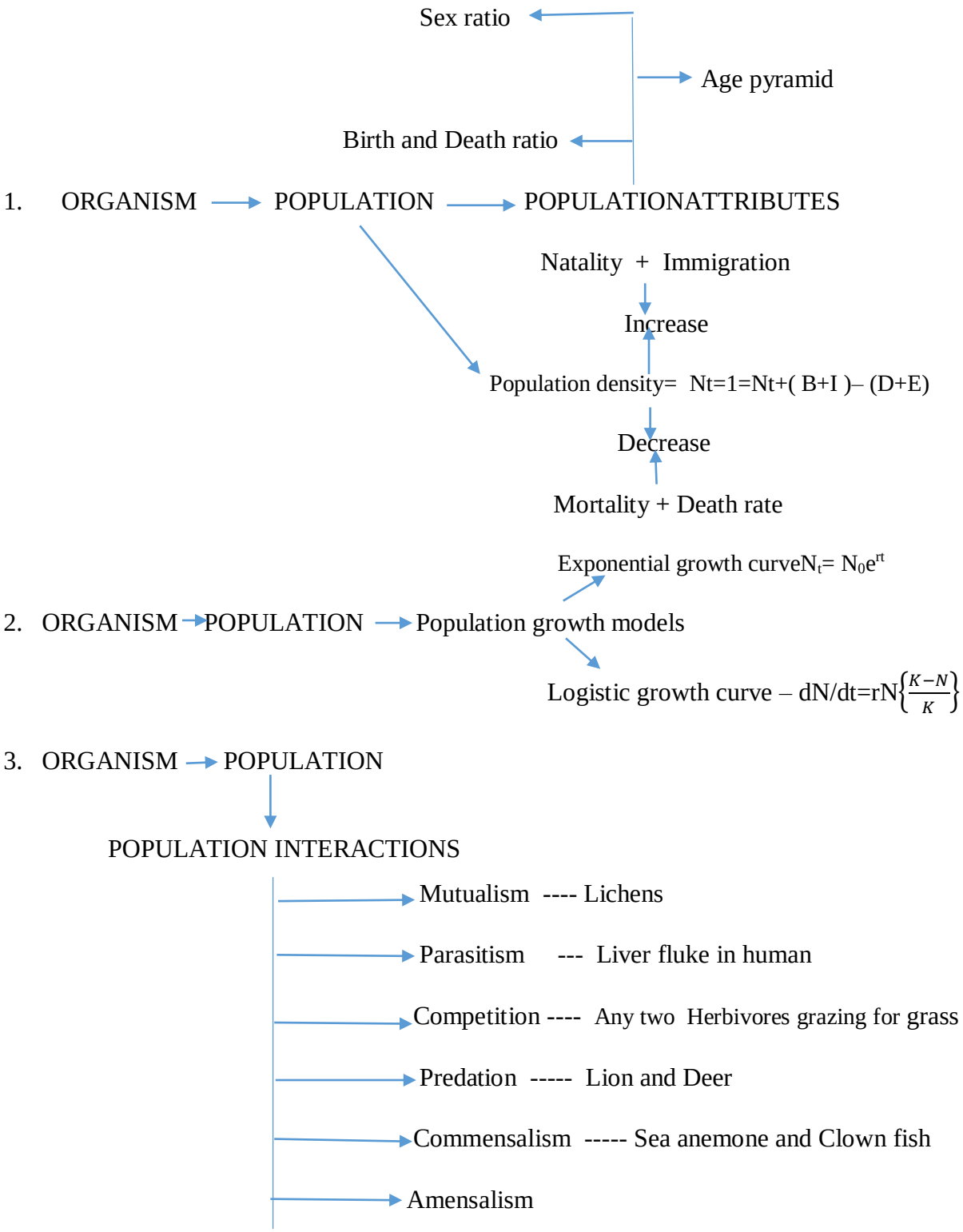
32.	GM crops especially Bt crops are known to have higher resistance to pest attacks. To substantiate this an experimental study was conducted in 4 different farmlands growing Bt and non Bt-Cotton crops. The farm lands had the same dimensions, fertility and were under similar climatic conditions. The histogram below shows the usage of pesticides on Bt crops and non-Bt crops in these farm	5

	lands.  a. Which of the above 4 farm lands has successfully applied the concepts of Biotechnology to show better management practices and use of agrochemicals? If you had to cultivate, which crop would you prefer (Bt or Non- Bt) and why? Cotton Bollworms were introduced in another experimental study onthe above farm lands **wherein no pesticide was used**. Explain what effect would a Bt and Non Bt crop have on the pest. Ans: a. Farm Land II. (½ mark) Bt crop. (½ mark) Because the use of pesticides is highly reduced for Bt crop // Decrease of pesticide used is also more significant forBt crop. (1 mark) b. In Bt cotton a cry gene has been introduce from bacterium *Bacillus thuringiensis* (Bt) which causes synthesis of a toxic protein. This protein becomes active in the alkaline gut of bollworm feeding on cotton, punching holes in the lining causing death of the insect. (2 marks) However; a Non Bt crop will have no effect on the cotton bollworm/ the yield of cotton will decrease / non Bt will succumb to pest attack. (1 mark)	
33.	RNAi is a natural process and works like a "dimmer switch" to dial down the level of a protein. It has evolved to protect cells from viruses. It begins when a form of RNA made of two strands (double- stranded RNA, or dsRNA) is introduced into the cell, for example by a virus, or produced in the cell. iRNAs are specific and usually synthesized to reduce the translation of specific messenger RNAs (mRNAs) this is done to reduce the synthesis of particular proteins. They form from double stranded RNA transcribed and then cut to size in the nucleus before releasing into the cytoplasm. i) Illustrate the RNAi mechanism introducing to tobacco for pest resistance. ii) What is meant by silencing sense RNA by anti sense RNA?	5

	Ans: Using *Agrobacterium* vector nematode specific genes are introduced into the host plant. The introduction of DNA such that it produces both sense and anti sense RNAs. These two are complimentary to each other formed a double stranded RNA (dsRNA). This silences the mRNA of the nematode and prevents its translation into protein. So nematode cannot survive in the roots of plants. Thus plant is protected from the parasite.	
34.	The advancement of diabetes treatment has gone from crude extracts of insulin and accidental discovery of sulfa-like drugs in antibiotics to the development of drugs based on improved understanding of the pathophysiology of diabetes mellitus and with the help of genetic engineering techniques. Insulin is important hormone that controls blood sugar level. Eli Lilly began producing insulin from animal pancreas but fell short of the demand. So he artificially produced it. a) Name the source from which insulin was extracted earlier. Why is this insulin no more in use by diabetic people? b) Explain process of synthesis of insulin by Eli Lilly company. Name the technique used by the company. c) How is the insulin produced by human body different from the insulin produced by the above mentioned company? Ans: a)pancreas of slaughtered cattle and pig=1/2 b) Eli Lilly used the following procedure prepared two DNA sequences corresponding to A and B chain of insulin,introduced them in plasmids of E.coli, insulin chains are produced separately, extracted and combined by creating disulphide bonds(assembled mature molecule of insulin), =1/2x4=2 using rDNA technique=1 c)the prohormone produced in the human body has an extra stretch of C peptide=1	5

CHAPTER 13 ORGANISMS AND POPULATIONS

1.CONCEPT MAP



2 .KEY POINTS

Population – A population is defined as a group of individuals of the same species that live in a particular time.

A population has certain attributes that an individual organism does not have. Individual may have births and deaths but a population has birth rates and death rates.

Sex ratio is an another attributes of population. An individual may be male or female but population has sex ratio.

A population at given time is composed of different individuals of different ages. If the age distribution is plotted for the population, the resulting structure is called age pyramid.

Population Density is a measurement of population per unit area.

Population growth – The main factors that determine the population growth are Natality- B (number of births), Mortality- D (number of deaths), Immigration – I (individuals that come into habitat) and

Emigration – E (individuals that leave the habitat)

Growth model- Exponential growth – This growth occurs when food and space is available in sufficient amount. The population grows in an exponential or geometric fashion.

Logistic growth – There is a competition between the individuals of a population for food and space. The fittest organism survives and reproduces. In nature, a given habitat has enough resources to support a maximum possible number, beyond which no further growth is possible.This limit as nature's carrying capacity(K) for that species in that habitat.

Population Interaction – All animals, plants and microbes in a biological community interact with each other.

These interactions may be beneficial, detrimental or neutral to one species or both.

i)Predation – It is the interaction between two species members in which the members of one species capture, kill and eat up the members of other species.

ii)Parasitism – It is the relationship between two living organisms of different species in which one organism called parasite obtains its food directly from another living organism called host.

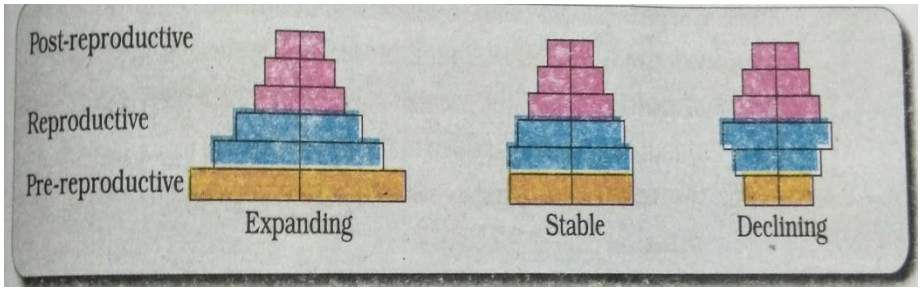
iii) Competition- It is the rivalry between two or more organisms for obtaining the same resources

iv) Mutualism – Interaction between two organisms of different species where both are benefited but cannot live separately.

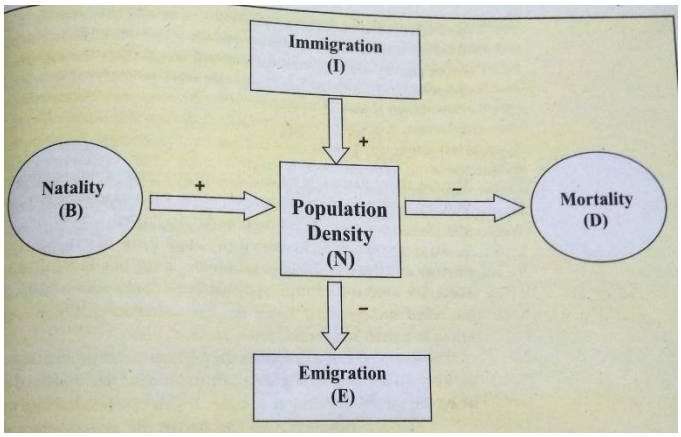
v) Commensalism – It is the interaction in which one species benefit and the other is neither harmed nor benefitted.

3. IMPORTANT DIAGRAMS

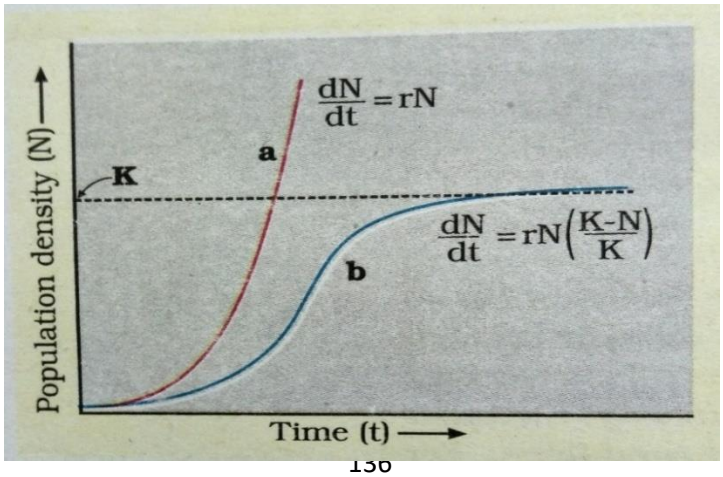
1) Age pyramid for human population



2) Population density



3) Population growth curve.



4. COMPETENCY BASED QUESTIONS & ANSWERS.

1. Read the following passage and answer any four questions given below.

No living organisms, whether plants, animals or microbes can occur in isolation in nature. They interact in various ways to form a biological community. This type of interaction where population of two or more different species interact with each other known as population interactions. These may be positive (beneficial), negative or neutral(neither harmed nor benefitted) that is, it may be mutualism or parasitism.

i) Mutualism is which type of interaction
   a) Positive b) negative c) neutral d) none

ii) Cuscuta is an example of
   a) Ectoparasitism b) brood parasitism c) predation d) endo parasitism

iii) Mycorrhizae is the example of
   a) Amensalism b) mutualism c) parasitism d) predation

iv) Cuckoo and crow are example of
   a) Competition b) ectoparasites c) brood parasitism d) predation

v) What is meant by population interactions?

Answers i) positive ii) ectoparasitismiii) mutualism iv) brood parasitism v) interaction where population of two or more different species interact with each other known as population interactions.

2. Read the following passage and answer the questions given below

Plants cannot run away from their predators. Plants therefore have evolved an astonishing variety of morphological and chemicals defences against herbivores. Thorns in Acacia, Cactus is the most common morphological evidence. Many plants produce and store chemicals that make the herbivore sick and when they are eaten, inhibit feeding or digestiondisrupt its reproduction or even kill it. Calotropis produces highly poisonous cardiac glycosides and that is why you never see any cattle or goats browsing on this plant. A wide variety of chemical substances that we extract from plants (nicotine, caffeine,quinine and opium) are produced by them as defences against grazers and browsers.

i) Why you never see cattle or goat browsing on weed Calotropis?

ii) Which of the following is most likely to sick by consuming chemicals produced by plants?

a) Frog b) goat c)human d)pigeon

iii) Plant evolve variety of morphological and chemical defences against

a) Predators b) prey c)parasites d) none

iv) Name any four chemical substances that we extract from plants on a commercial scale.

Answers. i) It produces highly poisonous cardiac glycosides. ii) goat iii) predators iv) nicotine, caffeine, quinine and opium

5. PREVIOUS YEARS' CBSE QUESTIONS

1. What does sigmoid growth curve of a population indicate?

   Ans-It represents logistic growth, which shows initially a lag phase, followed by phases of acceleration and deceleration and finally an asymptote, when the population density reaches the carrying capacity.

2. Provide an instance where the population size of a species can be estimated indirectly, without actually counting them or seeing them.

   Ans- Tiger census in National parks and Tiger reserves was done on the basis of counting pug marks/faecal pellets

3. Apart from being part of the food chain, predators play other important roles. Mention any two such roles supported by examples.

   Ans- Predators act as conduits for energy transfer across trophic level/They keep prey population under control/They help in maintaining species diversity in a community by reducing intensity of competition among competing prey species.

4.Compare, giving reason , the J shaped and S shaped models of population growth of a species.

Describe fitness of a species as mentioned by Darwin

Ans-J shaped growth curve

Resources are unlimited, growth is exponential, all individuals survive and reproduce

S shaped growth curve

Resources are limited, logistic growth, fittest individual will survive and reproduce.

When resources are limited, competition occurs between individuals, fittest will survive, which will reproduce to leave more progeny.

5. The population of a metro city experiences fluctuations in its population density over a period of time.

a) When does the population in a metro city tend to increase?

b) When does the population in a metro city tend to decline?

c) If N is the population density at the time of t, write the population density at the time of t+1.

Ans –a) number of birth& number of immigrants more than the number of death and number on emigrants.

b) If number of death and number of emigrants more than number of birth and number of immigrants.

c) Nt+1= Nt+(B+I) – (D+E)

6. COMPETITIVE BASED MCQ.

1. Which one of the following is a parasitic adaptation?

a) Presence of sense organs b) less reproductive capacity

c) presence of adhesive organs and suckers to cling on to the host

d) Well developed digestive system

Ans - c

2.A population has more young individuals compared to the older individuals. What would be the status of the population after some years?

a) It will decline b) it will stabilize c) it will increase d) it will first decline and then stabilize

Ans – c

3.If a population of 50 Paramecium present in a pool increases to 150 after an hour, what would be the growth rate of population?

a) 50 per hour b) 200 per hour c) 5 per hour d) 100 per hour.

Ans – d

4.Amensalism is an association between two species where

a.One species harmed and other is benefitted b)one species is harmed and other is unaffected

c) both the species are benefitted d)both the species are harmed

Ans – b

5. Lichens are the association of

a)Bacteria and fungus b) algae and bacteria

c) fungus and algae d) fungus and virus

Ans – c

6. Sea Anemone gets attached to the surface of the hermit crab. The kind of population interaction exhibited in this case is

(a) amensalism. b) commensalism c) mutualism d) parasitism

Ans. b

7.Swathi was growing a bacterial colony in a culture flask under ideal laboratory conditions where theresources are replenished. Which of the following equations will represent the growth in this case? *(Where population size is N, birth rate is b, death rate is d, unit time period is t, and carrying capacity is K).*

(a) $dN/dt = KN$ (b) $dN/dt = r N$

(c) $dN/dt = r N(K-N/K)$ (d) $dN/dt = r N(K+N/K)$

Ans . b

8. Mycorrhiza is an example to

a) decomposition b) endoparasitism c) symbiotic relationship d) ectoparasitism

Ans c

9. The maximum growth rate occurs in

a) lag phase b) exponential phase c) stationary phase d) senescent phase

Ans b

10. The size of the population tells us a lot about its status in the

a) environment b) sex ratio c) age pyramid d) habitat

Ans d

7. ASSERTION AND REASON BASED QUESTIONS

DIRECTIONS

In the following questions a statement of Assertion (A) is followed by a statement of 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) : Population has certain attributes which an individual organism does not have.

Reason (R): Population is a group of people living in a well defined area, at a particular time.

Ans B.

2. Assertion (A) : Natality contributes to the increase in population density.

Reason (R): Natality refers to the number of births during a given period in the population which is added to the initial density.

Ans A

3. Assertion(A): Clown fish maintains a commensalistic relation with the sea anemone.

Reason(R): In this interaction, one species benefits and the other is neither harmed nor benefitted.

Ans – A

4. Assertion (A): The human population represents the logistic growth curve.

Reason (R): When the resources are limited leading to competition between individuals and survival of fittest, the population tends to grow in a logistic manner.

Ans A.

5. Assertion(A) : The monarch butterfly is highly distasteful to its predator

Reason (R): A special chemical present in its body which is acquired by the butterfly by feeding on a crop plant during adult stage.

Ans. C

6. Assertion(A) : Plants benefit from having mycorrhizal symbiotic association

Reason (R): The fungi help the plant in the absorption of nutrients from the soil while the plant in turn provides food to the fungi

Ans A

7. Assertion(A): Ephiphytes growing on branches of the tree exhibit commensalism

Reason(R): In commensalism one organism benefits from the association while the other has no effect.

Ans A

8.Assertion(A): Logistic growth is more realistic for animal population as compared to exponential growth

Reason (R): Logistic growth is more common in nature because resources are limited and population density reaches carrying capacity of the population

Ans A

9.Assertion(A): Some insects and frogs are camouflaged.

Reason(R): To avoid being detected easily by the predators.

Ans. A

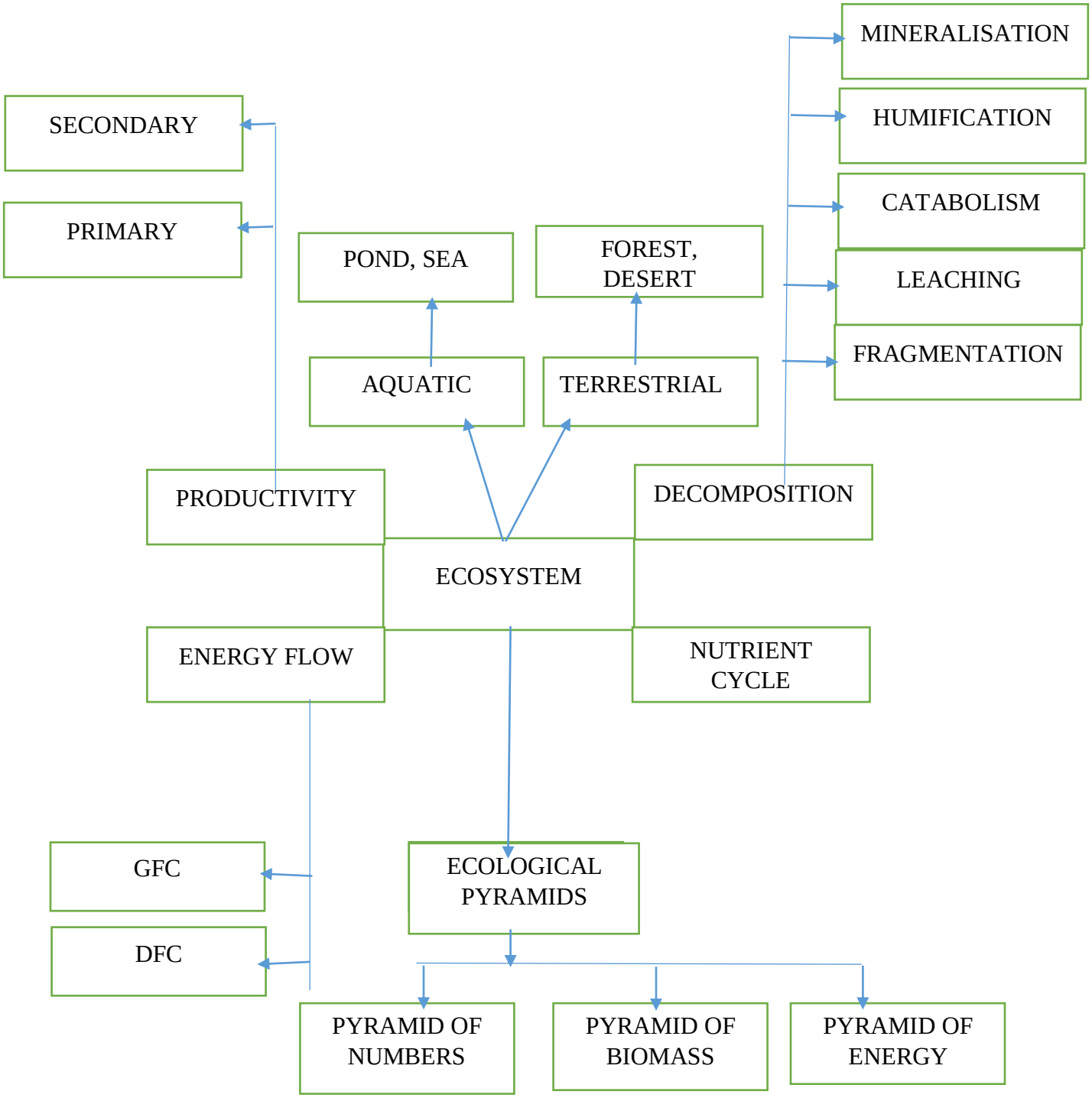
10. Assertion(A): Barnacles growing on the back of a Whale.

