

Solved Paper 2020

BIOLOGY

Time : 3 Hours

Class-XII

Max. Marks : 70

General Instructions:

Read the following instructions very carefully and strictly follow them:

- (i) Question paper comprises five sections : A, B, C, D and E.
- (ii) There are 27 questions in the question paper. All questions are compulsory.
- (iii) Section A question number 1 to 5 are multiple choice questions carrying 1 mark each.
- (iv) Section B question number 6 to 12 are short answer questions type-I, carrying 2 marks each.
- (v) Section C contains number 13 to 21 are short answer questions type-II carrying 3 marks each.
- (vi) Section D contains number 22 to 24 are short answer questions type-III, carrying 3 marks each.
- (vii) Section E question number 25 to 27 are long answer questions, carrying 5 marks each.
- (viii) Answer should be brief and to the point also the above word limit be adhered to as far as possible.
- (ix) There is no overall choice in the question paper. However, an internal choice has been provided in two questions of 1 mark, one question of 2 marks, two questions of 3 marks and three questions of 5 marks questions. Only one of the choices in such questions have to be attempted.
- (x) The diagram drawn should be neat proportionate and properly labelled, wherever necessary.
- (xi) In addition to this, separate instructions are given in each section and question, wherever necessary.

Delhi Set - I

Code No. 57/5/1

SECTION - A

- * 1. Which one of the following part of the plant when put into the soil is likely to produce new offspring?
(a) Part of an internode
(b) A stem cutting with a node
(c) Part of a primary root
(d) A flower 1
2. In a bacterium when RNA-polymerase binds to the promoter on a transcription unit during transcription, it
(a) terminates the process
(b) helps remove introns
(c) initiates the process
(d) inactivates the exons 1
Ans. Option (c) is correct.
3. The hypothesis that "Life originated from pre-existing non-living organic molecules was proposed by
(a) Oparin and Haldane (b) Louis Pasteur
(c) S.L. Miller (d) Hugo de Vries 1
Ans. Option (a) is correct.
4. * Mating of a superior male of a breed of a cattle to a superior female of another breed is called
(a) in breeding (b) out crossing
(c) out breeding (d) cross breeding 1
OR
Large-holes in 'Swiss-Cheese' are due to
(a) *Propionibacterium sharmanii*
(b) *Saccharomyces cerevisiae*
(c) *Penicillium chrysogenum*
(d) *Acetobacter aceti* 1
Ans. OR
Option (a) is correct.
5. * Increased concentration of DDT in fish-eating birds is due to
(a) eutrophication
(b) bio-magnification
(c) cultural eutrophication
(d) accelerated eutrophication 1
OR
Species-Area relationship is represented on a log scale as
(a) hyperbola
(b) rectangular hyperbola

- (c) linear
(d) inverted 1

Ans. OR

Option (c) is correct.

SECTION - B

6. State two advantages of an apomictic seed to a farmer. 2

Ans. Advantages of apomictic seeds to a farmer are:

- (i) Reduces the cost of hybrid breeding programmes.

8. Differentiate between opioids and cannabinoids on the basis of their

- (a) specific receptor site in human body.
(b) mode of action in human body. 2

Ans. Differences between opioids and cannabinoids:

	Opioids	Cannabinoids
Specific receptor site in human body	Receptors of opioids are located in the GI tract and central nervous system.	Receptors are located in the brain only.
Mode of action in human body	Act as depressant and slows down the body functions.	Affects the cardiovascular system of the body.

9. * (a) Name the two techniques employed to meet the increasing demand of fish in the world.
* (b) Name any two fresh water fishes. 2

OR

Describe the contributions of Alexander Fleming, Ernest Chain and Howard Florey in the field of microbiology. 2

Ans. Alexander Fleming while working on *Staphylococci* bacteria, once observed a mould growing in one of his unwashed culture plates around which *Staphylococci* could not grow. He found out that it was due to a chemical produced by the mould and he named it penicillin after the mould *Pencillium notatum*. Later, Ernest Chain and Howard Florey made its full potential effective antibiotic.

10. All cloning vectors do have a 'selectable marker'. Describe its role in recombinant DNA-technology. 2

Ans. Role of selectable marker in rDNA technology is to identify and distinguish the bacterial cells that have taken up the recombinant vector during the transformation process.

11. Mention how have plants developed mechanical and chemical defence against herbivores to protect themselves with the help of one example of each. 2

Ans. Several plants have evolved various mechanisms both morphological and chemical to protect themselves against herbivorous.

- (ii) Desired traits can be maintained without losing superiority of hybrids over parents. Farmers can replant these seeds year after year.

7. Explain when is a genetic code said to be

- (a) Degenerate
(b) Universal 2

Ans. (a) Genetic code is said to be degenerate when two or more codons specify a particular amino acid.
(b) Genetic code is said to be universal when its coded information specifies the same amino acid across different species.

Morphological defense mechanisms:

- Cactus plants (*Opuntia*) are modified into sharp spines (thorns) to deter herbivores from feeding on them.
- Sharp thorns along with leaves are present in Acacia to deter herbivores.
- In some plants, the margins of their leaves are spiny or have sharp edges that prevent herbivores from feeding on them. (Any one)

Chemical defense mechanisms:

- All parts of *Caloptropis* weeds contain toxic glycosides, which can prove to be fatal if ingested by herbivores.
- Chemical substances such as nicotine, caffeine, quinine and opium are produced in plants as a part of self-defence. (Any one)

12. Name and explain the processes earthworm and bacteria carry on detritus. 2

Ans. Earthworm and bacteria carry out following processes on detritus:

- (a) **Fragmentation:** In this process, detritivores such as earthworm breakdown the detritus into smaller fragments.
(b) **Catabolism:** In this, the smaller inorganic compounds are produced from detritus because of the enzymes secreted by bacteria and fungi.
(c) **Mineralisation:** In this, the humus is acted upon by microbes like bacteria and are converted into inorganic molecules. (Any two)

SECTION - C

13. Explain three different modes of pollination that can occur in a chasmogamous flower. 3

OR

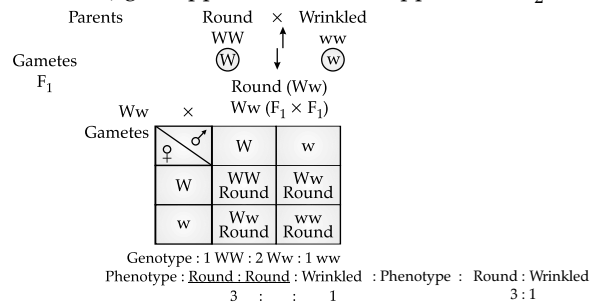
Explain the formation of placenta after implantation in a human female. 3

- Ans. (i) **Autogamy:** It is the transfer of pollen grains from the anther to the stigma of the same flower. Complete autogamy is rare in flowers with exposed anthers and stigma. Autogamy in such flowers requires synchrony in pollen release and stigma receptivity. Also, the anthers and stigma should lie close to each other to enable self-pollination.
- (ii) **Geitonogamy:** It is the transfer of pollen grains from the anther to the stigma of another flower of the same plant. It is functionally cross-pollination involving a pollinating agent. It is genetically similar to autogamy since the pollen grains come from the same plant.
- (iii) **Xenogamy:** It is the transfer of pollen grains from anther to the stigma of a different plant. This brings genetically different types of pollen grains to the stigma.

OR

- After implantation, the trophoblast forms finger-like projections called chorionic villi, surrounded by the uterine tissue and maternal blood.
 - The chorionic villi and uterine tissue gets interdigitated with each other to form the placenta.
 - Placenta is a structural and functional unit between embryo (foetus) and the maternal body.
 - Placenta is connected to the embryo by an umbilical cord. It transports substances to and from the embryo.
14. State Mendel's law of dominance. How did he deduce the law? Explain with the help of a suitable example. 3
- Ans. **Law of Dominance:** It states that characters are controlled by discrete units called factors, which occur in pairs. It states that a dominant allele expresses itself in a monohybrid cross and suppresses the expression of recessive allele. However, this recessive allele for a character is not lost and remains hidden or masked in the progenies of F_1 generation and reappears in the next generation. This law explains the expression of only one of the parental character in F_1 generation and expression of both in F_2 generation. For e.g., When pea plants with round seeds (RR) are crossed with plants with wrinkled seed (rr), all seeds in F_1 generation were found to be round (Rr). When these round seeds were self-

fertilized, both the round and wrinkled seeds appeared in F_2 generation in 3 : 1 ratio. Hence, in F_1 generation the dominant characters (round seed) appeared and the recessive character (wrinkled seeds) got suppressed, which reappeared in F_2 .



