

# BIOLOGY

Maximum Marks : 70

Time : 3 Hours

## General Instructions :

- All questions are compulsory.
- The question paper has five sections and 33 questions.
- Section-A has 16 questions of 1 mark each; Section-B has 5 questions of 2 marks each; Section-C has 7 questions of 3 marks each; Section-D has 2 case-based questions of 4 marks each; and Section-E has 3 questions of 5 marks each.
- There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
- Wherever necessary, neat and properly labeled diagrams should be drawn.

## SECTION - A

Q. No. 1 to 12 are multiple choice questions. Only one of the choices is correct. Select and write the correct choice as well as the answer to these questions.

1. Refer to the given figure of reproductive structure of *Papaver* and identify X and Y.



X

- Syncarpous ovary
- Stigma
- Thalamus
- Apocarpous ovary

Y

- Stigma
- Syncarpous ovary
- Apocarpous ovary
- Thalamus

2. Match column I with column II and select the correct option from the given codes.

	Column I		Column II
A.	Funicle	(i)	Mass of parenchymatous cells
B.	Hilum	(ii)	Basal part of an ovule
C.	Integument	(iii)	One or two protective layers of an ovule
D.	Chalaza	(iv)	Region where body of an ovule fuses with funicle
E.	Nucellus	(v)	Stalk of an ovule

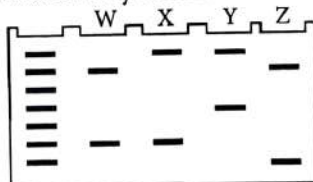
- A-(i), B-(ii), C-(iii), D-(iv), E-(v)
- A-(v), B-(iv), C-(iii), D-(ii), E-(i)
- A-(iv), B-(ii), C-(i), D-(iii), E-(v)
- A-(i), B-(iii), C-(v), D-(ii), E-(iv)

3. Which of the following is correct order of the evolutionary history of man?

- Homo habilis*, *Homo erectus*, *Homo sapiens*, Neanderthal man
- Homo habilis*, *Homo sapiens*, *Homo erectus*, Neanderthal man

- (c) *Homo habilis*, *Homo erectus*, Neanderthal man, *Homo sapiens*  
 (d) *Homo erectus*, Neanderthal man, *Homo sapiens*, *Homo habilis*
4. Evolutionary convergence is the development of  
 (a) a common set of functions in groups of different ancestry  
 (b) a dissimilar set of functions in closely related groups  
 (c) a common set of structures in closely related groups  
 (d) a dissimilar set of functions in unrelated groups.
5. If the Neanderthals are not the direct ancestors of humans, is it still possible for humans and Neanderthals to be related?  
 (a) Yes, because we share a common ancestor.  
 (b) Yes, but only if humans and Neanderthals could have interbred.  
 (c) No, because the human evolutionary tree is strictly linear and without branches.  
 (d) No, because this means that Neanderthals evolved from an entirely different branch of organisms than humans did.
6. Under which of the following conditions there will be no change in the reading frame of following mRNA?  
 5' AACAGCGGUGCUAAU 3'  
 (a) Deletion of GGU from 7<sup>th</sup>, 8<sup>th</sup> and 9<sup>th</sup> positions  
 (b) Insertion of G at 5<sup>th</sup> position  
 (c) Deletion of G from 5<sup>th</sup> position  
 (d) Insertion of A and G at 4<sup>th</sup> and 5<sup>th</sup> position respectively
7. If two persons with 'AB' blood group marry and have sufficiently large number of children, these children could be classified as 'A' blood group : 'AB' blood group : 'B' blood group in 1 : 2 : 1 ratio. Modern technique of protein electrophoresis reveals presence of both 'A' and 'B' type proteins in 'AB' blood group individuals. This is an example of  
 (a) partial dominance  
 (b) complete dominance  
 (c) co-dominance  
 (d) incomplete dominance.

8. The DNA fingerprinting analysis of four family members is shown below.



Study the band pattern obtained and assign each family member to W, X, Y and Z. Choose the correct option.

- (a) W - father  
 Y - child  
 X - mother  
 Z - paternal uncle
- (b) W - child  
 Y - mother  
 X - father  
 Z - maternal uncle
- (c) W - father  
 Y - mother  
 X - child  
 Z - paternal uncle
- (d) W - child  
 Y - maternal uncle  
 X - father  
 Z - mother
9. Refer to the given table showing water samples from different rivers. Which of the following water samples in this table will have a higher concentration of organic matter?

