Class XII Session 2026-27
Subject - Biology
Sample Question Paper - 2

Time Allowed: 3 hours **Maximum Marks: 70**

General Instructions:

1. 1All questions are compulsory.
2. The question paper has five sections and 33 questions. All questions are compulsory.
3. 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.
4. 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.
5. Wherever necessary, neat and properly labeled diagrams should be drawn.

Section A

1. In which of the following chromosomal disorders do individuals have short stature, underdeveloped feminine character and sterile ovaries? **[1]**

   a) Patau's syndrome
   b) Turner's syndrome
   c) Down's syndrome
   d) Klinefelter's syndrome

2. Human settlement often leads to habitat loss which leads to fragmentation, forming smaller patches of habitats. Select the statements that describe how a small patch differs from a large patch of the same habitat. **[1]**

   i. Invasive species will never be seen here.
   ii. Population of large animals decreases.
   iii. Biodiversity decreases.
   iv. Competition from surrounding habitats increases.

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

3. Intense lactation in mothers acts as a natural contraceptive due to the **[1]**

   a) Suppression of gametic transport
   b) Suppression of gonadotropins
   c) Suppression of fertilization
   d) Hypersecretion of gonadotropins

4. The cloning site present in the tetracycline resistance gene of E. coli cloning vector pBR322 is: **[1]**

   a) EcoR I
   b) Pvu II

c) Pst I d) Sal I

5. Which one of the following fixes the atmospheric nitrogen but is not an autotroph? **[1]**

a) Oscillatoria b) Rhizobium

c) Anabaena d) Nostoc

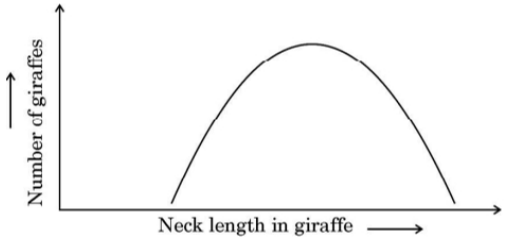
6. Which one of the following regarding ecological pyramid is not correct? **[1]**

a. In most ecosystems, the pyramid of numbers and biomass are upright.
b. In tree-dominated ecosystem, the pyramid of number is inverted.
c. The pyramid of energy expresses mainly the rate of food production.
d. In deep water ecosystem the pyramid of biomass is upright.

a) Statement d is not correct. b) Statement a is not correct.

c) Statement b is not correct. d) Statement c is not correct.

7. Select the option that gives the correct description of the process of Natural Selection with respect to the length of the neck of giraffe. **[1]**



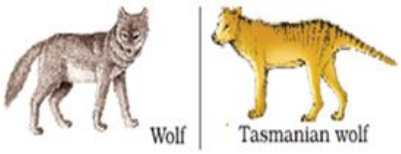
a) Stabilising selection as giraffes with medium neck lengths are selected.

b) Directional selection as giraffes with longer neck lengths are selected.

c) Disruptive selection as giraffes with smaller and longer neck lengths are selected.

d) Stabilising selection as giraffes with longer neck lengths are selected further.

8. Picture shown below is an example of:- **[1]**



a) Divergent evolution of Australian marsupials and placental mammals

b) Convergent evolution of Australian marsupials and placental mammals

c) Analogous organs of both animals

d) Homologous organs of both animals

9. During which month of pregnancy the first movement of fetus is observed: **[1]**

a) Sixth month b) Fifth month

c) Third month d) Fourth month

10. HIV selectively targets: **[1]**

a) T-Helper cells b) B-memory cells

c) T-cytotoxic cells d) B-effector cells

11. Which one is used as biofertilizer? **[1]**

a) Funaria
b) Volvox
c) Rhizopus
d) Nostoc

12. Given below is the restriction site of a restriction endonuclease Pst-I and the cleavage sites on a DNA molecule. **[1]**

$$5'C-T-G-C-A\overset{\downarrow}{-}G\ 3'$$
$$3'G\underset{\uparrow}{-}A-C-G-T-C\ 5'$$

Choose the option that gives the correct resultant fragments by the action of the enzyme Pst-I.

a) 5' C – T – G – C A – G 3'
   3' G – A – C – G T – C 5'

b) 5' C – T G – C – A – G 3'
   3' G – A – G – C T – C 5'

c) 5' C – T – G C – A – G 3'
   3' G – A – C – G – T C 5'

d) 5' C – T – G – C – A G 3'
   3' G A – C – G – T – C 5'

13. **Assertion (A):** Male contraceptive 'Nirodh' works on the principle of avoiding chances of ovum and sperm meeting. **[1]**
Reason(R)**:** It is made of thin rubber/latex sheath and is used to cover the penis before coitus.

