Class XII Session 2025-26
Subject - Biology
Sample Question Paper - 4

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

General Instructions:

1. All 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. Biological equilibrium is an equilibrium among the: **[1]**

   a) Producers and decomposers
   b) Producers, consumers and decomposers
   c) Producers and consumers
   d) Producers

2. Which one of the following is a barrier method of contraception? **[1]**

   a) IUCD
   b) Contraceptive pill
   c) Diaphragm
   d) Spermicidal

3. Which one among the following regions is not a hotspot of biodiversity? **[1]**

   a) The Himalayas
   b) The Western Ghats and Sri Lanka
   c) Jaintia Hills in Meghalaya
   d) The Indo-Burma Region

4. _____ involve the transfer of embryo at an 8-celled stage in the fallopian tube of the female. **[1]**

   a) ZIFT
   b) POST
   c) IVF
   d) GIFT

5. Enzyme that cuts DNA is **[1]**

   a) DNA polymerase
   b) DNA lyase
   c) Restriction endonuclease
   d) DNA ligase

6. Bacillus thuringiensis protein crystals which contain insecticidal protein. **[1]**
   This protein:

   a) Is activated at acid pH of the foregut of
   b) Does not kill the carrier bacterium which is

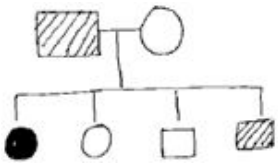
insect pest

itself resistant to this toxin

c) Binds with epithelial cells of midgut of the insect pest ultimately killing it

d) Is coded by several genes including the gene cry

7. Study the pedigree chart of a certain family given below and select the correct conclusion which can be drawn for the character **[1]**



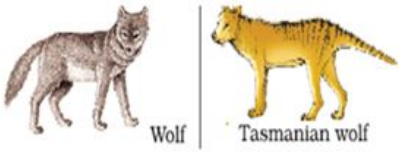
a) The parent could not have had a normal daughter for this character

b) The male parent is homozygous dominant

c) The female parent is heterozygous

d) The trait under study could not be colour blindness

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. Which of the following is primary consumer? **[1]**

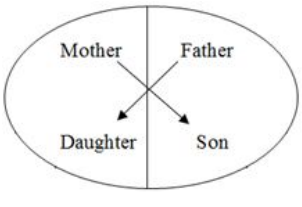
a) Grasshopper

b) Birds

c) Lion

d) Wolf

10. Represented below is the inheritance pattern of a certain type of trait in humans. Which one of the following conditions could be an example of this pattern? **[1]**



a) Thalassemia

b) Haemophilia

c) Sickle Cell anemia

d) Phenyl ketonuria

11. Bacteria present in rumen of a cattle digest cellulose to produce **[1]**

a) Sucrose

b) Ethanol

c) Methane

d) Polysaccharides

12. Cohen and Boyer isolated an antibiotic resistance gene, by cutting out a piece of DNA from a plasmid which was responsible for conferring antibiotic resistance, in the year: **[1]**

a) 1962

b) 1982

c) 1965

d) 1972

13. **Assertion (A):** PCR, ELISA, DNA hybridisation are confirmatory tests for sexually transmitted diseases. **[1]**

Reason (R): Incidence of STDs are very high in persons above the age of 30.

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:** Baculoviruses have no negative impacts on plants, mammals, birds, fish, or even on non-target insects. **[1]**

Reason: They are excellent species-specific, narrow spectrum insecticidal applications.

a) Assertion and reason both are correct statements and reason is correct explanation for assertion.

b) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

c) Assertion is correct statement but reason is wrong statement.

d) Assertion is wrong statement but reason is correct statement.

15. **Assertion (A):** Food web consists of several food chains. **[1]**

Reason (R): Food web decreases the stability of an ecosystem.

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):** Polyploidy occurs only in plants. **[1]**

Reason (R): The additional chromosomes in animals are mostly lethal.

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.