	Level of pollution	Value of BOD
(a)	High	High
(b)	Low	Low
(c)	Low	High
(d)	High	Low

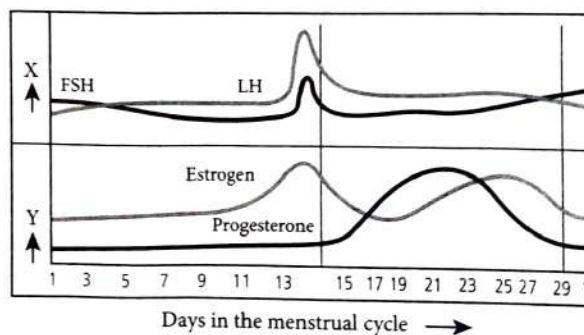
10. Micropropagation involves
- vegetative multiplication of plants by using microorganisms
  - vegetative multiplication of plants by using small explants
  - vegetative multiplication of plants by using microspores
  - non-vegetative multiplication of plants by using microspores and megaspores.
11. Use of bioresources by multinational companies and other organisations without proper authorisation from the countries and people concerned and without compensatory payment is termed as
- resource partitioning
  - biopiracy
  - patenting
  - biofortification.
12. Amensalism can be represented as
- Species A (+) ; Species B (0)
  - Species A (-) ; Species B (0)
  - Species A (+) ; Species B (+)
  - Species A (-) ; Species B (-).

**Question No. 13 to 16 consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:**

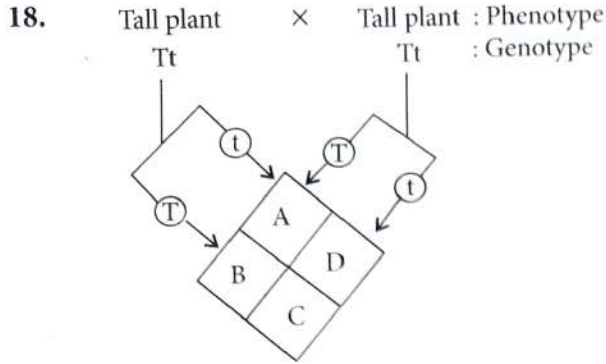
- Both A and R are true and R is the correct explanation of A.
  - Both A and R are true and R is not the correct explanation of A.
  - A is true but R is false.
  - A is false but R is true.
13. **Assertion (A) :** The middle thick layer, myometrium is an important part of uterus.  
**Reason (R) :** Myometrium produces strong contractions during parturition.
14. **Assertion (A) :** When white eyed, yellow bodied *Drosophila* females were hybridised with red eyed, brown-bodied males; and  $F_1$  progeny was intercrossed,  $F_2$  ratio deviated from 9 : 3 : 3 : 1.  
**Reason (R) :** When two genes in a dihybrid are on the same chromosome, the proportion of parental gene combinations is much higher than the non-parental type.
15. **Assertion (A) :** The principle of vaccination is based on the property of memory cells of the immune system.  
**Reason (R) :** Vaccines generate memory B cells and T cells that recognise the pathogen quickly.
16. **Assertion (A) :** Restriction enzymes cut the strand of DNA to produce sticky ends.  
**Reason (R) :** Stickiness of the ends facilitates the action of the enzyme DNA polymerase.

## SECTION - B

17. Refer to the graph given below where parts X and Y respectively show the level of pituitary and ovarian hormones which influence the menstrual cycle in a normal human female. Study the graph and answer the questions that follow:



- (a) Specify the sources of the hormones represented in parts X and Y.  
 (b) State the impact of the hormones in part Y on the uterus of the human female during 6 to 15 days of menstrual cycle.



Look at the above diagram and answer the following questions.

- (a) Write the genotypes of A, B, C, D.  
 (b) Write the phenotypes of A, B, C, D.  
 (c) Write phenotypic ratio of progeny.  
 (d) Write genotypic ratio of progeny.

OR

Name the genetic disorder caused by trisomy of 21<sup>st</sup> chromosome in humans. Write the diagnostic features of the disorder.

19. A student on a school picnic to a park suddenly became unwell, he/she started sneezing and had trouble in breathing.  
 Name and explain the term associated with such sudden responses. What would the doctor recommend for relief?

OR

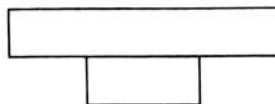
Differentiate between the roles of B-lymphocytes and T-lymphocytes in generating immune responses.

