Class XII Session 2024-25
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. Among the following, where do you think the process of decomposition would be the fastest? **[1]**

   a) Alpine region b) Antarctic

   c) Dry arid region d) Tropical rain forest

2. Amniocentesis is a method to: **[1]**

   a) Medical termination of pregnancy b) Fertilize the egg

   c) Sperm Count d) Detect genetic disorder

3. The species of animals protected in Kaziranga sanctuary is: **[1]**

   a) Macaca mullata b) P. leo

   c) Panthera tigris d) Rhinoceros unicornis

4. Which one of the following techniques is employed in test tube baby programme? **[1]**

   a) Intra-Cytoplasmic Sperm Injection b) Gamete Intra-Fallopian transfer

   c) Zygote Intra Fallopian transfer d) Intra-Uterine Insemination

5. A desirable change in genotype of an organism is obtained by: **[1]**

   a) DNA technology b) DNA replication

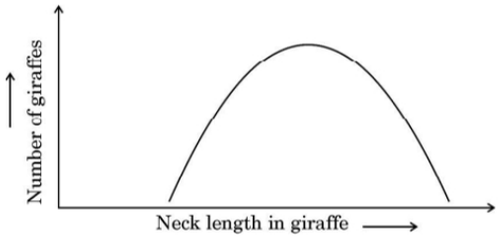
   c) Protein synthesis d) mRNA formation

6. Nitrogen fixation is performed by: **[1]**

   a) Blue-green algae and bacteria b) Green algae and fungi

   c) Legumes and cereals d) Ferns and cycads

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]**



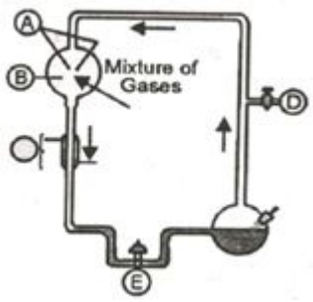
a) Stabilising selection as giraffes with medium neck lengths are selected.

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

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

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

8. What was the mixture of gases used in chamber marked A? **[1]**



a) Oxygen O_2, ammonia (NH_3), hydrogen H_2, and water H_2O

b) Methane(CH_4) v, ammonia(NH_3), hydrogen H_2 and water H_2O

c) Oxygen O_2, ozone O_3, hydrogen H_2, and water H_2O

d) Oxygen O_2, ozone O_3, hydrogen H_2

9. Sequence of species through which the organic molecules in a community process is: **[1]**

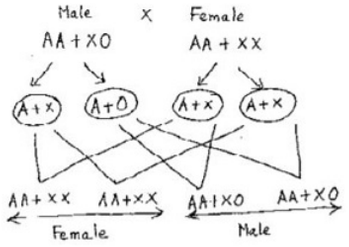
a) Ecological pyramid

b) Population

c) Food chain

d) Ecosystem

10. What does the chart give below represent? **[1]**



a) XX - XO type of sex determination

b) XX - XY type of sex determination

c) XO - XX type of sex determination

d) xy - xx type of sex determination

11. Single cell protein refers to: **[1]**

a) A specific protein extracted from a single cell.

b) Proteins extracted from a single cell.

c) Sources of mixed proteins extracted from pure or mixed culture of cells.

d) A specific protein extracted from pure culture of single type of cells.

12. Which of the given statements is correct in the context of visualizing DNA molecules separated by agarose gel electrophoresis? **[1]**

a) DNA can be seen in visible light.

b) Ethidium bromide-stained DNA can be seen under exposure to UV light.

c) Ethidium bromide-stained DNA can be seen in visible light.

d) DNA can be seen without staining in visible light.

13. **Assertion (A):** In India, there is rapid decline in infant mortality rate and MMR. **[1]**

Reason (R): In India, more and more attention is being given to RCH programmes.

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):** Large holes in **Swiss cheese** are due to the production of a large amount of carbon dioxide by specific microbe. **[1]**

Reason (R): The specificity of characteristic texture, flavour and taste of **Swiss cheese** is due to the use of bacterium Propionibacterium shermanii.

a) Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

b) Both Assertion and Reason are true, but Reason is **not** the correct explanation of the Assertion.

c) Assertion is true but Reason is false.

d) Both Assertion and Reason are false.