Reason(R): This is the interaction in which one species benefits and the other is neither harmed nor benefitted.

Ans A

CHAPTER 14. ECOSYSTEM

CONCEPT MAP



IMPORTANT CONCEPTS

Ecosystem- Functional unit of nature where living organisms interact among themselves and their surrounding physical environment.

Two structural features of ecosystem- Species composition and stratification.

Stratification-Vertical distribution of different species occupying different levels in an ecosystem. Example- In a forest ecosystem, trees occupy the top layer, shrubs the second layer and grasses occupy the bottom layers.

Major functions in an ecosystem

(i) Productivity
(ii) Decomposition
(iii) Energy flow
(iv) Nutrient cycling

Components of pond ecosystem

BIOTIC	**ABIOTIC**
Producers- Phytoplanktons, algae and plants	(i) water (with dissolved organic and inorganic matter) (ii) Dissolved CO_2 and O_2 (iii) Soil (iv)Solar radiation
Consumers- Zooplanktons, fishes	
Decomposers- Fungi, bacteria and flagellates	

PRODUCTIVITY

Primary productivity	**Secondary productivity**
(a) Gross Primary Productivity(GPP) Rate of production of organic matter during photosynthesis in an ecosystem. **Unit** -gm–2 yr –1 or kcal m–2 yr –1 Some of it will be used by plants for respiration and the rest is passed to the next trophic level.	Rate of formation of new organic matter by consumers.
(b) Net Primary Productivity(NPP) Available biomass for the consumption of heterotrophs. **NPP=GPP-R** R=Respiratory losses.	

Factors affecting primary productivity of an ecosystem

(a) Plant species in an area
(b) Availability of nutrients
(c)Environmental factors
(d) Photosynthetic capacity of plants

DECOMPOSITION

The process by which decomposers (bacteria and fungi) break down complex organic matterinto inorganic substances like water,CO_2 and nutrients.

Detritus –The raw materials which undergo decomposition

Eg-Dead plants and animals, fallen leaves and flowers, faecal matter.

Detritivores-Organisms which feed on detritus.Eg-Earthworm

STEPS IN DECOMPOSITION

(a)Fragmentation	Detritus is broken into smaller particles by detritivores.
(b)Leaching	Water-soluble inorganic nutrients go down into the soil horizon and get precipitated as unavailable salts
(c)Catabolism	The enzymes of bacteria and fungi break down detritus into simple inorganic molecules
(d)Humification	This happens in soil .The detritus is converted into a dark amorphous matter called humus.
(e)Mineralisation	Degradation of humus by microbes and release of inorganic substances into the soil**.**

Factors affecting the rate of decomposition

(a) Chemical composition of detritus	(i) Slow decomposition- When detritus is rich in lignin and chitin. (ii) Quick decomposition – when detritus is rich in Nitrogen and sugars.
(b) Climatic factors	(i) Temperature and soil moisture are major climatic factors (ii) Low temperature and lack of oxygen - Slow decomposition (iii) Warm and moist conditions Quick decomposition-

ENERGY FLOW

Flow of energy is unidirectional-From sun to green plants (producers) to animals (consumers) to decomposers.

Energy flows from one trophic level to another through food chains.

Food chains are of two types.

Grazing food chain (GFC)	**Detritus food chain (DFC)**
It starts with a producer. Grass→Goat→Man In aquatic ecosystem GFC is the major conduit for energy transfer.	It starts with detritus. It consists mainly of decomposers. In terrestrial ecosystem DFC is the major conduit for energy transfer.

Trophic level- The place occupied by an organism in a food chain. This is based on the source of their nutrition.

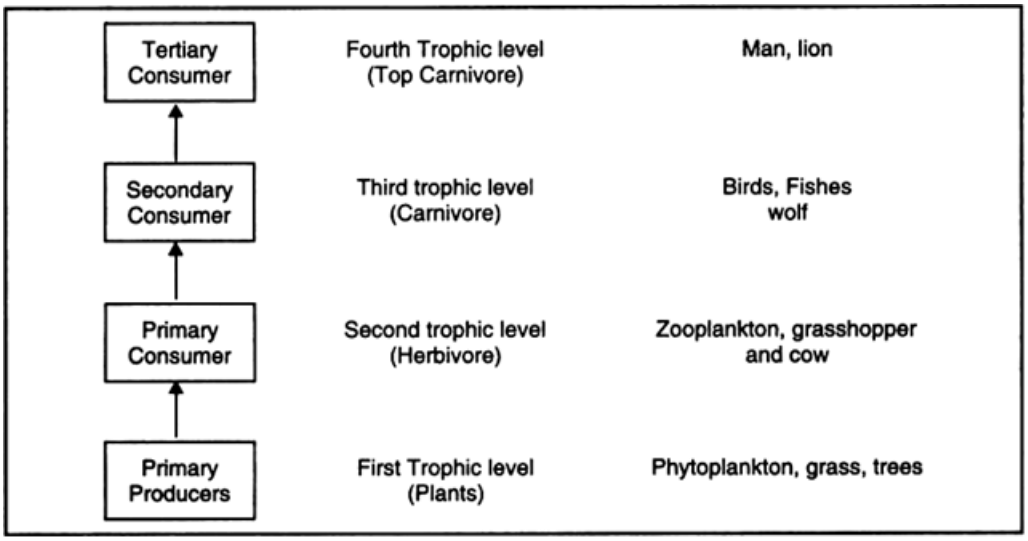
First trophic level-Producers.

Second trophic level – Herbivores (Primary consumers)

Third trophic level- Carnivores (Secondary consumers)

Fourth trophic level- Top carnivores (Tertiary consumers)

Diagrammatic representation of trophic levels in an ecosystem.



Food web- The natural interconnections of many food chains.

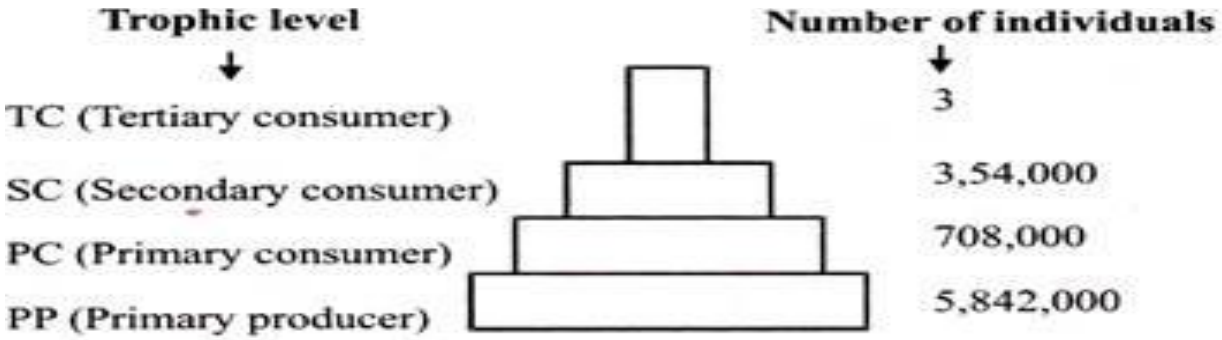
Standing crop-The biomass of living organisms in each trophic level at a particular time.

Ten per cent law- Only 10 % of the energy is transferred from one trophic level to the next.

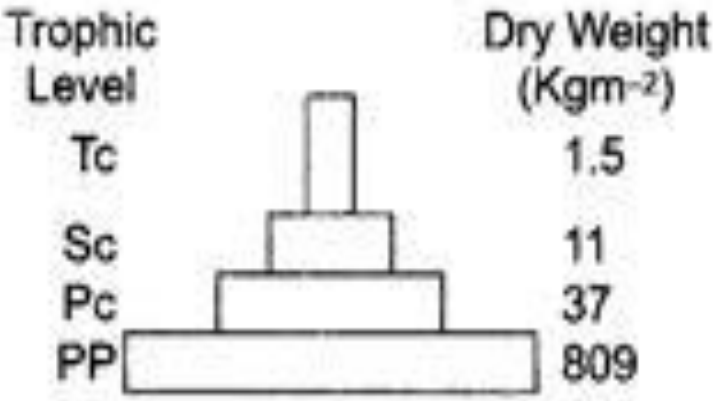
ECOLOGICAL PYRAMIDS

The base of the pyramid is occupied by the producers and the apex of the pyramid by top carnivores.

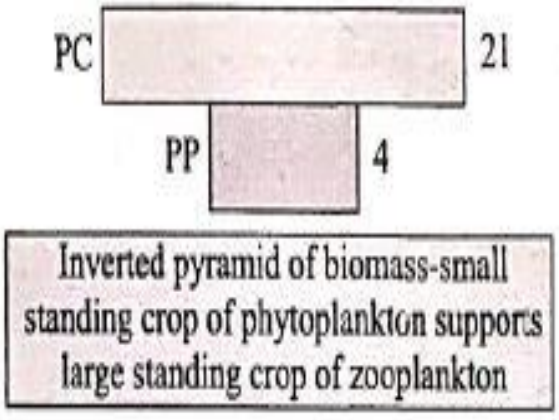
PYRAMID OF ENERGY	PYRAMID OF NUMBERS	PYRAMID OF BIOMASS
The amount of energy present in each trophic level. Always upright. Can never be inverted. As energy flows from one trophic level to next some energy is lost as heat.	The total number of organisms at each trophic level. Usually upright. The number of producers will be more than herbivores and herbivores will be more than carnivores. **Exception-** If we count the number of insects feeding on a big tree, we will get an inverted pyramid of number	The total biomass/weight of organisms at each trophic level. Usually upright. The biomass of producers will be more than that of consumers. **Exception-** In sea, the pyramid of biomass is inverted as the biomass of fishes will be more than that of phytoplanktons.



Pyramid of numbers in a grassland ecosystem.
Only three top-carnivores are supported in an ecosystem based on production of nearly 6 millions plants.



Pyramid of biomass shows a sharp decrease in biomass at higher trophic levels



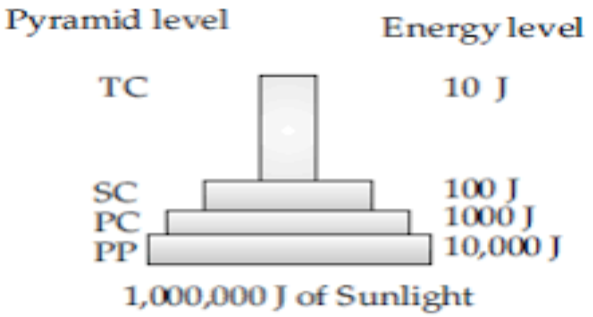


Fig 14.4 : An ideal pyramid of energy

Limitations of ecological pyramids

(1) Does not take into account same species belonging to two or more trophic levels
(2) It assumes a simple food chain and does not accommodate a food web.
(3) Saprophytes are not given any place in ecological pyramids.

COMPETENCY BASED QUESTIONS

MULTIPLE CHOICE QUESTIONS

1) Which one of the following is not functional unit of ecosystem
a) Productivity (b) Decomposition (c) Energy flow (d) Stratification
Ans- **d**

2) An inverted pyramid of biomass is represented by

(a)Grassland ecosystem (b) Tropical forest ecosystem (c) Aquatic ecosystem

(d) Desert ecosystem.

Ans- **c**

3) A frog feeding on a herbivorous insect is a

(a) Primary consumer (b) secondary consumer (c) Tertiary consumer

(d) Top carnivore

Ans-**b**

4) The base of an ecological pyramid represents

(a) Carnivores (b) Omnivores (c) Herbivores (d) Producers

Ans- **d**

5) Which of the following ecosystems is most productive in terms of net primary

production?

a) Tropical rain forests (b) Deserts (c) Oceans (d) Estuaries
Ans-**a**

6) The process of mineralization by microorganisms help in the release of

(a) Inorganic nutrients from humus

(b) Both organic and inorganic nutrients from detritus.

(c) Organic nutrients from humus.

(d) Inorganic nutrients from detritus and formation of humus.

Ans-**a**

7) What percentages of PAR can be captured by plants?
(a) 1-5% (b) 2-10%(c) 20%(d) 50% Ans-**b**

8) Which of the following ecological pyramids can never be inverted in a natural ecosystem?

(a)Pyramid of numbers (b) Pyramid of energy (c) Pyramid of biomass (d) none can be inverted.

Ans- **b**

9) Energy transferred from one trophic level to another

(a) 5 % (b) 15 % (c) 10 % (d) 20%

Ans- **c**

10) The rate of formation of new organic matter by rabbit in a grassland, is called

(a) Net productivity (b) Secondary productivity (c) Net primary productivity (d) Gross primary productivity.

Ans-**b**

11) The second trophic level in a lake is

(a) Zooplankton (b) Phytoplankton (c) Bottom dwellers (d) fishes

Ans: **a**

12) The limitations of ecological pyramid include all the following except

(a) They do not take into account the same species belonging to two or more trophic levels.

(b) They do not represent relationships between organisms at different trophic levels.

(c) They assume a simple food chain and do not consider food webs.

(d) Saprotrophs are not given any place in the ecological pyramids.

Ans- b

ASSERTION REASON QUESTIONS

A. Both Assertion & Reason are True and Reason is the correct explanation of Assertion.

B. Both Assertion & Reason are True and Reason is not the correct explanation of Assertion.

C. Assertion is True but Reason is False

D. Assertion is False but Reason is True

1. Assertion- The annual net primary productivity of the whole biosphere is approximately 170 billion tons (dry weight) of organic matter.

Reason- Majority of this is contributed by the oceans as they occupy larger area of earth.

Ans-**c**

2. Assertion-In a terrestrial ecosystem, detritus food chain is a major conduit for energy flow.
Reason: Solar energy is the direct source of energy supply in the detritus food chain.

Ans-**c**

3. Assertion- Ecosystem is the structural and functional unit of biosphere consisting of abiotic and biotic components which interact with each other and maintain a balance in nature.
Reason: In an ecosystem, energy and matter are continuously exchanged between living and non-living components.

Ans- **a**

4. Assertion-The rate of decomposition is controlled by chemical composition of detritus.

Reason-Decomposition is largely an oxygen requiring process**.**

Ans-b

5. Assertion-Primary productivity varies in different types of ecosystems.

R**eason:** Primary productivity depends on a variety of environmental factors, availability of nutrients and photosynthetic capacity of plants.

Ans- a

SHORT ANSWER QUESTIONS

1) Why are fungi called as decomposers?

Ans. Decomposers are organisms that break down complex organic materials into simple inorganic substances such as carbon dioxide, water and nutrients.

2) Detritus food chain is often connected to grazing food chain in a natural ecosystem. How does it happen?

Ans- Some of the members of DFC are prey to the animals of GFC.

Some omnivores like crow and cockroach occupy positions in both GFC and DFC.

3) The pyramid of energy is always upright, can never be inverted. Justify the statement.

Ans- Flow of energy follows the 10% law. When energy flows from one trophic level to the next trophic level, some energy is always lost as heat at each step.

4) In general all pyramids are upright. Explain. What are the exceptions to this generalization?

Ans-The producers are the most in terms of energy, biomass and number. The members in the subsequent trophic levels are fewer in number and have less biomass and energy. Hence in general all pyramids are upright.

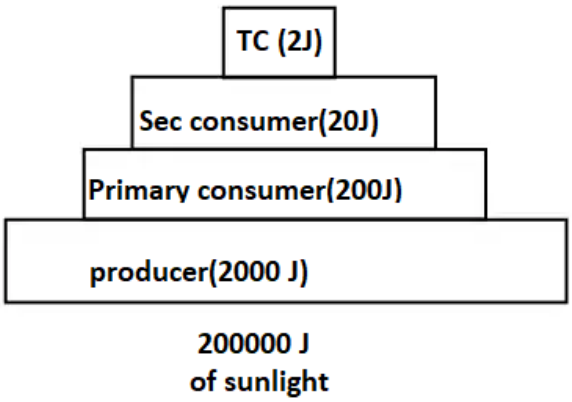
The pyramid of biomass in oceans and pyramid of numbers in case of a fruiting tree supporting hundreds of consumers can be inverted.

5) It is possible that a species may occupy more than one trophic level in the same ecosystem at the same time. Explain giving one example.

Ans- Sparrow is an omnivore. When it eat seeds, fruits or other plant products it is a primary consumer (second trophic level) while when it eats worms and insects it is a secondary consumer (third trophic level).

6) Construct an ideal pyramid of energy if 200000 Joules of sunlight is available

in an ecosystem.



7) What will happen to an ecosystem if

(a) All producers are removed.

(b) All herbivores are removed.

(c) All top carnivores are removed.

Ans- (a) Reduction in primary productivity. No biomass available for consumption by members of higher trophic level (heterotrophs) and they can die of starvation.

(b) Increase in primary productivity and biomass of producers. The number of carnivores will decrease due to shortage of food.

(c) Increase in the number of herbivores which leads to overgrazing that may cause desertification.

8) **Why is the number of trophic levels in an ecosystem limited?**

Ans- Normally a food chain has 4-5 levels. This is because only 10% of energy is passed from one trophic level to the next trophic level. The remaining energy is lost during respiration and is lost as heat. In case there are more levels, the remaining energy will be very less and would not be able to sustain any trophic level through energy flow. Hencetrophic levels are limited in a food chain.

LONG ANSWER QUESTIONS

9) Citing lake as an example of a simple aquatic ecosystem, interpret how various functions of this ecosystem are carried out. Make a food chain that is functional in this ecosystem.

Ans- (i) Productivity- The autotrophs like phytoplanktons, algae etc convert inorganic substances into organic molecules with the help of solar energy.

(ii) Energy flow- Unidirectional flow of energy from sun to producers in the pond to consumers.

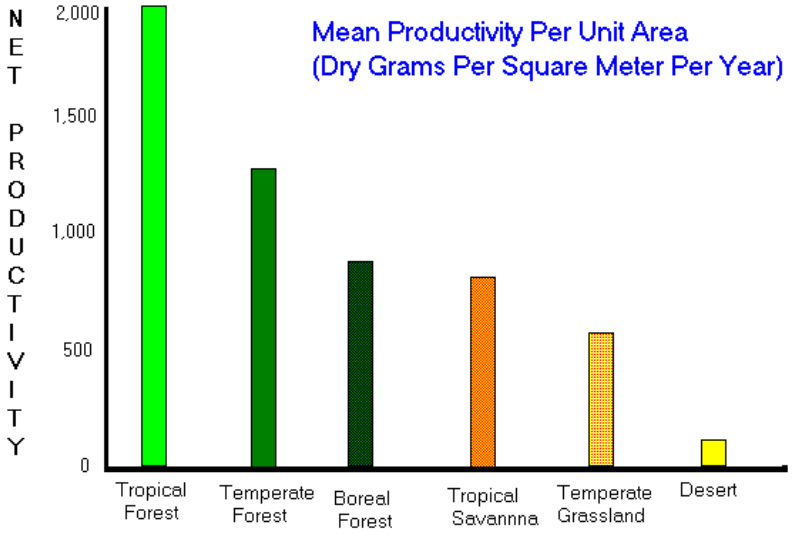
(iii) Decomposition- The complex organic molecules in the detritus (excreta and dead bodies of organisms) are broken down into simple inorganic substances by bacteria and fungi.

(iv) Nutrient cycling-Decomposition of dead matter releases the nutrients back into the ecosystem which can be used by autotrophs.

Food chain in aquatic ecosystem.