20. Read the following base sequence of a certain DNA strand and answer the questions that follow :

5'-CTTAAG-3'

3'-GAATTC-5'

- (a) What are such sequences called? Mention the name of the enzyme that recognises such nucleotide sequences.  
 (b) State the significance of enzyme that identify these nucleotide sequences.
21. (a) The diagram shows the pyramid of biomass in an ecosystem where each bar represents the standing crop available in the trophic level. Identify the type of the given ecological pyramid and give one example where this kind of pyramid is possible in nature.



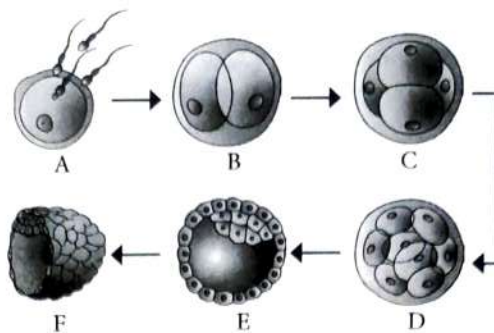
- (b) Will the pyramid of energy be also of the same shape in this situation? Give reason for your response.

OR

Construct a pyramid of numbers considering a big banyan tree supporting a population of insects, small birds and their predators.

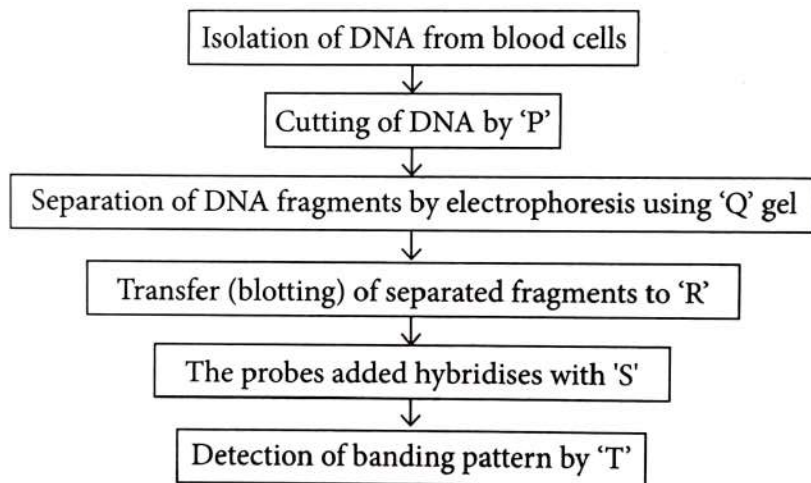
## SECTION - C

22. The given diagram represents the development of a human zygote from fertilisation to the late blastocyst stage.

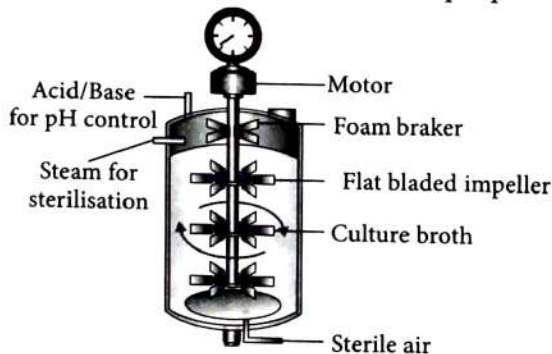


From the figure, identify at which stage ZIFT is done and explain it.

23. Mention the agent(s) which helps in pollinating the given plants. Also, explain the adaptations in these plants to ensure pollination :
- (a) *Vallisneria*                      (b) Water hyacinth                      (c) Corn
24. The following is the flow chart highlighting the steps in DNA fingerprinting technique. Identify P, Q, R, S and T.



25. (a) What does the following equation represent? Explain.  
 $p^2 + 2pq + q^2 = 1$   
 (b) List any two factors that can disturb the genetic equilibrium.
26. With the help of a diagram, explain the structural importance of an antibody molecule. Name the four types of antibodies found to give a humoral immune response. Also, mention the type of antibody (i) present in colostrum, (ii) produced in response to allergen in human body.
27. (a) Carefully observe the given figure of bioreactor. Write the purpose for which it is used.