15. What are 'SNPs'? Where are they located in a human cell? State any two ways the discovery of SNPs can be of importance to humans. 3

Ans. SNPs are Single nucleotide Polymorphism. It is the variation in the genome of the organisms within a particular species because of changes in the sequence of a single nucleotide. SNPs are located within the chromosome in certain discrete locations.

Importance of SNPs:

- (i) Used to identify genetic regions associated with certain genetic disorders.
 - (ii) Used in forensic sciences.
16. (a) State what does the study of Fossils indicate. * (b) Rearrange the following group of plants according to their evolution from Palaeozoic to Cenozoic periods: Rhynia; Arborescent Lycopods' Conifers; Dicotyledon. 3

Ans. Fossils are the remains or traces of animal and plant life of the past, found embedded in rock either as petrified hard parts or as moulds, casts or tracks. Fossils are written documents of evolution.

Significance of fossils:

- To study phylogeny (evolutionary history or race history). e.g. Horse evolution.
 - To study the connecting link between two groups of organisms. e.g. Archaeopteryx.
 - To study about extinct animals. e.g. Dinosaurs
 - To study about geological period by analysing fossils in different sedimentary rock layers. The study showed that life forms varied over time and certain life forms are restricted to certain geological time spans. (Any two)
17. (a) Explain the mode of action of Cu^{++} releasing IUDs as a good contraceptive. How is hormone releasing IUD different from it? (b) Why is 'Saheli' a preferred contraceptive by women (any two reasons)? 3

Ans. **Action of copper releasing IUDs:** IUDs increase phagocytosis of sperms. The Cu ions suppress motility and fertilising capacity of sperms.

In contrast to copper releasing IUDs, hormone releasing IUDs (e.g. Progestasert, LNG-20) makes the uterus unsuitable for implantation and the cervix hostile to the sperms.

Saheli is a non-steroidal preparation used as oral contraceptive pills. It is a 'once a week' pill with very few side effects and high contraceptive value.

- * 18. (a) Explain why bee-hives are setup on the farms for some of our crop-species. Name any two such crop species. 3
 (b) List any three important steps to be kept in mind for successful bee keeping. 3
19. Why GMOs are so called? List the different ways in which GMO plants have benefitted and have become useful to humans. 3

Ans. Genetically Modified Organisms (GMO) or transgenic organisms are the plants, bacteria, fungi and animals whose genes are altered by manipulation.

Advantages of genetic modification in plants :

- It makes crops more tolerant to abiotic stresses like cold, drought, salt, heat etc.
- Most of the GM plants have been developed for pest-resistance, which increases the crop productivity and therefore, reduces the reliance on chemical pesticides.
- It helps to reduce post harvesting loss of crops.
- It increases efficiency of mineral usage by plants. This prevents early exhaustion of fertility of soil.
- It enhances nutritional value of food. This is known as bio-fortification. e.g. Golden rice is transgenic variety in rice, which is rich in vitamin 'A'.
- GM is used to create tailor-made plants to supply alternative resources to industries, in the form of starches, fuels and pharmaceuticals

20. * Differentiate between "Pioneer-species; "Climax-community" and "Seres". 3

OR

Explain any three ways other than zoological parks, botanical gardens and wildlife safaries, by which threatened species of plants and animals are being conserved 'ex situ'. 3

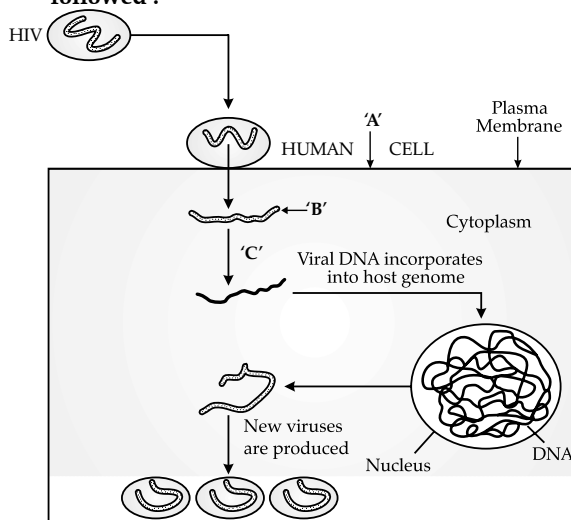
- Ans. (i) **Seed bank:** Seeds have the ability to show variable periods of dormancy. Therefore, many seed plants can be preserved in the form of their seeds in small packets for longer periods. Places where seeds are stored are called seed bank, gene bank or germplasm banks.
- (ii) **Cryopreservation:** Germplasm refers to any living plant organ or its part from which a complete new plant can be generated. This utilises the technique of cryopreservation in liquid nitrogen at a temperature of -196°C. Plants are propagated by using tissue culture methods called micro propagation.

- (iii) **Animal translocation:** It involves the release of animals in a new locality. It takes place when,
- (a) A species is endemic or restricted to a particular region.
 - (b) A species on which an animal is dependent becomes rare.
 - (c) Due to habit destruction and unfavourable conditions.
 - (d) Increase in population in an area.

- * 21. Explain 'Integrated organic' farming as successfully practiced by Ramesh C. Dagar, a farmer in Sonapat (Haryana). 3

SECTION - D

22. Study the diagram showing the entry of HIV into the human body and the processes that are followed :



- (a) Name the human cell 'A' HIV enters into. 3
 (b) Mention the genetic material 'B' HIV releases into the cell.
 (c) Identify enzyme 'C'.

- Ans. (a) A is helper T cells.
 (b) B is RNA
 (c) C is Reverse transcriptase

23. Following a road accident four injured persons were brought to a nearby clinic. The doctor immediately injected them with tetanus antitoxin.

- (a) What is tetanus antitoxin?
 (b) Why were the injured immediately injected with this antitoxin?
 (c) Name the kind of immunity this injection provided. 3

- Ans. (a) Tetanus antitoxin is a solution of pre-formed antibodies.
 (b) *Clostridium tetani* is a bacterium that enters the body through cut and wounds and obstructs nerve signaling. This antitoxin neutralizes the effect of tetanus toxin in the body. As the injured persons required immediate immunization in this case, so pre-formed antibodies were delivered to the patients.
 (c) Passive immunity.

24. "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 metro city tend to decline?
- (c) If 'N' is the population density at the time 't', write the population density at the time 't + 1'. 3

Ans. (a) Population in a metro city will tend to increase when natality and immigration will be higher.

(b) Population in metro city will tend to decline when mortality and emigration will be higher.

(c) The equation $N_{t+1} = N_t + [(B + I) - (D + E)]$ represents the population density at time $t + 1$.

Here,

N_{t+1} = Population density at time $t + 1$.

N_t = Population density at time t .

B = Natality

I = Immigration

D = Mortality

E = Emigration

SECTION - E

25. (a) Describe the process of megasporogenesis, in an angiosperm.

(b) Draw a diagram of a mature embryo sac of angiosperm, label its any six parts. 5

OR

(a) Where and how in the testes process of spermatogenesis occur in humans?

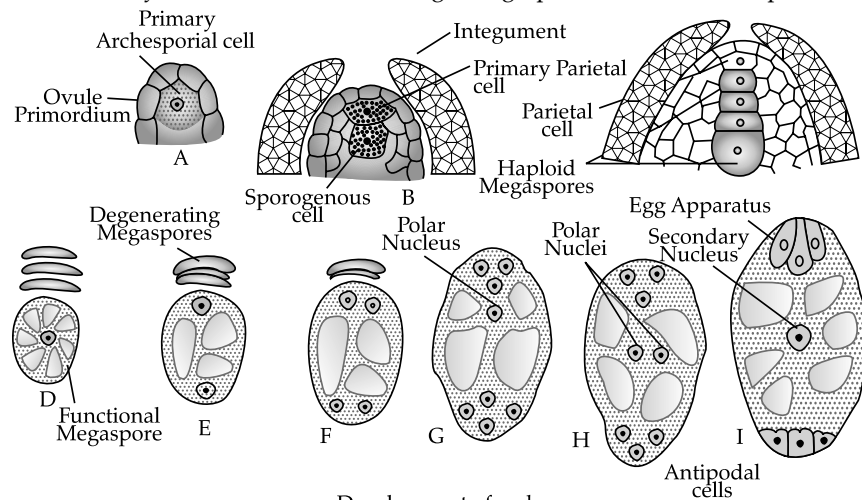
(b) Draw diagram of human sperm and label four parts. 5

Ans. (a) **Megasporogenesis** is the process of formation of the four megaspores from the megaspore mother cell (MMC) in the region of nucellus through meiosis. It occurs inside the ovule

Megaspore mother cell is large and contains a dense cytoplasm and a prominent nucleus. The MMC undergoes meiotic division to produce four megaspores.