Phytoplankton → Zooplankton→ Small fish →Large fish

10)



The net productivity of some ecosystems are given in the above histogram.

(i) Which ecosystem shows the maximum productivity?

(ii) Why does the productivity of one ecosystem different from that of another?

(iii)Differentiate between primary productivity and secondary productivity.

Ans- (i) Tropical forest

ii)Productivity of an ecosystem depends on the following factors.

(i)Plant species living in a particular area (ii) The photosynthetic capacity of plants in the area (iii) Availability of nutrients (iv) Environmental factors in the area.

Hence the productivity varies in different ecosystems

(iii)Primary productivity-Rate of production of organic matter during photosynthesis in an ecosystem.

Secondary productivity-Rate of formation of new organic matter by consumers.

(12) Composting is a process that works to speed up the natural decay of organic material by providing the ideal conditions for detritus-eating organisms to thrive. The end-product of this concentrated decomposition process is nutrient-rich soil that can help crops, garden plants and trees to grow. Different foods and compostable items break down according to different time frames. Composted items can take anywhere for four weeks to 12 months to decompose.About 80 to 90 percent of all microorganisms found in compost piles are bacteria. The remaining percentage of microorganisms are species of fungi, including molds and yeasts.

(i) What could be the reason for the faster decomposition of certain substances?

(ii) Among the following, where do you think the process of decomposition would be the fastest? Why?

(a) Antarctic (b) Dry arid region (c) Alpine region (d) Tropical rain forest

(iii) Define decomposition and describe the processes and products of decomposition.

Ans- (i) The rate of decomposition depends on

Chemical composition of detritus- Slow decomposition- When detritus is rich in lignin and chitin.

Quick decomposition – when detritus is rich in Nitrogen and sugars.

(ii) (d) Tropical rain forest- due to influence of climatic factors

Temperature and soil moisture are major climatic factors

Low temperature and lack of oxygen – Slow rate of decomposition-

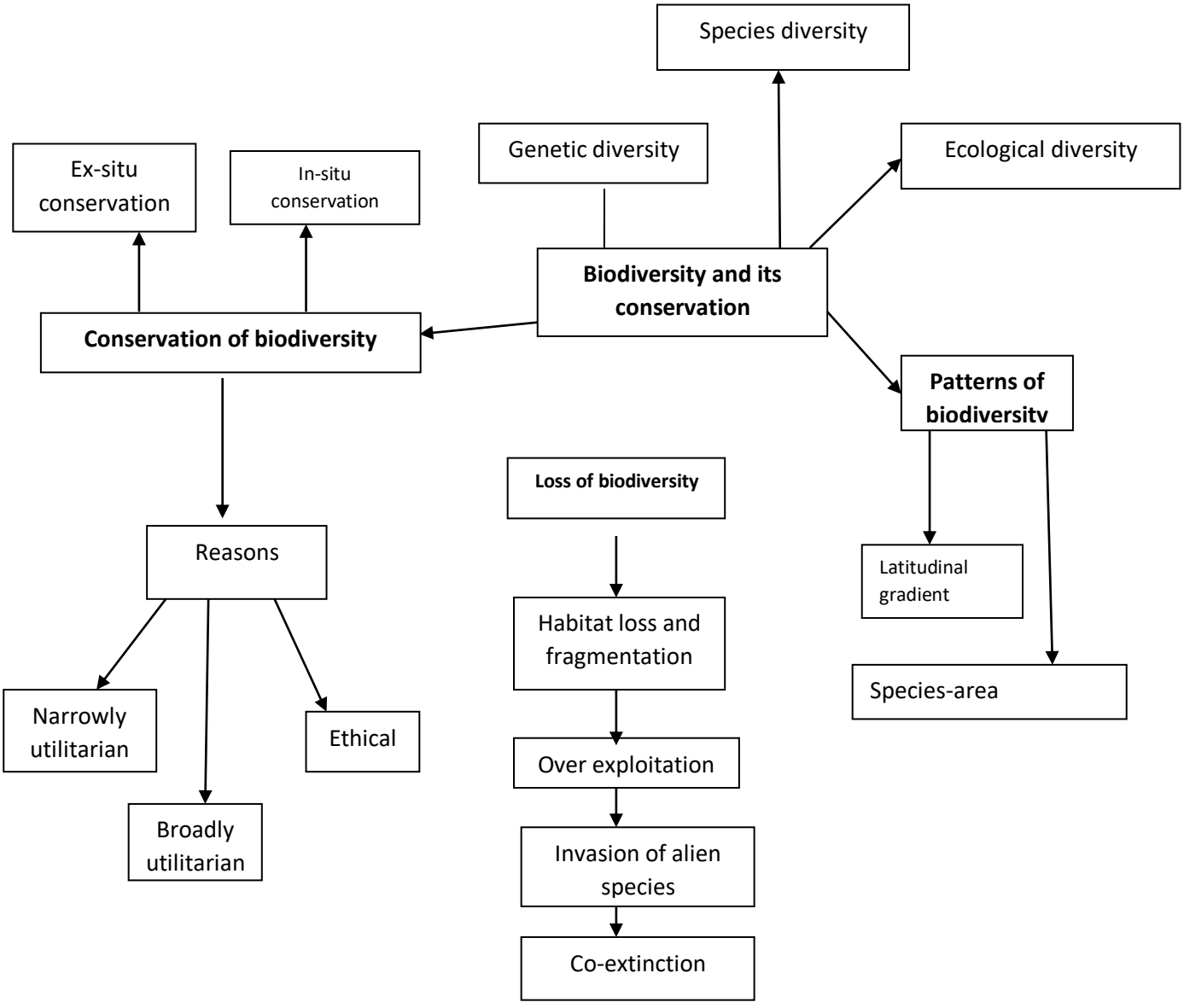
Warm and moist conditions- Quick rate of decomposition

(iii)Decomposition is the process by which complex organic molecules are broken down into simple inorganic substances by bacteria and fungi.

It involves five steps- Fragmentation, leaching, catabolism, humification and mineralization.

The products of decomposition are Water,CO_2 and nutrients.

CHAPTER:15 BIODIVERSITY AND ITS CONSERVATION
CONCEPT MAP



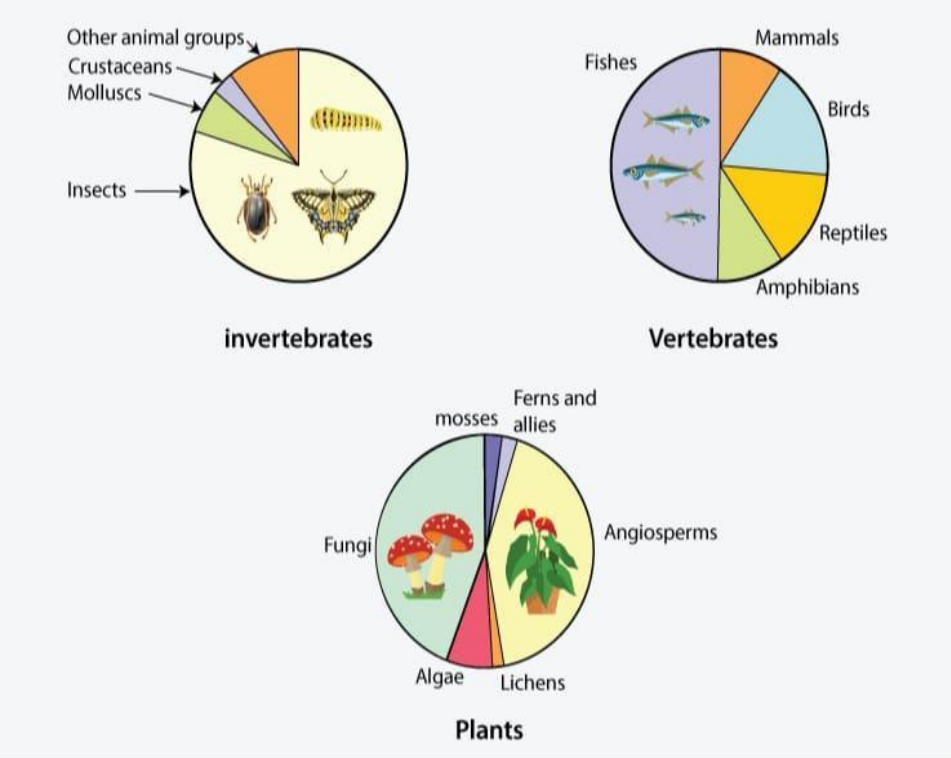
GIST OF THE LESSON

I. Genetic Diversity- a single species might show high diversity at the genetic level over its distributional range. Rauwolfia vomitoria shows genetic variation in terms of concentration and potency of chemical reserpine. India has more than 50,000 genetically different strains of rice and 1000 varieties of mango.

II. Species Diversity- diversity at species level for example, the Western Ghats have more amphibian species diversity than the Eastern Ghats.

III. Ecological Diversity- deserts, rain forests, mangroves, coral reefs, wetlands, estuaries and alpine meadows are types of ecological diversity.

REPRESENTATION OF GLOBAL BIODIVERSITY



Patterns of Biodiversity

a) Latitudinal gradients-Species diversity decreases as we move away from the equator towards the poles. Tropics harbor more species than temperate or polar areas. Various hypothesis has been proposed regarding this such as-

a) Speciation is a function of time unlike temperate regions subjected to frequent glaciation in past, tropical latitudes have remained relatively undisturbed for millions of years and thus had long evolutionary time for species diversification.

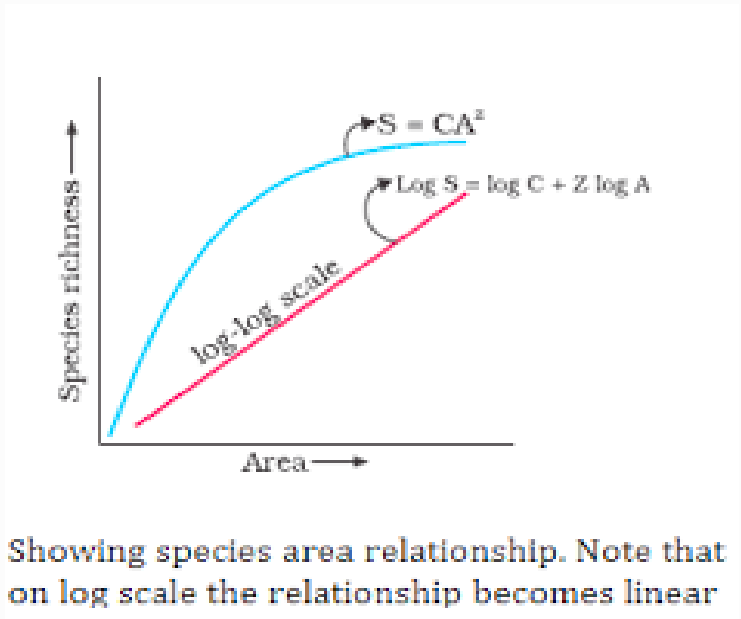
b) Tropical environments unlike temperate ones are less seasonal and more constant and predictable which promote niche specialization and lead to a greater species diversity.

c) There is more solar energy available in the tropics which contribute to higher productivity, this in turn contribute indirectly to greater diversity.

b) Species-Area relationships

• Alexander Von Humboldt has observed that within a region, species richness gets increased when explored area is increased, but only up to a limit.

• The relationship between species richness and area for a number of taxa like angiospermic plants, fresh water fishes and birds is found to be a rectangular hyperbola.



Showing species area relationship. Note that on log scale the relationship becomes linear

The importance of Species Diversity to the Ecosystem:

The communities with more species are generally more stable than those with less species. A stable community should not show too much variation in productivity from year to year.

Rivet popper hypothesis – given by Paul Ehrlich. In an airplane (ecosystem) all parts are joined together using thousands of rivets (species). If every passenger travelling in it starts popping a rivet to take home (causing a species to become extinct), it may not affect flight safety (proper functioning of the ecosystem) initially, but as more and more rivets are removed, the plane becomes dangerously weak over a period of time. Furthermore, which rivet is removed may also be critical. Loss of rivets on the wings (key species that drive major ecosystem functions) is obviously a more serious threat to flight safety than loss of a few rivets on the seats or windows inside the plane

Loss of Biodiversity

The biological wealth of our planets have been declining rapidly due to three factors – Population, Urbanisation and Industrialisation.

a. Decline in plant production
b. Lowered resistance to environmental perturbations, drought, and flood.
c. Increased variability in ecosystem processes such as productivity, water use, and pest and disease cycles.

Causes of biodiversity losses

Faster rates of species extinctions are largely due to human activities. The four major causes are called 'The Evil Quartet'.

1) **Habitat loss and fragmentation**– The main cause of extinction of species is the destruction of their habitat. For example, tropical rainforests once covering more than 14% of the land surface, now cover only 6% of land area. When large habitats are broken, mammals and migratory birds requiring large territories and animals with migratory habits are badly affected.

2) **Over-exploitation**– Overexploitation of natural resources by humans results in degradation and extinction of the resources. For example, Steller's sea cow, passenger pigeon and many marine fishes have become extinct in last 500 years.

3) **Alien species invasions**– Intentional or chance introduction of exotic species into new Islands or countries by man is called alien species invasion. For example, Nile perch introduced into Lake Victoria in East Africa caused loss of more than 200 species of cichlid fish.. Plant alien species-Lantana camara and animal alien species-Clarias gariepinus have posed threat to our Indian native species.

4) **Co-extinctions**– means that when a species is going to become extinct, the plant and animal species associated with it in an obligatory relationship also gets extinct. For example - coevolved plant-pollinator mutualism as in case of Pronuba yuccasella and Yucca, if one partner is on the verge of extinction, the other partner will also get extinct.

Biodiversity Conservation

(i) The narrowly utilitarian
(ii) The Broadly Utilitarian
(iii) Ethical

How do we conserve Biodiversity?

In situ (on site) conservation–conservationists have identified for maximum protection certain 'biodiversity hotspots' regions with very high levels of species richness and high degree of endemism, species found in that region and not found anywhere else. There are 34 biodiversity hot spots in the world. These hotspots are also regions of accelerated habitat loss. India has 14 biosphere reserves, 90 national parks and 448 wildlife sanctuaries.

Ex situ (off site) conservation– in this method, threatened animals and plants are taken out from their natural habitat and placed in special setting when they be protected and given special care . Zoological parks, Botanical Gardens and wildlife safari parks are used for this purpose. Now gametes of threatened species can be preserved in viable and fertile condition for long periods of time using cryopreservation technique. Eggs can be fertilized in vitro and plants can be propagated using tissue culture methods.

QUESTION BANK

MULTIPLE CHOICE QUESTIONS.

1. Which of these has the most Genetic Diversity in India?
a. Teak b) Tea c) Mango d) Potato
Ans: (c) Mango

2. **When the last individual in a particular species dies, it is known as**
a. Speciation b) Extinction c) Phylogenetic diversity d) Adaptation
Ans: (b) Extinction

3.Which of these is a suitable example of ex-situ conservation?
a. National park b) Wildlife sanctuary c) Sacred groves d) Seed bank
Ans: (d) Seedbank

4. _____ is the hotspot of Biodiversity in India.
a. Gangetic plain b) Sunderbans c) Eastern ghats d) Western ghats
Ans: (d) Western Ghats

5. Sacred Groves are useful in
a. Preventing soil erosion. b) Conserving endangered and rare species.
c. Spreading environmental awareness. d) Ensuring the sustainable flow of water in river.
Ans: (b) Conserving endangered and rare species

6. Threatened animals and plants are placed in a separate care unit for protection. It is called
a. Ex-situ conservation b) In situ conservation c) Wildlife sanctuary d) National park
Ans: (a) Ex-situ conservation

7. **How many species of plants contribute to the traditional medicines used by native peoples around the world?**
a) 2,500 b) 2,000 c) 5,000 d) 25,000
Ans: (d) 25,000

ASSERTION AND REASON QUESTIONS.

In the following questions, a statement of assertion is followed by a statement of reason.
Mark the correct choice as:
(a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.
(c) If Assertion is true but Reason is false.
(d) If both Assertion and Reason are false.

1. Assertion: Speciation is a function of time and tropical regions had got a long evolutionary time for species diversification as compared to temperate regions.
Reason: Temperate regions have undergone frequent glaciations in the past whereas tropical regions have remained relatively undisturbed for millions of years.
Ans: (a)

2. Assertion: Community with more species tends to be more stable than those with less species.
Reason: More will be the species, less will be year to year variation in total biomass.
Ans: (a)

3. Assertion: A stable community should not show too much variation in productivity from year to year.
Reason: A stable community must not be resistant to invasions by the alien species.
Ans: (c)

4. Assertion: Decrease in species diversity occurs as we ascend a high mountain.
Reason: Decrease in species diversity occurs with increase in altitude due to rise in temperature.
Ans: (c)

5. Assertion: If the species-area relationships are analysed among very large areas like the entire continents, the value of Z i.e., slope of line lies in the range of 0.1 to 0.2.
Reason: The value of Z i.e., slope of line of species area relationships lies in the range of 0.6 to 1.2 for frugivorous animals in tropical forests.
Ans: (d)

6. Assertion: Habitat loss and fragmentation is the most important cause driving animals and plants to extinction.
Reason: Tropical rain forests, once covering more than 14% of the earth's land surface now cover no more than 6%.
Ans: (b)

7. Assertion: Western Ghats have a greater amphibian species diversity than the Eastern Ghats.
Reason: It is an example for genetic diversity.
Ans: (c)

8. Assertion: "Sixth extinction" rate is estimated to be 100 to 1000 times faster than the pre-human times.
Reason: Human activities are responsible for the faster rates of extinction.
Ans: (a)

CASE STUDY BASED QUESTION.

Read the following and answer any four questions from (i) to (v) given below:

The Kakapo is the world's largest and heaviest parrot, found only in New Zealand. It is unusual in that it is nocturnal, flightless and ground-dwelling. It is an excellent climber of trees, has strong legs that allow it to "jog" several kilometres in a single trip, and has mossy green plumage mottled with brown and yellow. The Kakapo is also critically endangered as of now, there were only few known living individuals left.

(i) Which could be the possible reason for Kakapo to be well-adapted to its environment prior to the arrival of humans in New Zealand?
(a) Kakapo was active only in the night when its potential predators would not be out for hunting.
(b) The Kakapo cannot escape from the foliage due to its plumage.
(c) It was not able to effectively hunt food in the night.
(d) All of these.
Ans: (a)

(ii) When humans started to settle in New Zealand, they took with them non-native animals, including mammals such as cats, dogs and stoats. By which of the following ways, human settlement likely contributed to a near decimation of Kakapo populations in New Zealand?

(a) Habitat destruction (b) Alien species invasion (c) Pollution (d) Both (a) and (b)

Ans: (d)

(iii) All known survived Kakapo have been relocated by the New Zealand government to three predator-free islands, where they are monitored year round by staffs and volunteers to ensure that the birds are safe, healthy and well-fed. The extremely low population of Kakapo is a hurdle to the species becoming viable in the long term, despite such dedicated conservation efforts. This is because

(a) the small population results in very large gene pool
(b) there would be very limited genetic diversity among the resulting offspring.
(c) of increased capacity of the species to adapt and survive changes in the environment.
(d) All of these
Ans: (b)

(iv) The reasons behind conserving biodiversity have been grouped into which of the following categories?

(a) Narrowly utilitarian (b) Broadly utilitarian (c) Ethical (d) All of these

Ans: (d)

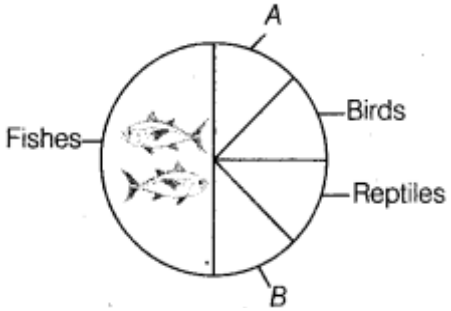
(v) One of the ex situ conservation methods for endangered species is

(a) Wild life sanctuaries (b) Biosphere reserves (c) Cryopreservation (d) National parks.

BOARD QUESTION PAPERS

1 Mark Questions

1. Identify A and B in the figure given below representing proportionate number of major ertebrate taxa.



Ans: A-represents mammals. B-represents amphibians.

2. Write the level of biodiversity represented by mangroves. Give another example falling in the same level.

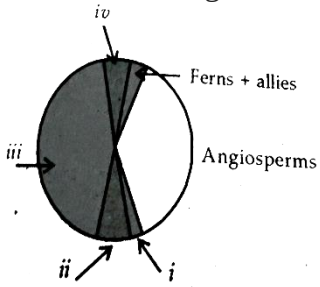
Ans: The mangroves represent biodiversity at ecological level. Other examples of ecological diversity are deserts, rainforests, coral reefs, etc.

3. Name the type of biodiversity represented by the following
(i) 1000 varieties of mangoes in India.
(ii) Variations in terms of potency and concentration of reserpine in Rauwolfia vomitoria growing in different regions of "Himalayas.
Ans: (i)Genetic diversity (ii) Genetic diversity.

2 Marks Questions

1. Why is tropical environment able to support greater species diversity?
Ans: Tropical latitudes have less seasonal variations and constant environment which promote niche and greater species diversity.