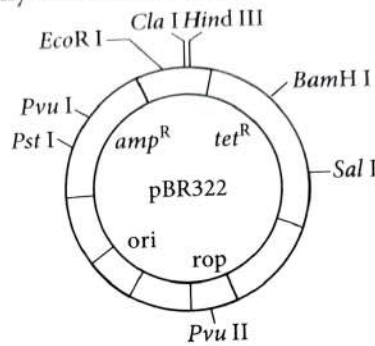


- (b) List five essential growth conditions related to this bioreactor.

28. (a) There was loss of biodiversity in an ecosystem due to a new construction project in that area. What would be its impact on the ecosystem? State any three.  
 (b) List any three major causes of loss of biodiversity.

### SECTION - D

29. Gene of interest/alien gene is introduced by a cloning vector into a host cell to bring about a desired phenotypic expression in a host cell. The cloning vectors used are plasmid and bacteriophages. Biotechnologists in their labs, for desired results engineered specialised cloning vectors. One such vector is pBR322. Study the diagram carefully and answer the questions that follows.



- (a) What do 'EcoR I', 'BamH I' and 'Hind III' represent? State their functions.

OR

- Identify the gene you would select for the role of a selectable marker in pBR322. Explain why?  
 (b) Write the property/characteristic of plasmid and bacteriophage that makes them efficient cloning vectors.  
 (c) Biotechnologists always insert 'ori' gene in their engineered cloning vector. Give reason.
30. Read the passage given below and answer the following questions:

IUCN maintains a Red Data Book or Red List which is a catalogue of taxa facing risk of extinction. The IUCN Red List (2004) documents the extinction of 784 species in the last 500 years. Some examples of recent extinctions are shown below in a table.

Name of species	Country
A	Mauritius
Quagga	B
C	Australia
Steller's sea cow	D

- (a) What could be A and C?  
 (b) What could be the most probable reason for Steller's sea cow extinction in D?  
 (c) Identify the native country 'B' where Quagga used to found.

OR

Name three subspecies of tiger that got recently extinct.

### SECTION - E

31. Highlight the events from copulation to zygote formation in a human female.

OR

Enumerate the development of a megaspore mother cell to the formation of mature embryo sac in a flowering plant.

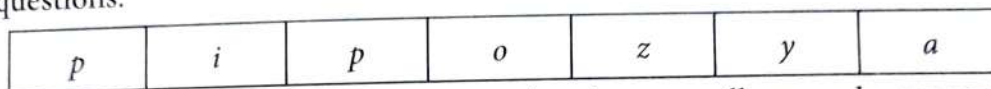
32. Consider the given segment of *mRNA*.



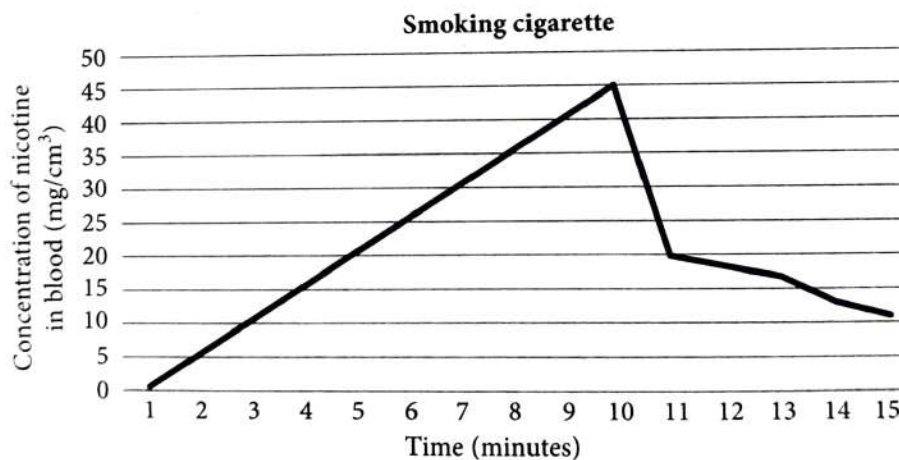
- (a) Explain and illustrate the steps involved to make fully processed *hnRNA*.  
 (b) Gene encoding RNA polymerase I and III have been affected by mutation in a cell. State its impact on the synthesis of polypeptide, stating reasons.

OR

Refer to the given schematic representation of the genes involved in the *lac* operon given below and answer the following questions.