15. **Assertion (A):** Decomposition process is slower if detritus is rich in lignin and cutin. **[1]**

Reason (R): Decomposition is largely an oxygen requiring process.

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):** Evolution is a continuous process that takes millions of years for speciation. **[1]**

Reason (R): During evolution, small variation accumulates guided by natural selection that leads to speciation.

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.

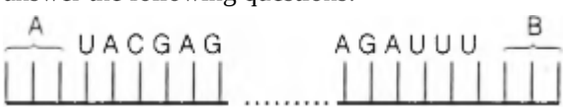
c) A is true but R is false.

d) A is false but R is true.

Section B

17. **Micro-organisms play an important role for the biological treatment of sewage**. Justify. **[2]**

18. Study the mRNA segment given below, which is complete and to be translated into a polypeptide chain and answer the following questions: **[2]**



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

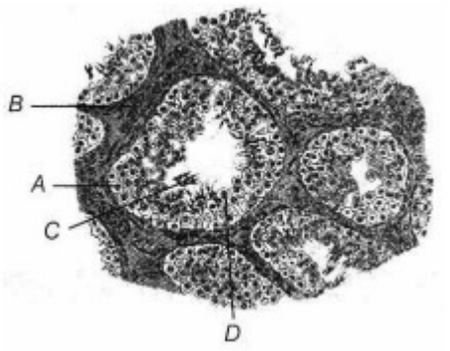
ii. What do they code for?

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

19. Draw a vertical section of maize grain and label its endosperm, plumule, coleoptile, scutellum, radicle and **[2]**

coleorhiza.

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.

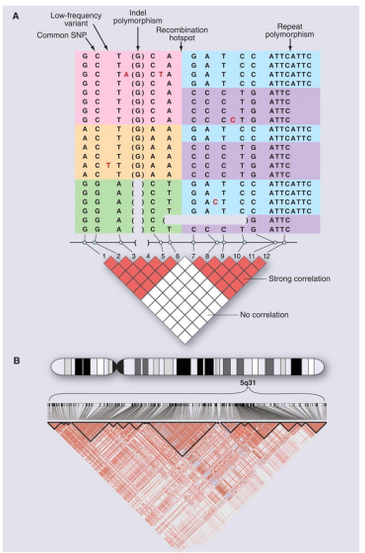
21. Name the enzyme produced by Streptococcus bacterium. Explain its importance in medical sciences. **[2]**

OR

Effluent from the primary treatment of the sewage is passed through large aeration tanks for biological treatment. Explain the complete process that follows till the water is ready to be released into the natural water bodies.

Section C

22. Observe the diagram for genetic mapping of human DNA and answer the following questions: **[3]**



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

ii. State the role of VNTR in DNA fingerprinting.

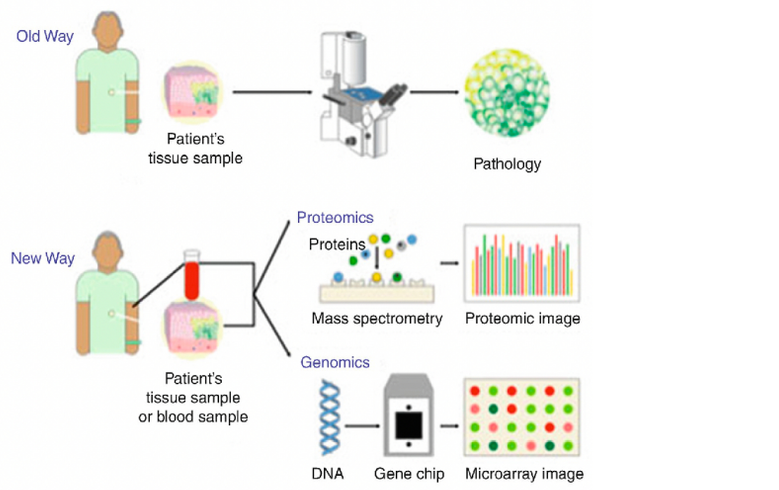
23. i. Compare the mechanism of sex determination in humans with that of honey bees, with respect to chromosome number. **[3]**

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

24. a. What does the equation $\frac{dN}{dt}$ = rN express in terms of population growth? **[3]**

b. Write the significance of **r** in a population survey.

