CONTENTS

Contents

CBSE Examination Paper, 2020
Delhi [Set-I, II, III]

Time Allowed: 3 Hours] **[Maximum 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 questions paper. **All** questions are compulsory.

(*iii*) Section **A** question number **1** to **5** are multiple choice questions, carrying **one** mark each.

(*iv*) Section **B** question number **6** to **12** are short answer questions type-I, carrying **two** marks each.

(*v*) Section **C** question number **13** to **21** are short answer questions type-II, carrying **three** marks each.

(*vi*) Section **D** question number **22** to **24** are short answer questions type-III, carrying **three** marks each.

(*vii*) Section **E** question number **25** to **27** are long answer questions, carrying **five** 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 with each section and question, wherever necessary.

SET-I

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**

Ans. (*b*)

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**

Ans. (*c*)

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**

Ans. (*a*)

4. Mating of a superior male of a breed of a cattle to a superior female of another breed is called

(*a*) inbreeding **(*b*) out-crossing**

(*c*) out-breeding **(*d*) cross-breeding**

Or

Large-holes in 'Swiss-Cheese' are due to

(*a*) *Propionibacterium sharmanii* **(*b*) *Saccharomyces cerevisae***

(*c*) *Penicillium chrysogenum* **(*d*) *Acetobacter aceti***

Ans. (*d*) or (*a*)

5. Increased concentration of DDT in fish-eating birds is due to

(*a*) eutrophication **(*b*) bio-magnification**

(*c*) cultural eutrophication **(*d*) accelerated eutrophication**

Or

Species-Area relationship is represented on a log scale as

(*a*) hyperbola **(*b*) rectangular hyperbola**

(*c*) linear **(*d*) inverted**

Ans. (*b*) or (*c*)

Section-B

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

Ans. (*i*) Since there will be no segregation of hybrid characters in the progeny plants, the farmers can collect the seeds to raise new crop year after year; he does not have to buy the expensive hybrid seeds every year.

(*ii*) The desirable hybrid characters can be maintained through generations.

7. Explain when is a genetic code said to be

(*a*) Degenerate **(*b*) Universal**

Ans. – The genetic code is 'degenerate' as certain amine acids are coded by more than one codon.

– The genetic code is 'universal' as one codon codes for the same amino acid in all organisms, be it a bacterium or a human being.

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.

Ans.

Opioids	Cannabinoids
(*a*) Specific receptor site	
– Receptors are present in the central nervous system and the gastrointestinal tract.	– Receptors are present principally in the brain.
(*b*) Mode of action	
– They are depressants and slow down the body functions.	– They affect 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.

Or

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

Ans. (*a*) Pisciculture and aquaculture are the two techniques.

(*b*) Catla, Rohu, Common carp (*any two*)

Or

– Alexander Fleming discovered the antibiotic penicillin, secreted by the fungus/mould, *Penicillium notatum*, while working on *Staphylococcus* bacterium.

– Ernst Chain and Howard Florey established the full petential of penicillin as an antibiotic.

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

Ans. – A 'selectable marker' helps in identifying the recombinants/transformants from the non-recombinants.

– The genes encoding resistance to antibiotics such as tetracycline ampicillin, kanamycin, etc. are considered suitable selectable markers for *E.coli*, as *E.coli* does not have resistance to these antibiotics.

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

Ans. (*i*) Thorns and spines are the most common morphological means of defence.
e.g. spines of *Acacia* and cacti.

(*ii*) Many plants produce and store chemicals, which when consumed by the herbivores make them sick, interfere with digestion, disrupt reproduction or even kill them.
e.g. *Calotropis* produces highly poisonous cardiac glycosides.

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

Ans. Earthworms:

– Earthworms break the detritus into smaller particles in the process, called fragmentation.

Bacteria:

– The bacterial enzymes degrade the detritus into simpler inorganic substances in the process, called catabolism.

Section-C

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

Or

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

Ans. Modes of pollination in a chasmogamous flower.

(*i*) **Autogamy:**

It refers to the transfer of pollen grains from the anther to the stigma of the same flower.

(*ii*) **Geitonogamy:**

It refers to the transfer of pollen grains from the anthers of flower to the stigma of another flower of the same plant.

(*iii*) **Xenogamy**:

It refers to the transfer of pollen grans from the anthers of a flower to the stigma of another flower on a different plant of the same species.

Or

Formation of Placenta:

– Just after implantation, finger-like projections, called chorionic villi appear on the trophoblast; they are surrounded by uterine tissue and maternal blood.

– The chorionic villi and the uterine tissue become interdigitated with each other and jointly form the placenta.

14. State Mendel's law of dominance. How did he deduce the law? Explain with the help of a suitable example.

Ans. – Law of dominance states that dominance is a phenomenon, in which one allele of a gene expresses itself and suppresses the expression of the other allele of the same gene, when they are present together in a hybrid.

– When a cross was made between two individuals, one with tall stem (homozygous) and the other with dwarf stem, the F_1 individual had tall stem.

– When an F_1 individual is self-pollinated, the F_2 generation produced tall and dwarf individuals in the ratio of 3 : 1.

Parents : Tall plant × Dwarf plant

TT tt

Gametes : (T) (t)

F_1 generation : Tt (Tall)

Selfing : Tt × Tt

Gametes : (T) (t) (T) (t)

F_2 generation :

	T	t
T	TT Tall	Tt Tall
t	Tt Tall	tt Dwarf

– The phenotypic ratio is
3 Tall : 1 Dwarf

– The genotypic ratio is
1 TT : 2 Tt : 1 tt

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.

Ans. – SNPs (single nucleotide polymorphisms) refer to single base (nucleotide) differences in the DND sequences.

– They have been identified in about 1.4 million locations in the human genome.

Importance of SNPs:

(*i*) By finding chromosomal locations for disease-associated sequences.

(*ii*) By tracing human history.

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

Ans. (*a*) Fossils indicate:

(*i*) the geological time period in which the organisms existed.

(*ii*) that life forms varied over time and certain life forms are restricted to certain geological time spans.

(*iii*) that new forms of life have appeared at different times in the history of earth.

(*b*) Rhynia ⟶ Arborescent Lycopods ⟶ Conifers ⟶ Dicotyledons

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)?

Ans. (*a*) (*i*) Copper-releasing IUDs like Cu7 or CuT.

– The copper ions released suppress sperm motility and thereby their fertilising-capacity.

– They increase the phagocytosis of sperms within the uterus.

(*ii*) Hormone-releasing IUDs like LNG–20 and Progestasert.

– They make the uterus unsuitable for implantation.

– They make the cervix hostile to the sperms.

(*b*) (*i*) It is a non-steroidal preparation.

(*ii*) It is a 'once a week' pill.

(*iii*) It has high contraceptive value.

(*iv*) It has fewer side effects than other oral contraceptives.

18. (*a*) Explain why bee-hives are setup on the farms for some of our cropspecies. Name any two such crop species.

(*b*) List any three important steps to be kept in mind for successful bee keeping.

Ans. (*a*) (*i*) **Advantages:**

– The honey collection improves as the honeybees visit a number of flowers.

– The yield of crop increases as pollination efficiency increases.

(*ii*) **Annual crop:** Sunflower/*Brassica*

Perennial crop: Apple/Pear

(*b*) – Successful bee keeping requires the following considerations:

(*i*) Knowledge of the nature and habits of bees.

(*ii*) Selection of suitable location for keeping beehives.

(*iii*) Catching and hiving of swarms.

(*iv*) Management of beehives at different seasons.

(*v*) Handling and collection of honey and beewax.

– *Apis indica* is commonly used for bee keeping.

19. Why GMOs are so called? List the different ways in which GMO plants have benefitted and have become useful to humans.

Ans. Any organism whose genes have been manipulated/altered to possess and express one/more foreign genes, is called a genetically modified organism (GMO).

Advantages:

– Genetic modification has made the crops more tolerant to abiotic stresses like cold, heat, drought, salinity, *etc*.

– It has reduced the dependence of crops on chemical pesticides as they are made pest-resistant.

– Post-harvest losses are much reduced.

– As the plants have increased efficiency of mineral usage by plants, the early exhaustion of fertility of soil is prevented.

– Food produced from GM (Genetically Modified) crops has enhanced nutritional value.
– Genetic modification has been used to create tailor-made plants to supply resources such as starch, fuels, pharmaceuticals, *etc. to* industries.

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

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*'.

Ans. Pioneer species:

– The species that invade a bare area and initiate succession, are called pioneer species.

Climax-community and Seres:

– Climax community refers to the community that gets established finally in succession and is in equilibrium with the environment.
– Sere refers to the entire sequence of communities that successively change in a given area.

Or

The advanced *ex situ* methods include:

(*i*) Cryopreservation, to preserve the gametes of threatened animal species.
(*ii*) Tissue culture, to propagate the threatened species of plants.
(*iii*) Seed banks, to store the seeds of genetic strains of plants.
(*iv*) *in vitro* fertilisation of eggs.