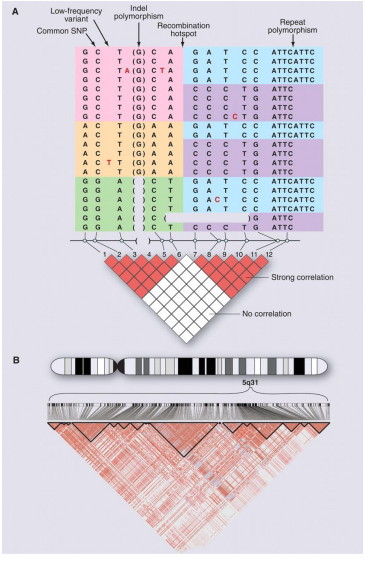
d) A is false but R is true.

Section B

17. a. Cattle excreta is important source for producing a domestic fuel. Name the fuel and write its main components. **[2]**

b. Write the biological process that is responsible for the production of this fuel.

18. Observe the diagram for genetic mapping of human DNA and answer the following questions: **[2]**

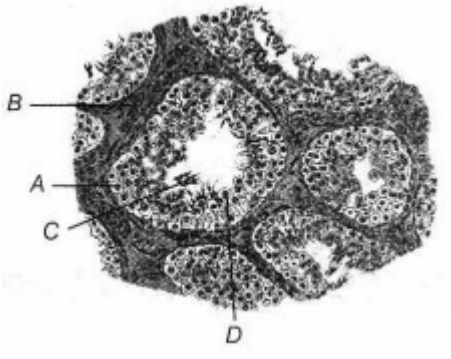


i. Explain DNA polymorphism as the basis of genetic mapping of the human genome.

ii. State the role of VNTR in DNA fingerprinting.

19. State two advantages of an apomictic seed to a farmer. **[2]**

20. Study the sectional view of human testis showing seminiferous tubules given below. **[2]**



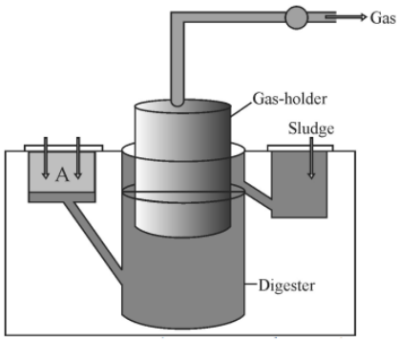
i. Identify A, B and C.

ii. Write the function of A and D.

21. It is strongly felt, the way integrated waste water including sewage water, treatment was carried in the town of Arcata (California) can be effectively used for waste water treatment in our country. Describe the different steps that were carried to get clean water from waste water. **[2]**

OR

Study the picture of biogas plant given below and answer the questions that follow:



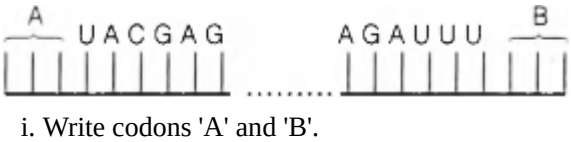
a. Name the components gaining entry from A into the chamber.

b. Mention the group of bacteria and the condition in which they act on the component that entered from A in the digester.

c. Name the components that get collected in gas holder.

Section C

22. Study the mRNA segment given below, which is complete and to be translated into a polypeptide chain and answer the following questions: **[3]**



i. Write codons 'A' and 'B'.

ii. What do they code for?

iii. How is the peptide bond formed between two amino acids in the ribosome?

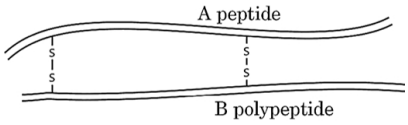
23. i. Compare the mechanism of sex determination in humans with that of honey bees, with respect to chromosome number. **[3]**

ii. How is the gamete formation comparable in the above two cases?

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

example of each.

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. How did Dr. David Tilman relate experimentally, the stability of a community and its species richness? Explain. **[3]**

OR

Alien species invasion has been a threat to biodiversity. Justify with the help of a suitable example. List any other three causes responsible for such a loss.