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

14. **Assertion (A):** Trichoderma species are free living fungi that are very common in the root ecosystems. **[1]**
Reason (R): They are effective bio-control agents of several plant pathogens.

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

15. **Assertion (A):** Some aquatic ecosystems have inverted biomass pyramids. **[1]**
Reason (R): More energy is required by the organisms occupying higher trophic levels.

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

16. **Assertion (A):** Fossils provide direct evidence for evolution. **[1]**
Reason (R): Fossils help to trace evolutionary relationships among organisms over time.

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

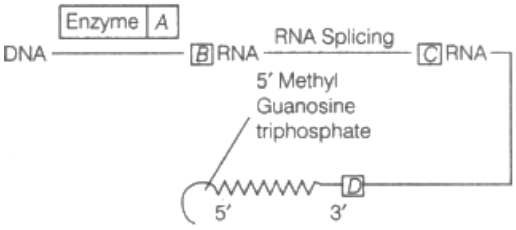
b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

Section B

17. Given below is a sequence of steps of transcription in a eukaryotic cell. Answer the following questions: **[2]**



i. Fill up the blanks (A, B, C and D) left in the sequence.

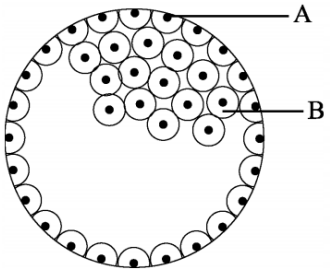
ii. Why hnRNA is required to undergo splicing?

OR

What is DNA polymorphism? Why is it important to study it?

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. **[2]**

19. In the given figure, give the name and functions of parts labelled A and B. **[2]**



20. a. Write the Scientific name of the plant from where natural cannabinoids are obtained. **[2]**

b. Mention the parts of the plant that are used for extracting the drug.

c. How does the drug affect human body?

OR

Write the scientific name of the plant and its part from which opioids are extracted. How does it affect our body functions?

21. 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. **[2]**

OR

Write the name of the bioactive molecules produced by the microbes listed below, and their role in the field of medical sciences.

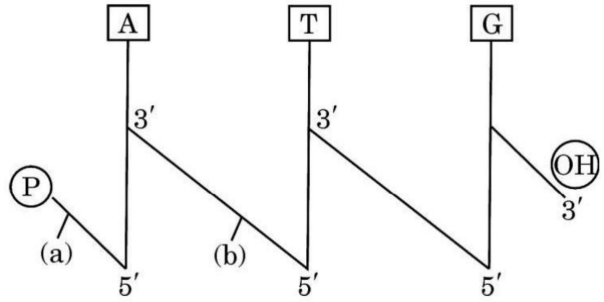
a. Monascus purpureus

b. Trichoderma polysporum

Section C

22. Study the given below single strand of deoxyribonucleic acid depicted in the form of a "stick" diagram with $5' - 3'$ end directionality, sugars as vertical lines and bases as **[3]**

single letter abbreviations and answer the questions that follow.



a. Name the covalent bonds depicted as (a) and (b) in the form of slanting lines in the diagram.

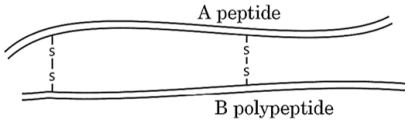
b. How many purines are present in the given "stick" diagram?

c. Draw the chemical structure of the given polynucleotide chain of DNA.