25. The image below describes the molecular diagnostic procedures. **[3]**



i. Write any two biochemical/molecular diagnostic procedures for early detection of viral infection.

ii. Explain the principle of any one of them.

26. List **six** advantages of ex-situ approach to conservation of biodiversity. **[3]**

OR

What are the consequences of loss of biodiversity in a region? Explain.

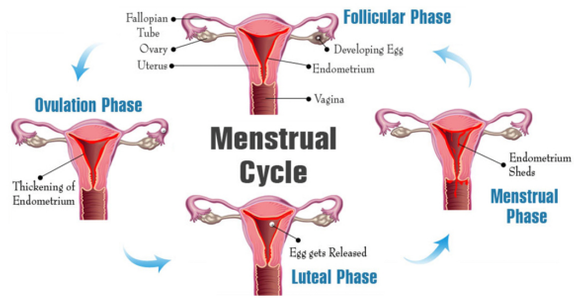
27. What are the main features of mutation theory? **[3]**

28. Mention the chemical nature of an antibody and name the type of cells they are produced by. Write the difference between active and passive immune responses on the basis of antibodies. **[3]**

Section D

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

The image below shows the menstrual cycle of a human female. On the basis of this cycle:



i. Explain the menstrual phase in a human female. State the level of ovarian and pituitary hormones during this phase. (1)

ii. Why is follicular phase in the menstrual cycle also referred as proliferative phase? Explain. (1)

iii. Explain the events that occur in a Graafian follicle at the time of ovulation and thereafter. (2)

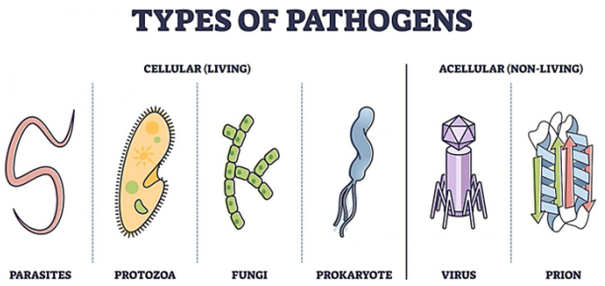
OR

Draw a Graafian follicle and label antrum and secondary oocyte. (2)

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

The pathogen of a disease depends on RBCs of human for growth and reproduction. The person with this

pathogen suffers with chill and high fever.



i. Identify the disease. (1)

ii. Name the pathogen. (1)

iii. What is the cause of fever? (2)

OR

Represent the life cycle of the pathogen diagrammatically. (2)

Section E

31. i. Double fertilisation is an event unique to all flowering plants. Explain the process. **[5]**

ii. Give a reason for the following:

a. A seed of an orange has many embryos.

b. Cashew is a false fruit but Guava is a true fruit.

OR

Explain the post pollination events up to double fertilisation, that occur in an angiosperm.

32. i. How and why is charging of tRNA essential in the process of translation? **[5]**

ii. State the function of ribosome as a catalyst in bacteria during the process of translation.

iii. Explain the process of binding of ribosomal units to mRNA during protein synthesis.

OR

Describe the experiment carried out by Hershey and Chase. Write the conclusion they arrived at.

33. Restriction enzymes are found in bacteria (and other prokaryotes). They recognize and bind to specific sequences of DNA, called restriction sites. Each restriction enzyme recognizes just one or a few restriction sites. When it finds its target sequence, a restriction enzyme will make a double-stranded cut in the DNA molecule. **[5]**

i. Write the palindromic nucleotide sequence for the following DNA segment.

5' - GAATTC-3'

ii. Name the restriction endonuclease that recognises this sequence.

iii. How are sticky ends produced? Mention their role.