- (a) If the nutrient medium for the bacteria contains only galactose; will operon be expressed? Give reason.  
 (b) The protein produced by the *i* gene has become abnormal due to unknown reasons. Explain its impact on lactose metabolism stating the reason.  
 (c) The active site of enzyme permease present in the cell membrane of a bacterium has been blocked by an inhibitor, how will it affect the *lac* operon?
33. Refer to the given graph representing the concentration of nicotine smoked by a smoker taking 10 puffs/minute.



- (a) What will be the concentration of nicotine in blood at 10 minutes. How will this affect the concentration of carbon monoxide and haembound oxygen at 10 minutes?  
 (b) What is the harmful impacts of cigarette smoking?  
 (c) "Cigarette smoking causes lung cancer and emphysema". Justify this statement.

OR

Choose any three microbes, from the following which are suited for organic farming which is in great demand these days for various reasons. Mention one application of each one chosen.

*Mycorrhiza*; *Monascus*; *Anabaena*; *Rhizobium*; *Methanobacterium*; *Trichoderma*.

1. (b) : The given figure shows multicarpellary, syncarpous pistil of *Papaver*. Here X is stigma and Y is syncarpous ovary.

2. (b)                      3. (c)

4. (a) : Development of common set of characters in groups of different ancestry is called convergent evolution.

5. (a)

6. (a) : Insertion or deletion of three or its multiple bases insert or delete one or multiple codon hence one or multiple amino acids and reading frame remains unaltered from that point onwards.

7. (c)

8. (c) : DNA fingerprinting (DNA profiling) is a technique of determining nucleotide sequences of certain areas of DNA which are unique to each individuals. DNA fingerprinting can help to distinguish one human being from another with exception of monozygotic twins. Individuals with highest number of matching DNA bands are considered closest.

In the given analysis, X has bands similar to both W and Y; upper band is common between X (child) and Y (mother) while lower band is common between X and W (father). Z has a band similar to W (upper band) while it has no similarity with X and Y. This indicates that Z is a relative of W and can be paternal uncle of X.

9. (a) : BOD is measure of organic matter present in water. The greater the BOD of wastewater, more is its polluting potential.

10. (b) : Micropropagation is the tissue culture technique used for rapid vegetative multiplication of ornamental plants and fruit trees by using small sized explants. Because of minute size of the propagules in the culture, the propagation technique is named as micropropagation.

11. (b)

12. (b) : Amensalism is an interaction in which one species is harmed and other is unaffected.

13. (a)                      14. (b)                      15. (a)

16. (c) : The stickiness of the ends facilitates the action of the enzyme DNA ligase, not DNA polymerase.

17. (a) X – Pituitary gland; Y – Ovary  
(b) During proliferative phase (days 6-15) of menstrual cycle, estrogen secretion increases and endometrium of the uterus regenerates.

18. (a) A            –    Tt  
      B            –    TT  
      C            –    Tt  
      D            –    tt

(b) A            –    Tall  
      B            –    Tall  
      C            –    Tall  
      D            –    Dwarf

(c) Phenotypic ratio is 3 : 1; Tall : Dwarf

(d) Genotypic ratio of progeny is

TT	Tt	tt
1	2	1
Homozygous	Heterozygous	Dwarf
tall	tall	tall

OR

Down's syndrome is an autosomal aneuploidy, caused by presence of an extra chromosome number 21.

Diagnostic features: The affected individual is short statured with small round head; has furrowed tongue; partially open mouth; palm is broad with characteristic palm crease; physical, psychomotor and mental development is retarded.

19. Such a response in the student is allergy. Allergy is an exaggerated response of the immune system to certain antigens present in the environment. Doctors would administer drugs like antihistamines, adrenaline and steroids (any one) to reduce the symptoms.

OR

Differences between the role of B-lymphocytes (B-cells) and T-lymphocytes (T-cells) in generating immune responses are :

S. No.	B-lymphocytes (B-cells)	T-lymphocytes (T-cells)
(i)	B-cells form humoral or antibody mediated immune system (AMIS).	T-cells form cell-mediated immune system (CMIS).
(ii)	They defend against viruses and bacteria that enter the blood and lymph.	They defend against pathogens including protists and fungi that enter the cells.
(iii)	Plasma cells formed by division of B-cells produce antibodies and provide immunity against foreign substances.	T-lymphocytes produce different types of T-cells, e.g., killer T-cells react against cancer cells, suppressor cells inhibit immune system.



20. (a) Sequences which remain same in forward and backward direction are called palindromic sequences. Restriction endonuclease recognises palindromic sequences in DNA and cuts them.