2. Eichhornia crassipes is an alien hydrophyte introduced in India. Mention the problem posed by this plant.
Ans: Water hyacinth (Eichhornia) introduced in India is threatening the existing aquatic life in ponds and lakes, etc., as it clogs the stagnant water bodies very fast, thus, the native species are threatened.
3. The Amazon rainforest is referred to as the lungs of planet. Mention any one human activity which causes loss of biodiversity in this region.
Ans: Many plants are cut in Amazon rainforest for cultivation of soybeans.
Forests are converted to grasslands for raising beef cattle
4. How is an alien species invasion considered as one of the cause of biodiversity loss? Support you answer with the help of an example.
Ans: Alien species become invasive, compete with the native species and cause extinction of indigenous species.
Introduction of Nile perch into Lake Victoria leads to extinction of more than 200 species of cichlid fish in that lake.
Carrot grass (Parthenium) and Lantana introduced in our country have become invasive and cause environmental damage. They pose a threat to the native species of plants in our forests
5. Identify the areas labelled i, ii, iii and iv in the pie chart given below representing the biodiversity of plants showing their proportionate number of species of major taxa.



Ans: (i) Lichens
(ii) Algae
(iii) Fungi
(iv) Mosses

6. "Stability of a community depends on its species richness.' Write how did David Tilman show this experimentally.
Ans: The stability of a community depends on species richness. This was confirmed by David Tilman. Through his ecology experiments Tilman showed
The plots with more species showed less year-to-year variations in total biomass.
Plots with increased diversity showed higher productivity
7. List any four techniques where the principle of ex situ conservation of biodiversity has been employed

Ans: Tissue culture, Cryopreservation, Botanical gardens, Zoological parks.

THREE MARKS QUESTIONS

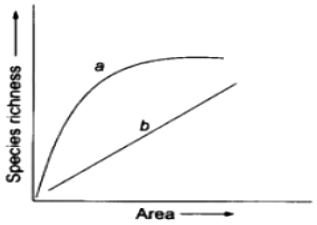
1. Where would you expect more species biodiversity in tropics or in polar regions? Give reasons in support of your answer.

Ans: Speciation is a function of time. The temperate regions were subjected to frequent glaciation in the past, while the tropics have remained undisturbed and so had longer time to evolve more species diversity.
More solar radiation is available in tropical region. This leads directly to more
productivity and indirectly to greater species diversity.
The environment of tropics is less seasonal and relatively more constant and predictable, which encourages niche specialisation and species diversity

2. Justify with the help of an example where a deliberate attempt by humans has led to the extinction of a particular species.

Ans: Overexploitation of natural resources or over hunting of animals has led to extinction of particular species, e.g. Steller's sea cow and passenger pigeon.
Other examples of human driven extinction include Dodo bird due to habitat fragmentation.

3. The given graph shows species-area relationship. Write the equation of the curve a and b, explain.



Ans: The equation for the curve a is $S = CA^Z$ and curve b is Log S= log C + Z log A where, S- Species richness,
A – Area,
C – Y-intercept,
Z – Slope of line (regression coefficient)
(i) Alexander von Humboldt observed that within a region, species richness increased with increasing explored area, but only up to a limit.
(ii) The relation between species richness and area for a wide variety of taxa like angiosperms, birds, fishes, etc., turns out to be a rectangular hyperbola

4. List the features that make a stable biological community.

Ans: Features of Stable Biological Community
It should not show much variation in productivity from year-to-year.
It should be resistant or resilient to occasional disturbances both natural and man-made.
It must be resistant to invasions of alien species

5. Explain rivet popper hypothesis. Name the ecologist who proposed it.

Ans: The hypothesis was proposed by Paul Ehrlich.In an airplane (ecosystem), all parts are joined together using thousands of rivets (species).If every passenger travelling in it, starts popping a rivet to take home (causing a species to become extinct), it may not affect the flight safety (proper functioning of ecosystem) initially, but as more and more rivets are removed, the plane becomes dangerously weak after some time.Further, loss of rivets on the wings. (Key species that drive major ecosystem function) is obviously a more serious threat to flight safety than loss of a few rivets on the seats or windows inside the plane.

6. Why is there a need to conserve biodiversity?

Ans: (a) Narrowly utilitarian reasons -These are obvious reasons as human derives multiple economic benefits like food, fibre, medicinal and industrial products, etc.

(b) Broadly utilitarian reasons - Biodiversity plays a major role in providing ecosystem services which cannot be given a price-tag, e.g. oxygen, pollination, aesthetic pleasure, etc.
(c) Ethical – Every species has an intrinsic value. We have a moral duty to care for their well-being.

FIVE MARKS QUESTIONS

1. Differentiate between in situ and ex situ approaches of conservation of biodiversity.
Ans:

In situ conservation	**Ex situ conservation**
This method involves protection of endangered species in their natural habitat.	It involves placing of threatened animals and plants in special care unit out of their natural habitat for their protection.
It helps in recovering populations in the surroundings where they have developed their distinct features.	It helps in recovering populations or preventing their extinction under stimulated conditions that closely resemble their natural habitats.
e.g. national parks, biosphere reserves, wildlife sanctuaries, etc.	e.g. botanical gardens, zoological parks.

2. Explain the four major causes of biodiversity loss.

Ans: i) Habitat Loss and Fragmentation : The main cause of extinction of species is the v destruction of their habitat. For example, tropical rainforests once covering more than 14% of the land surface, now cover only 6% of land area.

(ii) Overexploitation of natural resources byhumans results in degradation and extinction of the resources. For example, Steller's sea cow, passenger pigeon and many marine fishes have become extinct in last 500 years.

(iii). Alien species invasion- Intentional or chance introduction of exotic species into new Islands or countries by man is called alien species invasion.
For example, Nile perch introduced into Lake Victoria in East Africa caused loss of more than 200 species of cichlid fish. Plant alien species-Lantana camara and animal alien species-Clarias gariepinus have posed threat to our Indian native species.
(iv). Coextinction means that when a species is going to become extinct, the plant and animal species associated with it in an obligatory relationship also gets extinct. For example, coevolved plant-pollinator mutualism as in case of Pronuba yuccasella and Yucca. If one partner is on the verge of extinction, the other partner will also get extinct.

KENDRIYA VIDYALAYA SANGATHAN
CHENNAI REGION
SAMPLE QUESTION PAPER
CLASS XII
SUB: 044-BIOLOGY

MAXIMUM MARKS: 70 TIME: 3Hrs

SET-1

Unit wise Weightage of Marks

it	**me of the Unit**	**No.of Chapters**	**arks**
VI	Reproduction	2,3 & 4= **3 chapters**	**16**
VII	Genetics and Evolution	5,6 &7 = **3 chapters**	**20**
VIII	Biology and Human Welfare	8 & 10 = **2 chapters**	**12**
IX	Biotechnology and its Applications	11 & 12= **2 chapters**	**12**
X	Ecology and Environment	13,14 & 15 = **3 chapters**	**10**
)TAL		**Chapters**	**Marks**

Design of the Question Paper:

UNIT	**Sec-A / 1 mark**		**Sec-B 2mark**	**Sec-C3 mark**	**Sec-DCBQs 4mark**	**Sec-E 5 mark**	**TOTAL**
	MCQs	**A-R Type**					
VI	2(1)	1(1)	1(2)	2(3)	---	1(5)	16
VII	3(1)	1(1)	1(2)	3(3)	---	1(5)	20
VIII	2(1)	1(1)	1(2)	1(3)	1(4)	---	12
IX	3(1)	---	1(2)	1(3)	1(4)	---	12
X	2(1)	1(1)	1(2)	---	---	1(5)	10
	12(1)	4 (1)	5(2)	7(3)	2(4)	3(5)	
Total Marks	**16**		**10**	**21**	**08**	**15**	**70**

Note: Numbers given in the brackets indicate the marks

Reference:

1.CBSE Academics / Curriculum / Biology_Sr.Sec.2022-23

2. Circular No. ACAD-57/2022 / Dated: 20.05.2022 Assessment and Evaluation Practices of the Board for the Session 2022-23

Prepared by: ST. RAMANUJAM, PGT[Bio]

Kendriya Vidyalaya NLC Neyveli-TS

KENDRIYA VIDYALAYA SANGATHAN
CHENNAI REGION
SAMPLE QUESTION PAPER
CLASS XII
SUB: 044-BIOLOGY / SET: 1

MAXIMUM MARKS: 70 TIME: 3Hrs

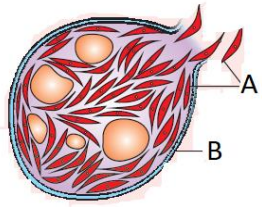
GENERAL INSTRCUTIONS:

(i) All questions are compulsory.
(ii) The question paper has five sections and 33 questions.
(iii) Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.
(iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
(v) Wherever necessary, neat and properly labelled diagrams should be drawn.

	SECTION: A	
Q.No	**Question**	**Marks**
1	Which of the following statements regarding the structure of microsporangium are correct? [i] it is generally surrounded by four wall layers- epidermis, endothecium, middle layers and tapetum. [ii] the outer three layers help in dehiscence of anther to release the pollen. [iii] the cells of tapetum undergo meiosis to produce microspore tetrad. [a] [i] & [ii] [b] [i] & [iii] [c] [ii] & [iii] [d] all of these	1
2	Which one of the following is not a human male accessory gland? [a] Acinar glands [b] Prostate gland [c] Bulbourethral gland[d] Seminal vesicle	1
3	All statements related to the adaptor molecule are correct except [i] anticodon loop that has bases complementary to the codon. [ii] it has amino acid accepter end to which it binds to amino acid [iii] there are three t-RNAs for three Stop codons. [iv] In actual structure the t-RNA is a compact molecule which looks like a clover leaf. [a] [i] & [ii] [b] [i] & [iii] [c] [ii] & [iii] [d] iii & iv	1
4	The wall of the uterus has three layers of tissue namely perimetrium[A] myometrium[B] and the endometrium[C]. Which layer is glandular & undergoes cyclical changes during menstrual cycle and Which layer exhibits strong contraction during delivery of the baby respectively? [a] B & C [b] C & A [c] A & C [d] C & B	1

<table>
<tr><td>5</td><td>Nostoc, Oscillatoria are the examples for:

[i] bacteria that can fix atmospheric nitrogen
[ii] cyano-bacteria that can fix atmospheric nitrogen
[iii] protozoa that can fix atmospheric nitrogen
[iv] Fungi that can fix atmospheric nitrogen</td><td>1</td></tr>
<tr><td>6</td><td>Match the column I and II with correct options

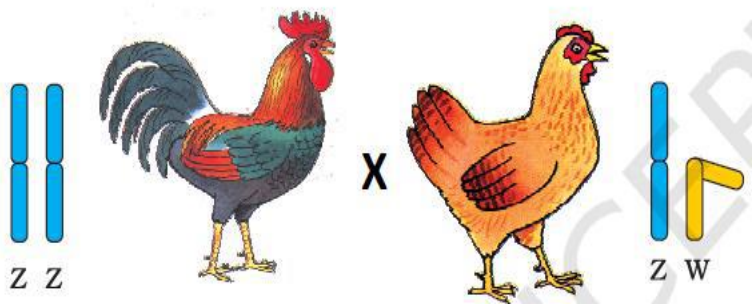
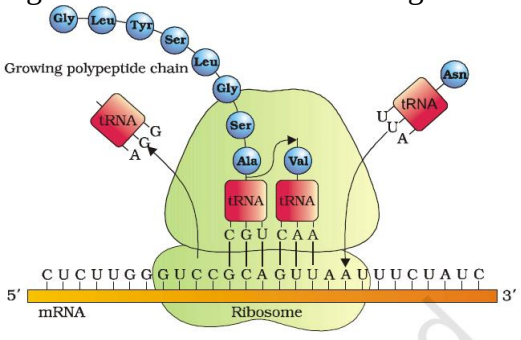
<table><tr><td>Column I</td><td>Column II</td></tr><tr><td>A.Oral Pills</td><td>[i] prevent contraception by blocking the entry of sperms through the cervix.</td></tr><tr><td>B.Diaphragm</td><td>[ii] They inhibit ovulation and implantation as well as alter the quality of cervical mucus to prevent/retard entry of sperms</td></tr><tr><td>C.Vasectomy</td><td>[iii]make the uterus unsuitable for implantation and the cervix hostile to the sperms</td></tr><tr><td>D. LNG-20</td><td>[iv] Surgical method done in females</td></tr><tr><td></td><td>[v] Surgical method done in males</td></tr></table>
[a] A-ii [b] B-i [c] C-v [d] D-iii [a] A-ii [b] B-i [c] C-iv [d] D-iii
[a] A-iii [b] B-ii [c] C-v [d] D-i [a] A-ii [b] B-iii [c] C-iv [d] D-i</td><td>1</td></tr>
<tr><td>7</td><td>Read the given figure and answer the questions.
 

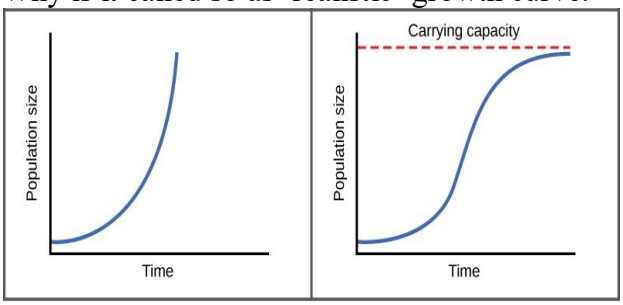
[i] A is Sporozoitesand B is the salivary gland cell of Human being
[ii] A isSporozoites and B is salivary glands of female Anopheles
[iii] A is filarial worms and B is the cells of thigh muscles
[iv] A is the filarial worm and B is salivary glands of female Anopheles</td><td>1</td></tr>
<tr><td>8</td><td>You are a biotechnologist, wanted to create a colony of E.coli possessing the plasmid pBR322, sensitive to ampicillin. Which one of the following restriction sites would he use to ligate a foreign DNA?

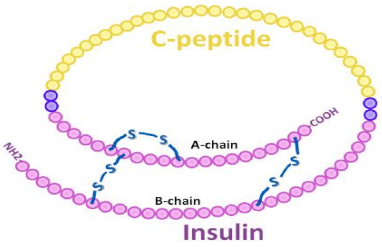
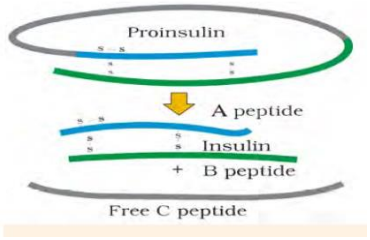
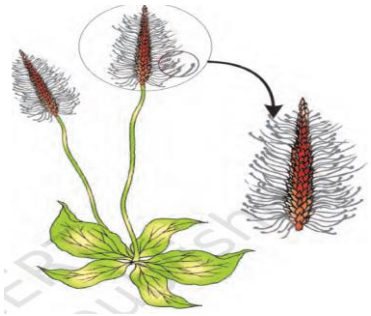
[a] Sal I [b] Hind III[c]Pvu I [d]Cla I</td><td>1</td></tr>
<tr><td>9</td><td>Silencing of a gene could be achieved through the use of :

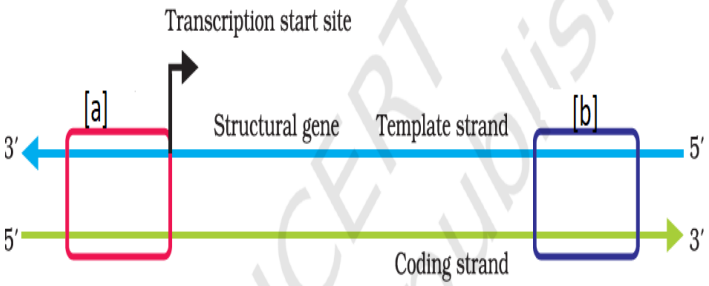
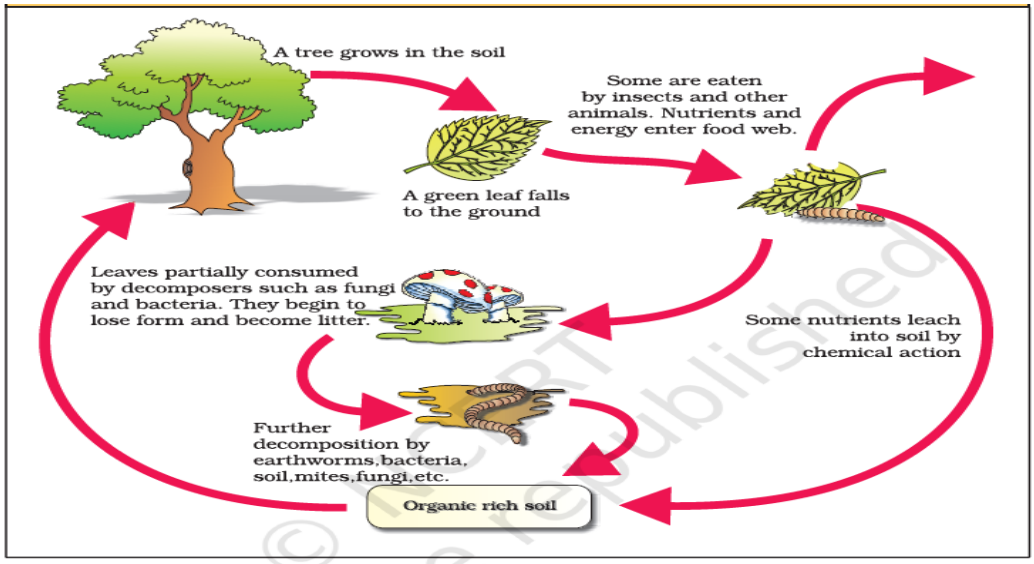
[a] RNAi only [b] RNAonly
[c] both RNAi and RNA [d] both RNAi and antisense RNA</td><td>1</td></tr>
<tr><td>10</td><td>In the gene-gun method of gene transfer,the cells are bombarded with high velocity micro-particles of _____ or _____ used (coated with DNA).</td><td>1</td></tr>
</table>

	[a] Gold or Silver [b] Gold or Tungsten [c] Gold or Platinum [d] Silver or Platinum	
11	Assigning a '+' sign for beneficial interaction, '-' sign for detrimental and 0 for neutralinteraction, then the population interaction represented by '+' sign and '-' sign refers to [a] Predation [b] Parasitism [c] Both predation and parasitism [d] Amensalism	1
12	How do you name 'the rate of formation of new organic matter by a Consumer such as goat? [a] Primary Productivity [b] Gross Primary productivity [c] Net Primary Productivity [d] Secondary Productivity	1
Question No. 13 to 16 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.		
13	**Assertion**-The detritus food chain (DFC) begins with dead organic matter. **Reason**-- It is made up of saprotrophs which are heterotrophic organisms, mainlyfungi and bacteria. They meet their energy and nutrient requirements by degrading dead organic matter	1
14	**Assertion**-DNA is chemically less reactive and structurally more stable when compared to RNA **Reason**-- DNA, however, is dependent on RNA for synthesisof proteins.	1
15	**Assertion**-When a host is exposed to antigens, which may be in the form of livingor dead microbes or other proteins, antibodies are produced in the host body. This type of immunity is called active immunity. **Reason**-Active immunityis faster and takes less time to give its full effective response.	1
16	**Assertion**- 'biodiversity hotspots' regions show low levels of species richnessand low degree of endemism **Reason**-Endemic species are confined to particular regionand not found anywhere else.	1
	SECTION: B	
17	Read the given sentences and write the correct technical terms for [a] [b] [c] & [d] "The gynoecium may consist of a single pistil **[a]** or may havemore than one pistil**[b].**When there are more than one,the pistils may be fused together**[c]** or may befree **[d]."**	2
18	Explain the type of sex determination in given example.	2

		
19	Give the reason for the following: [a] biogas plants are more often built in rural areas. [b] the excreta (dung) of cattle is commonly used to produce biogas.	2
20	Why are transgenic animals being produced? Give any four reasons.	2
21	Pyramid of energy is always upright. Can never be inverted. Why? Draw the diagram. **OR** "There are certain limitations of ecological pyramids" Write any two of them.	2
	SECTION: C	
22	Answer the following: [a] What is triple fusion? [b] Draw the diagram to show fertilised embryo sac.	3
23	[a] What is placenta? How it is connected to the embryo? [b] Write the role of Placenta as an endocrine structure.	3
24	[a] Differentiate between **α**- thalassemia and **β** thalassemia [b] Differentiate between thalassemia and sickle cell anaemia **OR** [c] What is aneuploidy? Write the symptoms of Down's syndrome	3
25	Read the given diagram and answer the following:  [a] What does the given diagram represent? Define it. [b] Where does this process occur in an eucaryotic cell?	3
26	Answer the following: [a] Name the two key concepts of Darwinian theory of Evolution. [b] What do you mean by convergent evolution? [c] Both *Ramapithecus* and *Dryopithecus* were hairy existed about 15mya walked like gorillas. Yet they differ each other in one aspect. Name it.	3
27	Write the role of:	3