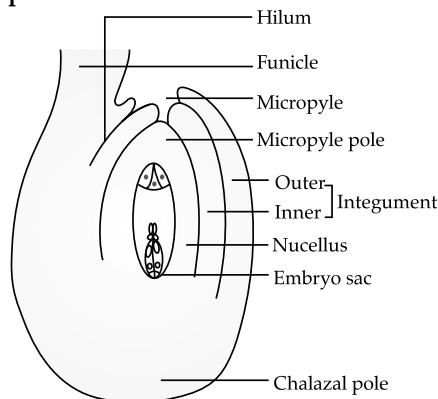
In a majority of flowering plants, only one megaspore is functional while the other three degenerate. The single functional megaspore develops into the female gametophyte.

This method of embryo sac formation from a single megaspore is termed monosporic development.



Development of embryo sac.

(b) **Diagram of mature embryo sac of an angiosperm :**



OR

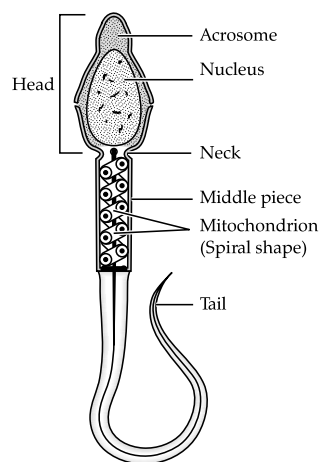
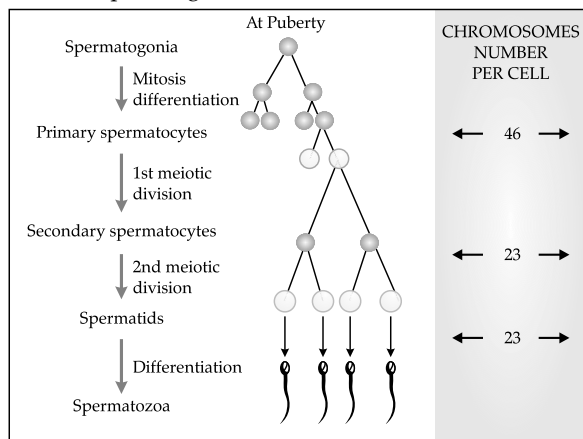
(a) **Spermatogenesis** is the process of formation of sperms (spermatozoa) from the immature germ cells in males. It takes place in seminiferous tubules present inside the testis. It consists of two stages: Formation of spermatids and Spermiogenesis.

During spermatogenesis, a diploid spermatogonium (male germ cell) increases its size to form diploid primary spermatocyte.

The diploid primary spermatocyte undergoes first meiotic division (meiosis I), which is a reductional division to form two equal haploid secondary spermatocytes.

Each secondary spermatocyte then undergoes second meiotic division (meiosis II) to form two equal haploid spermatids. Hence, a diploid

spermatogonium produces four haploid spermatids. These spermatids are transformed into spermatozoa (sperm) by the process called spermiogenesis. (b)



26. (a) Why did T.H. Morgan select *Drosophila melanogaster* for his experiments?

(b) How did he disprove Mendelian dihybrid F_2 phenotypic ratio of 9 : 3 : 3 : 1? Explain giving reasons. 2+3

OR

(a) List any four major goals of Human Genome project.

(b) Write any four ways the knowledge from HGP is of significance for humans.

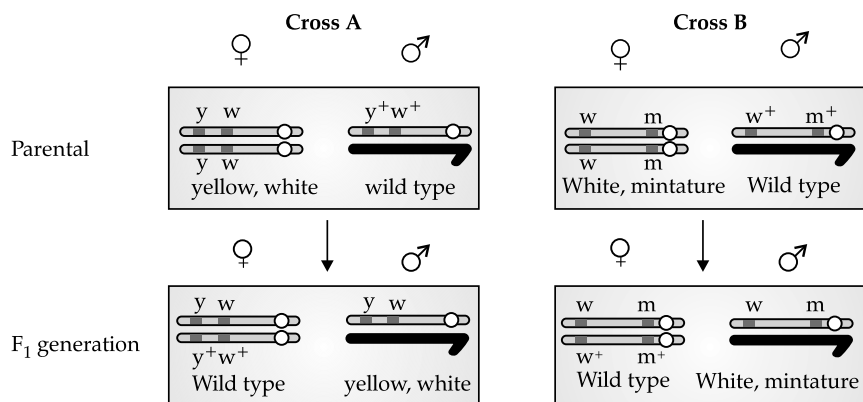
(c) Explain BAC and mention its importance.

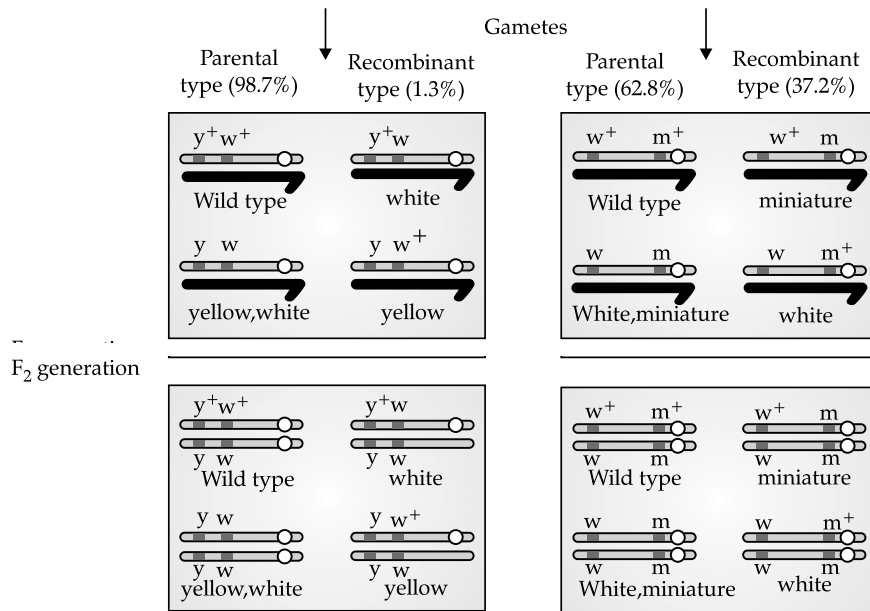
2+2+1

Ans. (a) Thomas Hunt Morgan chose *Drosophila* as his experimental model because,

- It breeds very quickly
- They complete their life cycle in about two weeks. Therefore, breeding can be done throughout the year.
- A single mating could produce a large number of progeny flies.
- They can be grown on simple synthetic medium in the laboratory.
- Easily distinguishable male and female
- Hereditary variations that can be clearly seen with low power microscopes. (Any four)

(b) Morgan carried out several dihybrid crosses in *Drosophila* to study sex-linked genes. He found that the two genes did not segregate independently of each other and the F_2 ratio deviated from the 9:3:3:1 ratio (expected when the two genes are independent).





OR

(a) **Goals of HGP**

- To identify all the estimated genes in human DNA
- To determine the sequences of the 3 billion chemical base pairs that makes up human DNA.
- To store this information in databases.
- To improve tools for data analysis.
- To transfer related technologies to other sectors.
- To address the ethical, legal and social issues (ELSI) that may arise from the project.

(b) **Advantages of the Human Genome Project are :**

- It has led to better understanding of Human biology and genetics in general.
- It has paved the way for personalized medicine in future based on one's own genome.
- It has shed a lot of light on human evolution and phylogenetics.

(c) BAC stands for Bacterial artificial chromosome. It is an artificially constructed vector containing the origin of replication and selectable marker for identification. It is capable of carrying large DNA fragments and can easily replicate easily inside a bacterial cell. It is used in human genome project for cloning large chunks of fragmented human genome with ease.

27. (a) **Name the insect that attacks cotton crops and causes lot damage to the crop. How has Bt cotton plants overcome this problem and saved the crop? Explain.**

(b) **Write the role of gene Cry IAb.**

5

OR

(a) **Explain the different steps carried out in Polymerase Chain Reaction, and the specific roles of the enzymes used.**

(b) **Mention application of PCR in the field of**
 (i) **Biotechnology**
 (ii) **Diagnostics**

Ans. (a) Cotton bollworm is the larvae that attack cotton crops.

Bt cotton plants are GMOs containing the active Cry gene from *Bacillus thuringiensis*, which form protein crystals during a particular phase of their growth. These crystals contain a toxic insecticidal protein.

These proteins are present in inactive protoxin form, but become active toxin in the alkaline pH of insect gut.

The activated toxin binds to the surface of midgut epithelial cells and creates pores that cause cell swelling and lysis and eventually cause death of the insect.