23. Why is the frequency of red-green color blindness is many times higher in males than that in females? **[3]**

24. Explain the difference between commensalism and mutualism types of interactions, with the help of a suitable example of each. **[3]**

25. A schematic diagram of matured human insulin is given below: **[3]**



How is the process of its formation naturally in the human body different from that of its formation by rDNA technology? Explain.

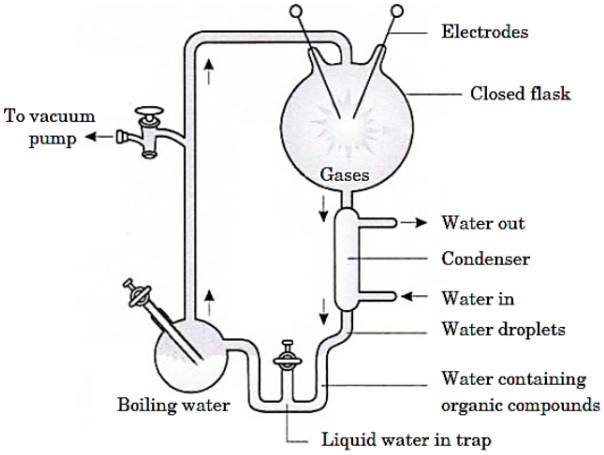
26. According to a recent wildlife report, the biggest threat to the tiger's survival in Mudumalai Tiger Reserve (MTR) was found to be a small, beautiful flower, Lantana camara, a tropical American shrub, that invaded 40% of India's tiger range. Tamil Nadu department's Lantana weed eradication drive helped to restore the dying MTR thereby also reducing human-wildlife conflicts. MTR is home to 25 species of grasses and legumes. **[3]**

Answer the given questions based on the information given above.

a. Explain how did the removal of Lantana help in restoring the dying Mudumalai Tiger Reserve.

b. Why is the invasion of Lantana camara a cause of concern in MTR.

27. Study the diagrammatic representation of S.L. Miller's experiment given below and answer the questions that follow: **[3]**



i. How did S.L. Miller create the conditions that existed before the origin of any life on Earth?

ii. Name the organic compound formed and collected at the end of his experiment.

iii. Mention the kind of evolution his experiment supports.

28. In humans there is a primary lymphoid organ which is quite large at the time of birth and keeps reducing in size with age and by the time puberty is attained it reduces to a very small size. **[3]**

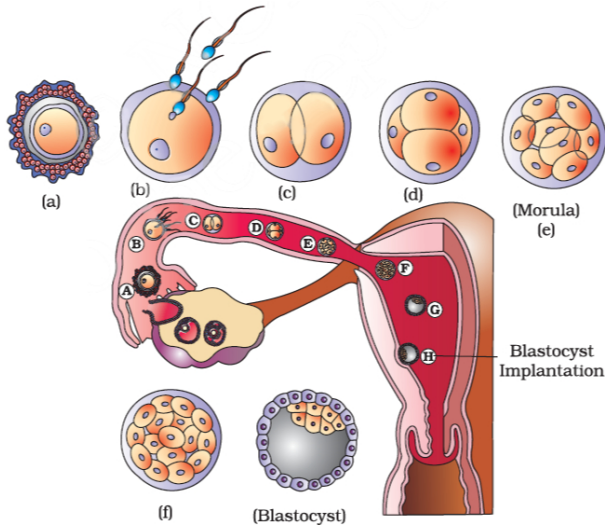
a. Name the organ, give its exact location and state its functions.

b. Name any other primary lymphoid organ in humans.

Section D

29. **Read the following text carefully and answer the questions that follow:** **[4]**

Nikita and Anita studying about fertilization and implantation. They have to represent a poster in the class on this topic so they both have made the following poster which includes all the stages starting from fertilization to implantation.



i. Discribe the zygote division till the stage of blastocysts. (1)

ii. Specify endocrine function of corpus luteum. How does it influence the uterus? Why is it essential? (1)

iii. What will happen if the fallopian tubes are partially blocked and the ovulated eggs are prevented from reaching the uterus? (2)

