Class: XII
SESSION : 2022-2023
SUBJECT: BIOLOGY (044)
SAMPLE QUESTION PAPER - 11
with SOLUTION

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

General Instructions:

(i) All questions are compulsory.
(ii) The question paper has five sections and 33 questions. All questions are compulsory.
(iii) 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.
(iv) 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.
(v) Wherever necessary, neat and properly labeled diagrams should be drawn.

Section A

1. Ex situ conservation is carried out in: **[1]**

a) Biosphere reserve
b) Zoo
c) National park
d) Sanctuary

2. The correct order of the male sex accessory ducts of a human being is: **[1]**

a) Rete testis, vasa efferentia, vas deferens, epididymis
b) Vasa efferentia, epididymis, rete testis, vas deferens
c) Rete testis, vasa efferentia, epididymis, vas deferens
d) Rete testis, epididymis, vasa efferentia, vas deferens

3. Which one of the following statements for the pyramid of energy is incorrect, whereas the remaining three are connected? **[1]**

a) It is inverted in shape

b) It shows energy content of different trophic level organisms

c) It is upright in shape

d) Its base is broad

4. High increase in the human population is due to: **[1]**

a) Increase in the death rate

b) Genetic change

c) Better medical facilities

d) The decrease in the birth rate

5. The first life on the earth was observed in: **[1]**

a) Mountain

b) Air

c) Soil

d) Water

6. In which of the following microbes are not used extensively? **[1]**

A. Converting milk into curd.

B. Making cheese of different flavors and tastes.

C. Production of viral drugs.

D. Production of antibiotics.

E. As bio-fertilizers.

F. Production of inorganic fertilizers.

a) Only C and F

b) Only B and C

c) Only C and D

d) Only A and B

7. Activated sludge should have the ability to settle quickly so that it can: [1]

a) Be rapidly pumped back from the sedimentation tank to the aeration tank.

b) Be discarded and anaerobically digested.

c) Absorb colloidal organic matter.

d) Absorb pathogenic bacteria present in waste water while sinking to the bottom of the settling tank.

8. The Pneumococcal experiment proves that: [1]

a) Bacteria do not reproduce sexually

b) RNA sometimes controls the production of DNA and proteins

c) DNA is the genetic material

d) Bacteria undergo binary fission

9. In Mendelian genetics one of the following characters is the dominant: [1]

a) Green colour of seeds

b) Green colour of pods

c) Wrinkled seeds

d) Terminal flowers

10. The technology of biogas production was developed in India mainly due to the efforts of: [1]

a) Pusa Agriculture

b) ICRI and KVIC

c) IARI and KVIC

d) ISRO

11. Select the incorrect match: [1]

a) UT - Sperms in uterus

b) CSI - Low sperm count

c) GIFT - Use of anovalatory female

d) ZIFT - IVF

12. EtBr is a mutagen as: [1]

a) It is used to treat trypanosmosis

b) It causes mutations

c) It is carcinogenic

d) It fluoresces under UV

13. **Assertion (A):** Beer and wine are called soft liquors while gin, rum, etc. are hard liquors. [1]
Reason (R): Beer and wine are made without distillation.

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):** Complementary genes are non-allelic genes. [1]
Reason (R): Complementary genes interact to produce completely new traits.

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):** Among animals, birds are the most efficient agent for fruit dispersal. [1]
Reason (R): Birds have fruit eating habit and they can travel long distances.

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):** Primitive atmosphere was of reducing type. [1]
Reason (R): First hydrogen atoms are combined with all oxygen.

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. Which three options could be thought for increasing food production? [2]

18. Raj's mother wondered why the mosquitos were not responding to the mosquito repellent which she had been using for several years. Raj asked his mother to change the brand they were using. When it worked, she opined that the quality of the brand she had been using might have degraded over the time. Raj objected and explained to his mother the reality. [2]

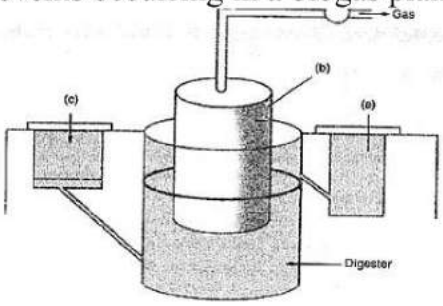
a) What values are reflected in the above case?

b) Why did the mosquitoes not respond to the repellent? Explain on the basis of Natural Selection.

c) Cite any two examples of natural selection which we often come across.