Specific Bt toxin genes were isolated from *B. thuringiensis* and genetically transferred to several crop plants such as cotton.

Most Bt toxins are insect-group specific. The toxin is coded by a gene named cry.

(b) The protein coded by gene cryIAb controls corn borer.

OR

(a) Polymerase Chain Reaction (PCR) is a technique in molecular biology to amplify a gene or a piece of DNA to obtain several copies.

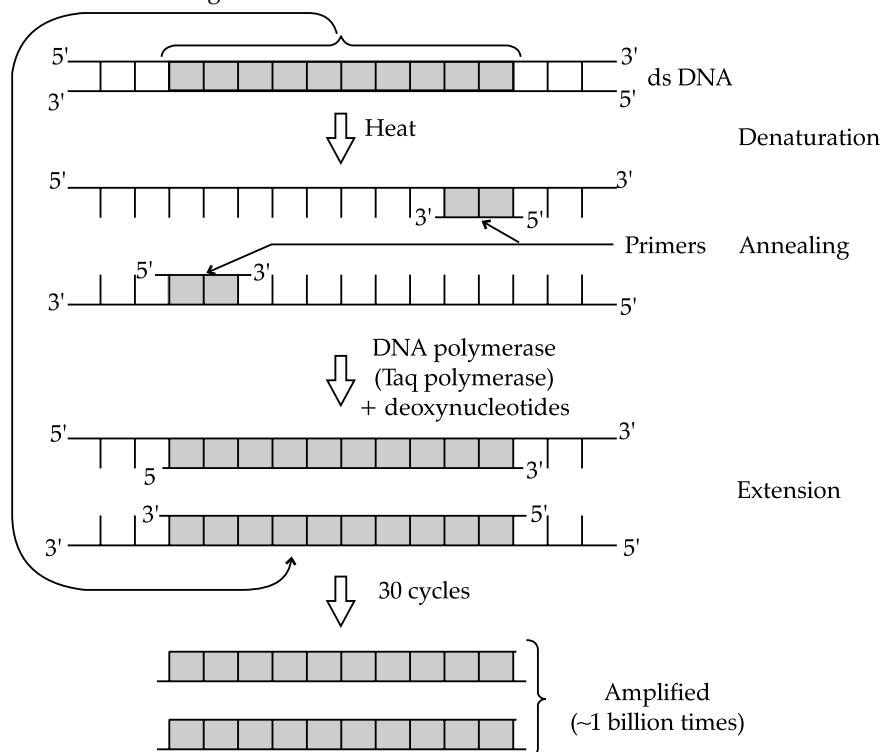
Each cycle has three steps: Denaturation, primer annealing and extension of primers.

- **Denaturation:** The double stranded DNA molecules are heated to a high temperature

(94°C) so that the two strands separate into a single stranded DNA molecule. This process is called denaturation. Each strand acts as template for DNA synthesis.

- **Annealing:** In this step, the two oligonucleotide primers anneal (hybridize) to each of the single stranded DNA

template, since, the sequence of the primers is complementary to the 3'ends of the template DNA. This step is carried out at a lower temperature depending on the length and sequence of the primers. This results in the duplication of the original DNA molecule.



- **Extension of primers :** DNA polymerase (Taq polymerase) extends the primers using the nucleotides provided in the reaction. The optimum temperature for this polymerization step is 72°C.

This process is repeated over several cycles to obtain multiple copies of rDNA fragment. The enzyme used in PCR is thermostable Taq polymerase enzyme, obtained from a bacterium called *Thermus aquaticus*.

- (b) **In biotechnology :** It is used to amplify a single or a few copies of a piece of DNA. The amplified fragment can be used to ligate with a vector for further cloning. This results recombinant DNA (rDNA).

In Diagnostic : PCR is used to detect HIV in suspected AIDS patients. It is also used to detect mutations in genes in suspected cancer patients. It is a powerful technique to identify many other genetic disorders.

Delhi Set - II

Code No. 57/5/2

Note : Except these, all other questions are from Delhi Set-I.

SECTION - A

2. The first cellular form of life evolved
- in air
 - on land
 - in water environment
 - in deep soil

1

Ans. Option (c) is correct.

SECTION - B

6. Name the Scientists and write how did they explain Mendel's laws after the chromosomes were discovered.

2

Ans. Walter Sutton and Theodore Boveri proposed Chromosomal Theory of inheritance.

Following are the observations that led Sutton and Boveri to come up with Chromosomal Theory of inheritance:

- Chromosome and genes are present in pairs in diploid cells.
- Homologous chromosomes separate during gamete formation (meiosis)
- Fertilization restores the chromosome number to diploid condition.
- The chromosomal theory of inheritance claims that, it is the chromosomes that segregate and assort independently.

8. List two diseases that spread through inhaling droplets or aerosols. Write one prominent symptoms for each one of them. 2

Ans. Disease that spread through inhaling droplets and aerosols are Diphtheria and common cold.

Symptoms of Diphtheria : Sore throat and swollen lymph nodes.

Symptoms of common cold : Nasal congestion and sneezing.

9. What makes humus a reservoir of nutrients? Name and write about the process humus undergoes that enriches the soil. 2

Ans. Humus is a reservoir of nutrients as it is derived from litter or organic matter scattered over soil surface such as leaves, twigs, dead bodies of organisms and their excretion. Humus is resistant to microbial action and so decomposes very slowly. Being colloidal in nature it serves as a reservoir of nutrients.

The humus is further degraded by the action of microbes, which finally leads to the release of inorganic nutrients into the soil. This process of releasing inorganic nutrients from the humus is called mineralization.

SECTION - C

15. You are asked to find the genotypes of a tall pea plant growing in your school garden. Name the cross and explain how you would confirm the genotypes. 3

Ans. The genotypes of a tall pea plant growing in your school garden can be found by test cross. Test cross is a cross between an organism with unknown genotype and a recessive parent. It is used to determine whether the individual is homozygous or heterozygous for a trait. For example, it is used to determine if tallness is coming from TT or Tt.

Case I : When TT is crossed with tt, we obtain all Tt (tall) individuals in the progeny.

Case II : When Tt is crossed with tt, we obtain all Tt (Tall) and tt (dwarf) individuals in the progeny.

Therefore, if tallness is coming from TT, then we obtain all tall progenies in test cross. We obtain both tall and dwarf varieties in test cross, if tallness is coming from Tt.

17. What is adaptive radiation? Explain with the help of a suitable example. 3

Ans. Adaptive radiation (evolution by adaptation) is the evolutionary process that produces new species from a single, rapidly diversifying lineage. This process occurs due to natural selection.

An example of adaptive radiation is Darwin finches, found in Galapagos Island. A large variety of finches is present in Galapagos Island that arose from a single species, which reached this island accidentally. As a

result, many new species have evolved, diverged, and adapted to occupy new habitats. These finches have developed different eating habits and different types of beaks to suit their feeding habits. The insectivorous, blood sucking, and other species of finches with varied dietary habits have evolved from a single seed eating finch ancestor.

- * 20. Explain the role of *Agrobacterium tumefaciens* in developing resistance in tobacco plant against nematode *Meloidogyne incognita*. Name the processes responsible for this. 3

SECTION - E

27. (a) Explain the process of syngamy and triple fusion in angiosperms.
(b) Trace the development of the product of syngamy upto its mature stage in a dicot plant.
(c) Draw and label three important parts of a mature dicot embryo. 5

OR

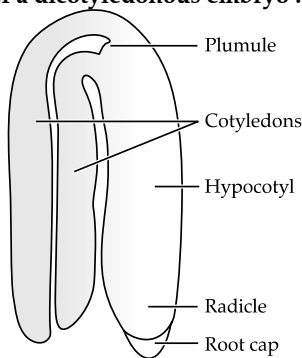
Name the gonadotropins in human. Explain their role in human male and female, respectively. 5

Ans. (a) When the pollen grain falls on the stigma, they germinate and give rise to the pollen tube that passes through the style and enters into the ovule. After this, the pollen tube enters one of the synergids and releases two male gametes. Out of the two male gametes, one gamete fuses with the nucleus of the egg cell and forms the zygote. The process is known as syngamy. The other male gamete fuses with the two polar nuclei located in the central cell to form a triploid primary endosperm nucleus (PEN). Since, the process involves the fusion of three haploid nuclei, it is known as triple fusion.