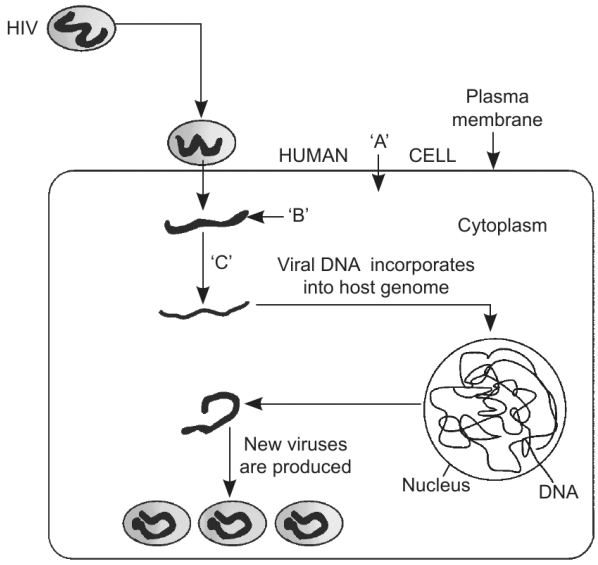
21. Explain 'Integrated Organic Farming' as successfully practiced by Ramesh C. Dagar, a farmer in Sonepat (Haryana).

Ans. Integrated Organic Farming

– Integrated organic farming is a cyclical, zero-waste procedure, where waste products from one process are cycled in as nutrients or resources for other processes.
– This allows maximum utilisations of resources and increases the efficiency of production.
– Ramesh Chandra Dagar has included bee-keeping, dairy management, water-harvesting, composting and agriculture in a chain of processes, which support one another and are extremely economical and sustainable.
– Cattle excreta is used as manure and for generating biogas that can be used as energy source for lighting and cooking.
– Crop waste is used to create compost and used as manure for crop fields; there is no need for chemical fertilisers for the crops.

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.

(*b*) Mention the genetic material 'B' HIV releases into the cell.

(*c*) Identify enzyme 'C'.

Ans. (*a*) Macrophage.

(*b*) RNA (Ribonucleic acid).

(*c*) 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.

Ans. (*a*) Tetanus antitoxin is a preparation containing antibodies to the tetanus toxin.

(*b*) Because tetanus is caused by a deadly microbe to which a quick immune response is needed.

(*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'.

Ans. (*a*) The population tends to increase when natality (number of births, B) and immigration (number of individuals coming into the population, I) increase.

(*b*) The population tends to decrease when mortality (number of deaths, D) and emigration (number of individuals leaving the population, E). decrease.

(*c*) $N_{t+1} = N_t + [(B + I) - (D + E)]$

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.

Or

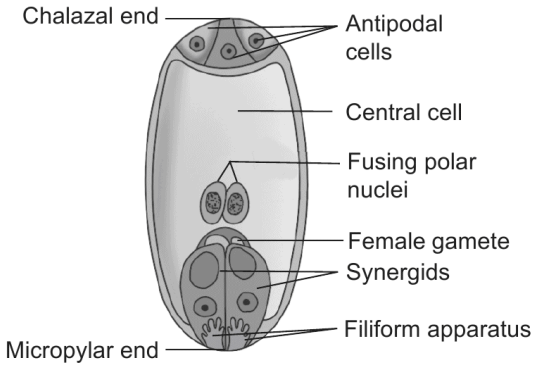
(*a*) Where and how in the testes process of spermatogenesis occur in humans.

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

Ans. (*a*) **Development of Female Gametophyte:**

- The megaspore mother cell undergoes meiosis to form four megaspores.
- Three of them degenerate and the functional megaspore enlarges to form the embryo sac.
- Its haploid nucleus undergoes a mitotic division and the two daughter nuclei move towards the opposite poles forming a two-nucleate embryo sac.
- Each of them undergoes two successive mitotic divisions, forming the four nucleate and then the eight-nucleate embryo sac.
- Cell wall formation starts in the 8-nucleate stage.
- Three of them at the micropylar end form the egg apparatus, consisting of a female gamete and two synergids.
- Three of them at the chalazal end form the antipodal cells.
- One nucleus from each of the poles moves to the centre; they are called polar nuclei.
- Later the two polar nuclei fuse in the centre (now the central cell) to form a diploid secondary nucleus.
- Thus, the mature embryo sac is 7-celled and 8-nucleate.

(*b*)



A fully developed embryo sac

Or

(*a*) Spermatogenesis occurs in the seminiferous tubules of testes.

Spermatogenesis

– Spermatogenesis is the process of formation of spermatozoa from the spermatogonia, in the seminiferous tubules of the testes.

– The spermatogonia (diploid, 2n) present on the inner lining of the wall of seminiferous tubules multiply by mitotic divisions and increase in number.

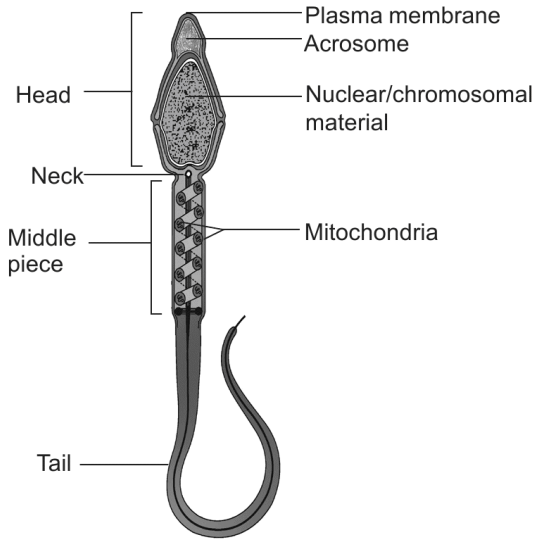
– Some of the spermatogonia increase in size and become the diploid (2n) primary spermatocytes.

– Each primary spermatocyte (2n) undergoes meiosis I, leading to the formation of two equal-sized, haploid cells, called secondary spermatocytes.

– The secondary spermatocytes (n) undergo meiosis II and form four equal-sized, haploid (n) cells, called spermatids.

– The spermatids (n) become transformed into spermatozoa/sperms (n), in a process, called spermiogenesis.

(*b*)



A Human Sperm

(*i*) – The head contains an elongated nucleus, the genetic material to be passed on to the progeny.

– The acrosome is filled with enzymes which help in dissolving the egg envelopes for the sperm to enter the ovum for fertilisation.

(*ii*) The middle piece contains a number of mitochondria, which provide energy for the movement of sperms in the female genital tract, towards the ovum.

(*iii*) The movement of tail is responsible for the motility of sperms towards the ovum.

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.

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*) Expand BAC and mention its importance.

Ans. (*a*) (*i*) These flies could be grown on simple synthetic medium in the laboratory.

(*ii*) They complete their life cycle in about two weeks.

(*iii*) A single mating produces a large number of flies in the progeny.

(*iv*) There is a clear differentiation of the sex, *i.e.* the male and female flies are easily distinguishable.

(*v*) It has many types of hereditary variations that can be seen with low power microscopes.

(*b*) **Morgan's experiment:**

– Morgan conducted dihybrid crosses in *Drosophila* to study the genes that were sex-linked; but his results deviated from the results of Mendel.

– They observed that when two genes of a dihybrid cross were present on the same chromosome, the proportion of parental combinations was much higher than that of non-parental combinations.

– Morgan coined the term linkage for the physical association of the genes present on a chromosome.

– The term recombination refers to the non-parental gene combinations.

– Even on the same chromosome, some genes are tightly linked and showed very low recombination while others are loosely linked and showed a higher recombination.

– Morgan found that genes for white eye and miniature wings showed 37.2% recombination, whereas genes for yellow body and white eye showed only 1.3% recombination.

Or

(*a*) **Some major goals of HGP:**

(*i*) Identify all the genes (approximately 20,000–25,000) in human DNA.

(*ii*) Determine the sequences of the three billion base pairs present in human DNA.

(*iii*) Store this information in databases.

(*iv*) Improve the tools for data analysis.

(*v*) Transfer the technologies to other sectors (like industries).

(*vi*) Address the ethical, legal and social issues (ELSI), that may arise from this project. (*any four*)

(*b*) **Significance of HGP**

(*i*) With whole genome sequences and new high-throughput technologies, all the genes in a genome can be studied as to how tens of thousands of genes and the proteins work together in an organism.

(*ii*) It will enable a radically new approach to the biological research.

(*iii*) The SNPs provide information that help to find the chromosomal locations of the disease-associated genes.

(*iv*) This will also help in tracing human history.

(*c*) 'BAC' – Bacterial Artificial Chromosome.

'YAC' – Yeast Artificial Chromosome.

– They are the commonly used vectors for cloning the DNA fragments in the hosts like bacteria and yeast.

– The cloning results into amplification (making multiple copies) of each fragment of DNA, so that they could be sequenced with ease.

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

(*b*) Write the role of gene *cryIAb*.

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 attacks cotton crops

– The '*cry*' genes are isolated from the bacterium, *Bacillus thuringiensis*.

– Biotechnologists have isolated the genes *cryIAc* and *cryIIAb*, which control the cotton bollworm, a lepidopteran.