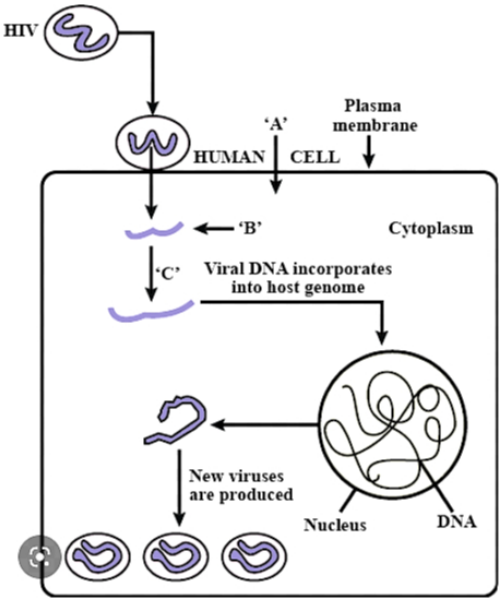
OR

State the fate of the trophoblast of a human blastocyst at the time of implantation. (2)

30. **Read the following text carefully and answer the questions that follow:** **[4]**

Study the diagram showing the entry of HIV into the human body and the processes

that are followed:



i. Why macrophages only being infected by HIV at first? (1)

ii. Mention the genetic material 'B' HIV releases into the cell. (1)

iii. Identify enzyme 'C'. Suggest preventive measure of the infection. (2)

OR

What are the symptoms and how are mild pathogen become virulent in human being? (2)

Section E

31. Draw a diagram of a transverse section of an angiospermic anther. Label any six parts. **[5]**

OR

i. Explain the process of double fertilization in an angiosperm starting from the germination of pollen grains on the stigma, mentioning the ploidy of the end products formed at the end. State the role of synergids during the course of the process.

ii. Why does the development of endosperm precede that of the embryo?

32. Explain how does lac operon in E. coli operate **[5]**

a. in the absence of an inducer.

b. in the presence of an inducer.

OR

a. Why did Hershey and Chase use ^{35}S and ^{32}P in their experiment? Explain.

b. State the importance of blending and centrifugation in their experiment.

c. Write the conclusion they arrived at after completing their experiment.

33. Describe the roles of heat, primers and the bacterium *Thermus aquaticus* in the process of PCR. **[5]**

OR

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

b. Mention application of PCR in the field of

i. Biotechnology
ii. Diagnostics

Solution

Section A

1.

(b) Turner's syndrome
Explanation:
Turner's syndrome is a random genetic disorder that affects females. The main characteristics include short stature and infertility. Usually, a female has two X chromosomes. However, in females with Turner's syndrome, one of these chromosomes is missing or abnormal.

2.

(c) (ii), (iii) and (iv) only
Explanation:
(ii), (iii) and (iv) only

3.

(b) Suppression of gonadotropins
Explanation:
Suppression of gonadotropins

4.

(d) Sal I
Explanation:
Sal I

5.

(b) Rhizobium
Explanation:
Rhizobium is heterotrophic soil bacteria with diverse lifestyles.

6. **(a)** Statement d is not correct.
Explanation:
Statement d is not correct.

7.

(b) Directional selection as giraffes with longer neck lengths are selected.
Explanation:
Directional selection as giraffes with longer neck lengths are selected.

8.

(b) Convergent evolution of Australian marsupials and placental mammals
Explanation:
Wolf and Tasmania Wolf are examples of convergent evolution of placental mammals and Australian marsupials. They are evolved differently due to different in climatic and geographic

regions.

9.

(b) Fifth month
Explanation:
The movement of the fetus is observed on the fifth month of pregnancy. In the first month, the heart is formed. In second month limbs and digits are formed. At the end of three months, all major organs and genital organs are formed.

10. **(a)** T-Helper cells
Explanation:
T-Helper cells

11.

(d) Nostoc
Explanation:
Nostoc

12.

(d)
5' C – T – G – C – A G 3'
3' G A – C – G – T – C 5'
Explanation:
5' C – T – G – C – A G 3'
3' G A – C – G – T – C 5'

13. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation:
Both A and R are true and R is the correct explanation of A.

14.