- (b) The product of syngamy is zygote. It develops into embryo having two cotyledons. The steps are:

- Embryo develops at the micropylar end of the embryo sac where the zygote is situated.
- The zygote gives rise to the proembryo and subsequently to the globular, heart-shaped and mature embryo.
- A typical dicot embryo consists of an embryonal axis and two cotyledons.
- The portion of embryonal axis, which lies above the level of cotyledon, is known as epicotyl. It terminates with the plumule (shoot tip).
- The cylindrical portion of the embryonal axis, which lies below the level of cotyledons, is hypocotyl. It terminates with the radicle (root tip). The root tip is covered with a root cap.

(c) Structure of a dicotyledonous embryo :



OR

Luteinizing hormone (LH) and Follicle Stimulating hormone (FSH) are the main gonadotropins produced in humans.

Functions of L.H:

- **In males:** It acts on the Leydig cells to secrete testosterone.
- **In females:** It helps in ovulation (release of ovum from mature Graafian follicle). It also takes part in development of corpus luteum.

Functions of FSH:

- **In males:** It stimulates the formation of sperms.
- **In females:** It stimulates the growth of Graafian follicle, helps in formation of estrogen.

Delhi Set - III

Code No. 57/5/3

Note : Except these, all other questions are from Delhi Set-I & II.

SECTION - A

1. Louis Pasteur demonstrated that

- early life came from outer space
- non-living chemicals produced living molecules
- life comes from pre-existing life
- life originated spontaneously

1

Ans. Option (c) is correct.

SECTION - B

6. Name one air-borne and a water borne disease in humans. List one specific symptom of each one of them.

2

Ans. **Air-borne diseases:** Tuberculosis (TB), Influenza

Symptoms: Pain and difficulty in breathing/ Coughing

Water-borne diseases: Diarrhoea, Typhoid

Symptoms: Loose motions/ Watery stool

10. How is humus formed? Mention any three characteristics of humus.

2

Ans. Humus is formed as a result of action of decomposers on the organic wastes by the process of Humification.

Characteristics of humus are :

- Amorphous
- Dark coloured
- Colloidal and rich in inorganic minerals.

11. State what are Mendelian disorders. Both Thalassaemia and colour blindness categorised as Mendelian disorders. Justify.

2

Ans. Mendelian disorders are a type of genetic disorders in humans which is caused by alteration or mutation in the single gene.

Thalassaemia: Thalassaemia is an autosomal recessive disorder of the red blood cells. In Thalassaemia one of the components of the haemoglobin molecule is inadequately produced or not produced at all. The reason for the inadequate or non- production of these components is a change in the genetic code (mutation), in that part of the DNA, which is the template for the production of the protein. A mutation may exist on one chromosome of a pair.

Colour blindness : It is a sex linked recessive disease in which the gene controlling a specific trait is present in its recessive form on the X-chromosome. It is a heredity disease in which the individual fails to distinguish red and green colours. This gene appears in the normal (dominant) and the mutant (recessive) form. Because the females have two X chromosome while males have only one X chromosome, for a female to get affected by colour blindness, she has to have the mutant gene on both the X chromosomes while males may be affected if they carry it on the X-chromosome.

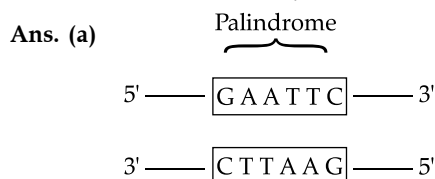
SECTION - C

13. (a) Write the palindromic nucleotide sequence EcoRI recognises.

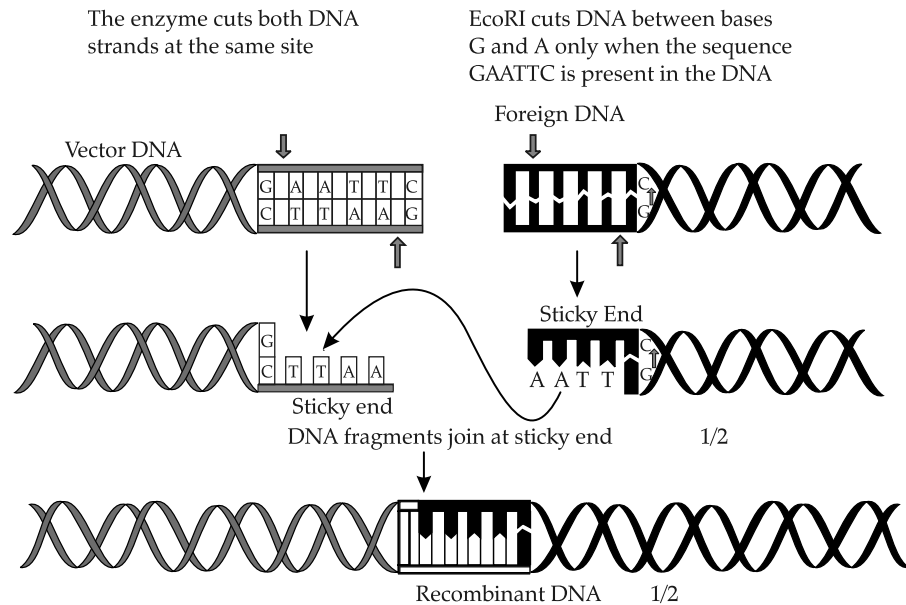
(b) Draw the vector DNA and a foreign DNA showing the sites where EcoRI has acted to form the sticky ends.

(c) Name the enzyme that helps in forming recombinant DNA.

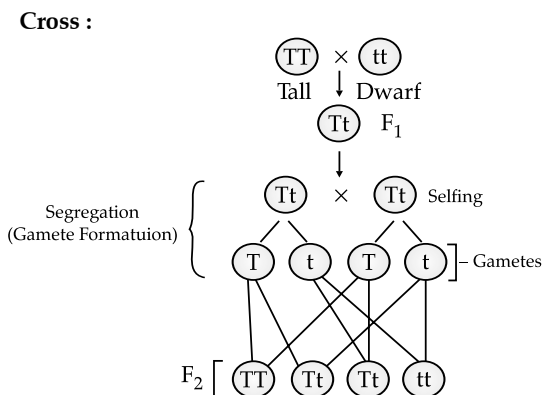
3



(b) Action of Restriction enzyme



- (c) Enzymes that help in formation of recombinant DNA are restriction enzymes, DNA ligases, DNA dependent DNA polymerase.
18. (a) **Rearrange the following in the correct order of their appearance on Earth between two million years and 40,000 years back.**
Neanderthals, Australopithecus, Homo erectus and Homo habilis.
- (b) Which one of the above
 (i) had the largest brain size
 (ii) ate fruits
- Ans. (a) Correct order of appearance of human on Earth between two million years and 40,000 years back is:
Australopithecus, Homo habilis, Homo erectus, Neanderthals
- (b) Neanderthal man had the largest brain size.
Australopithecus ate fruits.
19. **Explain Mendel's "Law of segregation" in a typical monohybrid cross with the help of a suitable example.**
- Ans. Mendel's Law of Segregation states that "During gamete formation, the factors (alleles) of a character pair present in parents segregate from each other such that a gamete receives only one of the two factors".



SECTION - E

26. (a) Describe the process of double fertilisation in angiosperms.
- (b) Trace the development of polyploidal cell that is formed after double fertilisation in a non-albuminous seed and albuminous seed. 5
- OR
- (a) List any two reasons other than physical and congenital disorders for causing infertility in couples.
- (b) Explain how IVF as a technique helped childless couples in having children.
- (c) Compare ZIFT with ICSI. 5
- Ans. (a) Double fertilisation is unique event to flowering plants. When the pollen grain falls on the stigma, they germinate and give rise to the pollen tube that passes through the style and enter into the ovule.
- After this, the pollen tube enters one of the of the synergids and releases two male gametes. Out of the two male gametes, one gametes fuses with the nucleus of the egg cell and forms the zygote. The process is known as syngamy. The other male gamete fuses with the two polar nuclei located in the central cell to form a triploid primary endosperm nucleus (PEN). Since, the process involves the fusion of three haploid nuclei, it is known as triple fusion. Since two kinds of fusions (syngamy and triple fusion) take place in an embryo sac it is known as double fertilisation.
- (b) The triploid endosperm nucleus formed during double fertilisation leads to the formation of the triploid primary endosperm cell (PEC). This PEC undergoes repeated mitotic divisions to

form a multicellular triploid endosperm. This serves as the nutritive tissue for the budding embryo within the seed.

In case of albuminous seeds, endosperm is retained and in many cases a rudimentary cotyledon often termed as Scutellum is derived from it in case of monocots.

In case of non-albuminous seeds, this Multicellular triploid endosperm is almost completely utilized or digested or absorbed to aid in the formation of fleshy cotyledon tissue as in case of most dicot seeds.