– They introduced the genes into cotton plants, where the genes code for the crystal protein (Bt toxin) that is toxic to the bollworm; it remains in an inactive state.

– When the insect ingests the parts of cotton plant, the toxin becomes activated in the alkaline pH of its gut; it binds to the gut epithelium of the insect, creates pores and lysis of the cells and ultimately kills the insect.

– Thus, the plants are made insect-resistant and no synthetic pesticide is required.

(*b*) Gene *cryIAb* codes for Bt toxin against corn borer.

– When this gene is isolated from the bacterium, *Bacillus thuringiensis* and introduced into corn plants, they show resistance to corn borer.

Or

(*a*) **PCR (Polymerase Chain Reaction)**

– It is the process/reaction of *in-vitro* synthesis of multiple copies of the gene or DNA of interest.

– The reaction occurs in the following three steps:

(*i*) Denaturation:

In this step, the two strands of DNA are segregated by high temperature treatment; they act as templates for the synthesis of new strands.

(*ii*) Annealing:

In this step, two sets of primers (the chemically synthesised oligonucleotides) that are complementary to the region of DNA, become bonded at the complementary regions of the DNA.

(*iii*) Extension:

In this step, the enzyme DNA polymerase extends the primers using the nucleotides provided in the reaction medium in a genomic template-dependent manner.

– In this process, if replication is repeated many times, a billion copies of DNA can be made; such repeated amplification is achieved by the use of thermostable DNA polymerase obtained from the bacterium, *Thermus aquaticus.*

(*b*) (*i*) **Biotechnology**

– Multiple copies of the gene of interest can be created.

– The amplified fragments can be used to ligate with a vector for further cloning.

(*ii*) **Diagnostics**

Polymerase Chain Reaction (PCR)

– Presence of a bacterial or viral pathogen in the body can be detected much before the symptoms of the disease appear, by amplification of the nucleic acid of the pathogen.

– PCR is routinely used to detect HIV infection.

SET-II

[Uncommon Questions to Set-I]

Section-A

2. The first cellular form of life evolved

(*a*) in air **(*b*) on land**

(*c*) in water environment **(*d*) in deep soil**

Ans. (*c*)

Section-B

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

Ans. – Sutton and Boveri noted that the behaviour of chromosomes was parallel to the behaviour of the genes and used the chromosome movement to explain the laws of Mendel.

– The chromosomes and the genes occur in pairs.

– The two alleles of a gene are located on homologous sites on the homologous chromosomes.

– The pairing and separation of a pair of homologous chromosomes would lead to segregation of a pair of factors present on the homologous chromosomes.

– Sutton combined the knowledge of chromosomal segregation with Mendelian principles to frame chromosomal theory of inheritance.

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

Ans. Pneumonia and common cold spread through droplet infection.

Symptoms of Pneumonia:

– The alveoli of the lungs get filled with a fluid leading to severe problems in respiration.

– In severe cases, the lips and finger nails become gray to bluish in colour.

Symptoms of Common cold:

– The respiratory passage is affected but not the lungs and is characterised by nasal congestion and discharge and sore throat.

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

Ans. – The colloidal nature of humus makes it a reservoir of nutrients; it is highly resistant to microbial action and undergoes decomposition at an extremely slow rate.

– Humus undergoes mineralisation, *i.e.,* it is degraded by microbes and inorganic nutrients are released

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 would you confirm the genotypes.

Ans. – A test cross is a cross devised by Mendel, where the offspring or an individual with a dominant phenotype, whose genotype is not known, is crossed with an individual homozygous for the recessive trait.

– When a hybrid or heterozygous individual is crossed with an individual homozygous recessive for the trait, the progeny will consist of the dominant phenotype and recessive phenotype in equal proportions.

Parents : Hybrid Tall × Pure Dwarf

Tt tt

Gametes : (T) (t) (t)

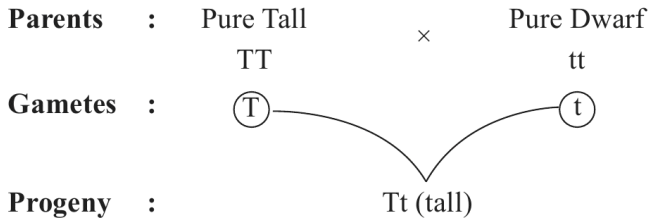
Progeny :

	t
T	Tt Tall
t	tt Dwarf

– The phenotypic and genotypic ratios are the same.

1 Tall (Tt) : 1 Dwarf (tt)

– If the dominant individual had been homozygous, all the individuals of F_1 would have been tall (hybrid tall).



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

Ans.
- Darwin's finches represent the phenomenon of adaptive radiation.
- Adaptive radiation is the process of evolution of different species in a given geographical area, starting from a point and literally radiating to other geographical areas or habitats.
- There were many varieties of small black birds in the Galapagos Islands, which are known as Darwin's finches.
- Darwin reasoned that after originating from a common seed-eating stock, the finches must have radiated to different geographical locations in the same island and undergone adaptive changes, especially in the type of beak, enabling them to be insectivorous or vegetarian finches.
- Living in isolation for long, the new kinds of finches emerged that could survive and function in the new habitats.

20. Explain the role of *Agrobacterium tumefaciens* in developing resistance in tobacco plant against nematode *Meloidegyne incognitia*. Name the processes responsible for this.

Ans.
- RNA interference (RNAi) occurs as a method of cellular defence in all eukaryotic organisms.
- It involves the silencing of a specific mRNA by a complementary dsRNA.
- The complementary RNA for making the double-stranded RNA comes either from an infection by RNA viruses or mobile genetic elements, called transposons, which replicate through an RNA intermediate.
- The nematode-specific genes are introduced into the host plant, using *Agrobacterium tumefaciens* as vector, in such a way that it produced both sense and anti-sense RNA in the host.
- The sense and antisense RNAs are complementary to each other and form dsRNA.
- The dsRNA binds to and prevents the translation of a specific mRNA.
- Consequently, the parasite is not able to live in the transgenic tobacco plant and hence the plant is protected.

Section-D

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.

Or

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

Ans. (*a*) **Syngamy:**
- Syngamy refers to the fusion of a male gamete with the female gamete in the embryo sac to form a diploid zygote.

Triple fusion:

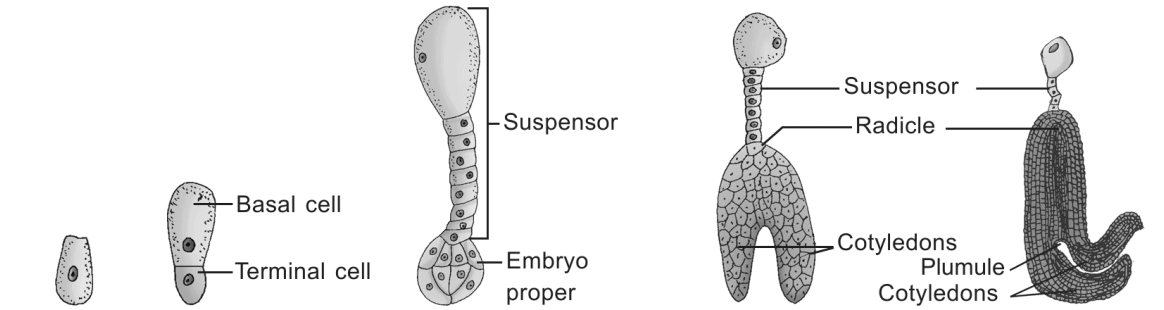
– Triple fusion refers to the fusion of a male gamete with the secondary nucleus (formed by the fusion of two haploid polar nuclei) to form the triploid primary endosperm nucleus.

(*b*) **Development of zygote into embryo:**

– The zygote undergoes mitotic divisions during embryogeny.

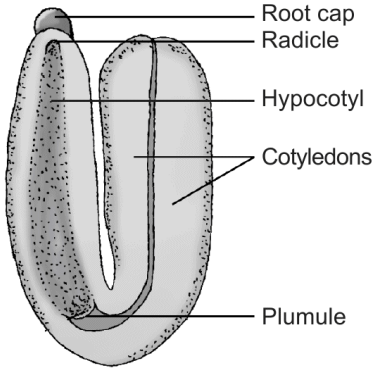
– The first division is transverse and results in a basal cell and a terminal cell; the basal cell forms the suspensor while the terminal cell forms the embryo proper.

– It first forms a filamentous proembryo, which later forms in sequence a globular embryo, heart-shaped embryo and then a mature embryo.



Development of Dicot Embryo

(*c*)



Dicot Embryo

Or

Follicle stimulating hormone (FSH) and luteinising hormone (LH) are the two gonadotropins in humans.

Role in Males:

– LH acts on the Leydig cells of testes and stimulates them to secrete testosterone, which stimulates the process of spermatogenesis.

– FSH acts on the Sertoli cells and stimulates them to secrete certain factors which are necessary for the process of spermiogenesis.