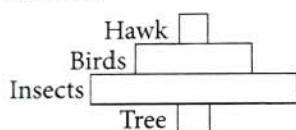
(b) Restriction enzymes can make complementary cut counterparts forming sticky ends for recombination DNA/rDNA technology to facilitate ligation of vector and foreign DNA.

21. (a) Inverted pyramid of biomass are seen in aquatic conditions where a small standing crop of phytoplankton supports a large standing crop of zooplankton/fish.

(b) No, the pyramid of energy is always upright, and can never be inverted because when energy flows from one trophic level to the next trophic level, some amount of energy is always lost as heat at each step.

OR

In the given case, pyramid of numbers will be spindle shaped as shown here.



22. Figure A, B, C, D, E and F shows fertilisation, 2-celled stage, 4-celled, 8-celled, early blastocyst and late blastocyst respectively. In ZIFT (*i.e.*, Zygote intra fallopian transfer), zygote or early embryo (upto 8 blastomeres) is transferred into fallopian tube. So, ZIFT can be done from stage B to D.

23. (a) *Vallisneria*: Water. In *Vallisneria*, the female flower reaches the surface of water by the long stalk and the male flowers or pollen grains are released onto the surface of water. They are carried passively by water currents; some of them eventually reach the female flowers and the stigma.

(b) Water hyacinth: Insects or wind. In water hyacinth, the flowers emerge above the level of water and are pollinated by insects or wind as in most of the land plants.

(c) Corn: Wind. Numerous flowers are packed in an inflorescence; the tassels seen in the corn cob are the stigma and style which wave in the wind to trap pollen grains.

24. P → Restriction endonuclease  
 Q → Agarose  
 R → Nitrocellulose membrane  
 S → VNTR  
 T → Autoradiography

25. (a) The given equation represents Hardy-Weinberg equation.

Hardy-Weinberg's principle says that allele frequencies in a population are stable and is constant from generation to generation. The gene pool (total genes and their alleles in a population) remains constant. This is called genetic equilibrium.

Hardy and Weinberg stated it using an algebraic equation.

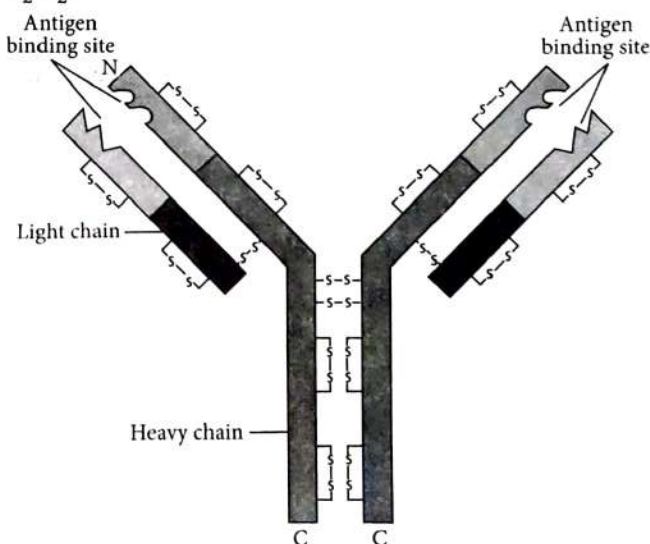
Sum total of all the allelic frequencies is 1. Individual frequencies, for example, can be named p, q, etc. In a diploid, p and q represent the frequency of allele 'A' and allele 'a' respectively. The frequency of AA individuals in a population is simply  $p^2$ . The probability that an allele A with frequency of p appear on both the chromosomes of a diploid individual is simply the product of the probabilities, *i.e.*,  $p^2$ . Similarly of aa is  $q^2$ , of Aa is  $2pq$ . Hence,  $p^2 + 2pq + q^2 = 1$ . This is a binomial expansion of  $(p + q)^2$ .

When frequency measured, differs from expected values, the difference (direction) indicates the extent of evolutionary change. Disturbance in genetic equilibrium, or Hardy-Weinberg equilibrium, *i.e.*, change of frequency of alleles in a population would then be interpreted as resulting in evolution.

(b) Factors that affect Hardy-Weinberg equilibrium are :

- (i) Gene migration or gene flow
- (ii) Genetic drift
- (iii) Mutation
- (iv) Genetic recombination
- (v) Natural selection (Any 2)

26. An antibody molecule consists of four polypeptide chains, two are long heavy (H) chains while other two are short light (L) chains. Both are arranged in the shape of Y. Hence, the antibody is represented as  $H_2 L_2$ .