OR

- (a) Infertility is the inability of couple to produce baby even after unprotected intercourse. The reasons for this may be physical, congenital, diseases, drugs, immunological or even psychological.
- (b) In vitro fertilisation (IVF- Test tube baby programme) is a technique in which the ova from the wife/donor and sperms from the husband/donor are collected and are induced to form zygote under simulated conditions in the laboratory. This is followed by Embryo transfer (ET). It is of two types:
- **Zygote Intra Fallopian Transfer (ZIFT):** It involves transfer of zygote or early embryos

(with up to 8 blastomeres) into fallopian tube.

- **Intra Uterine Transfer (IUT):** It involves transfer of embryos with more than 8 blastomeres into the uterus.

The babies thus produced from this method are known as test tube babies. Embryo formed by in vivo fertilisation (fertilisation within the female) can also be used for such transfer to assist those females who cannot conceive.

(c) Differences between GIFT and ICSI :

GIFT (Gamete Intra Fallopian Transfer)	ICSI (Intra cytoplasmic sperm injection)
It is the method of transfer of gamete (ovum) from a donor into the fallopian tube of another female who is unable to produce ovum, but can provide right conditions for fertilisation and development of an embryo.	It is a laboratory procedure in which a single sperm (from male partner) is injected directly into an egg (from female partner). Then the fertilised egg is implanted into the woman's uterus.

Outside Delhi Set - II

Code No. 57/3/2

SECTION - A

* 1. Nematode specific genes were introduced into the tobacco host plant by using the vector

- (a) Plasmid (b) Bacteriophage
(c) pBR 322 (d) *Agrobacterium* 1

2. The principle of vaccination is based on the property of

- (a) Specificity
(b) Diversity
(c) Memory
(d) Discrimination between 'self' and 'non'self' 1

OR

Opioids act as

- (a) Depressants (b) Pain killers
(c) Euphoria providers (d) Stimulants 1

Ans. Option (c) is correct.

OR

Option (b) is correct.

3. After spermiogenesis, the sperm heads get embedded in which of the following cells?

- (a) Leydig cells
(b) Sertoli cells

(c) Germinal epithelium

(d) Seminal vesicle 1

Ans. Option (b) is correct.

4. Introduction of an alien DNA into plant host cell is achieved by making them

- (a) Competent with bivalent ions
(b) Using microinjections
(c) Using gene gun
(d) Using lysozymes and chitinase 1

Ans. Option (c) is correct.

5. One of the ex-situ conservation methods for endangered species is

- (a) Biosphere reserves
(b) National parks
(c) Cryopreservation
(d) Wildlife sanctuaries 1

OR

* Ozone gas is continuously formed in the stratosphere by

- (a) Action of UV rays on nascent oxygen
(b) Reaction of oxygen with water vapour
(c) Action of UV rays on molecular oxygen
(d) Action of UV rays on water vapour 1

Ans. Option (c) is correct.

SECTION - B

6. Name and explain the technique that can be used in developing improved crop varieties in plants bearing female flowers only. 2

OR

- * When are the non-flowering plants said to be homothallic and monoecious, and heterothallic and dioecious? Give an example of each. 2

Ans. Artificial hybridization is one of the major approaches of crop improvement programme to improve crop yield. In this method, desired pollen grains are used for pollination. This is achieved by emasculation and bagging techniques. If the female parent is unisexual, then there is no need for emasculation. In this case, the female flower buds are directly bagged before the flowers open. When the stigma becomes receptive, suitable pollens are dusted onto it so as to allow germination.

7. (a) Explain the cause responsible in a human to have sex chromosomes as 'XXY' instead of 'XX' or 'XY'.
(b) List any two ways such individuals are different from the normal being. 2

Ans. (a) Cause: Presence of an additional copy of X-chromosome in male. This condition is known as Klinefelter's syndrome.

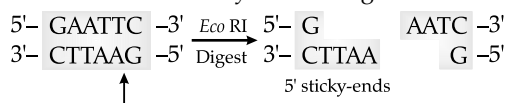
- (b) Features of affected individual : Overall masculine development, however, the feminine development is also expressed. e.g.,

- Development of breast (Gynaecomastia).
- Sterile.
- Mentally retarded.

- * 8. Spirulina is a rich source of proteins. Mention the two ways by which large scale culturing of these microbes is possible. 2

9. How does EcoRI specifically act on DNA molecule? Explain. 2

Ans. EcoRI cuts the DNA between bases G and A only when the sequence GAATTC is present in the DNA. This leaves single stranded overhanging stretches at the ends. They are called sticky ends. This stickiness facilitates action of the enzyme DNA ligase.



10. Name any two autotrophic microbes and state how they serve as biofertilizers. 2

Ans. Autotrophic microbes are : *Nostoc*, *Oscillatoria* and *blue green algae*. They add organic matter to the soil and increase its fertility.

11. How is the study of fossils an evidence of evolution of life forms which have taken place on the Earth? Explain giving two reasons. 2

Ans. Fossils are the remains or traces of animal and plant life of the past, found embedded in rock either as petrified hard parts or as moulds, casts or tracks. Fossils are written documents of evolution.

Significance of fossils:

- To study phylogeny (evolutionary history or race history). e.g. Horse evolution.
- To study the connecting link between two groups of organisms. e.g. *Archaeopteryx*.
- To study about extinct animals. e.g., Dinosaurs
- To study about geological period by analysing fossils in different sedimentary rock layers. The study showed that life forms varied over time and certain life forms are restricted to certain geological time spans. (Any two)

- * 12. How is the normal human body temperature of 37°C maintained during (i) Summer, and (ii) Winter? Explain. 2

SECTION - C

13. (a) Write the scientific name of methanogen bacteria. Where are these bacteria generally found? Explain their role in biogas production.

- (b) Name the components of biogas. 3

Ans. (a) Scientific name of methanogens : *Methanobacterium*.

Methanobacterium is found in the anaerobic sludge and rumen of cattle (for cellulose digestion). A lot of cellulosic material present in the food of cattle is also present in the rumen. In rumen, these bacteria help in the breakdown of cellulose and play an important role in the nutrition of cattle. Thus, the excreta (dung) of cattle, commonly called Gobar, is rich in these bacteria. Dung can be used for generation of biogas commonly called gobar gas.

- (b) Biogas contains methane (CH₄), CO₂ and H₂.

14. Explain double fertilization in an angiosperm. 3

Ans. Double fertilisation: It is a characteristic feature of flowering plants. In this process, out of the two sperm nuclei, one sperm nucleus fuses with the egg nucleus to form an embryo (process is called syngamy) and another fuses with the secondary nucleus to form an endosperm (process is called triple fusion).

Because two kinds of fusion—syngamy and triple fusion—take place, the process is known as double fertilisation.

15. Differentiate between the pattern of inheritance in humans of the blood diseases, haemophilia and thalassemia. 3

Ans. Mendelian disorders include genetic disorders caused by alterations or mutations in a single gene as in haemophilia and thalassemia.

- (a) **Haemophilia:** It is a type of genetic disorder in which blood clotting ability of the body is impaired due to the defect in one of the blood clotting factors. It is an X- linked recessive disorder and therefore is more common in males than in females. Males can inherit this disease from heterozygous carrier mother and such males become infertile. Females are rarely haemophilic as both the X- chromosomes need to be in recessive form. This disease leads to spontaneous bleeding on injury.
- (b) **Thalassemia:** It is an inherited autosomal recessive disorder of blood. In this disease abnormal haemoglobin is synthesized and this decreases the oxygen carrying capacity

of blood. Thus destruction of blood cells takes place causing anaemia. The individuals whose one of the parents is a carrier also becomes a carrier of the disease. If both the parents are carriers of the disease, the individual has 25% chance of inheriting the disease.

Thalassemia is life seizing disorder which does not allow the individual to live more than early stages of life. Different types of thalassemia exhibit different symptoms and severity.