Role in females:

Pituitary hormones:

– Follicle stimulating hormone (FSH) and luteinising hormone (LH) are the pituitary gonadotropins that influence the menstrual cycle.
– The levels of both these hormones gradually increase during the follicular phase; they influence the growth of a primary follicle into a mature Graafian follicle and secretion of estrogens from the follicular cells.
– They reach their peak level during the middle of the cycle, *i.e.* about the 14th day.
– Rapid secretion of LH leading to the maximum level during this period, is called LH surge and it induces ovulation, *i.e.* rupture of the Graafian follicle and release of the ovum (secondary oocyte).
– The LH also causes the transformation of the remaining parts of the follicle into corpus luteum and secretion of progesterone from it during the luteal phase.

SET-III

[Uncommon Questions to Set-I and Set-II]

Section-A

1. Louis Pasteur demonstrated that

(*a*) early life came from outer space

(*b*) non-living chemicals produced living molecules

(*c*) life comes from pre-existing life

(*d*) life originated spontaneously

Ans. (*c*)

Section-B

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

Ans. Air-borne Disease:

Pneumonia and common cold are air-borne diseases.

(*i*) **Pneumonia**

– The lung alveoli get filled with a fluid leading to severe problems in respiration.
– In severe cases, the lips and finger nails may turn gray to bluish in colour.

(*ii*) **Common cold**

– There is nasal congestion and discharge.
– Sore throat and hoarseness (*any one*)

Water-borne Disease:

Amoebiasis and typhoid are water-borne diseases.

(*i*) **Amoebiasis:**

(*a*) – *Entamoeba histolytica.*

– It infects the large intestine.

(*b*) **Symptoms:**

(*i*) Constipation

(*ii*) Abdominal cramps and pain

(*iii*) Stool with excess mucus and blood clots.

(*ii*) **Typhoid:**

– *Salmonella typhi* causes typhoid.

– **Symptoms:**

(*i*) Sustained high fever (39 – 40°C).

(*ii*) Loss of appetite.

(*iii*) Stomach pain.

(*iv*) Intestinal perforation in severe cases. (*any two*)

– It is transmitted by contaminated food and water.

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

Ans. Humus is formed during decomposition of detritus by the bacterial and fungal enzymes, in the process called humification.

Characteristics of humus.

(*i*) It is a dark-coloured amorphous substance.

(*ii*) It is highly resistant to microbial action and hence, undergoes decomposition at an extremely slow rate.

(*iii*) It is colloidal in nature and hence, serves as a reservoir of nutrients.

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

Ans. – Mendelian disorders are those genetic disorders, which

(*i*) are due to alteration or mutation in a single gene.

(*ii*) are transmitted to the next generation following Mendelian principles of inheritance.

(*iii*) can be traced in a family by pedigree analysis.

– Since thalassemia and colour blindness satisfy the above three characteristics, they are categorised as Mendelian disorders.

Section-C

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

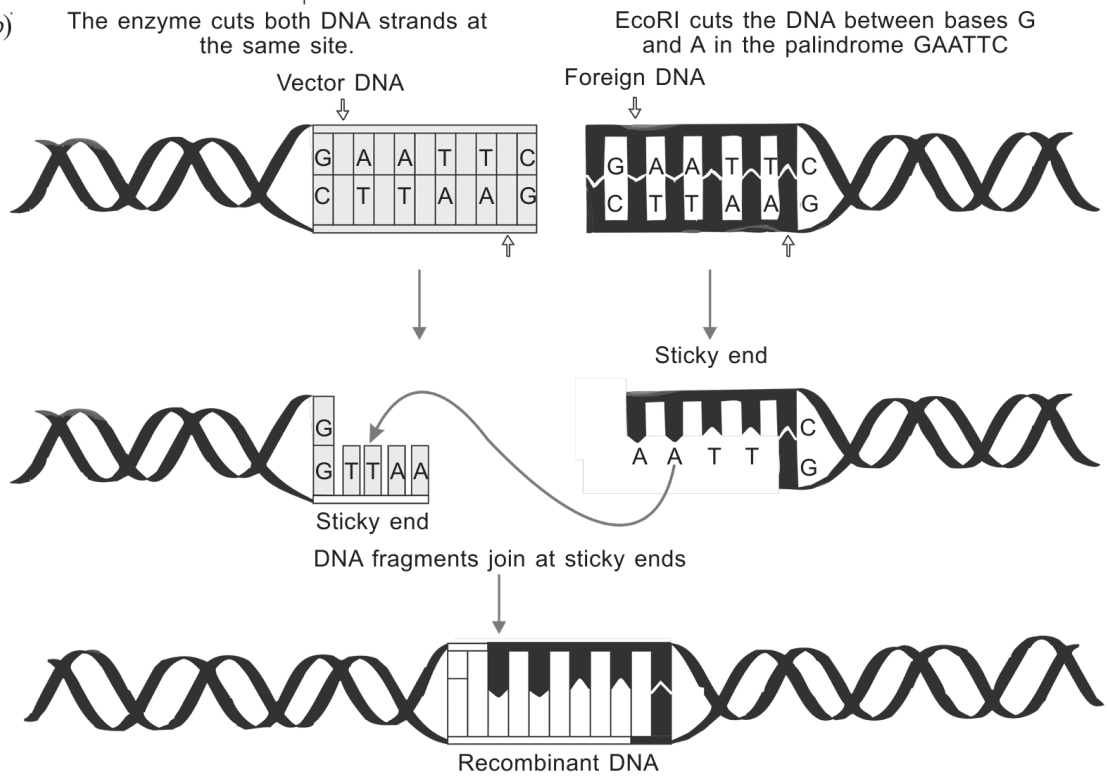
(*b*) Draw the vector DNA and a foreign DNA showing the sites where EcoRI has acted to form the sticky ends.

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

Ans. (*a*) 5′ – G↓ A A T T C – 3′

3′ – C T T A A↑ G – 5′

(*b*)



Steps in formation of recombinant DNA using EcoRI

(*c*) DNA ligase.

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*) *Australopithecus* ⟶ *Homo habilis* ⟶ *Homo erectus* ⟶ Neanderthals

(*b*) (*i*) Neanderthals

(*ii*) *Australopithecus*

19. Explain Mendel's "Law of segragation" in a typical monohybrid cross with the help of a suitable example.

Ans. Monohybrid cross:

– In *Pisum sativum*, yellow seeds are dominant over green seeds.

– A cross between a true-breeding yellow-seeded plant and a true-breeding green-seeded plant, is as follows:

Parents : Yellow-seeded × Green-seeded

YY × yy

Gametes : (Y) (y)

F_1 generation : Yy (Yellow-seeded)

Selfing : Yy × Yy

Gametes : (Y), (y) (Y), (y)

F_2 generation :

	Y	y
Y	YY Yellow-seeded	Yy Yellow-seeded
y	Yy Yellow-seeded	yy Green-seeded

The F_2 phenotypic ratio is : 3 yellow-seeded : 1 green-seeded

The F_2 genotypic ratio is : 1 YY : 2 Yy : 1 yy

Law of segregation:

– The two factors of the trait (like Y and y) that remained together in the hybrid, segregate during gametogenesis and enter different gametes.

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.

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 GIFT with ICSI.

Ans. (*a*) **Double fertilisation**

– In an angiosperm, two male gametes are discharged by a pollen tube into the embryo sac.

– One of the male gametes fuses with the ovum to form a zygote; this process, is called syngamy.

– The other male gamete fuses with the secondary nucleus (formed by fusion of two polar nuclei) to form the primary endosperm nucleus; this process is called triple fusion.

– Since there are two fusions (syngamy and triple fusion), inside an ovule during fertilisation, it is known as double fertilisation.

(*b*) – The endosperm development starts from the primary endosperm cell containing the primary endosperm nucleus.

– In the most common type of endosperm development, the primary endosperm nucleus undergoes successive free nuclear divisions to give rise to a number of free nuclei; at this stage, it is called free nuclear endosperm.

– Subsequently wall formation takes place from the periphery and proceeds towards the centre and the endosperm becomes cellular.

– This type of endosperm development is seen in coconut; the water of the tender coconut represents the free nuclear endosperm with thousands of nuclei in it and the white kernel around it represents the cellular endosperm.

– In albuminous seeds, some amount of endosperm persists in the mature seed, as the developing embryo does not consume it fully, *e.g.* wheat/maize.

– In exalbuminous seeds, the endosperm is completely consumed by the developing embryo before seed maturation, *e.g.* groundnut and pea.

Or

(*a*) **The reasons for infertility**

(*i*) Congenital or hereditary diseases.

(*ii*) Use of certain drugs.

(*iii*) Immunological responses.

(*iv*) Some diseases.

(*v*) Psychological factors.

(*vi*) Certain physical factors. (*any two*)

(*b*) (*i*) **Test tube baby programme**

– It involves two steps:

• *In vitro* fertilisation (IVF) and

– In this method, the ovum of the woman or a healthy donor and the sperm of her husband or a donor, are made to fuse to form a zygote in the laboratory under conditions very similar to that in the body; it is called *in vitro* fertilisation (IVF).

• Embryo transfer (ET)

– The zygote or early embryo with upto eight blastomeres is implanted in the fallopian tube (ZIFT) or embryo with more than eight blastomeres is implanted in the uterus (IUT) for further development.