	[i] Primary Lymphoid organs such as Bone marrow and Thymus. [ii] The Spleen [iii] Lymph nodes.	
28	In the given set of graphs which one (a) or (b) is the Logistic growth curve. Write its equation. Why is it called so as 'realistic' growth curve.  (a) (b)	3
	SECTION: D	
Q.no 29 and 30 are case based questions. Each question has subparts with internal choice in one subpart.		
29	Domestic sewage primarilycontains biodegradable organic matter, which readily decomposes –thanks to bacteria and other micro-organisms, which can multiply usingthese organic substances as substrates and hence utilise some of thecomponents of sewage. It is possible to estimate the amount ofbiodegradable organic matter in sewage water by measuring BiochemicalOxygen Demand (BOD). Based on this, an experiment was done. Three water samples namely river water, untreated sewage water andsecondary effluent discharged from a sewage treatment plant weresubjected to BOD test. The samples were labelled A, B and C; but thestudent did not note which was which. The BOD valuesof the three samples A, B and C were recorded as 20mg/L, 8mg/L and400mg/L, respectively. Answer the following: [a] Treatment of waste water is done by the heterotrophic microbes naturally present inthe sewage. This treatment is carried out in two stages: Name them. [b] What is 'BOD' (biochemical oxygen demand) [c] Based on this experiment which water water sample- A or B or C is the most polluted? How is BOD and pollution level of aquatic bodies related? **OR** [c] In anaerobic sludge digesters the anaerobic bacteria digest the other bacteria and fungi and produce bio gas. What is the composition of Biogas?	4
30	In mammals, including humans, insulin is synthesised as a pro-insulin. Insulin used for diabetes was earlier extracted from pancreas of slaughtered cattle and pigs. Insulin from an animal source, though caused some patients to develop allergy or other types of reactions to the foreign protein. Now the American Company called Eli Lily produces the human insulin using r-DNA technology. Observe the given diagram showing Maturation of pro-insulin into insulin and answer the questions that follow.	4

	  [a] Differentiate 'Pro-insulin' and mature insulin? [b] State the chemical changes that proinsulin under goes to become the mature functional insulin. [c] What is the challenge in the production of insulin using r-DNA techniques? OR [c] The two main types of cells in the Islet of Langerhans are called **α**-cells and **β**-cells. Which types of cell**α**-cells or β-cells secrete the insulin?	
	SECTION: E	
31	[a] What is pollination? Mention its three types and state which type of pollination brings genetically different type of pollen grains to the stigma? [b] Read the given flower and state the type of pollination occurs in it. Also write any three adaptative features it possess to get pollinated.  **OR** [c] Continued self-pollination result in inbreeding depression. If so, how do flowering plants discourage self-pollination. Explain.	5
32	[a] "The unequivocal proof that DNA is the genetic material came from the experiments of Alfred Hershey and Martha Chase" Explain how did Hershey and Chase differentiate between DNA and protein in their experiment while proving that DNA is the genetic material. **OR** **Read the given diagram and answer the given questions:** [b] Write the role of [a] and [b] in the given diagram [c] What is cistron? [d] Why both the strands are not copied during transcription	5

		
33	Given here is the schematic representation of decomposition cycle in a terrestrial ecosystem. What is 'decomposition'? Why it is important for an ecosystem? Explain its steps.  **OR** Reference to the 'Biodiversity'answer the given questions. [i] Name the socio biologist who have popularised the term 'Biodiversity' [ii] Explain 'latitudinal gradient in diversity' with suitable example. [iii] Explain 'Rivet-popper hypothesis.	5

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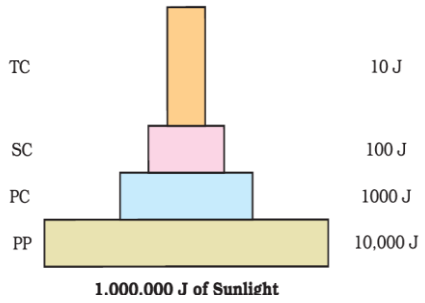
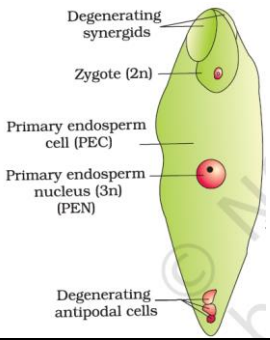
KENDRIYA VIDYALAYA SANGATHAN
CHENNAI REGION
SAMPLE QUESTION PAPER
CLASS XII
SUB: 044-BIOLOGY/ SET-1

MAXIMUM MARKS: 70 TIME: 3Hrs

MARKING SCHEME

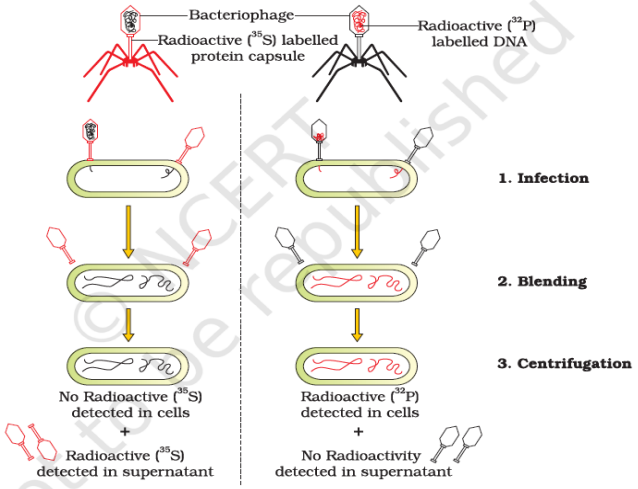
	SECTION: A		
Q.No	**Question**	**Value Points**	**Marks**
1	[a] [i] & [ii]	1	1
2	(a) Acinar glands	1	1
3	[d] iii & iv	1	1
4	[d] C & B	1	1
5	[ii] cyano-bacteria that can fix atmospheric nitrogen	1	1
6	[a] A-ii [b] B-i [c] C-v [d] D-iii	1	1
7	[ii] **A** is Sporozoites and **B** is salivary glands of female *Anopheles*	1	1
8	c) Pvu I	1	1
9	[d] both RNAi and antisense RNA	1	1
10	[b] Gold or Tungsten	1	1
11	[c] Both predation and parasitism	1	1
12	[d] Secondary Productivity	1	1
13	A. Both A and R are true and R is the correct explanation of A.	1	1
14	B. Both A and R are true and R is not the correct explanation of A.	1	1
15	C. A is true but R is false.	1	1
16	D. A is False but R is true.	1	1
	SECTION: B		
17	[a] Monocarpellary [b] Multi carpellary [c] Syncarpous [d] Apocarpous	4 x ½	2
18	• the total number of chromosomes is same in both males and females. • But two different types of gametes in terms of the sex chromosomes, are produced by females, i.e., female heterogamety. • the two different sex chromosomes of a female bird have been designated to be the Z and W chromosomes. • In these organisms the females have one Z and one W chromosome, whereas males have a pair of Z-chromosomes besides the autosomes.	4 x ½	2
19	[a] Cattle dung is available in large quantities in rural areas	1+1	2

	where cattle are used for a variety of purposes [b] the excreta (dung) of cattle, commonly called *gobar*, is rich in methanogen bacteria		
20	Transgenic animals are produced for the following reasons: [a] To study the normal physiology and development. [b] To study diseases [c] To obtain biological products [d] To study Vaccine safety [e] To study chemical safety testing [any four]	4 x ½	2
21	Pyramid of energy is always upright, can never be inverted, because when energy flows from a particular trophic level to the next trophic level,some energy is always lost as heat at each step.  **OR** • Ecological pyramid does not take into account the same species belonging to two or more trophic levels. It assumes a simple food chain, something that almost never exists in nature; • it does not accommodate a food web. • saprophytes are not given any place in ecological pyramids [any two]	1+1	2
	SECTION: C		
22	[a] The second male gamete moves towards the two polar nuclei located in the central cell and fuses with them to produce a triploid primary endosperm nucleus (PEN) As this involves the fusion of three haploid nuclei itis termed triple fusion. [b] Diagram + labelling:  	1+1+1	3

<table>
<tr><td>23</td><td>[a] The chorionic villi and uterine tissue become interdigitated with each other and jointly form a structural and functional unit between developing embryo (foetus) and maternal body called placenta.
• The placenta is connected to the embryo through an umbilical cord
[b] Secrete the following hormones: human chorionic gonadotropin (hCG), human placental lactogen (hPL), estrogens, & progestogens</td><td>1+1+1</td><td>3</td></tr>
<tr><td>24</td><td>[a]
<table><tr><td>S.No</td><td>α- thalassemia</td><td>β-Thalassemia</td></tr><tr><td>1</td><td>In αThalassemia, production of α globin chain is affected</td><td>In βThalassemia, production of βglobin chain is affected</td></tr><tr><td>2</td><td>αThalassemia is <u>controlled by</u> two closely linked genes HBA1 and HBA2 on chromosome 16 of each parent.</td><td>βThalassemia is <u>controlled by</u> a single gene HBB on chromosome 11 of each parent</td></tr><tr><td>[b]</td><td>Thalassemia</td><td>Sickle cell anaemia</td></tr><tr><td></td><td>is a quantitative problem of synthesising too few globin molecules</td><td>is a qualitative problem of synthesising an incorrectly functioning globin.</td></tr></table>
OR
[C] Aneuploidy (1m)
Failure of segregation of chromatids during cell division cycle results in the gain or loss of a chromosome(s), called aneuploidy.
Symptoms of Downs Syndrome:
Broad flat face, big and wrinkled tongue, palm crease, may loops on finger tips, short statured with small roundhead…
any four [4 x ½]</td><td>2+1</td><td>3</td></tr>
<tr><td>25</td><td>[a] Translation.
Translation refers to the process of polymerisation of amino acids to form a polypeptide.
mRNA $\xrightarrow{\text{translation}}$ protein
[b] in Cytoplasm</td><td>1+1+1</td><td>3</td></tr>
<tr><td>26</td><td>[a] Branching descent and Natural Selection
[b] Convergence means: different structures evolving for the Same function.
[c] Ramapithecus was more man-like while Dryopithecus was</td><td>1+1+1</td><td>3</td></tr>
</table>

	more ape-like		
27	[i] **Bone marrow**- where blood cells including lymphocytes are produced. **Thymus:** provide micro-environments for the development and maturation of T-lymphocytes. [ii] **Spleen:** acts as a filter of the blood by trapping blood-borne microorganisms. Spleen also has a large reservoir of erythrocytes. [iii] **Lymph Nodes**: serve to trap themicro-organisms or other antigens,	1+1+1	3
28	• Curve 'b' is the logistic growth curve. • The equation: $dN/dt = rN\left(\frac{K-N}{K}\right)$ Where N = Population density at time t r = Intrinsic rate of natural increase K = Carrying capacity • Since resources for growth for most animal populations are finiteand become limiting sooner or later, the logistic growth model is considered a more realistic one.	1+1+1	3
	SECTION:D		
29	[a] Primary and Secondary treatment [b] BOD refers to the amount of the oxygen that would be consumed if all the organic matter in one litre of water were oxidised by bacteria. [c] Sample C The BOD test measures the rate of uptake of oxygen by micro-organisms in a sample of water and thus, indirectly, BOD is a measure of the organic matter present in the water. The greater the BOD of waste water, more is its polluting potential. **OR** [c] Composition of Biogas: mixture of gasessuch as methane, hydrogen sulphide and carbon dioxide.	1+1+2	4
30	[a] Pro-insulin is not functional one and it needs to be processed before it becomes a fully mature and functional hormone. [b] The chemical Changes: ---the C-peptide is removed. ---the peptide chains A and B are joined by disulphide bridges [c] The challenge: • The main challenge for production of insulin using rDNA techniques was getting insulin assembled into a mature form. **OR** [c] β- cells secrete Insulin.	1+2+1	4
	SECTION: E		

31	[a] Transfer of pollen grains (shed from the anther) to the stigma of a pistil is termed pollination. • **Types**: Autogamy, Geitonogamy and Xenogamy and • **Xenogamy** brings genetically different type of pollen grains to the stigma [b] pollinated by **Wind:** **Three adaptations:** ✓ the pollen grains are light and non-sticky ✓ possess well-exposed stamens ✓ large often-feathery stigma to easily trap air-borne pollen grains. **OR** [c] . • [i] pollen release and stigma receptivity are not synchronised. Either the pollen is released before the stigma becomes receptive or stigma becomes receptive much before the release of pollen. • [ii] the anther and stigma are placed at different positions so that the pollen cannot come in contact with the stigma of the same flower. Both these devices prevent autogamy. • [iii] self-incompatibility: This is a genetic mechanism and prevents self-pollen (from the same flower or other flowers of the same plant) from fertilising the ovules by inhibiting pollen germination or pollen tube growth in the pistil. • [iv]Another device to prevent self-pollination is the production of unisexual flowers. If both male and female flowers are present on the same plant such as castor and maize (monoecious), it prevents autogamy but not geitonogamy. • [v] In several species such as papaya, male and female flowers are present on different plants, that is each plant is either male or female (dioecy). This condition prevents both autogamy and geitonogamy. [5x1=5]	1+1+1+2	5
32	[**a] Hershey and Chase Experiment:** **Procedure:** The bacteriophage attaches to the bacteria and its genetic material then enters the bacterial cell. The bacterial cell treats the viral genetic material as if it was its own and subsequently manufactures more virus particles. Hershey and Chase worked to discover whether it was protein or DNA from the viruses that entered the bacteria. They grew some viruses on a medium that contained radioactive phosphorus and some others on medium that contained	3+2	

	radioactive sulphur. **Viruses grown in the presence of radioactive phosphorus contained radioactive DNA but not radioactive protein because DNA contains phosphorus but protein does not.** Similarly, viruses grown on radioactive sulphur contained radioactive protein but not radioactive DNA because DNA does not contain sulphur. Radioactive phages were allowed to attach to *E. coli* bacteria. Then, as the infection proceeded, the viral coats were removed from the bacteria by agitating them in a blender. The virus particles were separated from the bacteria by spinning them in a centrifuge. **Conclusion:** Bacteria which was infected with viruses that had radioactive DNA were radioactive, indicating that DNA was the material that passed from the virus to the bacteria. Bacteria that were infected with viruses that had radioactive proteins were not radioactive. This indicates that proteins did not enter the bacteria from the viruses. DNA is therefore the genetic material that is passed from virus to bacteria (Figure)  **OR** [b] • [**a]is the promotor**: It is a DNA sequence that provides binding site for RNA polymerase, and it is the presence of a promoter in a transcription unit that also defines the template and coding strands. • **[b] is the terminator:** defines the end of the process of transcription [c] **CISTRON**: as a segment of DNA coding for a polypeptide, the structural gene in a transcription unit could be said as monocistronic or polycistronic. [d] **Reason:**	1+1+1+1+1	5

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	✓ First, if both strands act as a template, they would code for RNA molecule with different sequences and in turn, if they code for proteins, the sequence of amino acids in the proteins would be different. Hence, one segment of the DNA would be coding for two different proteins, and this would complicate the genetic information transfer machinery. ✓ Second, the two RNA molecules if produced simultaneously would be complementary to each other, hence would form a double stranded RNA. This would prevent RNA from being translated into protein and the exercise of transcription would become a futile one.		
33	**Decomposition:** **Definition:** • Breakdown of complex organic matter into inorganic substances like carbon dioxide, water and nutrients is called decomposition. • Decomposition process enrich the soil with inorganic nutrients and make soil fertile. **The Steps:** • The important steps in the process of decomposition are fragmentation, leaching, catabolism, humification and mineralisation. • **Fragmentation:**Detritivores (e.g., earthworm) break down detritus into smaller particles. • **Leaching:**Water-soluble inorganic nutrients go down into the soil horizon and get precipitated as unavailable salts. • **Catabolism:** Bacterial and fungal enzymes degrade detritus into simpler inorganic substances. • **Humification** and mineralisation occur during decomposition in the soil. Humification leads to accumulation of a dark coloured amorphous substance called humus. • **Mineralisation:** humus is further degraded by some microbes and release of inorganic nutrients **OR** [i] Edward Wilson [ii] Latitudinal gradient in diversity means the species diversitydecreases as we move away from the equator towards the poles. Given below table indicates that species diversity decreases from the equator towards the poles.	1+1+1+1+1 **OR** 1+2+2	5

Country	Located @	Latitude	Species diversity
Colombia	Equator	0˚ N or S	1400 species of birds
India	Tropical	23˚.5N	1200 species of birds
New York	Towards North pole	41˚N	105 species of birds
Greenland	Towards North pole	71˚N	56 species of birds

[iii] The analogy as per the 'rivet popper hypothesis'used by Stanford ecologist Paul Ehrlich is:

- ✓ airplane is the **ecosystem**
- ✓ the rivets that join the parts together are equal to the **species.**
- ✓ A passenger popping a rivet to take home is equal to causing a **species to become extinct.**
- ✓ The flight safety is the proper **functioning of the ecosystem**
- ✓ Loss of rivets on the wings means the **loss of key species** that drive major ecosystem functions.

KVS CHENNAI REGION

CLASS 12 BIOLOGY 2022-23 BLUE PRINT / SET 1

S.NO	UNITS	MCQ	2Marks	3marks	CBQ [4 marks]	5 marks	Total
VI	Reproduction	3(1)	1(2)	2(3)		1(5)	16
VII	Genetics and Evolution	3(1)	1(2)	2(3)	1(4)	1(5)	20
VIII	Biology and Human Welfare	3(1)	1(2)	1[3]	1(4)		12
IX	Biotechnology and its Applications	2(1)	1(2)	1[3]		1(5)	12
X	Ecology and Environment	5(1)	1(2)	1[3]			10
		16(1)	5(2)	7(3)	2(4)	3(5)	
	Total Marks	16	10	21	8	15	70

Note: Numbers given in the brackets indicate the marks for each question

Prepared by : Mr. Sivakumar PGT[Bio] Madurai No1

KENDRIYA VIDYALAYA SANGATHAN CHENNAI REGION

SAMPLE QUESTION PAPER 2022-23

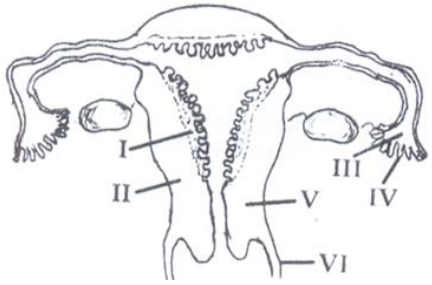
CLASS XII

BIOLOGY (044) SET 2

MAXIMUM MARKS: 70 **Time: 3Hrs**

General Instructions:

(i) All questions are compulsory
(ii) The question paper has five sections and 33 questions. All questions are compulsory.
(iii) Section A has 16 questions of 1 mark each ; Section B has 5 questions of 2 marks each. Section C has 7 questions of 3 marks each. Section D has 2 case – based questions of 4 marks each ; and Section --E has 3 questions of 5 marks each.
(iv) There is no overall choice. However, internal choice has been provided in some questions. A student has to attempt only one of the alternative s in such questions.
(v) Where ever necessary, neat and properly labeled diagrams should be drawn.

NO	SECTION A	ARKS
	The site where Lymphocytes interact with antigen and proliferate to become effective cells are a) Spleen and Lymph Node b) Bone marrow and thymus. c) Peyer's Patches and Tonsils. d) Both (a) and (c)	
	The figure given below depicts a diagrammatic sectional view of the female reproductive system of human , which are of the three parts out of I—IV have been correctly identified  a) (i) Perimetrium (ii) Myometrium (iii) Fallopian Tube b) (ii) Endometrium (iii) Infundibulum (iv) Fimbriae c) (iii) Infundibulum (iv) Fimbriae (v) cervix d) (iv) Oviduct funnel (v) Uterus (vi) Cervix	
	Identify the Human developmental stage shown below as wellas the related right Place of its occurrence in a normal pregnant woman, and select the right option for the together.	

S.No	Developmental stage	Site of occurrence
1	Late Morula	Middle part of fallopian tube
2	Blastula	End part of fallopian tube
3	Blastocyst	Uterine wall
4	8 celled stage	Starting point of fallopian tube

Match the column A with Column B

	A		B
a	Cyclosporin –A	i	Reduce cholesterol
b	Lactic acid	ii	Clot Buster
c	Statin	iii	Turns milk in to curd
d	Streptokinase	iv	Immune suppressor

1. a(iii) b (iv) c (ii) d(i)
2. a(iv) b (iii) c(ii) d(i)
3. a (iv) b(iii) c (i) d(ii)
4. a(i) b(ii) c(iii) d(iv)

Which of the following cells of microsporangium have more than one nucleus, possess dense cytoplasm and nourishes the developing pollengrains. 1

[a] Endothelium [b] Tapetum
[c] Epidermis [d] Middle layer

Even after killing the generative cell with a laser beam the pollen grain of flowering plant germinates and produces normal pollen tube.

a) Laser beam stimulates pollen germination
b) Laser beam does not damage the region from which pollen tube emerges
c) The contents of the killed generative cell permit germination of pollen growth.
d) The vegetative cell has not been damaged.