(b) Both A and R are true but R is not the correct explanation of A.
Explanation:
Both statements are true: Trichoderma species are saprophytic, free-living fungi commonly found in the rhizosphere and root ecosystems, and they are widely used as effective biocontrol agents against many plant pathogens. However, the reason given (they are effective biocontrol agents) does not explain why they are free-living and common in root ecosystems. Their biocontrol activity arises from specific biological traits - rapid growth and root colonization, competition for nutrients and space, mycoparasitism, production of cell-wall degrading enzymes and antibiotics, and induction of host systemic resistance - whereas their common occurrence in the rhizosphere is due to their saprophytic lifestyle and ability to utilize root exudates and soil organic matter. In other words, R describes what they do (their function), while A describes where and how they live; R is not the causal explanation of A.

15.

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

16. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation:
Fossils are the preserved remains or traces of past organisms that record anatomical features not present in living species; because they are physical specimens they constitute direct, tangible evidence that forms and species once existed and have changed. Fossils occur in

sedimentary rock layers whose relative order and, where dated radiometrically, absolute ages give a time sequence of forms; by comparing anatomical features across successive layers one can identify transitional forms (for example Archaeopteryx between reptiles and birds, or Tiktaalik between fish and tetrapods). This ability to place organisms in time and to show intermediate morphologies is precisely how fossils allow us to trace evolutionary relationships and document descent with modification. Therefore the reason given correctly explains why fossils provide direct evidence for evolution.

Section B

17. i. A - DNA polymerase, B - hnRNA, C - Spliced RNA, D - mRNA
    ii. hnRNA is required to undergo splicing because of the presence of introns in it. These need to be removed and the exons have to be joined in a specific sequence for translation to take place.

OR

If an inheritable mutation appears in a population at high frequency, this is known as DNA polymorphism. Since inheritable mutations finally lead to evolution, hence study of DNA polymorphism is important from the evolutionary perspective.

18. During treatment (after adding small amount of inoculum) primary effluent is constantly agitated mechanically in (large) aeration tanks and air is pumped into it, this allows the vigorous growth of useful microbes into flocs, the microbes consume the major part of the organic matter in the effluent, it reduces the BOD of the effluent, the effluent is then passed into settling tank where the bacterial flocs are allowed to sediment, major part of the activated sludge is pumped into aerobic sludge digester.
19. A. = Trophoblast - Gets attached to the endometrium and draws nutritive material secreted by uterine endometrium gland.
    B. = Inner cell mass - Differentiates as Embryo.
20. a. The natural cannabinoids are obtained from the inflorescences of the plant Cannabis sativa.
    b. Dried leaves and inflorescences of flower.
    c. When these drugs are taken, the pupils of the eyes dilate, blood sugar level and frequency of urination increases.

OR

Opioids are extracted from the **latex of plant called the opium poppy**, whose scientific name is **Papaver somniferum.**

Opioids are generally used as **an analgesic and given as a medicine for pain relief.** They bind to opioid receptors present in the the central and peripheral nervous system and also in the gastrointestinal tract and block the release of neurotransmitters from the neuron ending.

21. Microorganisms such as Lactobacillus and others commonly called lactic acid bacteria (LAB) grow in milk and convert into curd.
    LAB produce acid that coagulate and partially digest the milk proteins.
    Beneficial role - Increases Vitamin B_{12} / Checks disease causing microbes in the stomach.

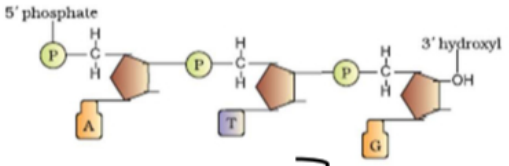
OR

a. Monascus purpureus : **Statins**
b. Trichoderma polysporum : **Cyclosporin A**

Section C

22. a. a. Phosphoester linkage/Phosphoester bond
       b. Phospho-di-ester linkage/Phospho-di-ester bond
    b. Two

c.