Types of Antibody – IgA, IgM, IgE, IgG

- (i) IgA – Lactating mother to protect their infant
- (ii) IgE – To protect from allergen

27. (a) It is a stirred tank bioreactor. These bioreactors are used to produce large quantities of the desired products.

(b) Bioreactors provide optimum growth conditions like:

- (i) Temperature
- (ii) pH
- (iii) Salts
- (iv) Vitamins
- (v) Oxygen

28. (a) Impacts of loss of biodiversity on the ecosystem:

- (i) Decline in plant production
- (ii) Lowered resistance to environmental perturbations such as drought.
- (iii) Increased variability in certain ecosystem processes such as plant productivity, water use, pest and disease cycles.

(b) Causes of biodiversity loss are:

- (i) Habitat loss and fragmentation
- (ii) Over-exploitation
- (iii) Alien species invasion.

29. (a) 'EcoRI', 'BamHI' and 'Hind III' are type II restriction enzymes. They are used in recombinant DNA technology. They recognise specific sites within the DNA and cut these sites.

OR

Plasmid pBR322 has two resistance gene – ampicillin resistance ( $amp^R$ ) and tetracycline resistance ( $tet^R$ ) which are considered useful for selectable markers. The presence of restriction sites within the markers  $tet^R$  and  $amp^R$  permits an easy selection for recombinant and non-recombinant cells.

(b) The plasmid and bacteriophages are efficient cloning vectors as they have ability to replicate within bacterial cells independent of the control of chromosomal DNA.

(c) Biotechnologists always insert 'ori' gene in their engineered cloning vector because ori is the sequence of DNA bases which is responsible for initiating replication. It is also responsible for controlling the copy number of the linked DNA.

30. (a) Dodo (A) and Thylacine (C) got extinct from Mauritius and Australia respectively.

(b) Steller's sea cow got extinct from Russia (D) due to over exploitation.

(c) Quagga got extinct from Africa (B).

OR

(c) Bali, Javan and Caspian are the three subspecies of tiger that extinct recently.

31. The events from copulation to zygote formation in human female is as follows :

(i) During copulation (coitus) semen is released by the penis into the vagina (insemination).

(ii) The motile sperms swim rapidly, pass through the cervix, enter into the uterus and finally reach the ampullary region of the fallopian tube.

(iii) The ovum released by the ovary is also transported to the ampullary region where fertilisation takes place.

(iv) Fertilisation can only occur if the ovum and sperms are transported simultaneously to the ampullary region. This is the reason why not all copulations lead to fertilisation and pregnancy.

(v) The process of fusion of a sperm with an ovum is called fertilisation.

(vi) During fertilisation, a sperm comes in contact with the zona pellucida layer of the ovum and induces changes in the membrane that block the entry of additional sperms. Thus, it ensures that only one sperm can fertilise an ovum.

(vii) The secretions of the acrosome help the sperm enter into the cytoplasm of the ovum through the zona pellucida and the plasma membrane.

(viii) This induces the completion of the meiotic division of the secondary oocyte.

(ix) The second meiotic division is also unequal and results in the formation of a second polar body and a haploid ovum (ootid).

(x) Soon the haploid nucleus of the sperms and that of the ovum fuse together to form a diploid zygote.

OR

The process of formation of megaspores from the megaspore mother cell is called megasporogenesis.

(i) Ovules generally differentiate a single megaspore mother cell (MMC) in the micropylar region of the nucellus. It is a large cell containing dense cytoplasm and a prominent nucleus. The MMC undergoes meiotic division to form megaspores.

(ii) In a majority of flowering plants, one of the megaspores is functional while the other three degenerate. Only the functional megaspore develops into the female gametophyte (embryo sac). This method of embryo sac formation from a single megaspore is termed monosporic development.

(iii) The nucleus of the functional megaspore divides mitotically to form two nuclei which move to the opposite poles, forming the 2-nucleate embryo sac.

(iv) Two more sequential mitotic nuclear divisions result in the formation of the 4-nucleate and later the 8-nucleate stages of the embryo sac.

(v) These mitotic divisions are strictly free nuclear, that is, nuclear divisions are not followed immediately by cell wall formation.

(vi) After the 8-nucleate stage, cell walls are laid down leading to the organisation of the typical female gametophyte or embryo sac.