(*ii*) This programme is to assist an infertile couple to bear a child, especially when the female is not able to conceive, but can provide suitable conditions for embryo development.

(*c*) **Differences:**

ICSI	GIFT
– It is a specialised procedure to form an embryo in the laboratory.	– It is a method of transfer of an ovum collected from a donor female into the fallopian tube of another woman.
– In this method a sperm is directly injected into the ovum for fertilisation and later embryo is transferred into the body of the woman.	– It is a procedure where fertilisation is *in vivo*, *i.e.* it occurs in the body of a female.

Contents

CBSE Examination Paper, 2019

Time Allowed: 3 Hours] [Maximum Marks: 70

General Instructions:

(*i*) There are total **27** questions and **four** sections in the question paper. **All** questions are compulsory.

(*ii*) Section **A** contains questions number **1** to **5**, very short answer type questions of **one** mark each.

(*iii*) Section **B** contains questions number **6** to **12**, short answer type-**I** questions of **two** marks each.

(*iv*) Section **C** contains questions number **13** to **24**, short answer type-**II** questions of **three** marks each.

(*v*) Section **D** contains question number **25** to **27**, long answer type questions of **five** marks each.

(*vi*) There is no overall choice in the question paper, however, an internal choice is provided in **two** questions of **one** mark, **two** questions of **two** marks, **four** questions of **three** marks and all the **three** questions of **five** marks. In these questions, an examinee is to attempt any **one** of the **two** given alternatives.

(*vii*) Wherever necessary, the diagram drawn should be neat and properly labelled.

SET-1

Section-A

1. British geneticist R.C. Punnett developed a graphical representation of a genetic cross called "Punnett Square". Mention the possible result this representation predicts of the genetic cross carried. 1

Ans. This graphical representation predicts the probability of all possible genotypes of offspring in the genetic cross carried out.

2. State the two principal outcomes of the experiments conducted by Louis Pasteur on origin of life. 1

Ans. – It demonstrated that life comes only from pre-existing life.
– Theory of spontaneous generation was disproved.

3. Name the layer of the atmosphere that is associated with 'good ozone'. 1

Or

Mention the term used to describe a population interaction between an orchid growing on a forest tree.

Ans. Stratosphere.

Or

The interaction is commensalism.

4. What are 'flocs', formed during secondary treatment of sewage? 1

Or

Write any two places where methanogens can be found.

Ans. Flocs are the masses of bacteria associated with fungal hyphae forming mesh-like structures.

Or

They are found in (*i*) the rumen of cattle and (*ii*) anaerobic sludge produced during sewage treatment.

5. At what stage does the meiosis occur in an organism exhibiting haploidic life cycle and mention the fate of the products thus produced. 1

Ans. – Meiosis occurs during the germination of zygote.
– The haploid spores formed after meiosis develop into haploid individuals.

Section-B

6. You are conducting artificial hybridization on papaya and potato. Which one of them would require the step of emasculation and why? However for both you will use the process of bagging. Justify giving one reason. 2

Ans. – Potato will require emasculation, as it produces bisexual flowers; hence, the stamens must be removed.
– Papaya plants produce unisexual flowers and are also dioecious; hence, it does not need emasculation.
– Bagging is necessary for the emasculated potato flower and the female flower of papaya, to prevent any unwanted pollen from falling on the stigma.

7. How would the gene flow or genetic drift affect the population in which either of them happen to take place? 2

Ans. It affects the genetic equilibrium of the population; any disturbance in genetic equilibrium indicates an evolutionary change.

Gene flow

– When gene migration occurs a number of times, i.e., gene flow, the gene frequencies of both the populations change.

Genetic drift

– Due to some chance events, the allele frequency in a population becomes so different that they become a new (founder) species.

8. Differentiate between the roles of B-lymphocytes and T-lymphocytes in generating immune responses. **2**

Or

Principle of vaccination is based on the property of "memory" of the immune system. Taking one suitable example, justify the statement.

Ans. Differences:

B-lymphocytes	T-lymphocytes
– These cells secrete an army of proteins, called antibodies, in response to pathogens.	– These cells stimulate the B-lymphocytes to produce antibodies.
– These are concerned with humoral immunity.	– These are involved in cell-mediated immunity.
– They are not involved in organ transplant.	– These are responsible for rejecting organ transplants.

Or

– When our body encounters a pathogen for the first time, it produces primary immune response, which is of low intensity.

– Subsequent encounter with the same pathogen, elicits a highly intensified secondary or anamnestic response.

– This is attributed to the fact that our immune system appears to have memory of the first encounter, e.g. vaccination for polio, chicken pox, etc.

9. Explain the relevance of "Totipotency" and "Somaclones" in raising healthy banana plants from virus infected banana plants. **2**

Ans. – Explants are taken from shoot apical meristem and grown in a nutrient medium in a test tube under aseptic conditions.

– Totipotency refers to the capacity of a plant cell (explant) to generate a whole plant from an explant.

– A number of virus-free plants can be produced through micropropagation, because meristems are not infected by virus.

– The plants grown through tissue culture and micropropagation are called somaclones as they are genetically identical among themselves and also to the parent plant.

10. How is a continuous culture system maintained in bioreactors and why? **2**

Ans. – In a continuous culture system, the used medium is drained out from one side and fresh medium is added from the other side.

– This facilitates maintenance of cells in their physiologically most active exponential phase.

– It results in the production of larger biomass and hence, high yield.

11. List any four ways by which GMO's have been useful for enhanced crop output. 2

Ans. Advantages:

– Genetic modification has made the crops more tolerant to abiotic stresses like cold, heat, drought, salinity, *etc*.

– It has reduced the dependence of crops on chemical pesticides as they are made pest-resistant.

– Post-harvest losses are much reduced.

– As the plants have increased efficiency of mineral usage, the early exhaustion of fertility of soil is prevented.

– Food produced from GM (Genetically Modified) crops has enhanced nutritional value.

– Genetic modification has been used to create tailor-made plants to supply resources such as starch, fuels, pharmaceuticals, *etc*. to industries. (*any four*)

12. Mention four significant services that a healthy forest ecosystem provides. 2

Or

Substantiate with the help of one example that in an ecosystem, mutualists (*i*) tend to co-evolve and (*ii*) are also one of the major causes of biodiversity loss.

Ans. A healthy forest ecosystem provides the following benefits:

(*i*) Control of floods.

(*ii*) Mitigating droughts.

(*iii*) Providing habitat to wildlife.

(*iv*) Generation of fertile soil.

(*v*) Purification of air (adding oxygen) and water.

(*vi*) Storage site of carbon.

(*vii*) Pollination of crops. (*any four*)

Or

– Mutualism is the interspecific/population interaction that confers benefits to both the interacting species.

– In many species of fig, there is a tight one-to-one relationship with its pollinator wasp species and the two have co-evolved.

– If one of them becomes extinct, invariably the other mutualist will also become extinct, *i.e.,* co-extinction, one of the major causes for loss of biodiversity.

Section-C

13. Pollen banks are playing a very important role in promoting plant breeding programme the world over. How are pollens preserved in the pollen banks? Explain. How are such banks benefitting our farmer? Write any two ways. 3

Ans. – Pollen grains are stored in liquid nitrogen at –196°C.

Advantages:

(*i*) Such stored pollen grains can be used for crop breeding programmes whenever necessary.

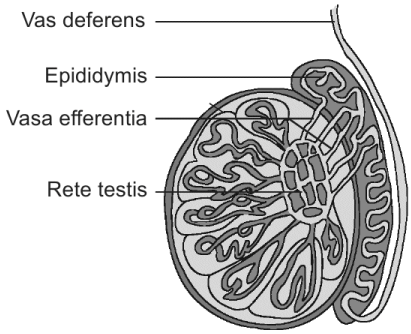
(*ii*) They can also be transported to other places for breeding programmes.

14. Draw a labelled diagram to show interrelationship of four accessory ducts in a human male reproductive system. 3

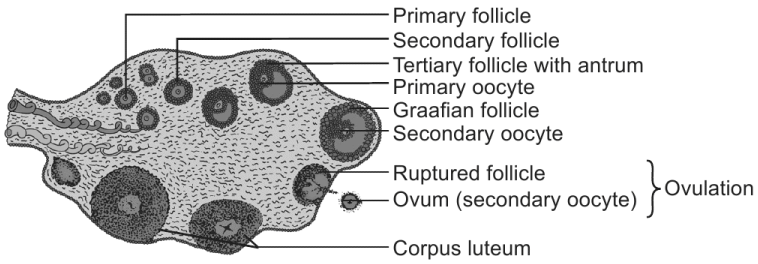
Or

Draw a sectional view of the human ovary showing the different stages of developing follicles, corpus luteum and ovulation.

Ans.



Or



T.S. of ovary

15. Compare in any three ways the chromosomal theory of inheritance as proposed by Sutton and Bovery with that of experimental results on pea plant presented by Mendel. 3

Or

(*a*) **Explain linkage and recombination as put forth by T.H. Morgan based on his observations with *Drosophila melanogaster* crossing experiment.**

(*b*) **Write the basis on which Alfred Sturtevant explained gene mapping.**

Ans. (*i*) The chromosomes as well as the genes occur in pairs in diploid organims; the two alleles of a gene are located on homologous sites on homologous chromosomes.