correct 3'-5'

ends
correct sugar phosphate backbone
correct nitrogenous bases

23. The genes that produce photopigments are present on X-chromosomes. If some of the genes are missing or damaged, it can result in colour blindness. Since males have only one X-chromosome, the chances of colour blindness are very high in males. In the case of females, to be colourblind must have the allele for it in both her X-chromosomes. In case, if female possesses the allele for colourblind in only one X-chromosome, then she will act as a carrier and won't be affected by it.
24. **Commensalism:** This is the interaction in which one species benefits and the other is neither harmed nor benefitted. An orchid growing as an epiphyte on a mango branch, and barnacles growing on the back of a whale benefit while neither the mango tree nor the whale derives any apparent benefit.
    Mutualism: This interaction confers benefits on both the interacting species. Lichens represent an intimate mutualistic relationship between a fungus and photosynthesising algae or cyanobacteria. Similarly, the mycorrhizae are associations between fungi and the roots of higher plants. The fungi help the plant in the absorption of essential nutrients from the soil while the plant in turn provides the fungi with energy-yielding carbohydrates.
25. **Insulin production in human body:**
    - Synthesised naturally in the form of proinsulin consisting of polypeptide chain A and polypeptide chain B, linked together by disulphide bonds and an extra stretch called C-peptide
    - The C-peptide is removed during processing and proinsulin matures into functional insulin.

    Insulin production by rDNA technology
    - Two DNA sequences corresponding to chain A and chain B of human insulin are synthesised
    - They are introduced into two different plasmids of E.coli
    - Chain A and chain B are produced separately
    - extracted and combined by disulphide bond to form human insulin.
26. a. Removal of Lantana allows other plants to grow, due to which herbivores population increases and that helps to restore the tiger population.
    b. Lantana being invasive does not allow other plants to grow in its surroundings, this will decrease in herbivore population which can in turn cause decline in the tiger population.
27. i. The conditions were created by electric discharge (high temperature) in a closed flask containing CH_4, NH_3, H_2, water vapours.
    ii. Amino acids is the organic compound formed and collected at the end of his experiment.
    iii. The experiment support chemical evolution.
28. a. The thymus gland is quite large in size at the time of birth but shrinks in size with age.
    - **Location:** The thymus gland is located in the anterior part of the chest, right behind the breastbone (or the sternum) and between the lungs.
    - **Functions:** One of the most important functions of the thymus is to stimulate the production of very specialized cells called T-cells (also called T-lymphocytes).

    b. Bone marrow

Section D

29. i. When the zygote moves through the isthmus of the oviduct, the mitotic division is initiated and is called the cleavage towards the uterus to form 2,4,8,16 daughter cells called

blastomeres. It is an embryo containing 8 to 16 blastomeres from the morula. It continues to transform and divide into blastocysts as it further approaches the uterus.

ii. The endocrine function of corpus luteum is to secrete progesterone which is essential for the maintenance of endometrium layer of uterus. Thickened endometrium is necessary for the implantation of fertilised ovum and other events of pregnancy.

iii. Fertilization may take place but the zygote may develop in the tube instead of the uterus.

OR

The trophoblast layer of the human blastocyst gets attached to the endometrium and the inner cell mass gets differentiated into an embryo. After attachment, the uterine cells divide rapidly and cover the blastocyst.

30. i. For host cell specificity purpose.

ii. Viral RNA

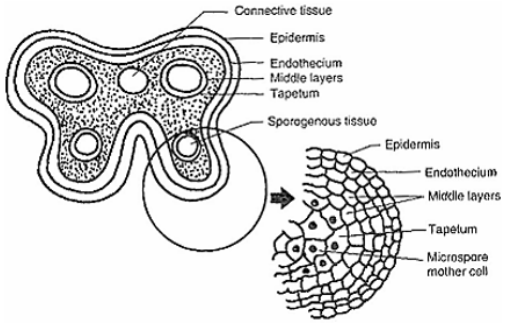
iii. Reverse transcriptase. Avoid sexual act with unknown partners, avoid used syringes and salon tools and check the blood before transfusion, early diagnosis of HIV in pregnant women.

OR

Immune system greatly weakens the body, fever, fatigues etc. and mild pathogen become virulent in humans through their ability to multiply within host.

Section E

31.



OR

i. Pollen tube passes down the style, generative cell divides mitotically into two male gametes and male gametes are discharged into the embryo sac through the micropyle,

One of the male gamete + Egg/ovum $\rightarrow$ Zygote (2n)/zygote is diploid, Process is known as syngamy.