The treatment of snake bite by Antivenom is an example of

a) Artificially acquired active immunity
b) Artificially acquired passive immunity
c) Naturally acquired passive immunity
d) Specific natural immunity

ABO blood group in human are controlled by the gene I . It has a three alleles, six different genotypes are possible. How many phenotypes can occur?

[a] Four [b]Two [c] Three [d] one

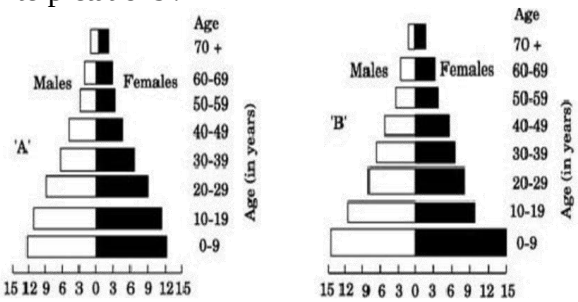
A biologist studied the population of rats in a barn. He found that the average natality was 250, average mortality 240, immigration 20 and emigration 30. The net increase in population is

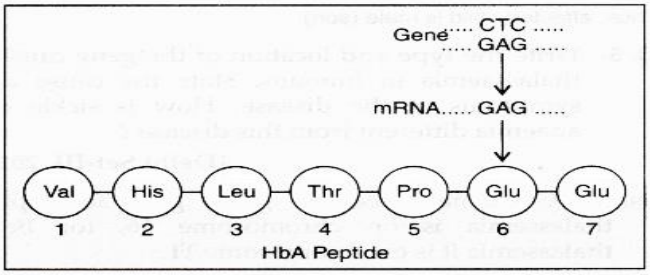
a) Zero b) 10 c) 15 d) 05

Which one the following is a wrong statement regarding mutation.

a) Deletion and insertion of base pairs cause frame shift mutation.
b) Cancer cells commonly show chromosomal aberrations.
c) UV radiations and Gamma radiations are mutagens
d) Change in a single base pair of DNA does not cause mutations.

Light coloured pepper moth (*Biston betularia*) gets changed into dark *Carbonaria*

	variety due to a) Translocation of block of genes in response to heavy carbons b) Deletion of gene segments due to industrial pollution c) Mutations of single gene for survival in smoke laden industrial environment. d) Industrial Carbon deposited on wings.	
	A country with a high rate of population growth took measures to reduce it. The figure below shows age –sex pyramids of populations A and B twenty years apart ,. Select correct interpretations :  a) 'A' is more recent and shows slight reduction in the growth rate. b) 'B' is earlier pyramid and shows stabilized growth rate. c) 'B ' is more recent showing that population is very young. d) 'A' is more earlier pyramid and no change has occurred in the growth rate.	
	Question no 13 to 16 consist of two statements – Assertion 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 B are true and R is not the correct expiation of A C. A is true but R is false. D Both Assertion and Reason are False .	
	Assertion: Genetic engineering overcomes the drawbacks of traditional hybridization. **Reason:** Genetic engineering involves creation of recombinant DNA and introduce the desirable genes in to target organisms.	
	Assertion: A second immune response is quicker and stronger than primary one **Reason:** Memory cells conversant with the recoming antigens are ready to combat the invader.	
	Assertion: Predation and parasitism are considered to be negative interactions. **Reasons:** Parasites and predators limit the population.	
	Assertion: A part of cellulosic materials of human food is digested in the intestine. **Reason:** Methanogen present in the human intestine digest the cellulose.	
	SECTION B	
	Given below is the representation of amino acids composition of the relevant translated portions bêta. Chain of Hemoglobin ,related to the shape of human red blood cells	



a) Is this representation indicating a normal human or a sufferer from certain related genetic disorder? Give reason in support of your answer.
b) What difference would be noticed in phenotype of the normal and the sufferer related to this gene?

Complete the given table:

S.NO	stages in human evolution	Features
1	Australopithecians	A
2	B	robably ate meat, Their brain capacity was around 900cc
3	Niianderthal man	C
4	D	Arose between 75000 -100000 years ago.

Describe active and passive immunity with suitable example.

When you go for a trek / trip to any high altitude places, you are advised to take rest for the first two days. Comment, giving reasons.

A team of students are preparing to participate in the inter school sports meet. During a practice session you find some vials with labels of certain cannabionoids
(a) Will you report to the authorities? Why?
(b) Name a plant from which such chemicals are obtained.
(c) Write the effect of these chemicals on human body.

OR

Recombinant DNA-technology is of great importance in the field of medicine. With the help of a flow chart, show how this technology has been used in preparing genetically engineered human insulins.

SECTION C

How does a detritivore differ from a decomposer ? Explain with an example each.

Choose any three microbes, from the following which are suited for organic farming which is in great demand these days for various reasons. Mention one application of each one chosen. Mycorrhiza; Monascus; Anabaena; Rhizobium; Methanobacterium; Trichoderma.

	Unless the vector and source DNA are cut, fragments separated and joined, the desired recombinant vector molecule cannot be created. (a) How are the desirable DNA sequences cut? (b) Explain the technique used to separate the cut fragments. (c) How are the resultant fragments joined to the vector DNA molecule?	
	How do "Pleiotropy", "incomplete dominance", "co-dominance" and "polygenic inheritance" deviate from the observation made by Mendel ? Explain with the help of one example for each. **OR** How did Griffith prove transforming principle in Genetics. Explain the procedure.	
	If there is a history of haemophilia in the family, the chances of male members becoming haemophilic are more than that of the female. (a) Why is it so ? (b) Explain it with suitable cross.	
	Name the kind of diseases/disorders that are likely to occur in humans if (i) Mutation in the gene that codes for an enzyme phenyl alanine hydrolase occurs, (ii) There is an extra copy of chromosome number 21, (iii) the karyotype disease is XXY.	
	Differentiate between mutualism, parasitism and commensalism. Provide one example for each of them	
	SECTION D	
	If a child has cold like symptoms lasting longer than a week or develops a cold at the same time every year ,talk with your doctor ,who might diagnose an allergy and prescribe medicines ,or may refer you to an allergist for allergy test. To find the cause of an allergy, the allergist usually do skin test for the most common environment and food allergens. [i] What is known as allergy? [ii] Write the symptoms of allergy and what are the chemicals released during Allergy? [iii] Write any four allergens and any three chemical used for treatment.	
	A youth in his twenties met with an accident and succumbed to the injuries. His parents agreed to donate his organs. Organ transplantation is medical procedure in which an organ is removed from one body and placed in the recipient, toreplace a missing or damaged organ.	

[i] List any two essential clinical steps to be undertaken before any organ transplant.

[ii]Why is the transplant rejected sometimes?

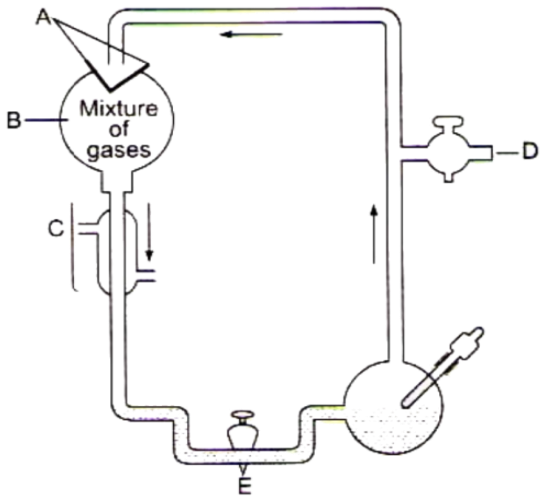
[iii] What is known as auto transplantation? Give examples.
[iv] What views would you share with your health club members to promote organ donation. ?

SECTION E

Under polio prevention programme, infants in India are given polio vaccines on a large scale at regular intervals to eradicate polio from the country.
(a) What is a vaccine?
Explain how it imparts immunity to the child against the disease.
(b) With the help of an example explain the auto immune system..

OR

What are bio fertilizers? Describe their role in agriculture.
Why are they preferred to chemical fertilizers?



i) What is the given structure is showing ?

ii) Name the parts marked in the diagram

iii) Who made the structure shown in the figure?

(iv) What were the findings on the basis of this experiment?

v) What products recovered from the part E after experiment?

	OR a) Explain the structure of t-RNA with the help of a diagram. b) Describe its role in the process of translation.	
	Answer the following: [a] Mention the name of the causal organism , symptoms and mode of transmission of the disease Ameoebiosis. [b] Nmae the confirmatory test for Typhoid and AIDS. **OR** a) Name the scientific name of the parasite that causes malignant Malaria in human. b) Name the respective forms in which the malaria parasite gain entry into i) Human body ii) body of female Anopheles. c) Name the hosts where the sexual and asexual reproductions of Malaria parasite occur respectively. d) Name the Toxin responsible for the appearance of symptoms of malaria in humans. Why do the symptoms occur periodically?	

	KENDRIYA VIDYALAYA SANGATHAN CHENNAI REGION SAMPLE PAPER.2022-23 CLASS XII BIOLOGY (044) / SET-2 MARKING SCHEME	
Q.No	Gist of the Answer	Marks
1	Both a and c	1
2	b (ii)Endometrium (iii) Infundibulum ((iv) Fimbriae	1
3	3 Blastocyst --- Uterine Wall	1
4	3 a(iv) b(iii) c(i) d(ii)	1
5	B Tapetum	1
6	D The vegetative cell has not been damaged.	1
7	B Artificially acquired passive immunity	1
8	A Zero	1
9	A Four	1
10	D Change in a single pair of DNA does not cause mutations.	1
11	C Mutations of single gene for survival in smoke laden industrial environment	1
12	A 'A' is more recent and shows slight reduction in the growth rate.	1
13	A	1
14	A	1
15	A	1
16	D	11
17	Glutamic acid replaced by valine ---- sickle cell anaemia	2
18	A -- hunted with stone weapons , ate fruits	½
	B---*Homo erectus*	½
	C – Hide and protect and Buried their dead body	½
	D – Homo sapiens	½
19	Active --- Antibodies are produced by body Passive -- Readymade antibodies are directly given	1+1
20	Altitude sickness due to low oxygen level, low atmospheric pressure, It will take time to adapt .	2
21	Yes, *Cannabis sativa*, Affect Cardio vascular system	1+1
22	Detritivores: Earthworm, break down detritus into small particles. Decomposers: Complex organic substances break into inorganic substances.	1½+ 1½
23	Mycorrhiza -- absorb phosphorus, Anabaena -- fix atmospheric Nitrogen , Methano bacterium -- Methane.	1+1+1
24	By Restriction Endonuclease enzyme , Gel Electrophoresis, DNA Ligase	1+1+1
25	Explanation with Example of each Pleiotropy, incomplete dominance, Polygenic inheritances (Phenylketonuria, 4'o' clock plant , skin colour) OR Griffith 's experiment on Transforming Principle. R- Bacteria/S-bacteria, Heat killed Bacteria + R –Bacteria, Transformation.	1+1+1
26	The heterozygous female (carrier) for haemophilia may transmit to sons .(correct explanation with cross)	3

27	Phenylketouria, Down 'syndrome, Klinefelter's syndrome	1+1+1
28	Mutualism: interaction confers benefits on both the interacting species. Parasites: that one species is benefitted the other species [host] is harmed. Commensalism :in which one species benefits and the other is neither harmed nor benefited. Correct example for each	1+1+1
29	Allergy; immunity shows exaggerated response to substances. Symptoms: watery eyes, difficulty in Breathing, sneeze. Histamine , serotonin -- chemical released Antihistamine, Adrenaline, Steroid --- for treatment.	1+1+1 +1
30	Tissue matching, blood Group matching are essential. Patient has to take immune suppressant. Cell mediated immune response is responsible for the graft rejection.	2+1+1
31	 Protein or inactivated pathogen. Produces B- Lymphocytes and T.Lymphocytes (and antibodies) Auto immunity : damage the own cells (or) Organism that enriches the quality of nutrient quality. Rhizobium, free living Azosprillum, Azotobacter, Mycorrhza for growth. Cyanobacteria – Anabaena ,Noostooc, Oscillatoria . are able to fix	1+1+1 +1+1
32	Condition of primitive earth and that formation life was preceded by chemical evolution. Electrode, gases , To vacuum pump, water in & out and liquid water in trap. SL.Miller. Formation of aminoacids.(or) tRNA structure, Its function in Translation	3+2
33	**Amoeibiosis:** causal organism: *Entamoeba histolytica* , symptoms: Internal bleeding, ulcers mode of transmission: Contaminated food and water. Houseflies are the mechanical carriers. OR *Plasmodium falciparum* Sporozoites and Gametocytes Asexual reproduction in human Sexual reproduction in mosquitoes.	3+2

KENDRIYA VIDYALAYA SANGATHAN
CHENNAI REGION
SAMPLE QUESTION PAPER
CLASS XII DESIGN OF QUESTION PAPER
SUB:-BIOLOGY

MAXIMUM MARKS: 70 TIME: 3Hrs

SET-3

Unit wise Weightage of Marks

it	**me of the Unit**	**.of Chapters**	**arks**
VI	Reproduction	& 4= **3 chapters**	**16**
VII	Genetics and Evolution	&7 = **3 chapters**	**20**
VIII	Biology and Human Welfare	& 10 = **2 chapters**	**12**
IX	Biotechnology and its Applications	& 12= **2 chapters**	**12**
X	Ecology and Environment	,14 & 15 = **3 chapters**	**10**
)TAL		Chapters	**Marks**

Design of the Question Paper:

UNIT	**Sec-A / 1 mark**		**Sec-B 2mark**	**Sec-C3 mark**	**Sec-DCBQs 4mark**	**Sec-E 5 mark**	**TOTAL**
	MCQs	**A-R Type**					
VI	2(1)	1(1)	1(2)	2(3)	---	1(5)	16
VII	3(1)	1(1)	1(2)	1(3)	1(4)	1(5)	20
VIII	2(1)	----	1(2)	2 (3)	1(4)	---	12
IX	1(1)	1(1)	1(2)	1(3)	---	1(5)	12
X	4(1)	1(1)	1(2)	1(3)	---	-----	10
	12(1)	4 (1)	5(2)	7(3)	2(4)	3(5)	
Total Marks	**16**		**10**	**21**	**08**	**15**	**70**

Note: Numbers given in the brackets indicate the marks

Prepared By: R.TAMILSELVAN

PGT(Bio)

KV PUDUCHERRY No. 1[S-1]

KENDRIYA VIDYALAYA SANGATHAN
CHENNAI REGION
BIOLOGY CLASS XII
SAMPLE PAPER - SET III(2022 -2023)

Maximum Marks: 70 **Time: 3hours**

General Instructions:

i. All questions are compulsory.

ii. The question paper has five sections and 33questions. All questions are compulsory.

iii. Section - A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section – C has7questions of 3marks each;Section – D has 2 case-based questions of 4 marks each; and Section - E has 3 questions of 5 marks each.

iv. There is no overall choice. However, internal l choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.

Wherever necessary, neat and properly labelled diagrams should be drawn.

SECTION-A **Marks (16 x 1 = 16)**

1. The technique called gamete intra fallopian transfer is recommended for those females

a. Who cannot produce an ovum

b. Who cannot retain the foetus inside the uterus

c. Whose cervical canal is too narrow to allow the passage for the sperms

d. Who cannot provide a suitable environment for fertilisation

2. After parturition, which natural contraception way can be utilized?

(a) Lactational menorrhea (b) Lactational amenorrhea

(c) Lactational deficiency (d) Lactational prevention

3. Which one of the following statements about Histones is wrong?

a. Histones carry positive charge in the side chain

b. Histones are organized to form a unit of 8molecules

c. The pH of histones is slightly acidic

d. Histones are rich in amino acids-Lysine andArginine

4. In 1953, S. L. Miller created the primitive earth conditions in the laboratory and gave experimental evidence for the origin of first form of life from pre-existing non-living organic molecules.

The primitive earth conditions created include

a. Low temperature, volcanic storms, atmosphere rich in oxygen

b. Low temperature, volcanic storms, reducing atmosphere

c. High temperature, volcanic storms, non-reducing atmosphere

d. High temperature, volcanic storms, reducing atmosphere containing CH4, NH3, etc

5. Drugs like barbiturates, amphetamines, benzodiazepines, and other similar drugs, that are normally used as medicines for……

a. Sedative and pain killer

b. Diuretics

c. Depression and insomnia

d. Analgesics

6. Every time, when the dosage of a drug, has to be increased, to achieve the same effect, that initially occurred, in response to a smaller dose. This condition is known as

(a) Rebound effect (b) Tolerance

(c) Withdrawal syndrome (d) Addiction

7. What type of gametes will be formed by genotype RrYy?

a. RY,Ry,rY,ry b. RY,Ry,ry,ry c. Ry,Ry,Yy,ry d. Rr,RR,Yy,YY

8. Genetically modified food can be harmful because it can cause

a. Allergy and toxicity

b. Incorporation of antibiotic resistance genes in human beings

c. Disturbance in metabolism due to enzymes for antibiotic resistance

d. All of the above

9. Carrying capacity K means _____

a. Organism's capability of maximum reproduction

b. Nature's limit for supporting maximum growth of a species

c. Nature's limit for supporting maximum number of species

d. Organism's capability to withstand environmental odds

10. Gause's principle of competitive exclusion states that:

a. More abundant species will exclude the less abundant species through competition

b. Competition for the same resources excludes species having different food preferences

c. No two species can occupy the same niche indefinitely for the same limiting resource

d. Larger organisms exclude smaller ones through competition

11. Which ecosystem has the highest primary productivity?

(a) Pond ecosystem (b) Lake ecosystem

(c) Grassland ecosystem (d) Forest ecosystem

12. Which of the following countries has the highest biodiversity?

(a) Brazil (b) South Africa

(c) Russia (d) India

Question No. 13 to 16 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.

13. Assertion(A): Functional megaspore divide repeatedly to form seven celled eight nucleated structure

Reason(R): The Miotic divisions are free nuclear not followed by cell wall formation immediately

14. Assertion(A): Morgan carried out several Dihybrid crosses in drosophila and found F2 ratio deviated significantly from the expected MendelianRatio

Reason(R): The reason attributed by Morgan for this deviation is incomplete dominance

15. Assertion(A):ADA deficiency can be cured by bone marrow transplantation

Reason(R):ADA deficiency can be treated by enzyme replacement therapy

16. Assertion(A): Analysis of age pyramids for the human population can provide important inputs for long-term planning

Reason(R): The shape of the age pyramid shows the density of the human population

SECTION-B Marks(5 x 2 = 10)

17. Name and explain the role of inner and middle walls of human uterus.

18. Point out any too similarities in the behaviour of chromosomes and genes

19. How are morphine and heroin related? Mention the effect each one of them has on the human body?

20. Explain the significance of satellite DNA in DNA finger printing?

21. In a botanical Garden of a city there is a huge banyan tree growing, on which hundreds of birds and thousands of insects live. Draw the pyramid of numbers and biomass represented by this community.

(OR)

The pyramid of energy is always erect. Explain with reasons.

SECTION - C **Marks (7 x 3 = 21)**

22. Describe the process of parturition in humans

23. Why angiosperm anthers are called dithecous? Describe the structure of its microsporangium.

24. How are the following microbes useful to us?

a) *Trichoderma polysporum* b) *Monascus purpureus* c) *Streptococcus*

25. How does Hardy-Weinberg equation explain genetic equilibrium? How this equilibrium gets disturbed?

26. What is Allergy? What is the role of histamine in inflammatory response? Name two drugs which reduce the symptoms of allergy

(OR)

Describe the sexual and asexual phases of life cycle of plasmodium that causes malaria in humans

27. How are recombinant vector created? Why is only one type of restriction endonuclease required for creating one Recombinant vector?

28. (a) Why should we conserve biodiversity? How can we do it?

(b)Explain the importance of biodiversity hot-spots

SECTION - D **Marks (2 x 4 = 8)**

29. Every gene contains the information to express a particular trait. In a diploid organism there are two copies of each gene called alleles. In heterozygotes one of these two alleles will be different. The normal allele produces a normal enzyme and the modified allele would be responsible for normal or less efficient enzyme or non-functional enzyme or no enzyme at all. But if the allele produces a non-functional enzyme or no enzyme, the phenotype may be affected. The phenotype will only be dependent on the functioning of the unmodified allele.

a. Why recessive allele is unable to express itself in a heterozygous state?
b. Give an example for an incomplete dominance and write the phenotypic and genotypic ratios of incomplete dominance

(OR)

In heterozygotes the phenotype will only be dependent on the functioning of the modified allele. Substantiate the statement with the help of an example.

30. Cancer occurs when a normal cell starts dividing uncontrollably. This happens when the genes that regulate cell growth fail (or) deleted. Proto-oncogenes are genes that normally promote the growth and division of normal cells. Tumour suppressor genes are the genes that normally inhibit the division and survival of abnormal cells.

Once a Normal cell transforms into a cancer cell, it starts dividing out of control.Cancer cells can spread from the original site called the primary tumour to other tissues.This can occur in three different ways. One way is local spread in which aggressively dividing cancer cells directly invade nearby tissues. Another way involves the lymphatic system. The third way, cancer cells can spread through the blood to distant sites.

(i) How does a cancerous cell differ from a normal cell?