16. (a) **Compare the mechanism of sex determination of humans with that of honey bees, with respect to chromosome number.**
- (b) **How is the gamete formation comparable in the above two cases?** 3

Ans. Difference between sex determination in humans and honey bee:

Sex determination in humans	Sex determination in honey bee
(a) Human has 23 pairs of chromosomes (22 pairs are autosomes and 1 pair is sex chromosomes). A pair of X-chromosomes (XX) is present in the female, whereas X and Y chromosomes are present in male.	The female are diploid having 32 chromosomes and males are haploid i.e. having 16 numbers of chromosomes. This is called haplo-diploid sex determination system.
<p>(b) Parents</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>Female 32</p> <p>↓ Meiosis</p> <p>Gametes ⊙ 16 ⊙ ⊙ 16 ⊙</p> <p>↓</p> <p>F₁: Male 16</p> </div> <div style="text-align: center;"> <p>Male 16</p> <p>↓ Mitosis</p> <p>Gametes ⊙ 16 ⊙</p> <p>↓</p> <p>F₁: Female 32</p> </div> </div>	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <p>♂ 44 A+XY</p> <p>↓</p> <p>Gametes: ⊙ 22A+X ⊙</p> <p>↓</p> <p>♀ 44 A+XX</p> </div> <div style="text-align: center;"> <p>♀ 44 A+XX</p> <p>↓</p> <p>Gametes: ⊙ 22A+Y ⊙</p> <p>↓</p> <p>♂ 44 A+XY</p> </div> </div>

17. **Differentiate between Dominance, Incomplete dominance and Co-dominance with the help of a suitable example of each.** 3
- Ans.** **Dominance:** One allele expresses itself in the hybrid heterozygous condition, other is suppressed. e.g., In the case of A, B and O, law of dominance is the pattern of inheritance as I^A / I^B dominant over i.
- Co dominance :** Both the alleles of a gene express in a heterozygous hybrid containing two dominant alleles. e.g., In AB group, both the alleles I^A and I^B express. It is the case of co-dominance.
- Incomplete dominance :** Neither of the two alleles of a gene is completely dominant over the other in heterozygous the hybrid is Intermediate. e.g., Dogflower/ snapdragon/*Antirrhinum*
18. **Mention the chemical nature of an antibody and name the type of cells they are produced by. Write the difference between active and passive immune responses on the basis of antibodies.** 3
- OR**
- Name the cells that act as HIV factory in humans when infected by HIV. Explain the events that occur in these infected cells.** 3
- Ans.** Chemically antibodies are proteins. They belong to immunoglobulin family of proteins which are Y

shaped large molecules produced by plasma cells. They are important constituents of the immune system.

Antibodies are produced by specialized white blood cells called B lymphocytes (or B cells). When an antigen binds to the B-cell surface, it stimulates the B cell to divide and mature into a group of identical cells called a clone.

Differences between active and passive immune responses:

Active immunity	Passive immunity
It is a type of acquired immunity in which the body produces its own antibodies against disease-causing antigens.	It is a type of acquired immunity in which readymade antibodies are transferred from one individual to another.
It has a long lasting effect.	It does not have a long-lasting effect.
It is slow. It takes time in producing antibodies and giving responses.	It is fast. It provides immediate relief.

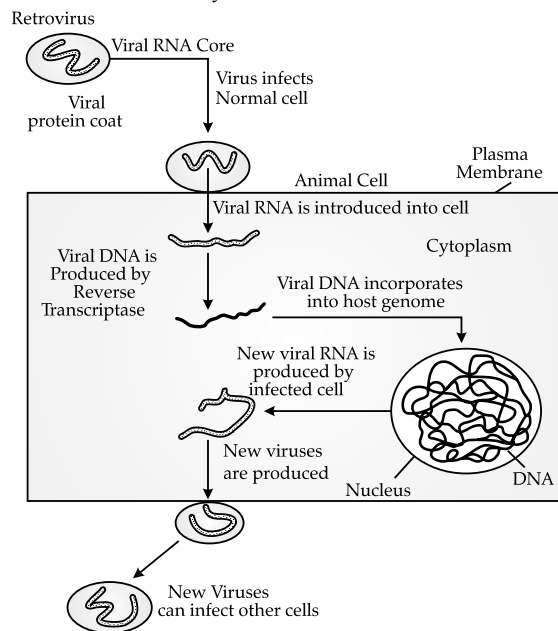
e.g. Injecting microbes through vaccination inside the body.	e.g. Transfer of antibodies present in the mother's milk to the infant.
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OR

Macrophages cells acts as HIV factory in human when infected by HIV where RNA of virus replicates to form viral DNA with the help of enzyme reverse transcriptase.

Events that occur in these infected cells are:

- After entering the human body, the HIV virus attacks and enters the macrophages. Inside the macrophages, the RNA of the virus replicates with the help of enzyme reverse transcriptase and give rise to viral DNA.
- Then, this viral DNA incorporates into the host DNA and directs the synthesis of virus particles.
- At the same time, HIV enters the helper T-lymphocytes. It replicates and produces viral progeny here. These newly formed progeny viruses get released into the blood, attacking healthier helper T-lymphocytes in the body.
- As a result, the number of T-lymphocytes in the body of an infected person decreases progressively, thereby decreasing the immunity of the body.



* 19. Explain the solutions found by Ahmed Khan, a Bengaluru based plastic sack manufacturer, after realising the problems created by plastic wastes. 3

* 20. Explain the effect of the sewage discharge on the characteristic (quality) of a river. 3

21. "Cotton bollworms enjoy feeding on cotton plants, but get killed when feed on Bt cotton plant". Justify the statement. 3

OR

(a) Mention the cause of ADA deficiency in humans.

(b) How is gene therapy carried out to treat the patients suffering from this disease?

(c) State the probability of a permanent cure of this disease. 3

Ans. Bt-cotton plant is a transgenic plant which produces an insecticide to bollworm. *Bacillus thuringiensis* is the bacterium which has a Bt gene or Cry gene which is incorporated in the cotton plant through biotechnological methods and thus, it produces a crystalline product Bt. The product acts as a toxin when ingested by the pests as it gets activated after reaching the alkaline gut of pests and creates pores in the intestine and kills the pests. The gene provides protection to GMO against budworm, bollworm, beetle, borer, etc.

OR

(a) The disease is caused by a mutation in a gene on chromosome 20. The gene codes for the enzyme ADA. It is an inherited disorder that damages the immune system.

(b) ADA is very crucial for the immune system to function. The deficiency of ADA causes severe combined immuno deficiency disease. The patient lack functional T-lymphocytes and fails to fight the infectious pathogens.

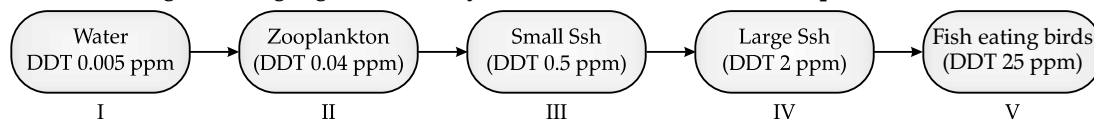
Using gene therapy, lymphocytes are extracted from the patient's bone marrow and a normal functional gene for ADA is introduced into these lymphocytes with the help of the retrovirus.

The lymphocytes of bone marrow contain the functional ADA gene and reactivate the patient's immune system.

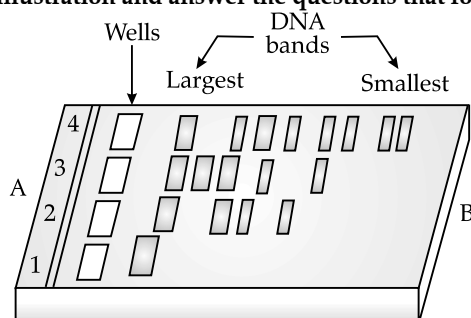
(c) In some children, ADA deficiency can be cured by bone marrow transplantation, in others it can be treated by enzyme replacement therapy, in which functional ADA is given to the patient by injection. But the problem is that they are not completely curable. If the gene isolated from marrow cells producing ADA is introduced into cells at early embryonic stages, it could be a permanent cure.

SECTION - D

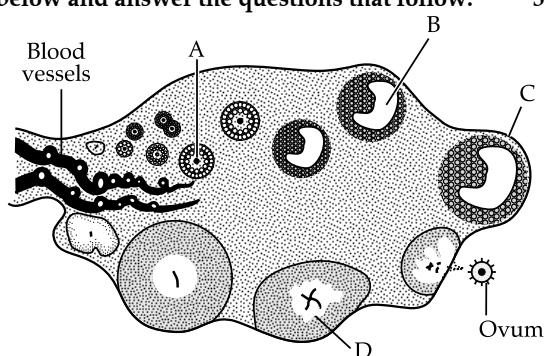
- * 22. Indiscriminate use of chemicals pesticides and weedicides by humans are polluting our water bodies, which in turn are harming the living organisms. Study the flow chart and answer the questions based on it. 3



- (a) Why does the concentrations of DDT seem to be considerably high in the top consumer?
 (b) How would the organisms at the highest level to be affected?
 (c) Name the phenomenon observed.
23. Give below is the diagram representing the observations made for separating DNA fragments by Gel electrophoresis technique. Observe the illustration and answer the questions that follow. 3



- (a) Why are the DNA fragments seen to be moving in the direction A → B?
 (b) Write the medium used on which DNA fragments separate.
 (c) Mention how the separated DNA fragments can be visualised for further technical use.
- Ans. (a) B is the anode end. DNA fragments are negatively charged thereby moving towards anode which is a positive rod, under the influence of an electric field during gel electrophoresis.
 (b) Most commonly used matrix is agarose. Agarose is a natural polymer extracted from sea weeds.
 (c) Ethidium bromide is used as stain for DNA, which on exposure to UV-light appear as orange coloured bands.
24. Study the transverse section of human ovary given below and answer the questions that follow: 3



- (a) Name the hormone that helps in the growth of A → B → C.