(*ii*) The chromosomes segregate at the time of gamete formation and only one member of each pair is transmitted to the gamete; along with the chromosomes, the genes also segregate during gamete formation and only one of each pair enters a gamete.

(*iii*) Each pair of homologous chromosomes segregate independently of each other; the alleles of a gene segregate independently of the alleles of any other gene.

Or

(*a*) **Morgan's experiment:**

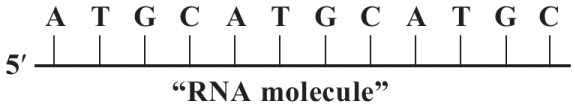
- Morgan conducted dihybrid crosses in *Drosophila* to study the genes that were sex-linked; but his results deviated from the results of Mendel.
- They observed that when two genes of a dihybrid cross were present on the same chromosome, the proportion of parental combinations was much higher than that of non-parental combinations.
- Morgan coined the term linkage for the physical association of the genes present on a chromosome.
- The term recombination refers to the non-parental gene combinations.
- Even on the same chromosome, some genes are tightly linked and showed very low recombination while others are loosely linked and showed a higher recombination.
- Morgan found that genes for white eye and miniature wings showed 37.2% recombination, whereas genes for yellow body and white eye showed only 1.3% recombination.

(*b*) Sturtevant used the frequency of recombination between gene pairs on the same chromosome as a measure of distance between the genes and mapped their position on the chromosome.

16. Explain the mechanism of DNA replication with the help of a replication fork. What role does the enzyme DNA-ligase play in a DNA replication fork? 3

Or

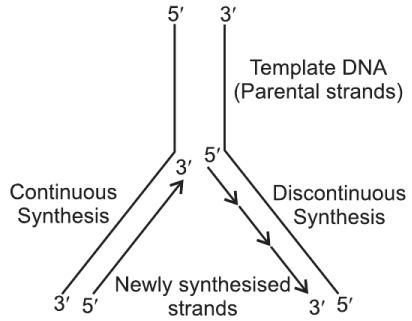
Construct and label a transcription unit from which the RNA segment given below has been transcribed. Write the complete name of the enzyme that transcribed this RNA.



Ans. DNA Replication

- DNA replication is initiated at a definite region on DNA, called origin of replication.
- The two strands unwind up to a certain length forming a replication fork; both the strands act as templates to synthesise a new complementary strand each.

– The main enzyme involved in DNA replication is the DNA-dependent DNA polymerase, which can polymerise the nucleotides only in $5' \rightarrow 3'$ direction.
– On the template strand with $3' \rightarrow 5'$ polarity, the new strand is synthesised as a continuous stretch, i.e, continuous synthesis.
– On the template strand with $5' \rightarrow 3'$ polarity, DNA is synthesised as short stretches (discontinuous synthesis).
– Later, the discontinuously synthesised stretches become joined by the action of enzyme, DNA-ligase.
–



Replication Fork of DNA

Or

Note: The question has been given wrong by the CBSE, so we are not providing with the solution.

17. (*a*) Write two differences between *Homo erectus* and *Homo habilis*.

(*b*) Rearrange the following from early to late geologic periods: Carboniferous, Silurian, Jurassic. 3

Ans. (*a*) **Differences:**

Homo erectus	*Homo habilis*
– His brain capacity was 900 cc.	– His brain capacity was 650-800 cc.
– He probably ate meat.	– He probably did not eat meat.

(*b*) Silurian → Carboniferous → Jurassic

18. Name the group of bacteria involved in setting milk into curd. Explain the process they carry in doing so. Write another beneficial role of such bacteria. 3

Ans. – Lactic acid bacteria set milk into curd.
– During growth, they secrete some acids, which coagulate and partially digest the milk proteins and convert milk into curd; the process is fermentation.

Other benefits

(*i*) They increase the nutritional quality of curd by increasing vitamin B_{12} content.
(*ii*) They check the diseasing-causing microbes in our stomach.

19. Bee keeping practice is a good income generating industry. Write the different points to be kept in mind for successful bee keeping. Write the scientific name of the most common Indian species used for the purpose. **3**

Ans. – Successful bee keeping requires the following considerations:

(*i*) Knowledge of the nature and habits of bees.

(*ii*) Selection of suitable location for keeping beehives.

(*iii*) Catching and hiving of swarms.

(*iv*) Management of beehives at different seasons.

(*v*) Handling and collection of honey and beewax.

– *Apis indica* is commonly used for bee keeping.

20. (*a*) Match the microbes listed under Column-A with the products mentioned under Column-B.

Column-A	Column-B
(H) ***Penicillium notatum***	**(*i*) Statin**
(I) ***Trichoderma polysporum***	**(*ii*) Ethanol**
(J) ***Monascus purpureus***	**(*iii*) Antibiotic**
(K) ***Saccharomyces cerevisiae***	**(*iv*) Cyclosporin-A**

(*b*) Why does 'Swiss Cheese' develop large holes? **3**

Ans. (*a*) H – (*iii*), I – (*iv*), J – (*i*), K – (*ii*)

(*b*) The bacterium *Propionibacterium sharmanii* produces large amount of carbon dioxide; hence, large holes are formed in 'Swiss cheese'.

21. Describe the formation of recombinant DNA by the action of EcoRI. **3**

Or

Describe the process of amplification of "gene of interest" using PCR technique.

Ans. – The restriction enzyme, EcoRI recognises the palindromic sequence, shown below:

5′ – G ↓ A A T T C – 3′

3′ – C T T A A ↑ G – 5′

– It cuts the DNA strands a little away from the centre of the palindrome site, but between the same two bases on both the strands (indicated by the arrows)

– This leaves single-stranded stretches, called sticky ends, overhanging at the end of the strands.

5′	G	Sticky end				A	A	T	T	C	3′
3′	C	T	T	A	A	Sticky end				G	5′

– When cut by the same restriction enzyme, the resultant DNA fragments (of the vector DNA and foreign DNA) have the same kind of sticky ends.

– DNA ligase can catalyse hydrogen bond formation between the cut complementary parts of the vector DNA and foreign DNA.

Or

PCR (Polymerase Chain Reaction)

– It is the process/reaction of *in-vitro* synthesis of multiple copies of the gene or DNA of interest.

– The reaction occurs in the following three steps:

(*i*) **Denaturation:**

In this step, the two strands of DNA are segregated by high temperature treatment; they act as templates for the synthesis of new strands.

(*ii*) **Annealing:**

In this step, two sets of primers (the chemically synthesised oligonucleotides) that are complementary to the region of DNA, become bonded at the complementary regions of the DNA.

(*iii*) **Extension:**

In this step, the enzyme DNA polymerase extends the primers using the nucleotides provided in the reaction medium in a genomic template-dependent manner.

– In this process, if replication is repeated many times, a billion copies of DNA can be made; such repeated amplification is achieved by the use of thermostable DNA polymerase obtained from the bacterium, *Thermus aquaticus.*

22. Two children, A and B aged 4 and 5 years respectively visited a hospital with a similar genetic disorder. The girl A was provided enzyme-replacement therapy and was advised to revisit periodically for further treatment. The girl, B was, however, given a therapy that did not require revisit for further treatment.

(*a*) Name the ailments the two girls were suffering from?

(*b*) Why did the treatment provided to girl A required repeated visits?

(*c*) How was the girl B cured permanently? 3

Ans. (*a*) The girls were suffering from Adenosine deaminase (ADA) deficiency.

(*b*) – The lymphocytes are not immortal, but have a life span; hence, with the formation of new lymphocytes, the enzyme has to be injected periodically.

(*c*) – The girl B had a permanent cure, because she was given gene therapy.

– In this, the functional ADA gene isolated from marrow cells is introduced into the body cells to give a permanent cure.

23. List six advantages of "*ex-situ*" approach to conservation of biodiversity. 3

Ans. (*i*) Zoological parks are meant for protection of threatened animals by placing them in special settings; there are many animals that have become extinct continue to live in zoos.

(*ii*) Many threatened plant species are grown in botanical gardens under protected conditions.

(*iii*) Gametes of threatened species of animals are preserved in viable and fertile condition for long periods using cryopreservation techniques.

(*iv*) Eggs can be fertilised *in vitro* (outside the animal body) using the gametes stored by cryopreservation.

(*v*) Tissue culture and micropropagation help in raising a number of threatened species of plants in large numbers in a short span of time.

(*vi*) Seeds of different genetic varieties/strains of economically or commercially important plant species are stored in seed banks for very long periods.

24. While on a visit to a pond in the city-neighbourhood, the visitors were delighted to find large expanse of water covered with colourful algal mass.

(*a*) As a student of biology, do you agree with their delight? Give reasons in support of your answer.

(*b*) Explain the cause of such algal growth. 3

Ans. (*a*) No, I do not agree with their delight.

– It is actually an algal bloom, which imparts a distinct colour to the water bodies.

– The algal bloom causes deterioration of water quality.

– It reduces the dissolved oxygen content of the waterbody and leads to fish mortality.