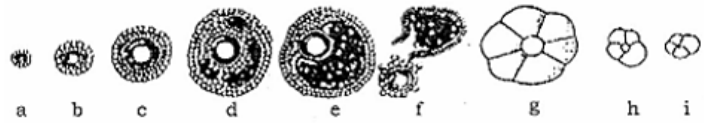
27. Describe the cosmozoic theory of origin of life. What are its drawbacks? **[3]**

28. Name and explain the two types of immune responses in humans. **[3]**

Section D

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

The following is the illustration of the sequence of ovarian events (a-i) in a human female.



i. Identify the figure that illustrates ovulation and mentions the stage of oogenesis it represents. (1)

ii. Name the ovarian hormone and the pituitary hormone that have caused the above-mentioned event. (1)

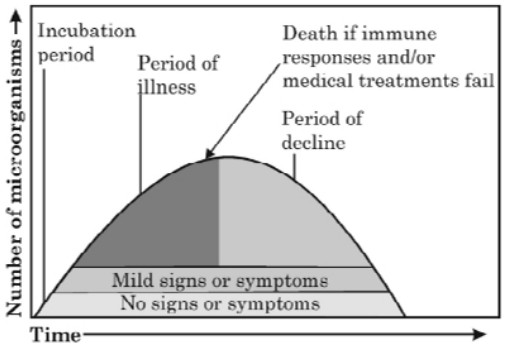
iii. Explain changes that occur in the uterus simultaneously in anticipation. (2)

OR

Draw a labelled sketch of the structure of a human ovum prior to fertilization. (2)

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

When a microorganism invades a host, a definite sequence of events usually occur leading to infection and disease, causing suffering to the host. This process is called pathogenesis. Once a microorganism overcomes the defense system of the host, development of the disease follows a certain sequence of events as shown in the graph. Study the graph given below for the sequence of events leading to appearance of a disease and answer the questions that follow:



:

i. In which period, according to the graph there are maximum chances of a person transmitting a disease/infection and why? (1)

ii. Study the graph and write what is an incubation period. Name a sexually transmitted disease that can be easily transmitted during this period. Name the specific type of lymphocytes that are attacked by the pathogen of this disease. (1)

iii. Draw a schematic labelled diagram of an antibody. (2)

OR

In which period, the number of immune cells forming antibodies will be the highest in a person suffering from pneumonia?

Name the immune cells that produce antibodies. (2)

Section E

31. i. How are the characteristic features of pollen, anther and stigma of a maize plant suited for pollination by wind? **[5]**

ii. How do you justify that:

1. Pollen grains are recovered from fossils?
2. Micropyle remains as a small pore in the seed coat of a fully developed seed?

OR

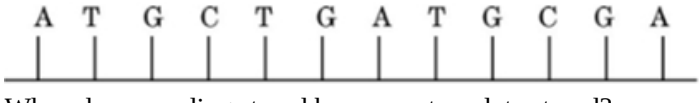
a. Where does microsporogenesis occur in an angiosperm? Describe the process of microsporogenesis.

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

32. Explain Griffith's experiment conducted in search of genetic material and write the conclusion he arrived at. How did Avery, MacLeod and McCarty establish the biochemical nature of the "Genetic Material" identified by Griffith? **[5]**

OR

i. Construct a transcription unit with a coding strand given below with proper labelling:



ii. When does a coding strand become a template strand?

iii. Why does a double-helix DNA molecule transcribe into a single-stranded RNA molecule?

33. If a desired gene is identified in an organism for some experiments, explain the process of the following: **[5]**

i. Cutting this desired gene at specific location.

ii. Synthesis of multiple copies of this desired gene.

OR

Answer the following questions with respect to recombinant DNA technology:

i. Why is plasmid considered to be an important tool in rDNA technology? From where can plasmids be isolated? (Any two sources)

ii. Explain the role of **ori** and selectable marker in a cloning vector.

iii. r-DNA technology cannot proceed without restriction endonuclease. Justify.