OR

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

Solution

Section A

1. **(d)** Tropical rain forest
   Explanation: Dead plant remains such as leaves, bark, flowers, and dead remains of animals, including fecal matter, constitute detritus, which is the raw material for decomposition. The tropical rain forest produces the highest biomass and hence produces the highest detritus. Hence the rate of decomposition is highest in the tropical rain forest.
2. **(d)** Detect genetic disorder
   Explanation: Amniocentesis is a method to known the chromosome type of foetus. It is used to detect the genetic disorder of foetus by analyzing chromosome. It is misused to known the sex of the foetus.
3. **(d)** Rhinoceros unicornis
   Explanation: Rhinoceros unicornis
4. **(c)** Zygote Intra Fallopian transfer
   Explanation: Fertilization outside the followed by embryo transfer is called test-tube. The zygote or early embryo up to 8 blastomeres could transfer into the fallopian tube is called zygote intrafallopian transfer (ZIFT).
5. **(a)** DNA technology
   Explanation: DNA technology
6. **(a)** Blue-green algae and bacteria
   Explanation: Blue-green algae and bacteria
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)** Methane(CH_4) v, ammonia(NH_3), hydrogen H_2 and water H_2O
   Explanation: the gases used in Urey and Miller experiment in chamber marked A are Methane (CH_4), ammonia (NH_3), hydrogen H_2, and water H_2O
9. **(c)** Food chain
   Explanation: Food chain
10. **(a)** XX - XO type of sex determination
    Explanation: The chart given below represents XX-XO type of sex determination in which XX forms the female and XO develops as a male. It is common in birds.
11. **(d)** A specific protein extracted from pure culture of single type of cells.
    Explanation: A specific protein extracted from pure culture of single type of cells.
12. **(b)** Ethidium bromide-stained DNA can be seen under exposure to UV light.
    Explanation: The separated DNA fragments by gel electrophoresis can be visualized only after staining the DNA with a compound known as ethidium bromide followed by exposure to UV radiation (you cannot see pure DNA fragments in the visible light and without staining).
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. **(a)** Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.
Explanation: Both Assertion and Reason are true, and Reason is the correct explanation of the Assertion.

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).

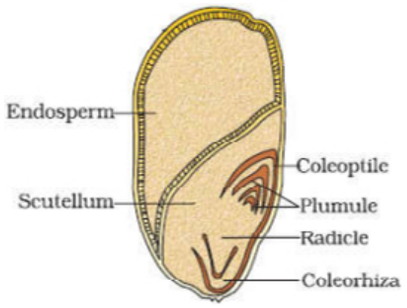
16. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation: Evolution is a slow and continuous process that takes a long time to form a new species. Variation due to mutation, genetic drift, geographical isolation leads to speciation.

Section B

17. Micro-organisms play an important role in the biological treatment of sewage as these microbes use the organic matter present in wastewater and reduce the BOD (Biological oxygen demand). BOD is the amount of oxygen that aerobic bacteria utilise to break down biodegradable organic matter into end products such as water and Carbon dioxide.

18. 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.

19. **Vertical section of maize grain:**



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. Enzyme produced by Streptococcus bacterium is streptokinase.
It is used as a 'clot buster' for removing clots from the blood vessels of patients who have undregone myocardial infraction leading to heart attack.

OR

- During treatment (after adding small amount of inoculum) primary effluent is constantly agitated mechanically 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.
- A Major part of the activated sludge is pumped into an aerobic sludge digester.

Section C

22. 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.

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. a. It indicates exponential / geometric growth

b. Assesses impact of biotic and abiotic factors on population growth, indicates intrinsic rate of natural increase.

25.
- **Name of biochemical/molecular diagnostic tests for viruses:**
  - **ELISA** - Enzyme-Linked Immunosorbent Assay
  - **PCR** – Polymerase Chain Reaction
- **Principle of ELISA -** It is based on antigen-antibody interaction. Infection by a pathogen can be detected by the presence of antigens or by detecting the antibodies synthesized against the pathogen.

26. **Following are the advantages of ex-situ approach to conservation of biodiversity:**

i. The exploitation of endangered species by poachers can be avoided.

ii. Breeding programs can be regulated for threatened species and the gametes, as well as embryos, can be preserved in viable and fertile conditions for long term storage.

iii. Seeds from different genetic strains having better characteristics can be stored for future purposes.

iv. The health of individuals can be monitored and medical assistance can be given as required.

v. Modern reproductive technology can increase the chances of reproductive success for endangered species.

vi. Research into reproductive physiology, lifestyle, and ecology of an endangered species is made easier.