– Some bloom-forming algae are extremely toxic to humans and other animals.

(*b*) Such an algal growth is caused by large amounts of nutrients mainly nitrates and phosphates.

Section-D

25. (*a*) Explain one application of each one of the following:

(*i*) Amniocentesis

(*ii*) Lactational amenorrhea

(*iii*) ZIFT

(*b*) Prepare a poster for the school programme depicting the objectives of: "Reproductive and Child Health Care Programme". 5

Or

(*a*) Explain any two ways by which apomictic seed can develop.

(*b*) List one advantage and one disadvantage of a apomictic crop.

(*c*) Why do farmers find production of hybrid seeds costly?

Ans. (*a*) (*i*) **Amniocentesis**

– It is a pre-natal diagnostic technique to detect any chromosomal abnormality in the foetus.

(*ii*) **Lactational amenorrhea**

– It acts as a natural method of contraception for about a maximum period of six months, following parturition.

(*iii*) **ZIFT**

– It is transfer of embryo (with upto 8 blastomeres) into the fallopian tube of those females who cannot conceive.

(*b*) **Objectives of RCH**

1. Creating awareness among people about various reproduction-related aspects.
2. Providing facilities and support for building up a reproductively healthy society.

Or

(*a*) (*i*) Certain nucellar cells around the embryo sac divide, protrude into embryo sac and develop into embryos, *e.g. Citrus*, mango, etc.

(*ii*) The diploid egg cell of the embryo sac, formed without meiosis in the megaspore mother cell develops into embryo without fertilisation.

(*b*) **Advantage**

– The hybrid traits will not segregate in the progeny plants; hence, seeds can be collected generation after generation.

Disadvantage

– Inbreeding depression may set in and productivity may decrease.

(*c*) Since hybrid characters segregate in the progeny plants, the seeds have to be produced every year; production of hybrid seeds every year becomes costly.

26. Differentiate between incomplete dominance and co-dominance. Substantiate your answer with one example of each. 5

Or

(*a*) Write the contributions of the following scientists in deciphering the genetic code.

George Gamow : Hargobind Khorana : Marshall Nirenberg : Severo Ochoa.

(*b*) State the importance of a Genetic code in protein biosynthesis.

Ans. Differences:

Incomplete dominance	Codominance
– It is the phenomenon in which neither of the two alleles of a gene is completely dominant over the other.	– It is the phenomenon in which two alleles of a gene are equally dominant and both express themselves in the presence of the other.
– The hybrid does not resemble either of the parents and is intermediate between the two.	– The hybrid resembles both the parents.

Incomplete Dominance

– Incomplete dominance is exemplified in the inheritance of flower colour in snapdragon.

– The homozygous dominant (RR) plant bears red flowers and the recessive (rr) individual bears white flowers.

– The hybrid resulting from a cross between a red-flowered plant and a white-flowered plant bears pink flowers, as shown below:

Parents: Red-flowered RR × White-flowered rr

Gametes: R, r

F_1 hybrid: Rr (Pink-flowered)

Codominance

– Codominance is exemplified in the inheritance of blood group trait in humans.

– The gene controlling blood group character, I, exists in three allelic forms, I^A, I^B and i.

– Genes I^A and I^B are not only dominant over i, but are also codominant.

– The individual with genotype I^AI^B is of blood group AB, as I^A produces glycoprotein A and I^B produces glycoprotein B, even when they are together in the hybird.

Or

(*a*) – It was George Gamow, who suggested that the code must be made of three bases, in order to code for the twenty different amino acids, with only four bases; this would generate (4^3) or ($4 \times 4 \times 4$) = 64 triplet codons, many more codons than required.

– Har Gobind Khorana could synthesize RNA molecules with definite combinations of bases (homopolymers and copolymers).

– Marshal Nirenberg made a cell-free system for protein synthesis that helped in deciphering the code.

– Severo Ochoa discovered enzyme polynucleotide phosphorylase that could polymerise RNA with definite sequences in a template-independent manner.

(*b*) – The process of translation requires transfer of genetic information from a polymer of nucleotides to a polymer of amino acids.

– The genetic code could direct the sequence of amino acids during protein synthesis, *i.e.*, it shows the relationship between the sequence of nucleotides on *m*RNA and the sequence of amino acids in the polypeptide.

27. (*a*) What is "population" according to you as a biology student?

(*b*) "The size of a population for any species is not a static parameter." Justify the statement with specific reference to fluctuations in the population density of a region in a given period of time. 5

Or

(*a*) What is hydrarch succession?

(*b*) Compare the pioneer species and climax communities of hydrarch and xerarch succession respectively.

(*c*) List the factors upon which the type of invading pioneer species depend in secondary hydrarch succession. Why is the rate of this succession faster than that of primary succession?

Ans. (*a*) In ecology, population is defined as a group of individuals of the same species, occupying the same area at a given time.

(*b*) The density of a population in a given region at a given period of time fluctuates due to changes in the four basic processes, given below:

(*i*) Natality refers to the number of births in a given population during a given period; this increases the population density.

(*ii*) Mortality refers to the number of deaths in the population in a given time; this decreases the population density.

(*iii*) Immigration refers to the number of individuals of the same species that have come into the habitat from elsewhere during the given period of time; it adds to the population density.

(*iv*) Emigration refers to the number of individuals of the population who left the habitat and gone elsewhere during the given period of time; it decreases the population density.

Or

(*a*) Hydrarch succession refers to the establishment of communities in succession starting from water bodies and progressing to mesic conditions.

(*b*) **Differences:**

Hydrarch Succession	Xerarch Succession
Pioneer species	
– Phytoplanktons are the pioneer species.	– Lichens are the pioneer species.
Climax community.	
– A mesic forest.	– A mesic forest.

(*c*) – The factors on which the pioneer species of secondary succession depend are:

(*i*) Availability of water.

(*ii*) Chemical nature/pH of water.

(*iii*) Depth of the water body.

(*iv*) Sunlight (quality, intensity and duration).

– The rate of secondary succession is faster than primary succession because already some soil/substratum is available.

SET-2

2. How did Charles Darwin express 'fitness'? 1

Ans. The fitness, according to Darwin, refers ultimately and only to reproductive fitness.

6. Express the process of pollination in *Vallisneria*. 2

Ans. Pollination in *Vallisneria*

– In *Vallisneria*, the male flowers (later pollen grains) are released on the surface of water; the female flowers reach the surface of water by uncoiling of the long stalk.

– When the passively floating male flowers/pollen grains meet the female flowers, pollination is effected; the stalk of the female flower coils and the flower is drawn back inside the water column.

9. Why is crossbreeding in animals practiced? How is a breed *Hisardale* developed? 2

Ans. – In crossbreeding, a superior male of one breed and superior female of another breed are mated; it allows combining of the desirable traits of the two different breeds into one.

– *Hisardale* is developed by crossing Bikaneri ewes and Marino rams.

10. β-galactosidase enzyme is considered a better selectable marker. Justify the statement. 2

Ans. – When an rDNA or alien DNA is inserted within the coding sequence of the enzyme β-galactosidase, it results in the inactivation (insertional inactivation) of the enzyme.

– The recombinants and non recombinants can be differentiated on the basis of colour production in the presence of a chromogenic substrate.
– The non-recombinants, produce a blue colour with the chromogenic substrate, but recombinants do not produce any colour.
– It is a better method because selection of recombinants by inactivation of antibiotic resistance genes is a cumbersome procedure.

13. (*a*) Differentiate between geitonogamy and xenogamy.

(*b*) Write the difference in the characteristics of the progeny produced as a result of the two processes. 3

Ans. (*a*) Differences:

Geitonogamy	Xenogamy
– It is the process of transfer of pollen grains from the anther to the stigma of another flower, but of the same plant. – Pollen grains are genetically similar to that of the pistil.	– It is the process of transfer of pollen grains from the anther to the stigma of another flower, of a different plant of the same species. – Pollen grains are genetically different from that of the pistil.

(*b*) – The plants in the progeny produced after geitonogamy do not show genetic variation.
– The plants in the progeny produced after xenogamy show genetic variation.

18. How does the activity of each one of the following help in organic farming?

(*a*) Mycorrhiza

(*b*) Cyanobacteria

(*c*) *Rhizobium* 3

Ans. (*a*) **Mycorrhiza**
– The fungus absorbs phosphorus from the soil and passes it to the plant.
– Plants with mycorrhiza show resistance to root-borne pathogens.
– They show increased tolerance to salinity and drought.
– There is an overall increase in plant growth and development.

(*b*) **Cyanobacteria**
(*i*) Cyanobacteria can fix atmospheric nitrogen in the soil.
(*ii*) They also add organic matter to the soil to increase soil fertility.

(*c*) ***Rhizobium***
Rhizobium lives as a symbiont in the root nodules of legumes and fixes atmospheric nitrogen as ammonia.

23. Mention the special adaptations evolved in parasites and why? 3

Ans. – The special adaptations evolved in parasites include:

(*i*) Loss of unnecessary sense organs.

(*ii*) Presence of adhesive organs/hooks to cling on to the host and suckers.

(*iii*) Loss of digestive system.