Solution

Section A

1. **(b)** Producers, consumers and decomposers
   Explanation:
   Producers, consumers and decomposers

2. **(c)** Diaphragm
   Explanation:
   Diaphragm

3. **(c)** Jaintia Hills in Meghalaya
   Explanation:
   The hotspot area includes all the seven districts, i.e. East Garo Hills, West Garo Hills, South Garo Hills, East Khasi Hills, West Khasi Hills, Jaintia Hills and Ri-Bhoi

4. **(a)** ZIFT
   Explanation:
   The transfer of embryo at the 8-celled stage in the fallopian tube of the female is called ZIFT (zygote intrafallopian transfer). During the test tube, baby program egg fertilized in vitro is transferred to fallopian tube for further growth and development.

5. **(c)** Restriction endonuclease
   Explanation:
   Restriction endonuclease

6. **(c)** Binds with epithelial cells of midgut of the insect pest ultimately killing it
   Explanation:
   Bt-toxin make midgut lining porous.

7. **(c)** The female parent is heterozygous
   Explanation:
   Pedigree chart is used to detect the flow of particular trait in the family over several generations. The given charts indicate that the female parent is heterozygous in nature.

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. **(a)** Grasshopper
   Explanation:
   Grasshopper

10.

(b) Haemophilia

Explanation:

The inheritance pattern of a certain type of trait in humans shown above is haemophilia.

A son cannot inherit the defective gene from his father. This is a recessive trait and can be passed on if cases are more severe with the carrier. Genetic testing and genetic counselling are recommended for families with haemophilia. The disease is X-linked and the father cannot pass haemophilia through the Y-chromosome.

11.

(c) Methane

Explanation:

Methane

12.

(d) 1972

Explanation:

1972

13.

(c) A is true but R is false.

Explanation:

STDs are a major threat to a healthy society. The incidence of STDs is very high in persons who have 15-24 years of age.

14. **(a)** Assertion and reason both are correct statements and reason is correct explanation for assertion.

Explanation:

Assertion and reason both are correct statements and reason is correct explanation for assertion.

15.

(c) A is true but R is false.

Explanation:

Food web is a network of food chains which become interconnected at various trophic levels so as to form a number of feeding connections amongst the different organisms of a biotic community. Food web is meant for increasing the stability of an ecosystem by providing alternate source of food and allowing the endangered population to grow in size.

16.

(d) A is false but R is true.

Explanation:

Increase in number of chromosomes or chromosome sets is called polyploidy. Polyploidy does not occur commonly in animals. Few animals such as brine shrimp, Artemia salina show polyploidy. The additional chromosomes in animals are mostly lethal. However, polyploidy occurs commonly in plants.

Section B

17. a. Cattle excreta is known for producing Biogas (Gobar Gas), which has main components such as **Methane, CO_2, H_2, N_2 and O**. b.)

b. The biological process for fuel production involves microbial fermentation, where microorganisms convert organic materials like biomass or waste into biofuels like bioethanol or biodiesel.

18. i. Polymorphism is inherited from parents to children. So, it is useful for identification and paternity testing. It arises due to the mutations and plays an important role in speciation and evolution. Thus, DNA polymorphism exhibited by certain repetitive DNA sequences and it is the basis to construct genetic and physical maps of the genome which are used in the human genome project.

ii. Variable Number of Tandem Repeats (VNTRs) belongs to a class of satellite DNA called a minisatellite. VNTRs are used as probes in DNA fingerprinting.

19. Two advantages of an apomictic seed to a farmer are
    i. It reduces the cost of hybrid breeding programes.
    ii. Desirable traits can be managed without losing the superiority of hybrids over parents, and farmers can replant these seeds year after year simultaneously.
20. 1. A-Spermatogonia,
    B-Interstitial cells
    C-Spermatozoa.
    2. A-Spermatogonia produces a spermatogonium (plural: spermatogonia) is an undifferentiated male germ cell. Spermatogonia undergo spermatogenesis to form mature spermatozoa in the seminiferous tubules of the testes.
    D-Sertoli cells provide nutrition to sperms.
21. Step carried out to get clean water from waste water are as follows:
    Ist step - sedimentation, filtration, and chlorine treatment are given (still on water remains a lot of dangerous pollutants like heavy metals)
    (Innovative approach) - A series of six connected marshes (over 60 hectares) of marshland, appropriate plants-algae /fungi /and bacteria were seeded into this area, which neutralise and absorb and assimilate the pollutants.