(ii) Benign tumours are less dangerous than malignant tumours. Why?

(OR)

Write the two probable causes of cancer.

SECTION - E **Marks (3 x 5 = 15)**

31. Describe the events of spermatogenesis with the help of schematic representation

Explain the hormonal regulation of spermatogenesis in humans.

(OR)

When and where primary oocytes formed in human female? Trace the development of these oocytes till ovulation. How gonadotropins influence this developmental process?

32. Explain the process of amino acylation of tRNA. Mention its role in Translation. How do ribosomes act as factories for protein synthesis? Describe initiation and termination phases of protein synthesis

(OR)

(a) DNA polymorphism is the basis of DNA fingerprinting explain

(b) Describe the role of lactose in Lac Operon

33. What is ADA deficiency? How does gene therapy help to solve this deficiency? What will be the permanent cure for this disease?

(OR)

(i) How does RNA interference help in developing pest-resistant plants?

(ii) List four advantages of genetically modified organisms

KENDRIYA VIDAYALA SANGATHAN CHENNAI REGION
CLASS XII BIOLOGY
MARKING SCHEME SAMPLE PAPER SET III (2022-23)

S.No	Gist of the Answer	Value points	Marks
1	(a) Who can not produce an ovum	1	1
2	(b) Lactational amenorrhea	1	1
3.	(a) Histones carry positive charge in the side chain	1	1
4	(d) high temperature volcanic storms, reducing atmosphere containing CH_3, NH_3, etc.	1	1
5	(c) Depression and insomnia	1	1
6	(b) tolerance	1	1
7.	(a) RY,Ry,rY,ry	1	1
8	(b) incorporation of antibiotic resistance genes in human beings	1	1
9	(c) Nature's limit for supporting maximum number of species	1	1
10	(c) No two species can occupy the same niche indefinitely for the same limiting resource	1	1
11	(d) Forest ecosystem	1	1
12	(a) Brazil	1	1
13	(c) A is true but R is False	1	1
14	(c) A is true but R is False	1	1
15	(d) A is false but R is true	1	1
16	(c) A is true but R is False	1	1
17	The endometrium undergoes cyclical changes during menstrual cycle	1	2
	The myometrium exhibits contraction during parturition	1	
18	Both of them occur in pairs in the body cells	1	2
	Only One of these will be present in the gametes(Gametes are haploid)	1	
19	Morphine is latex. Heroine is diacetylmorphine.	1	2
	Both of them used as depressant	1	
20	They show high degree of polymorphism	1	2
	They can be easily separated gy density gradient separation.	1	
21	Pyramid of numbers is inverted	1	2
	Pyramid of biomass is upright	1	
	Lower trophic levels have more energy than higher trophic levels	1	2
	As per 10% law, only 10% of the energy is available for the next trophic level	1	
22	Parturition definition	1	3
	Foetal ejection reflex	1	
	Hormonal action	1	
23	Since the anthers of angiosperm flowers are bilobed with two thecae in each lobe they are called as dithecous	1	3
	Structure of microsporangium	2	
24	Cyclosporine; A immunosuppressive agents	1	3
	Statins; blood cholesterol lowering agent	1	

	Streptokinase; clot buster	1	
25	Explanation of Hardy-Weinberg equation	2	3
	Factors affecting equilibrium	1	
26	The Exaggerated response of the immune system to certain antigens present in the environment is called allergy	1	3
	Histamine is responsible for inflammation and itching 1	1	
	Antihistamine, adrenaline, steroids. (any two)	1	
	Asexual phase of malarial parasite	1 ½	3
	Sexual phase of malarial parasite	1 ½	
27	The vector DNA is cut at a particular restriction site using the restriction enzyme used to cut the desired DNA segment from the the source DNA The alien DNA is then linked with plasmid DNA using ligase to form Recombinant vector	1	3
	Since a restriction enzyme recognises and cuts the DNA at a particular sequence called recognition site, the same restriction enzyme is used for cutting the DNA segment from both the vector and the source DNA	1	
	When cut by the same enzyme the resultant DNA fragments have the the same kind of sticky ends, which easily form hydrogen bonds with their complementary strands with the help of DNA ligase	1	
28	Significance of biodiversity	1	3
	Conservation methods	1	
	Any two importance of biodiversity hot-spots	1	
29	Recessive allele is responsible for production of less efficient enzyme or non functional enzyme or no enzyme at all	2	4
	Dog flower or Snapdragon or antirrhinum species (1 mark) Phenotypic ratio & Genotypic ratio 1:2:1 (1 mark)	2	
	If the modified allele produces normal enzyme the phenotype will be dominant	2	
30	Difference between cancer cells and normal cells	2	4
	Benign tumours will not spread malignant tumours will spread	2	
	Carcinogens, oncogenic viruses, mutagens (any two)	2	
31	Schematic diagram of spermatogenesis (refer NCERT class 12 textbook Pg. No 49)	3	5
	Hormonal regulation of spermatogenesis	2	
32	Describing the process of oogenesis (refer NCERT Class 12 Textbook Pg.No. 48)	4	5
	Effect of gonadotropins	1	
	DNA polymorphism refers to the occurrence of inheritable mutations at a frequency greater than 0.01 in a population The probability of such variations is more in the non coding sequences and they keep on accumulating generation of the generation There is a variety of types of polymorphism ranging from single nucleotide	3	5

	Change to very large scale changes. The single nucleotide polymorphism is used in locating the disease associated sequences of DNA on the chromosome. Tracing of human history. The variable number of tandem repeats so high degree of polymorphism, DNA polymorphisms arise due to mutations.		
	Lactose in Lac Operon is an inducer.It combines with the repressor protein, which otherwise has higher affinity for the operator.This inactivate the repressor from binding to the operator and hence transcription continuous This is example for inducible Operon	2	
33.	Definition of ADA Deficiency	1	5
	Treating the disease using gene therapy	2	
	Possible permanent cure	2	
	Describing the process of RNA interference	3	5
	Any 4 advantages of GMO	2	

Sample Question Paper 2022-23

CLASS XII

BIOLOGY (044)

MaximumMarks:70 **Time: 3hours**

General Instructions:

(i) All questions arecompulsory.

(ii) The question paper has five sections and 33 questions. All questions arecompulsory.

(iii) Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 markseach.

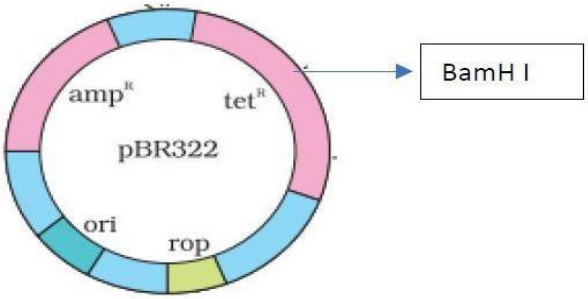
(iv) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in suchquestions.

(v) Wherever necessary, neat and properly labeled diagrams should bedrawn.

	SECTION - A	
Q.No.	Question	Marks
1.	An infertile couple was advised to undergo In vitro fertilization by the doctor. Out of the options given below, select the correct stage for transfer to the fallopian tube for successful results? (a) Zygote only (b) Zygote or early embryo upto 8blastomeres (c) Embryos with more than 8blastomeres (d) BlastocystStage	1
2.	Given below are four contraceptive methods and their modes of action. Select the correct match: *S.No. Method S.No Mode ofaction* a) Condom (i) Ovum not able to reachFallopian tube b) Vasectomy (ii) Prevents ovulation c) Pill (iii) Prevents sperm reaching thecervix d) Tubectomy (iv) Semen contains nosperms (a) a)–(i) b)–(ii) c)–(iii) d)–(iv) (b) a)–(ii) b)–(iii) c)–(iii) d) – (i) (c) a)–(iii) b)–(iv) c)–(ii) d)–(i) (d) a)–(iv) b)–(i) c)–(iii) d)–(ii)	1

3.3.	Which of the following amino acid residues will constitute the histone core? (a) Lysine andArginine (b) Asparagine andArginine (c) Glutamine andLysine (d) Asparagine andGlutamine	1
4	Evolutionary convergence is development of a (a) common set of functions in groups of differentancestry. (b) dissimilar set of functions in closely relatedgroups. (c) common set of structures in closely relatedgroups. (d) dissimilar set of functions in unrelatedgroups.	1
5.	*Apis mellifera* are killer bees possessing toxic bee venom. Identify the treatment and the type of immunity developed from the given table to treat a person against the venom of this bee. *Remedy* — *Immunity* (a) Inactivatedproteins — Active (b) Proteins ofthevenom — Passive (c) Preformedantibodies — Passive (d) Deadmicro-organisms — Active	1
6.	Interferons are most effective in making non-infected cells resistant against the spread of which of the following diseases in humans? (a) ascariasis (b) ringworm (c) amoebiasis (d) AIDS	1
7.	Which of the following water samples in the table given below, will have a higher concentration of organic matter? *WaterSample* — *Levelofpollution* — *Value ofBOD* (a) High High (b) Low Low (c) Low High (d) High Low	1

8. The figure below shows the structure of a plasmid. 1



A foreign DNA was ligated at BamH1. The transformants were then grown in a medium containing antibiotics tetracycline and ampicillin.
Choose the correct observation for the growth of bacterial colonies from the given table

	Medium with Tetracycline	*Medium withAmpicillin*
(a)	Growth	No growth
(b)	No growth	Growth
(c)	No growth	No Growth
(d)	Growth	Growth

9. Swathi was growing a bacterial colony in a culture flask under ideal laboratory conditions where the resources are replenished. Which of the following equations will represent the growth in this case? 1

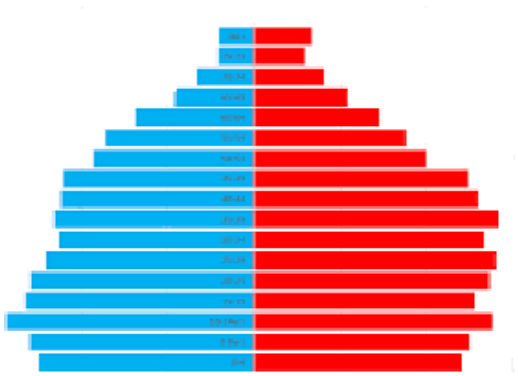
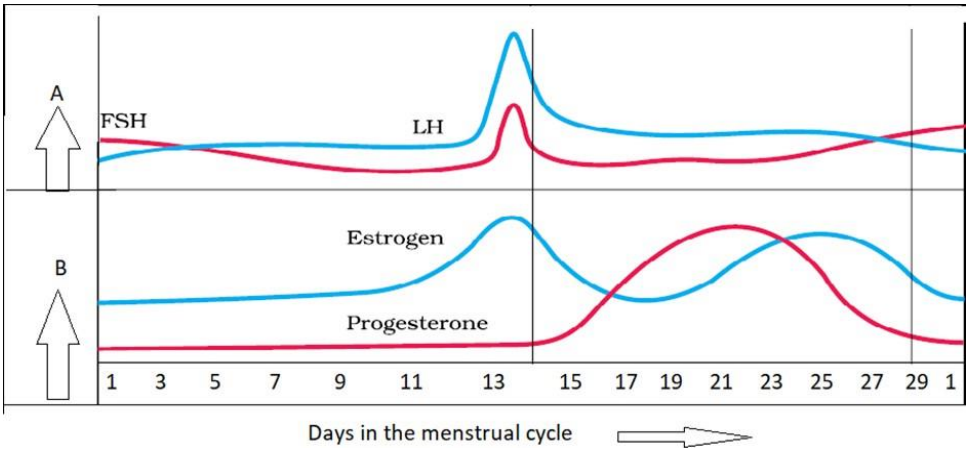
(Where population size is N, birth rate is b, death rate is d, unit time period is t, and carrying capacity is K).

(a) dN/dt = KN
(b) dN/dt = r N
(c) dN/dt = rN(K-N/K)
(d) dN/dt = rN(K+N/K)

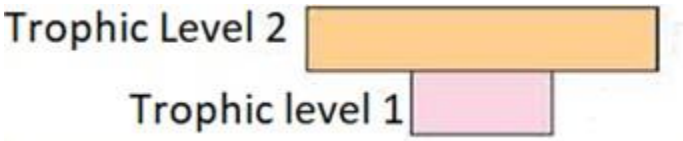
10. Sea Anemone gets attached to the surface of the hermit crab. The kind of population interaction exhibited in this case is 1

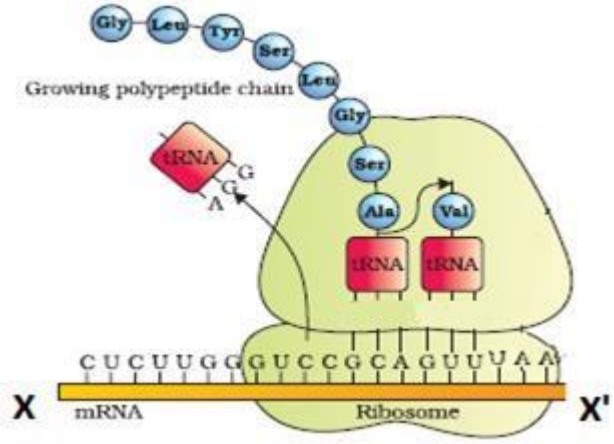
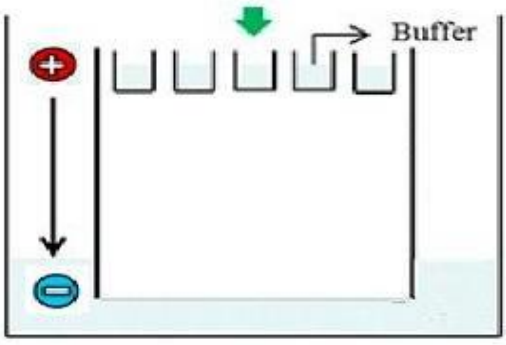
(a) amensalism.
(b) commensalism.
(c) mutualism.
(d) parasitism.

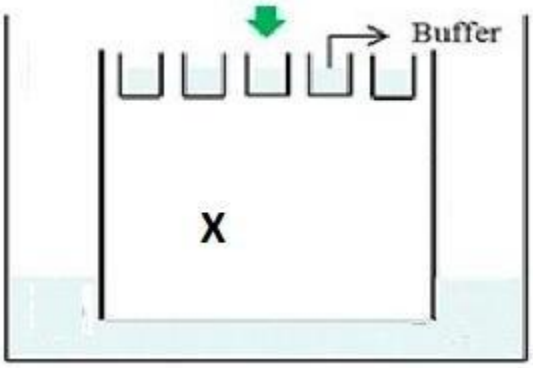
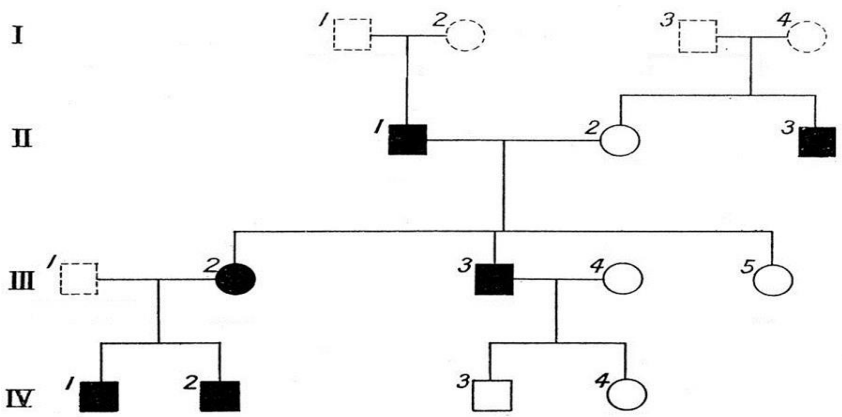
11.	Which of the following food chains is the major conduit for energy flow in terrestrial and aquatic ecosystems respectively? *TerrestrialEcosystem* — *Aquatic Ecosystem* (a) Grazing — Grazing (b) Detritus — Detritus (c) Detritus — Grazing (d) Grazing — Detritus	1
12	Which of the following is an example of ex situ conservation? (a) SacredGroves (b) NationalPark (c) BiosphereReserve (d) Seed Bank	1
	Question No. 13 to 16 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 ofA. B. Both A and R are true and R is not the correct explanation ofA. C. A is true but R isfalse. D. A is False but R istrue.	
13.	Assertion: Apomictic embryos are genetically identical to the parent plant. Reason: Apomixis is the production of seeds without fertilization.	1
14.	Assertion: When white eyed, yellow bodied *Drosophila* females were hybridized with red eyed, brown-bodied males; and F1 progeny was intercrossed, F2 ratio deviated from 9 : 3 : 3 : 1. Reason: When two genes in a dihybrid are on the same chromosome, the proportion of parental gene combinations is much higher than the non-parentaltype.	1
15.	Assertion: Functional ADA cDNA genes must be inserted in the lymphocytes at the early embryonic stage. Reason: Cells in the embryonic stage are mortal, differentiated and easy to manipulate.	1
16.	Given below is the Age Pyramid of population in one of the states in India as per 2011 census. It depicts the male population on the left hand side, female population on the right hand side, newborns towards the base and gradually increasingage groups as we move from base to the top, with the oldest population at the top.Study	1

	this pyramid and comment upon the appropriateness of the Assertionand theReason.  Assertion: It is a stable population. Reason: The pre-reproductive and reproductive individuals are almost in equal numbers and the post-reproductive individuals are relatively fewer.	
	SECTION - B	
17.	In the figure given below, parts A and B show the level of hormones which influence the menstrual cycle. Study the figure and answer the questions that follow:  (a) Name the organs which secrete the hormones represented in parts A andB. (b) State the impact of the hormones in part B on the uterus of the human female during 6 to 15 days of menstrualcycle?	2
18.	A true breeding pea plant, homozygous dominant for inflated green podsis crossed with another pea plant with constricted yellow pods (ffgg). With the help of punnett square show the above cross and mention the results obtained phenotypically and genotypically in F1 generation?	2

19	During a field trip, one of your friend in the group suddenly became unwell, she started sneezing and had trouble in breathing. Name and explain the term associated with such sudden responses. What would the doctor recommend for relief?	2

20	CTTAAGG AATTC (a) What are such sequences called? Name the enzyme used that recognizes such nucleotidesequences. (b) What is their significance in biotechnology?	2
21	(a) Given below is a pyramid of biomass in an ecosystem where each bar represents the standing crop available in the trophic level. With the help of an example explain the conditions where this kind of pyramid is possible in nature?  (b) Will the pyramid of energy be also of the same shape in this situation?Give reason for yourresponse. **OR** (a) Draw a pyramid of numbers where a large number of insects are feeding on the leaves of a tree. What is the shape of thispyramid? (b) Will the pyramid of energy be also of the same shape in this situation? Give reason for yourresponse.	2
	SECTION - C	
22	Explain the functions of the following structures in the human male reproductive system. (a) Scrotum (b) Leydigcells (c) Male accessoryglands	3
23	State the agent(s) which helps in pollinating in the following plants. Explain the adaptations in these plants to ensure pollination: (a) Corn (b) Water hyacinth (c) Vallisneria	3
24	(a) Identify the polarity of x to x' in the diagram below and mention how many more amino acids are expected to be added to this polypeptide chain.	3

	 (b) Mention the codon and anticodon foralanine. (c) Why are some untranslated sequences of bases seen in mRNA coding fora polypeptide? Where exactly are they present onmRNA?	
25	(a) How is Hardy-Weinberg's expression "$(p^2 + 2pq+q^2) =1$"derived? (b) List any two factors that can disturb the geneticequilibrium.	3
26	Highlight the structural importance of an antibody molecule with a diagram. Name the four types of antibodies found to give a humoral immune response, mentioning the functions of two of them you have studied. **OR** (a) Explain the Life cycle of *Plasmodium* starting from its entry in the body offemale *Anopheles* till the completion of its life cycle in humans. (b) Explain the cause of periodic recurrence of chill and high fever during malarial attack in humans.	3
27	Carefully observe the given picture. A mixture of DNA with fragments ranging from 200 base pairs to 2500 base pairs was electrophoresed on agarose gel with the following arrangement.  (a) What result will be obtained on staining with ethidium bromide? Explain with reason. (b) The above set-up was modified and a band with 250 base pairs was obtained at X.	3

	 What change(s) were made to the previous design to obtain a band at X? Why did the band appear at the position X?	
28	(a) There was loss of biodiversity in an ecosystem due to a new construction project in that area. What would be its impact on the ecosystem? State any three. (b) List any three major causes of loss ofbiodiversity?	3
	SECTION - D	
	Q.no 29 and 30 are case based questions. Each question has subparts with internal choice in one subpart.	
29	Study the Pedigree chart given below and answer the questions that follow:  Symbols used in the given Pedigree Chart are as follows: Carrier male, - Affected male, - Normal male -Carrier female, - Affected Female, - Normal female (a) On the basis of the inheritance pattern exhibited in this pedigree chart, what conclusion can you draw about the pattern ofinheritance? (b) If the female is homozygous for the affected trait in this pedigree chart, then what percentage of her sons will be affected?	4

	(c) Give the genotype of offsprings 1,2,3 and 4 in III generation. **OR** (c) In this type of inheritance pattern, out of male and female children which one has less probability of receiving the trait from the parents. Give areason.	
30.	The data below shows the concentration of nicotine smoked by a smoker taking 10 puffs/ minute.  (a) With reference to the above graph explain the concentration of nicotine inblood at 10minutes. (b) How will this affect the concentration of carbon monoxide andhaembound oxygen at 10minutes? (c) How does cigarette smoking result in high blood pressure and increase inheart rate? **OR** (c) How does cigarette smoking result in lung cancer and emphysema?	4
	SECTION - E	
31	Trace the events from copulation to zygote formation in a human female. **OR** Trace the development of a megaspore mother cell to the formation of mature embryo sac in a flowering plant.	5
32.	Observe the segment of mRNA given below.	5

(a) Explain and illustrate the steps involved to make fully processedhnRNA?