- (b) Name the hormone secreted by A and B.
 (c) State the role of the hormone produced by D.
- Ans. (a) Follicle stimulating hormone (FSH) secreted under the influence of releasing hormone from the hypothalamus stimulates development of primary follicles into Graafian follicles. LH leads to the growth of follicle and secretion of estrogen.
 (b) Hormone secreted is Estrogen.
 (c) Progesterone hormone helps in maintenance and preparation of endometrium for the implantation of the embryo. High levels of progesterone hormone in the blood decrease the secretion of LH and FSH, therefore inhibiting further ovulation.

SECTION - E

25. (a) Name the type of DNA that forms the basis of DNA fingerprinting and mention two features of this DNA. 5
 (b) Write the steps carried out in the process of DNA fingerprinting technique and mention its application. 5

OR

Explain the role of different genes in a *lac* operon, when in a 'Switched On' state. 5

- Ans. (a) The variation between individuals in the lengths of their DNA satellites forms the basis of DNA fingerprinting.
Features of DNA satellites:
 (i) They are divided into minisatellites and microsatellites whose characteristic makes them simple for identification between two samples as the DNA is polymorphic. It was called as Variable Number Tandem Repeats (VNTR).
 (ii) They are also inheritable from parents to offspring and can be used for paternity testing.
- (b) **Steps of DNA fingerprinting are:**
- Isolation of DNA (From any cells like blood stains, semen stains or hair roots).
 - Make copies (amplification) of DNA by polymerase chain reaction (PCR).

- Digestion of DNA by restriction endonucleases.
- Separation of DNA fragments by gel electrophoresis.
- Transferring (blotting) of separated DNA fragments to synthetic membranes, such as nitrocellulose or nylon and then baked in a vacuum oven at 80°C for 3-5 hours (to fix the DNA fragment on the membrane).
- Double stranded DNA made single stranded.
- Hybridization using labeled VNTR probe.
- Detection of hybridized DNA fragments by autoradiography. After hybridization with VNTR probe the autoradiogram gives many bands of different sizes. These bands give a characteristic pattern for an individual DNA. It differs from individual to individual.
- The image (in the form of dark & light bands) obtained is called DNA fingerprint.
- The DNA from a single cell is enough to perform DNA fingerprinting.

Application of DNA fingerprinting

- It is used in forensic science to identify potential crime suspects.
- It is used to establish paternity and family relationships.
- It is used to identify and protect the commercial varieties of crops and livestock.
- It is used to find out evolutionary history of an organism and trace out the linkages between various groups of organisms. **(Any two)**

OR

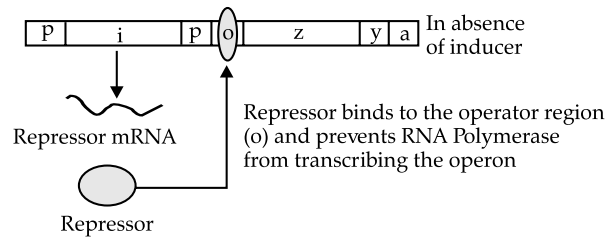
Lac operon in *E. coli* : It is the operon that controls the lactose metabolism. The lac operon consists of

- One regulatory gene (i-gene), which codes for repressor.
 - Three structural genes (z, y and a).
- (i) **z gene**: Codes for β -galactosidase, which hydrolyze lactose to galactose and glucose.
- (ii) **y gene**: Codes for *Permease*, which increases the permeability of the cell to lactose.
- (iii) **a gene**: Codes for a *transacetylase*.

The genes present in the operon function together in the same or related metabolic pathway. There is an **operator region** for each operon. In lac operon, lactose acts as an inducer. The lactose is transported into the *E. coli* cells by the action of permease.

In the presence of lactose (inducer): Lactose (inducer) binds with repressor protein and inactivates it. So repressor protein cannot bind to operator gene. The operator gene becomes free and induces the RNA polymerase to bind with promoter gene. Hence, three structural genes express their

product and respective enzymes are produced. These enzymes act on lactose so that lactose is metabolized into glucose and galactose. **5**



26. (a) According to ecologists, tropical regions in the world account of greater biological diversity. Justify.
- (b) Why are habitat loss and alien species invasion considered as the causes of biodiversity loss? Explain with the help of an example of each **5**
- OR

- * (a) What is an ecological succession?
- * (b) Differentiate between primary and secondary succession. Why is secondary succession faster than primary succession? Explain with suitable examples.
- * (c) What are pioneer species? Give examples of pioneer species in Xerarch and Hydrarch successions respectively. **5**

Ans. (a) Tropical regions have less seasonal variations and have more or less constant environment. This promotes the niche specialisation and thus, high species richness.

- (b) **Habitat loss**: Habitat of various organisms are altered or destroyed by uncontrolled and unsustainable human activities such as deforestation, slash, and burn agricultural, mining and urbanisation. This results in the breaking up of the habitat into small pieces, which effects the movement of migratory animals and also, decreases the genetic exchange between populations leading to a declination of species. E.g. Tropical rain forests (loss from 14% to 6%). Thousands hectares of rain forests is being lost within hrs. Similarly, the Amazon rain forest is being cut for cultivating soya beans or for conversion of grass lands for cattle. Due to fragmentation, animals requiring large territories and migratory animals are badly affected.

Alien species invasions: Accidental or intentional introduction of non-native species into a habitat has led to the declination or extinction of indigenous species. Alien species cause decline or extinction of indigenous species. E.g. The Nile Perch introduced in Lake Victoria (East Africa) caused extinction of more than 200 species of native fish, cichlid fish in the lake.

27. Where does fertilization occur in the oviduct of a human female? Describe the process of fertilization. 5

OR

(a) Where does microsporogenesis occur in an angiosperm? Describe the process of microsporogenesis.

(b) Draw a labelled diagram of the two-celled male gametophyte of an angiosperm. How is the three-celled male gametophyte different from it? 5

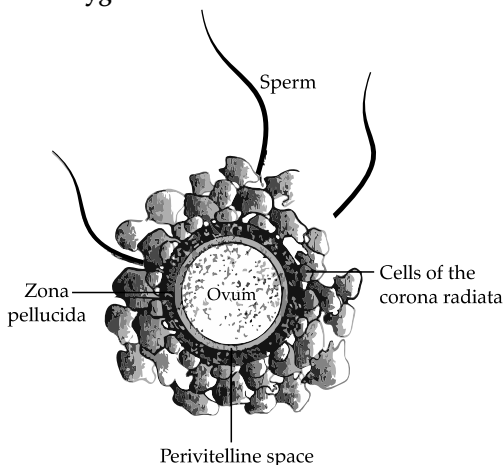
Ans. (a) The site of fertilisation is the ampullary isthmus junction (fallopian tube).

(b) During fertilization, the sperm induces changes in the zona pellucida and blocks the entry of other sperms. This ensures monospermy that only one sperm fertilizes the ovum and prevents polyspermy.

The enzymatic secretion of acrosome help the sperm enters the cytoplasm of the ovum.

This causes second meiotic division of the secondary oocyte to form a secondary polar body and a haploid ovum (ootid).

Then the haploid sperm nuclei fuse with the haploid nucleus of ovum to form a diploid zygote.



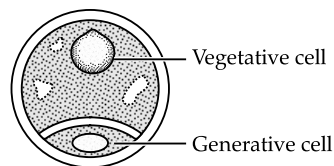
1+4

OR

(a) The process of formation of microspores or pollen grains from microspore or pollen mother cell (MMC or PMC) by meiosis is called microsporogenesis. It takes place in pollen sacs or microsporangia of each anther lobe.

The cells of sporogenous tissue of microsporangium functions as potential MMC/PMC in the anther. They undergo meiosis and as a result form four microspores or pollen grains arranged in tetrads. The pollen grains separate from the tetrads and give rise to two celled male gametophytes while still in situ. In the majority of angiosperms, the pollen is released from the anther at 2-celled stages while in some at 3-celled stage as the generative cell divides to form 2 male gametes.

(b) Structure of 2-celled gametophytes :



Difference between 2-celled gametophyte and 3-celled gametophyte: In over 60% of angiosperms, pollen grains are shed at the 2-celled stage. In others, the generative cell divides mitotically to give rise to the two male gametes before pollen grains are shed (3-celled stage).

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