(*iv*) High reproductive capacity.

– Mostly parasites have evolved to be host-specific and there is coevolution of the host and the parasites.

– In order to be successful with the same host species, the parasites have evolved adaptations in accordance to the life style of the host.

25. Where does the process of megasporogeneis start in an angiosperm? Describe the process upto the formation of embryo sac. 5

Or

(*a*) Explain the process of fertilization in human.

(*b*) Name the embryonic stage that gets implanted in human females. Explain the process of implantation.

Ans. Development of Female Gametophyte:

– The megaspore mother cell undergoes meiosis to form four megaspores.

– Three of them degenerate and the functional megaspore enlarges to form the embryo sac.

– Its haploid nucleus undergoes a mitotic division and the two daughter nuclei move towards the opposite poles forming a two-nucleate embryo sac.

– Each of the two nuclei undergoes two successive mitotic divisions, forming the four nucleate and then the eight-nucleate embryo sac.

– Cell wall formation starts in the 8-nucleate stage.

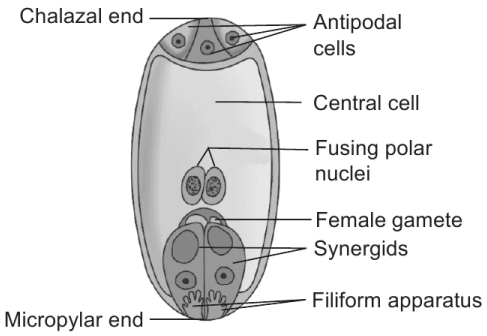
– Three of them at the micropylar end form the egg apparatus, consisting of a female gamete and two synergids.

– Three of them at the chalazal end form the antipodal cells.

– One nucleus from each of the poles moves to the centre; they are called polar nuclei.

– Later the two polar nuclei fuse in the centre (now the central cell) to form a diploid secondary nucleus.

– Thus, the mature embryo sac is 7-celled and 8-nucleate.



A fully developed embryo sac

Or

(*a*) **Fertilisation:**

– Fertilisation occurs in the ampullary-isthmic junction of the fallopian tube.

– When a sperm comes in contact with the ovum, it induces changes in the zona pellucida of the ovum that block the entry of additional sperms and thus, ensures entry of only one sperm.

– The secretions of the acrosome help the sperm to enter the cytoplasm of the ovum by dissolving the zona pellucida and plasma membrane.

– The entry of sperm into the cytoplasm induces completion of meiosis II (of secondary oocyte) to form a larger cell, the ootid (ovum) and a smaller cell, the second polar body.

– Fusion occurs between the nucleus of ootid and that of sperm to form a diploid zygote.

(*b*) **Implantation:**

– Implantation occurs at the blastocyst stage.

– The trophoblast layer of the blastocyst gets attached to the endometrium.

– The uterine cells divide rapidly and cover the blastocyst.

– So, the blastocyst becomes embedded in the endometrium of uterus, i.e. implantation has occurred.

SET-3

2. Write the number of chromosomes, the body cells of honey bee workers and drones have. 1

Ans. – Worker honey bees have 32 chromosomes.
– Drones have 16 chromosomes.

6. It is said apomixis is a type of asexual reproduction. Justify. 2

Ans. – Since apomixis does not involve formation and fusion of gametes, it is considered as a method of asexual reproduction.
– Embryos develop from the cells of integument or nucellus involving mitotic divisions; apomictic embryos are genetically similar.

8. Write the steps in sequence as carried in multiple ovulation embryo transfer technology. 2

Ans. The steps in MOET Technology:
– A cow is administered hormones with FSH–like activity to induce superovulation; 6–8 eggs are produced in a cycle.
– The animal is mated with an elite bull or artificially inseminated.
– Fertilised eggs at 8–32 celled stage are recovered non-surgically.
– They are transfered to the uterus of a surrogate mother.

9. What is an origin of replication in a chromosome? State its function. 2

Ans. – The specific DNA sequence, where the replication of DNA is initiated, is called origin of replication (Ori).
– For the multiplication of the alien DNA in the host, it has to be integrated to the origin of replication (Ori); it also decides the copy number of the linked DNA.

13. How does a bisexual flowering plant ensures cross pollination? Explain. 3

Ans. The outbreeding devices are as follows:
(*i*) Self-incompatibility is the genetic mechanism that prevents self-pollen from fertilising the ovule by inhibiting pollen germination or retarding the growth of pollen tube.
(*ii*) Certain plant species produce male and female flowers on different plants, *i.e.* the plants are dioecious; this prevents both autogamy and geitonogamy.
(*iii*) Pollen release and stigma receptivity are not synchronised; either the anthers mature first or the pistil/gynoecium matures first.
(*iv*) The anthers and stigma of a flower are placed in such a way that the pollen of the flower cannot fall on the stigma of the same flower. (*any three*)

18. Effluent from the primary treatment of sewage is passed for secondary treatment. Explain the process till the water is ready to be released into natural water bodies. 3

Ans. Secondary Treatment:

- It is a biological process, that employs the heterotrophic microbes naturally present in the sewage.
- The effluent from the primary treatment is passed into large aeration tanks, where it is constantly agitated and air is pumped into it.
- This allows the rapid growth of aerobic microbes into flocs, which consume the organic matter of the sewage and reduce the BOD.
- The effluent is passed into a settling tank, where the flocs are allowed to sediment forming the activated sludge.
- A small part of the activated sludge is pumped back into aeration tank as inoculum.
- The remaining major part of the sludge is pumped into anaerobic sludge digesters, where the anaerobic bacteria digest the bacteria and fungi of the flocs and the organic matter and produce methane, hydrogen sulphide and carbon dioxide.
- The effluent from this is released into natural waterbodies.

24. Explain any two most important levels of biological organisation showing biodiversity with the help of an example each. 3

Ans. Levels of Biodiversity:

(*i*) Genetic diversity refers to the, diversity of genes within a species, *e.g.* there are more than 50,000 genetically different strains of rice in India.

(*ii*) Species diversity refers to the number of different species within a given region, *e.g.* Western Ghats have a greater amphibian species diversity than Eastern Ghats.

(*iii*) Ecological diversity refers to variation of habitats, community types and abiotic environments present in a given area.

– India has a greater ecosystem or ecological diversity than Scandinavia.

(*any two*)

25. (*a*) Differentiate between spermatogenesis and Oogenesis on the basis of

(*i*) Time of initiation of the process

(*ii*) Site of completion of the process

(*iii*) Nature of meiotic division undergone by gamete mother cells

(*b*) Name the hormones and state their role involved in controlling spermatogenesis in humans. 5

Or

(*a*) Explain the process of double fertilization in angiosperms.

(*b*) Why does the development of endosperm preceeds that of embryo?

(*c*) List the parts of a typical dicot embryo.

Ans. (*a*) **Differences:**

Spermatogenesis	Oogenesis
(*i*) **Time of initiation of the process** – It is initiated at puberty.	– It is initiated during embryonic stages.
(*ii*) **Site of completion** – It is completed in the testes.	– It is completed in the ampullary-isthmic junction of fallopian tube, when a sperm enters its cytoplasm.
(*iii*) **Nature of meiotic division** – The primary spermatocyte undergoes meiosis I and forms two equal-sized secondary spermatocytes. – The secondary spermatocytes complete meiosis II to form equal-sized spermatids. – Meiosis is completed at a stretch.	– The primary oocyte undergoes meiosis I and forms a large cell, the secondary oocyte and a smaller cell, the polar body. – The secondary oocyte undergoes meiosis II and forms a large cell, the ootid and a small cell, the polar body. – Meiosis becomes suspended in between.

(*b*) – The secretion of gonadotropin-releasing hormone (GnRH) by the hypothalamus increases significantly during puberty.

– GnRH acts on the anterior pituitary and stimulates the secretion of two gonadotropins, namely follicle stimulating hormone (FSH) and luteinising hormone (LH), (also called interstitial cell stimulating hormone (ICSH).

– LH acts on the Leydig cells of testes and stimulates them to secrete testosterone, which stimulates the process of spermatogenesis.

– FSH acts on the Sertoli cells and stimulates them to secrete certain factors, which are necessary for the process of spermiogenesis.

Or

(*a*) **Double fertilisation**

– In an angiosperm, two male gametes are discharged by a pollen tube into the embryo sac.

– One of the male gametes fuses with the ovum to form a zygote; this process, is called syngamy.

– The other male gamete fuses with the secondary nucleus (formed by fusion of two polar nuclei) to form the primary endosperm nucleus; this process is called triple fusion.

– Since there are two fusions (syngamy and triple fusion), inside an ovule during fertilisation, it is known as double fertilisation.

(*b*) The endosperm development precedes that of embryo as an adaptation to provide assured nutrition to the developing embryo.

(*c*) – A dicot embryo consists of an embryonal axis and two cotyledons.

– Epicotyl is the part of embryonal axis above the point of attachment of cotyledons; it terminates in the plumule.

– Hypocotyl is the part of embryonal axis below the point of attachment of cotyledons; it terminates at its lower end in the radicle.

– The radicle or root tip is covered by the root cap.