Other male nucleus (n) + secondary nucleus (2n) $\rightarrow$ PEN/Primary Endosperm Nucleus (3n)/PEN is triploid, this is known as triple fusion. **(Ploidy of zygote and PEN)**

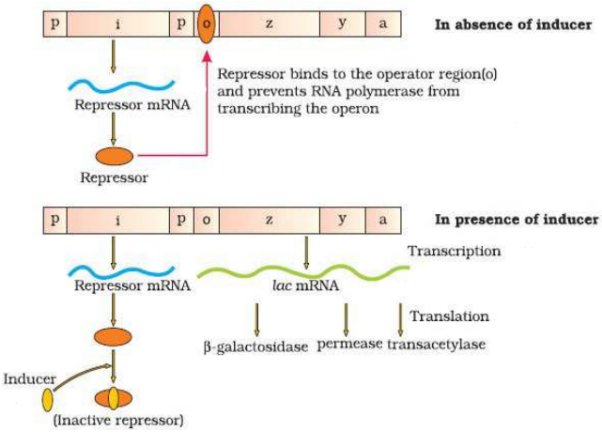
Since two types of fusion (syngamy and triple fusion) in an embryo sac called double fertilization.

Filiform apparatus of synergids guide entry of the pollen tube (at the micropylar end).

ii. The endosperm provides nutrition to the growing embryo, hence, endosperm development precedes embryo development. Endosperm provides nourishment to the developing embryo; thus, embryo development starts after an endosperm is made.

32. a. In the absence of an inducer - The repressor of the Lac-operon is synthesised from the i gene, The repressor protein binds to the operator region of the operon in absence of the inducer, and prevents RNA polymerase from transcribing the operon.

b. In the presence of an inducer, (lactose) the repressor is inactivated by interaction with the inducer, This allows RNA polymerase access to the promoter and transcription proceeds.



OR

a. Radioactive phosphorus (^{32}P) to make the DNA of the bacteriophage radioactive
Radioactive Sulphur (^{35}S) to make the protein of the bacteriophage radioactive.

b. Blending- Radioactive phages allowed to attach to E.coli, as the infection proceeded the viral coats were removed from bacteria by blending.
Centrifugation- the virus particles were separated from bacteria by (spinning them in a centrifuge) centrifugation.

c. Bacteria that were infected with viruses that had radioactive DNA were radioactive, indicating that DNA was the material that passed from the virus to the bacteria. Bacteria that were infected with viruses that had radioactive proteins were not radioactive. This indicates that proteins did not enter the bacteria from the viruses. DNA is, therefore, the genetic material that is passed from virus to bacteria.

33. **Role of Heat** - In PCR (in vitro), the DNA strands are separated by heating them at 95°C for 2 minutes. Heating causes the breakdown of H-bonds between the bases of two strands leading to their unwinding.
Role of Primers - Primers are short lengths of DNA about 20bp long that are required to start DNA polymerisation in PCR. The primers hybridise to their complementary sequence on the DNA strands at 40-50°C temperature and help in DNA polymerisation.
Role of *Thermus aquaticus* - An enzyme called Taq polymerase is isolated from *Thermus aquaticus*. Since this bacterium thrives in temperature as high as 95°C, this enzyme can also tolerate high temperature without undergoing denaturation. Therefore, this enzyme is used in PCR instead of normal DNA polymerase.

OR

a. Polymerase chain reaction or PCR consists of the following three steps:
Denaturation- The two DNA strands of template DNA separate from each other when heated to 92°C.
Annealing- The primers anneal to the 3' end of single strands of DNA.
Extension- The primers are extended by DNA polymerase by the addition of nucleotides to form complete strands of DNA.
DNA polymerases are enzymes responsible for assembling nucleotides to create new DNA molecules. During DNA replication, the polymerase reads the existing DNA strands and semi-conservatively creates new complementary DNA strands.

b. Application of PCR in the field of:

i. Biotechnology
Multiple copies of the gene of interest can be made through In vitro process
gene amplification

ii. Diagnostics
Early detection of disease at a time when the symptoms are not yet visible
can detect mutations in genes in suspected cancer patients
a powerful technique to identify many other genetic disorders