    OR

    a. Slurry of dung
    b. Methanogens, as it grows anaerobically
    c. Methane

Section C

22. i. A-AUG, B-UAA/UAG/UGA
    ii. AUG codes for methionine. UAA/UAG/UGA does not code for any amino acid, but brings about termination of polypeptide synthesis.
    iii. In the large subunit of ribosome, there are two sites in which subsequent amino acids bind to and come close enough for the formation of peptide bond. It is catalysed by the enzyme called peptidyl transferase.
23. i. In honeybee union of a sperm and an egg develops as a female, and an unfertilised egg develops as a male by means of parthenogenesis. Whereas the females are diploid and having 32 chromosomes and males are haploid and they have 16 chromosomes but in humans, both the male and female individuals have 23 pair of chromosomes, that is female 44+ XX and males 44+ XY.
    ii. In humans gametes are formed by the process of cell division called meiosis and in the honeybee, the process is different in case of female and male:
        a. female gametes are formed by meiosis
        b. male gametes are formed by mitosis
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. The stability of a community depends on its species richness. David Tilman's long-term ecosystem experiments using outdoor plots provided the answer for species richness. Tilman found that plots with more species showed less year-to-year variations in

total biomass. He also showed that increased diversity contributed to higher productivity. Thus he established that the stability of a community depends on its species richness.

OR

Alien species invasion has been a threat to biodiversity. Example of Alien species invasion are as follows:

i. Nile Perch, introduced into lake Victoria (in East Africa), led to the extinction of Cichlid fish (more than 200 species) in the lake
ii. Introduction of African catfish (Clarias gariepinus), for aquaculture, posing threat to indigenous catfish
iii. Introduction of carrot grass (Parthenium) I Lantana I Water hyacinth (Eichhornia), which are invasive weed, that pose threat to native species or any other appropriate example.

Other Causes of biodiversity loss

i. Habitat loss and fragmentation
ii. Over exploitation
iii. Co-extinction

27. **Cosmozoic theory**- This theory is also known as the theory of panspermia. According to this theory, primitive life came to the earth from some heavenly body through meteorites in the form of spores, microorganisms, etc (Richter 1865).
Few of the drawbacks of this theory are:

i. The possibility of some living beings coming from some other planet seems to be highly remote because of the distance involved and absence of life on nearby planets.
ii. Presence of lethal radiations in the interstellar space diminishes this possibility up to a large extent.
iii. Presence of very high temperature in the outer part of the atmosphere makes it difficult to agree with the credibility of this theory.
iv. It was unable to explain the origin of life.

28. There are two immune response.

i. The primary immune response occurs when an antigen comes in contact with the immune system for the first time. During this time the immune system has to learn to recognize the antigen and how to make an antibody against it and eventually produce memory lymphocytes.
ii. The secondary immune response occurs when the second time (3rd, 4th, etc.) the person is exposed to the same antigen. At this point, immunological memory has been established and the immune system can start making antibodies immediately.

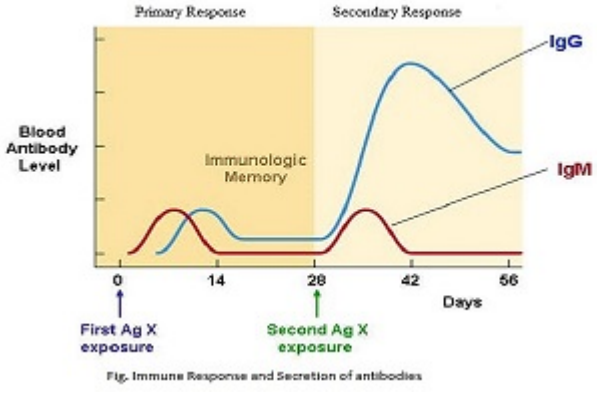
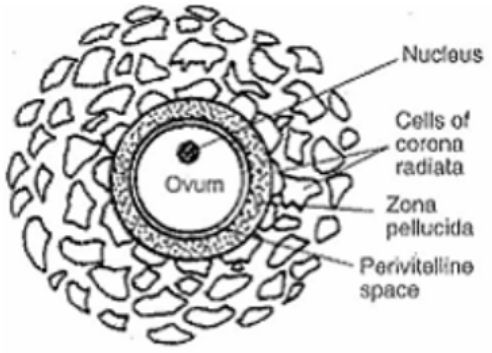