19. With the help of an example differentiate between incomplete dominance and co-dominance. [2]

20. The diagram below is that of a typical biogas plant. Explain the sequence of events occurring in a biogas plant. Identify a, b and c [2]



OR

Name the enzyme produced by Streptococcus bacterium. Explain its importance in medical sciences.

21. Give two examples of evolution from anatomy. [2]

Section C

22. i. List any three ways of measuring population density of a habitat. [3]
    ii. Mention the essential information that can be obtained by studying the population density of an organism.

23. Snake charmer came to the house and smelled the presence of a cobra which the residents had never seen in the last 10 years. The landlord agreed to allow the man to search, catch and take away with him the snake. Little Jazman disagreed and drove the man away. [3]
    i. Did Jazman do the right thing? What values did he show?
    ii. What importance do snakes have in nature?
    iii. Draw a food web showing the place of snakes.

24. Anita was happy when she gave birth to her first child. Her in-laws were dissatisfied at her not giving birth to a male child and blamed Anita. Anita tried to convince her in-laws that she had no role in the child's gender. They understood the biological reason but were yet to be satisfied. Anita's husband took up the matter and convinced the parents. [3]
    i. What values did Anita's husband show in the above situation?
    ii. What governs sex determination in humans? How is it different from birds?
    iii. Why can't Anita be blamed for not giving birth to a male child?

25. A species-area curve is drawn by plotting the number of species against the area. How is it that when a very large area is considered the slope is steeper than that for smaller areas? [3]

OR

How is biodiversity important for ecosystem functioning?

26. Why is **Saheli** considered an effective contraceptive for women to space children? **[3]**

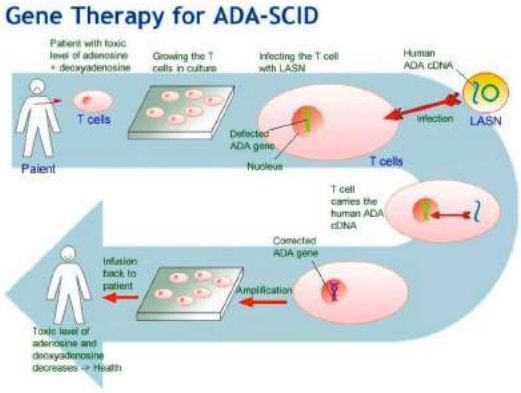
27. Define the terms **[3]**

i. Palaeontology

ii. Phylogeny

iii. Fossils.

28. This image highlights the process of Gene Therapy of ADA-SCID. **[3]**



i. Mention the cause of ADA deficiency in humans.

ii. How has genetic engineering helped patients suffering from it?

Section D

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

The first menstruation is called menarche that usually occurs between 12 and 15 years. In human females, menstruation is repeated at an average interval of about 28/29 days and is called menstrual cycle. It is regulated by certain hormones; as pituitary gland is stimulated by releasing factors produced in hypothalamus. The hormones produced by pituitary gland influence the ovaries. The hormones secreted by the ovaries affect the walls of uterus.

(i) At which phase the breakdown of endometrium occurs?

(ii) Which days of the menstrual cycle marks the proliferative phase?