OR

Decline in flora/fauna, Lower resistance to environmental perturbations such as drought, Increased variability in certain ecosystem process such as plant productivity/ water use/pest/disease cycle.

27. This theory was given by deVries. Some of the features of this theory are as follow:

i. Mutations cause evolution and not the minor variations (heritable) as mentioned by Darwin.

ii. Large differences arise suddenly in a population.

iii. Mutations are random and directionless.

iv. The mutation causes speciation (formation of new species), also known as saltation (single step, large mutation).

v. Mutations which are inheritable in nature are the part of the evolution process.

vi. Evolution is discontinuous, not a gradual process.

28. The antibody is made up of proteins or peptide. Antibody is produced by B-lymphocytes or B-cells

Active immunity	Passive immunity
Active immunity is due to exposure to antigens or pathogens or vaccination or immunization.	Passive immunity is ready-made antibodies are directly given to protect the body of an individual against foreign agents.
It leads to production of antibodies by the individual.	It provides immediate immunity.
It is slow process.	It is fast process.

Section D

29. i. The reproductive cycle in female primates, e.g. monkeys, apes and human beings is called the **menstrual cycle.**
Menstrual phase starts from 3rd day and ends on 5th day. It is initiated due to reduced secretion of progesterone and estrogen from the regressing corpus luteum in the ovary. The endometrium breaks down and blood along with degenerated ovum constitute the menstrual flow.
The secretion of pituitary hormones, i.e. FSH and LH is also reduced during this phase.

ii. In follicular phase, primary follicles in the ovary grow under the influence of Follicle Stimulating Hormone (FSH). It starts from 6th day of the menstrual date and ends on 13th or 14th day of a 28-day cycle. FSH also stimulates the ovarian follicles to secrete estrogen which in turn stimulates endometrium to proliferate, so that it becomes thicker and highly vascularised. Thus, it is also called proliferative stage of menstrual cycle.

iii. At the time of ovulation following events occurred in **Graafian Follicle:**

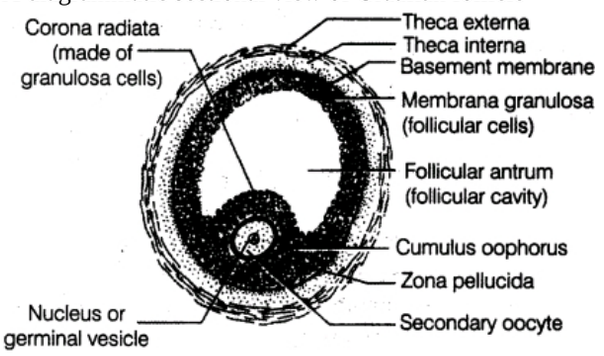
a. LH and FSH reached peak levels (about 14th-16th day of cycle).

b. High level of LH induces Graafian follicle to rupture and the release of a secondary oocyte from it.

c. After ovulation, the remaining cells of Graafian follicle are stimulated by LH to develop corpus luteum (an endocrine gland to secrete progesterone hormone).

OR

A diagrammatic sectional view of Graafian follicle



30. i. Malaria

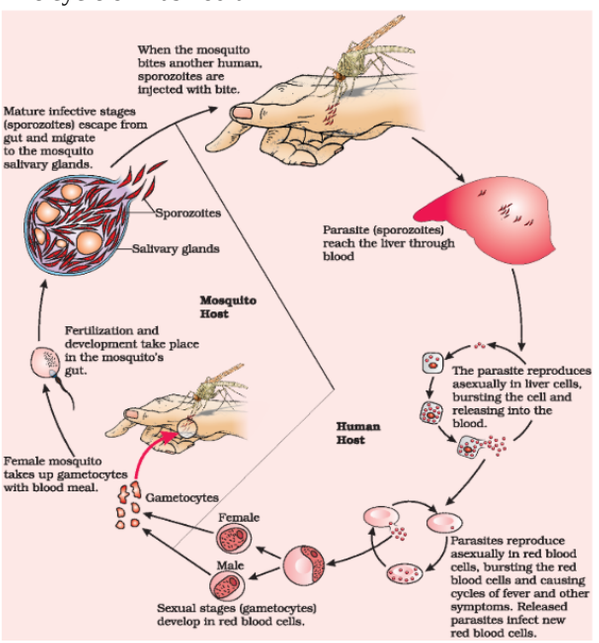
ii. Different species o f Plasmodium viz P. vivax, P Malariae and P. falciparum.

iii. Malaria is caused by the toxins (haemozoin) produced in the human body by the malarial parasite. This toxin is released by the rupturing of RBCs.