Fig. Immune Response and Secretion of antibodies

Section D

29. i. Figure f illustrates ovulation.
ii. It represents secondary oocyte stage of oogenesis.
-Pituitary hormone -LH
iii. Endometrium proliferates and becomes thicker by rapid cell multiplication development and maturation of ovum is in progress, while the figure 'h' shows that corpus luteum going towards degeneration.

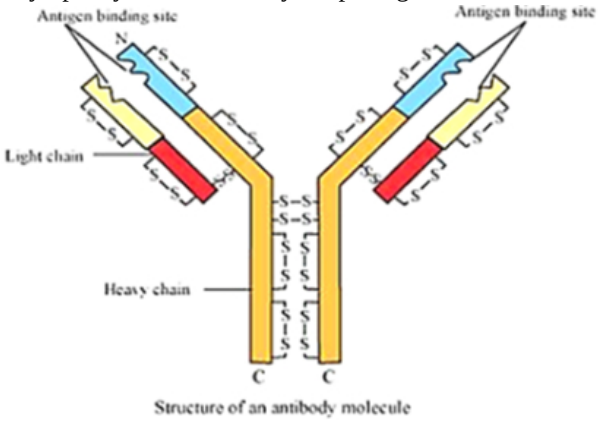
OR



30. i. Period of illness: The number of disease-causing microorganisms reaches its maximum during the period of illness so, there are maximum chances of a person transmitting a disease/infection at this stage.

ii. Time period between infection and appearance of its symptoms is known as incubation period.
AIDS/any other correct example
T lymphocytes are attack by the pathogen of this disease.

iii.



Structure of an antibody molecule

OR

Period of illness
B lymphocytes/B cells produces antibodies.

Section E

31. i. The characteristic features of pollen, anther, and stigma in maize plants are adapted for wind pollination:

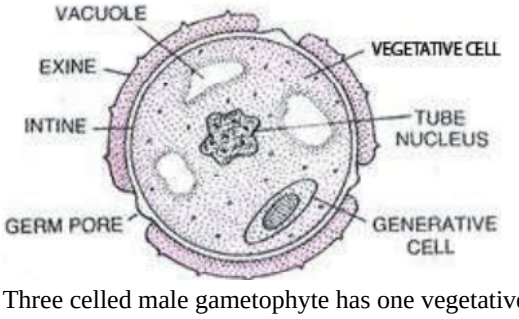
- Pollen- light / non-sticky, to travel easily through air
  produce in enormous amount, to compensate the wastage during pollination
- Anther -well exposed, pollen easily dispersed into wind current
- Stigma -Large / often feathery, to easily trap air-borne pollen grains

ii. 1. Pollen grains have hard outer layer exine made up of sporopollenin, which is one of the most resistant organic material known / no enzyme can degrade sporopollenin.
2. It allows the entry of water, oxygen into the seed at the time of germination.

OR

a. Microsporogenesis occurs within the microsporangia/ sporogenous tissue/ PMC of the anthers in angiosperms.
Each cell of the sporogenous tissue acts as microspore mother cell, undergoes meiosis forming tetrad of haploid microspore, as the anthers mature the tetrad dissociates and develop into pollen grains

b.