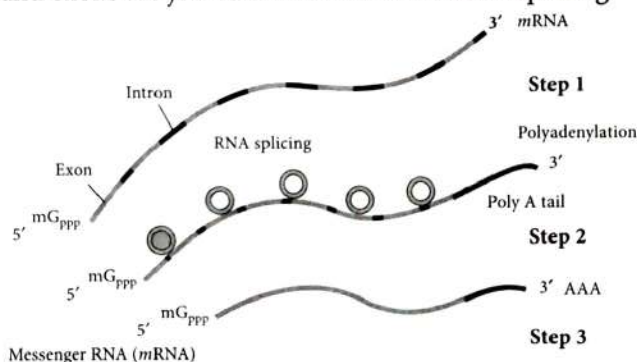
(vii) Six of the eight nuclei are surrounded by cell walls and organised into cells; the remaining two nuclei, called polar nuclei are situated in the large central cell.

(viii) Three cells are grouped together at the micropylar end and constitute the egg apparatus. The egg apparatus, in turn, consists of two synergids and one egg cell. The synergids have special cellular thickenings at the micropylar tip called filiform apparatus.

(ix) Three cells are at the chalazal end and are called the antipodals.

(x) The large central cell, as mentioned earlier, has two polar nuclei which come to lie below egg apparatus. Thus, a typical angiosperm embryo sac, at maturity, though 8-nucleate is 7-celled.

32. (a) The *hnRNA* undergoes processes called capping and tailing followed by splicing. In capping, an unusual nucleotide (methyl guanosine triphosphate) is added to the 5'-end of *hnRNA*. In tailing, adenylate residues (about 200–300) are added at 3'-end in a template independent manner. Now the *hnRNA* undergoes a process where the introns are removed and exons are joined to form *mRNA* called splicing.



(b) Due to mutation in gene encoding RNA polymerase I and III, the process of translation will not happen, thus the polypeptide synthesis is stopped or hampered.

The reason for the above is:

RNA polymerase I transcribes rRNAs which is the cellular factory for protein synthesis.

RNA polymerase III helps in transcription of tRNA which is the adaptor molecule, that transfers amino acids to the site of protein synthesis.

OR

(a) No, because galactose is not an inducer. It is a product of lactose metabolism.

(b) Since the repressor protein synthesised by the *i* gene is abnormal, it will not bind to the operator region of the operon, resulting in a continuous state of transcription process.

(c) When the active site of enzyme permease present in the cell membrane of a bacterium has been blocked by an inhibitor, the lactose is not transported into the cell. As lactose is the inducer, the *lac* operon will not be switched on.

33. (a) Concentration of nicotine is maximum at 10 minutes where concentration of nicotine increases steadily in the blood to reach  $45\text{mg}/\text{cm}^3$ . The concentration of CO will increase resulting in reduced concentration of haembound oxygen.

(b) Nicotine results in stimulating the adrenal gland which results in release of adrenaline / nor - adrenaline in the blood resulting in increase of blood pressure and heart rate.

(c) Chemical carcinogens present in tobacco smoke are the major cause of lung cancer due to chemical present in tobacco. The cigarette smoke also causes emphysema as it irritates the air passages of the lungs causing them to produce mucus which causes cough resulting collapse of alveolar septa which greatly reduces the surface area for gas exchange. Walls of alveolar sac loses elasticity and thus alveolar sacs remain filled with air even after expiration.

OR

Among the given microbes, the ones which are in great demand for organic farming are: Mycorrhiza, *Anabaena* and *Rhizobium*.

Mycorrhiza is a mutually beneficial or symbiotic association of a fungus with the roots of a higher plant. Mycorrhizal roots show a sparse or dense growth of fungal hyphae on their surface. Plants having mycorrhizal associations show resistance to root-borne pathogens.

*Anabaena* is free living and symbiotic nitrogen fixing cyanobacteria. Cyanobacteria are photosynthetic and have the property of nitrogen fixation. They add organic matter as well as extra nitrogen to the soil. Cyanobacteria are an extremely low cost biofertilisers. *Rhizobium* is symbiotic nitrogen fixing bacteria. They form a mutually beneficial association with the plants. The bacteria obtain food and shelter from plants. In return, they give a part of their fixed nitrogen to the plants, thus enhancing the availability of nutrient to crops. It forms nodules on the roots of legume plants. They develop the ability to fix nitrogen only when they are present inside the root nodules.