OR

Life cycle of Plasmodium

iv.



Section E

31. i. All angiosperms are characterised by a unique process called double fertilisation.

Double fertilisation is the occurrence of two types of fusion syngamy and triple fusion in an embryo sac of the angiosperm.

Syngamy- Fusion of one of the male gamete and the egg cell resulting in formation of a zygote (diploid).

Triple fusion- Fusion of another male gamete with two haploid polar nuclei to produce a (triploid) primary endosperm nucleus.

ii. a. The fruit of orange is an example of polyembryony. The egg is fertilized and leads to the formation of multiple embryos. This phenomenon is known as polyembryony. There are many embryos produced from the single fertilized egg of ovule.

b. In case of Cashew thalamus also contribute in fruit formation along with ovary/development of fruit after fertilisation from the part other than ovary, Guava fruit develops only from the ovary after fertilisation therefore it is true fruit.

OR

Post pollination event up.to double fertilization, that occur in an angiosperm is as follows:

The Pollen grain germinates on the stigma to produce pollen tube through one of the germ pore, the contents of the pollen grain/vegetative cell/generative cell/two male gametes move into the pollen tube, the pollen tube grows through the tissues of stigma and pollen tube to reach the ovary, the pollen tube enters (through micropyle) enters the synergids through filiform apparatus, pollen tube releases two male gametes in the cytoplasm of the synergids, one of the male gametes fuses with egg cell/female gamete completing syngamy, to form (diploid) zygote, the other male gamete fuses with two polar nuclei in the

(central cell) to produce (triploid) primary endospermic cell, three haploid cells fuse called triple fusion, two type of fusion syngamy and triple fusion is called double fertilisation.

32. i. Amino acid activated in presence of ATP and attached to their cognate tRNA
When two charged tRNA are in close contact they form peptide bond/Peptide bond formation between two charged tRNA is favoured energetically therefore the charging of tRNA is essential in the process of translation.
ii. Function - To enhance the rate of peptide bonds formation/ help in formation of peptide bond formation.
iii. Small subunit encounter an mRNA, the process of translation begins, there are two sites in larger subunit for subsequent amino acid to bind to, and thus be close enough to each other for the formation of peptide bond.

OR

The Hershey And Chase Experiment:

i. Hershey and Chase cultivated viruses inside a solution medium containing 32P radioactive phosphorus.
ii. Then enabled them to infect *E. coli* while the mixture was stirred in a mixer.
iii. Viral coats and bacterial cells containing viral particles were isolated using centrifugation.
iv. The steps were repeated using radioactive sulfur 35S, where no radioactivity was found inside the bacterium.
v. Because S was never incorporated in Genome.
vi. However, radioactivity was discovered in the supernatant with protein coats of viruses.

Conclusion:

i. They concluded that genetic information was DNA rather than proteins.
ii. Since the protein coat stays outside of the host genome and only the DNA penetrates.
iii. They discovered that hardly any protein, but only DNA, was accountable for their proliferation.
iv. The DNA was responsible for all of the radioactive substances that managed to enter the cell.

33. i. Palindromic sequence for
5' - GAATTC - 3'
3' - CTTAAG - 5'
ii. Restriction endonuclease Eco RI recognises the above palindromic sequence.
iii. Sticky ends on DNA are formed by the action of enzymes restriction endonucleases. These enzymes cut the strand of DNA a little away from the centre of the palindrome sequence between the same two bases on both the strands. This results in single-stranded stretches on both the complementary strands at their ends. These overhanging stretches are called sticky ends as they form hydrogen bonds with the complementary basepair sequences.
Role of the sticky ends -These sticky ends produced from hydrogen bonds with their complementary cut counterparts. This stickiness of the ends facilitates the action of the enzyme DNA ligase.

OR

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^{o}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.