Three celled male gametophyte has one vegetative cell and two male gametes (instead of a generative cell)

32. Griffith selected ‘S’ strain and ‘R’ strain bacteria Streptococcus pneumoniae, ‘S’ strain - Virulent causes pneumonia, ‘R’ strain - Non-virulent does not cause pneumonia

'S' strain $\xrightarrow{\text{Inject into mice}}$ mice die

'R' strain $\xrightarrow{\text{Inject into mice}}$ mice live.

'S' strain (heat-killed) $\xrightarrow{\text{Inject into mice}}$ mice live

Heat killed 'S' strain + 'R' strain (live) $\xrightarrow{\text{Inject into mice}}$ mice die.

Griffith concluded that the 'R' strain bacteria had somehow been transformed by the heat killed 'S' strain bacteria.

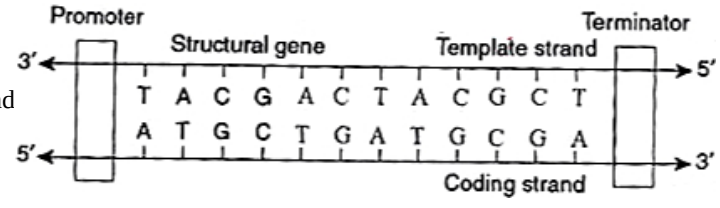
They purified biochemicals (Proteins, DNA, RNA etc.) from the heat killed 'S' cells and the fractions were added individually to the culture of the live 'R' cells,

DNA was able to cause transformation of 'R' cells into 'S' cells/they found that protein digesting enzyme or RNA digesting enzymes did not affect transformation or digestion with DNase did inhibit transformation indicating that the transforming substance is not a protein or RNA, This suggests that the DNA is the "genetic material".

Oswald Avery Colin Macleod and McCarty worked to determine the biochemical nature of transforming principle in Griffiths experiment. They purified biochemicals proteins DNA RNA etc. from the heat killed S cells to see which ones could transform live R cells into S cells.

OR

i. Correct transcription unit with coding strand



ii. By switching the position of promoter and terminator the coding strand becomes template strand.

iii. If both strands acts as template, they would code for RNA molecule with complementary sequences hence would form a dsRNA and prevent translation.

If both strands acts as template, they would code for RNA molecules with different sequences and if they code for proteins, they will make different proteins. Hence one segment of DNA would be coding for two different proteins and complicate genetic information transfer machinery.

Single stranded RNA molecule is required for the process of translation.

33. i. Cutting of the desired gene at a specific location is done by incubating the DNA with specific restriction endonuclease.

Restriction enzymes recognise a particular palindromic nucleotide sequence and cut the DNA at that site.

ii. Synthesis of multiple copies of the desired gene is carried out by Polymerase Chain Reaction (PCR)

Amplification of recombinant DNA gene is done using Polymerase Chain Reaction (PCR). It is carried out in the following steps:

a. **Denaturation** -The double-stranded DNA is denatured by applying high temperature of 95°C for 15 seconds. Each separated strand acts as a template.

b. **Annealing -** Two sets of primers are added, which anneal to the 3'end of each separated strand.

c. **Extension -** DNA polymerase extends the primers by adding nucleotides complementary to the template provided in the reaction. Taq polymerase is used in the reaction, which can tolerate heat. All these steps are repeated many times to get several copies of the desired DNA.

OR

i. Plasmid considered to be an important tool in rDNA technology as it can act as vector/can self-replicate to form multiple copies/have selectable markers/ small in size will facilitate insertion/presence of 'Ori'-

E. coli, Agrobacterium tumefaciens, Salmonella typhi, Bacteria.

ii. Role of 'Ori'- this is a sequence from where replication starts/any piece of DNA when linked to this sequence can be made to replicate with in the host cells/controls copy number of linked DNA.

Role of selectable marker helps in identifying and eliminating non-transformants, and selectively permitting the growth of transformants during recombinant DNA technology.

iii. Restriction endonuclease identifies a specific palindromic sequence of DNA and cut the DNA at the specific sites in both the host as well in desired/foreign DNA, thereby creates "sticky ends" facilitating ligation to form a recombinant DNA.