(b) Gene encoding RNA Polymerase I and III have been affected by mutation ina cell. Explain its impact on the synthesis of polypeptide, statingreasons.

OR

Study the schematic representation of the genes involved in the lac operongiven below and answer the questions thatfollow:

(a) The active site of enzyme permease present in the cell membrane of a bacterium has been blocked by an inhibitor, how will it affect the lacoperon?

(b) The protein produced by the i gene has become abnormal due to unknown reasons. Explain its impact on lactose metabolism stating thereason.

(c) If the nutrient medium for the bacteria contains only galactose; will operonbe expressed? Justify youranswer.

33. Oil spill is a major environmental issue. It has been found that different strains of *Pseudomonas* bacteria have genes to break down the four major groups of hydrocarbons in oil. Trials are underway to use different biotechnological tools to incorporate these genes and create a genetically engineered strain of *Pseudomonas*
- a *'super-bug'*, to break down the four major groups of hydrocarbons in oil. Such bacteria might be sprayed onto surfaces polluted with oil to clean thin films of oil. 5

(a) Listtwoadvantagesofusingbacteriaforsuch biotechnologicalstudies?

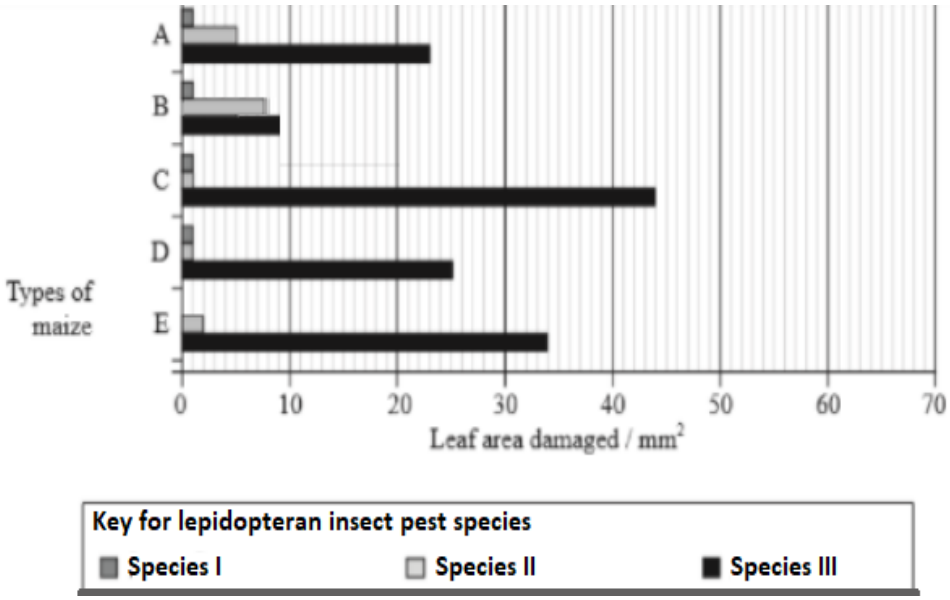
(b) For amplification of the gene of interest PCR was carried out. The PCR was run with the help of polymerase which was functional only at a very low temperature. How will this impact the efficiency of the PCR?Justify.

(c) If such bacteria are sprayed on water bodies with oil spills, how will this havea positive or negative effect on the environment?Discuss.

OR

Insects in the Lepidopteran group lay eggs on maize crops. The larvae on hatching feed on maize leaf and tender cob. In order to arrest the spread of three such Lepidopteran pests, Bt maize crops were introduced in an experimental field.
A study was carried out to see which of the three species of lepidopteran pests was

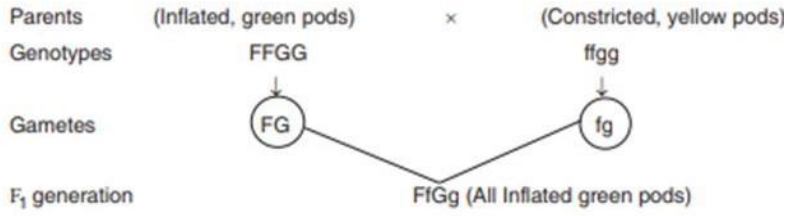
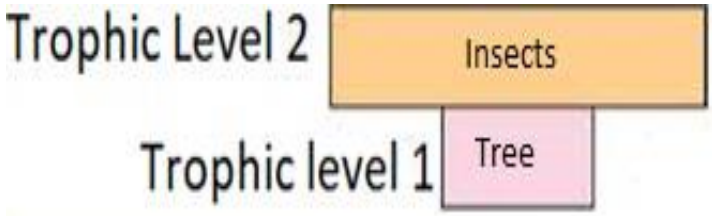
most susceptible to Bt genes and its product.
The lepidopteran pests were allowed to feed on the same Bt-maize crops grown on 5 fields(A-E).
The graph below shows the leaf area damaged by these three pests after feeding on maize leaves for five days.



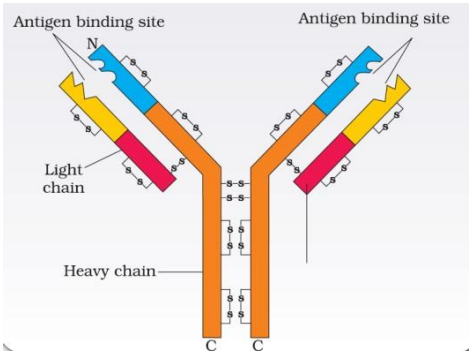
Insect gut pH was recorded as 10, 8 and 6 respectively for Species I, II and III respectively.

(a) Evaluate the efficacy of the Bt crop on the feeding habits of the three species of stem borer and suggest which species is least susceptible to Bttoxin.
(b) Which species is most susceptible to Bt-maize, explainwhy?
(c) Using the given information, suggest why similar effect was not seen inthe three insectspecies?

	MARKING SCHEME (2022-23) CLASS XII BIOLOGY (044)	
Q.No.	Question	Marks
	SECTION - A	
1	(b) Zygote or early embryo upto 8 blastomeres	1
2	(c) a) - iii, b) - iv, c) - ii, d) - i	1
3	(a) Lysine and Arginine	1
4	(a) common set of characters in groups of different ancestry	1
5	(c) Preformed Antibodies, Passive	1
6	(d) AIDS	1
7	(a) High , High	1
8	(b) No growth, growth	1
9	(b) dN/dt = r N	1
10	(b) commensalism	1
11	(c) Detritus; Grazing food chain respectively	1
12	(d) Seed Bank	1
	Question No. 13 to 16 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	
13	(a) Both A and R are true and R is the correct explanation of A	1
14	(a) Both A and R are true and R is the correct explanation of A	1
15	(c) A is true but R is false	1
16	(a) Both A and R are true and R is the correct explanation of A	1
	SECTION – B	
17	(a) A –Pituitary gland; B: Ovary(½ x 2 =1 Mark) (b) Endometrium of the uterus regenerates through proliferation.(1 Mark)	2

18	 Making the correct punnett square (1 mark) Phenotype - All Inflated green pods (½ mark) Genotype –FfGg (½ mark)	2
19	(a) Allergy, the exaggerated response of the immune response to certain antigens present in the environment is called allergy. (1 Mark) (b) Doctors would administer drugs like antihistamines, adrenaline and steroids (any one) to reduce the symptoms. (1 Mark)	2
20	(a) Palindromic sequences (0.5), endonuclease enzyme(½ Mark) (b) Restriction enzymes can make complementary cut counterparts forming sticky ends for recombination DNA / RDNA technology/ tofacilitate ligation of vector and foreign DNA.(1 Mark)	2
21	(a) Inverted pyramids of biomass are seen in aquatic conditions where a small standing crop of phytoplankton supports a large standing crop of zooplankton/fish/In terrestrial ecosystem where a large number of insects are feeding on the leaves of a tree. (1 Mark) (b) No, the Pyramid of energy is always upright, and can never be inverted because when energy flows from one trophic level to the next trophic level some amount of energy is always lost as heat at each step.(1 Mark) **OR**  (a) Inverted pyramid because a large number of insects feed on one tree. (b) No, the Pyramid of energy is always upright, and can never be inverted because when energy flows from one trophic level to the next trophic level some amount of energy is always lost as heat at each step. (1 x 2 = 2 marks)	2

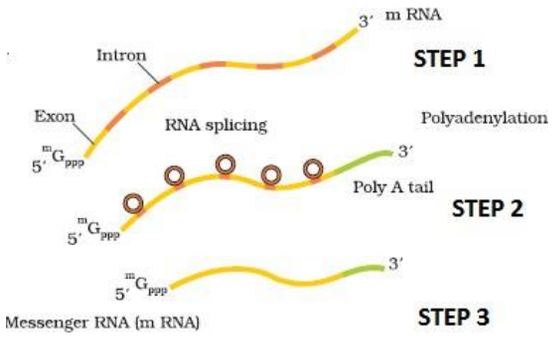
SECTION – C		
22	(a) Scrotum: The testes are situated outside the abdominal cavity within a pouch called scrotum. The scrotum helps in maintaining the low temperature of the testes (2–2.5 degree celsius lower than the normal internal body temperature) necessary for spermatogenesis. (b) Leydig cells: The regions outside the seminiferous tubules called interstitial spaces, contain small blood vessels and interstitial cells or Leydig cells. Leydig cells synthesize and secrete testicular hormones called androgens. (c) Male accessory glands: The male accessory glands include paired seminal vesicles, a prostate and paired bulbourethral glands. Secretions of these glands constitute the seminal plasma which is rich in fructose, calcium and certain enzymes. The secretions of bulbourethral glands also help in the lubrication of the penis. (1 x 3 = 3 marks)	3
23	(a) Corn: **Wind**. Numerous flowers are packed in an inflorescence; the tassels seen in the corn cob are the stigma and style which wave in the wind to trap pollen grains. (b) Water hyacinth: **Insects or wind**. In water hyacinth the flowers emerge above the level of water and are pollinated by insects or wind as inmost of the land plants. (c) Vallisneria: **Water**, In Vallisneria - the female flower reaches the surface of water by the long stalk and the male flowers or pollen grains are released onto the surface of water. They are carried passively by water currents; some of them eventually reach the female flowers and the stigma. (½ x 6 =3 Marks)	3
24	(a) x to x' is 5′—— —— ——— > 3′ (½ Mark) No more amino acids will be added(½ Mark) (b) GCA(½ Mark) Anticodon is CGU (½ Mark) (c) The untranslated regions are required for an efficient translation process. (½Mark)They are present before the initiation codon at the 5' –end and after the stop/termination codon, at the 3' – end (½ Mark)	3
25	(a) Sum Total of All the Allele Frequencies is 1: Let there be two alleles A and a in a population. The frequencies of alleles A and a are 'p' and 'q'respectively.(½ Mark) The frequency of AA individuals in a population is p^2 and it can be explained that the probability that an allele A with a frequency of p would appear on both the chromosomes of a diploid individual is simplythe product of the probabilities, i.e., p^2. Similarly, the frequency of aa is q^2 and that of Aa is 2pq. (½ Mark)	3

	$p^2 + 2pq+q^2) = 1$,where p^2 represents the frequency of homozygous dominant genotype, 2pq represents the frequency of the heterozygousgenotype and q 2 represents the frequency of the homozygous recessive.(1 Mark) (b) Factors that affect Hardy–Weinberg equilibrium: (i) Gene migration or gene flow (ii) Genetic drift (iii) Mutation (iv) Genetic recombination (v) Natural Selection (Any 2)(½+½= 1 mark)	
26	An antibody molecule consists of four polypeptide chains, two are long called heavy (H) chains while other two are short called light (L) chains. Both are arranged in the shape of Y. Hence, the antibody is representedas H_2 L_2.  (Diagram with Labels – Light chain (½ mark), Heavy Chain (½ Mark)Types of Antibody — IgA, IgM, IgE,IgG (**1mark awarded when all 4 types are stated**)IgA – Lactating Mother to protect their infant(½ Mark) Ig E – To protect from allergen(½ Mark) **OR** (a) When a female *Anopheles* mosquito bites an infected person, the parasites enter the mosquito's body as **gametocytes**(½ mark). It leadsto **fertilization and development in the gut** (½Mark)of the mosquito and undergoes further development to form **sporozoites** that are **stored in salivary glands** (½ Mark)until their transfer to human body. In the human body – the **sporozoites reach the liver and reproduce asexually** (½ Mark), bursting the cells and releasing theminto the **RBCs as gametocytes** (½ Mark)**.** *(Labeled diagram explaining the mentioned stages can also be considered)*	3

	(b) The **rupture of RBCs releases a toxic substance called haemozoin**, (1/2 Mark) which is responsible for the chill and high fever.	
27	**(a) No bands will be obtained as/All DNA will be seen in the well only;** (½ Mark) DNA fragments being **negatively charged** will **not move towards -ive end/ cathode.** DNA being negatively charged **will remain stationed at the positive end/ anodeend** of the agar block; (1 Mark) **(b)** (a) Position of the positive terminal/ end/ anode and the negative terminal/ end/ cathode was inter-changed (½ Mark) (ii) The fragment with least base pairs will get separated faster andmove faster to the anode end. (1 Mark)	3
28	Impacts of loss of biodiversity on the ecosystem:(a) (i) Decline in plant production (ii) Lowered resistance to environmental perturbations such asdrought (iii) Increased variability in certain ecosystems — processes such asplant productivity, water use, pest and disease cycles. (½ x 3 = 1 ½ marks) (b) (i) Habitat loss and fragmentation (ii) Over-exploitation (iii) Alien invasive species (iv) Co-extinctions. (Any three - ½ x 3 = 1½)	3
SECTION –D		
29	(a) X- linked (½ Mark), Recessive trait (½ Mark) (b) 100% (1 Mark) (c) XY OR <u>X</u>Y, 2. <u>X X</u>, 3. <u>X</u>Y, 4. XX (½ x 4 =2 Marks) **OR** The possibility of the female getting the trait is less. (1 Mark) The female will get the trait only if the mother is at least a carrier and thefather is affected. (1 Mark)	4
30	(a) Concentration of nicotine is maximum at 10 minutes/ conc. of nicotine increases steadily in the blood to reach 45mg/cm^3 (1 Mark) (b) The Concentration of CO will increase resulting in reduced	4

	concentration of haemboundoxygen.(1 Mark) (c) Nicotine results in stimulating the adrenal gland which results in releaseof adrenaline / nor - adrenaline in the blood resulting in increase of blood pressure and heart rate. (2 Marks) **OR** (c) Chemical carcinogens present in tobacco smoke are the major causeof lung cancer.(1 Mark) The cigarette smoke irritates the air passages of the lungs causing them toproduce mucus which causes cough resulting in enlarging air spaces/ reduce surface area/lose their elasticity (any point can be mentioned) thus difficulty in breathing causing emphysema. (1 Mark)	
	SECTION –E	
31.	i) During copulation (coitus) semen is released by the penis into the vagina (insemination). ii) The motile sperms swim rapidly, pass through the cervix, enter into the uterus and finally reach the ampullary region of the fallopian tube. iii) The ovum released by the ovary is also transported to the ampullary region where fertilization takes place. iv) Fertilisation can only occur if the ovum and sperms are transported simultaneously to the ampullary region. This is the reason why not all copulations lead to fertilisation and pregnancy. v) The process of fusion of a sperm with an ovum is called fertilisation. vi) During fertilisation, a sperm comes in contact with the zona pellucidalayer of the ovum and induces changes in the membrane that block the entry of additional sperms. Thus, it ensures that only one sperm can fertilise an ovum. vii) The secretions of the acrosome help the sperm enter into the cytoplasm of the ovum through the zona pellucida and the plasma membrane. viii) This induces the completion of the meiotic division of the secondary oocyte. ix) The second meiotic division is also unequal and results in the formation of a second polar body and a haploid ovum (ootid). x) Soon the haploid nucleus of the sperms and that of the ovum fuse together to form a diploid zygote. (½ x 10 = 5) **OR**	5

	Trace the development of a megaspore mother cell to the formation of mature embryo sac in a flowering plant. The process of formation of megaspores from the megaspore mother cell is called megasporogenesis. i) Ovules generally differentiate a single megaspore mother cell (MMC) in the micropylar region of the nucellus. It is a large cell containing dense cytoplasm and a prominent nucleus. The MMC undergoes meiotic division to form megaspores. ii) In a majority of flowering plants, one of the megaspores is functional while the other three degenerate. Only the functional megaspore develops into the female gametophyte (embryo sac). This method of embryo sac formation from a single megaspore is termed monosporic development. iii) The nucleus of the functional megaspore divides mitotically to form two nuclei which move to the opposite poles, forming the 2-nucleate embryo sac. iv) Two more sequential mitotic nuclear divisions result in the formation of the 4-nucleate and later the 8-nucleate stages of the embryo sac. v) These mitotic divisions are strictly free nuclear, that is, nuclear divisions are not followed immediately by cell wall formation. vi) After the 8-nucleate stage, cell walls are laid down leading to the organisation of the typical female gametophyte or embryo sac. vii) Six of the eight nuclei are surrounded by cell walls and organisedinto cells; the remaining two nuclei, called polar nuclei are situated inthe large central cell. viii) Three cells are grouped together at the micropylar end and constitute the egg apparatus. The egg apparatus, in turn, consists of two synergids and one egg cell. The synergids have special cellular thickenings at the micropylar tip called filiform apparatus. ix) Three cells are at the chalazal end and are called the antipodals. x) The large central cell, as mentioned earlier, has two polar nuclei. Which come to lie below egg apparatus. Thus, a typical angiosperm embryo sac, at maturity, though 8-nucleate is 7-celled. (½ x 10 = 5)	
32	(a) The hnRNA undergoes processes called **capping and tailing followed by splicing** .In capping, an unusual nucleotide is added tothe 5¢-end of hnRNA methyl guanosine triphosphate.In tailing, adenylate residues (about 200–300) are added at 3¢-end in a template independent manner.Now the hnRNA undergoes a processwhere the introns are removed and exons are joined to form mRNA called splicing. (½x 6 =3 marks)	5



(b) The process of translation will not happen, thus the polypeptide synthesis is stopped/ hampered. (1 Mark)

The reason for the above is:

RNA polymerase I transcribes rRNAs which is the cellular factory for protein synthesis. (½ Mark)

RNA polymerase III helps in transcription of tRNA which is the adaptor molecule/ that transfers amino acids to the site of proteinsynthesis.(½ Mark)

OR

(a) When the active site of enzyme permease present in the cell membrane of a bacterium has been blocked by an inhibitor, the lactose is not transported into the cell (1 Mark). As lactose is the inducer, the lac operon will not be switched on.

(1Mark)

(b) Since the repressor protein synthesized by the i gene is abnormal, itwill not bind to the operator region of the operon (1 Mark), resulting in a continuous state of transcription process
(1 Mark)

(c) No (½ Mark), because galactose is not an inducer/ it is a product of lactose metabolism (½ Mark)

33. (a) You can easily grow a large quantity of the bacteria/no ethical issues/have plasmids/ can easily transform (any 1) — 5

(b) PCR will not amplify the gene. (½ Mark)

If the polymerase enzyme denatures at low temp, it will not be able to withstand **high temperature which is essential for separating/opening/unwinding/ denaturing DNA** strand to open. Thus subsequent step of **extending the primers using the nucleotides provided in the reaction and the genomic DNA as template will not occur**.(1½ Marks)

(c) Positive effect: oil spills can be treated and the environment becomes better/ cleaner/ water becomes more potable/ safe for aquatic forms/ safe for water birds like sea gulls. (any one 1)

	Negative effect: the bacteria can mutate/ can harm other organisms/can conjugate with other non-virulent forms and make them super bugs with detrimental effect/ unpredictable/ for a longer duration it may reduce the dissolved oxygen and leading to mortality of aquaticorganisms (any one 1) **OR** (a) Species III is least susceptible (1 Mark) (b) Bt toxin **protoxins are converted into an active form in the gut** which solubilises the toxin crystals. The **activated toxin binds to the surface of midgut epithelial cells** and **create pores** that **cause cell swelling and lysis** and eventually cause death of the insect (2 Marks) (c) Insect **species I and II have alkaline gut pH** which **solubilises the insecticidal protein crystals of protoxin and makes it active**. Species **III has an acidic** and the **protoxin continues to remain in an inactive form** doing no harm to insect species III (2 Marks)	