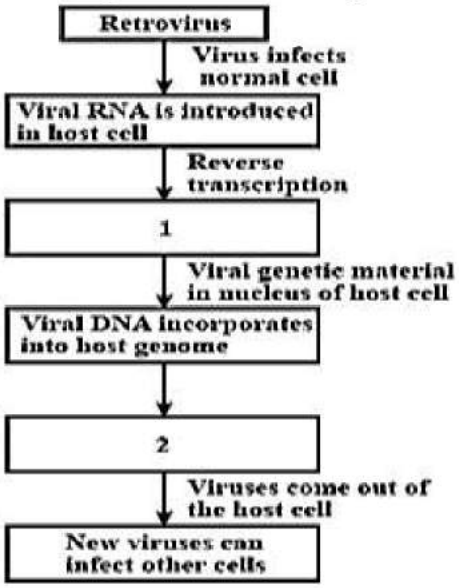
(iii) List the events that occur during secretory phase?

OR

What are the two cells that are formed after ovulation and write their fate.

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

The diagram shows the replication of the retrovirus in the host.



(i) Fill in the missing data in boxes labelled 1 & 2.

(ii) Why is it named as retrovirus?

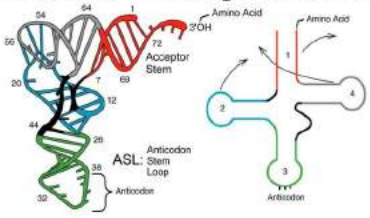
(iii) While the virus is being replicated and released, does the infected cell survive and why the virus infected cells prevent spreading of virus to healthy cells?

OR

What is the effect of HIV infection on immune system?

Section E

31. Observe the diagram for the tRNA molecule and answer the following questions: **[5]**



i. Name the scientist who called tRNA an adapter molecule.

ii. Draw a cloverleaf structure of tRNA showing the following

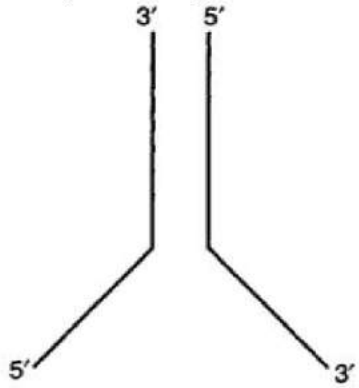
a. Tyrosine attached to its amino acid site.

b. Anticodon for this amino acid in its correct site (codon for tyrosine is UAC).

iii. What does the actual structure of tRNA look like?

OR

Study the image below and answer the questions that follows:



i. Identify the structure shown above.

ii. Redraw the structure as a replicating fork and label the parts.

iii. Write the source of energy for this replication and list the enzymes involved in this process. **OR**

iv. Mention the difference in the synthesis based on the polarity of the two template strands.

32. What are the applications of Recombinant DNA technology? **[5]**

OR

i. Why must a cell be made 'competent' in biotechnology experiments? How does calcium ion help in doing so?

ii. State the role of 'biolistic gun' in biotechnology experiments.

33. Trace the development of microspore mother cell in the anther to a mature pollen grain. **[5]**

OR

Trace the events that would take place in flower from the time of pollination upto the completion of fertilization.

SOLUTION

Section A

1. **(b)** Zoo
   Explanation: Zoo

2. **(c)** Rete testis, vasa efferentia, epididymis, vas deferens
   Explanation: The male accessory ducts are rete testis, vasa efferentia, epididymis, and vas deferens. The seminiferous tubules of the testis open into the vasa efferentia through rete testis. The vasa efferentia leaves the testis and opens into the epididymis located along the posterior surface of each testis. The epididymis leads to vas deferens that ascend to the abdomen and loops over the urinary bladder.

3. **(a)** It is inverted in shape
   Explanation: It is inverted in shape
4. **(c)** Better medical facilities
   Explanation: A high increase in the human population is due to the availability of better medical facilities to increase IMR and decrease MMR.
5. **(d)** Water
   Explanation: Water
6. **(a)** Only C and F
   Explanation: Microbes are not used in the production of antiviral drugs and the production of inorganic fertilizers. Although, microbes are used in converting milk into curd, antibiotic production, sewage treatment, bread, and cheese industry, etc.
7. **(a)** Be rapidly pumped back from the sedimentation tank to the aeration tank.
   Explanation: A small part of the activated sludge is pumped back into the aeration tank to serve as the inoculum. The remaining major part of the sludge is pumped into large tanks called anaerobic sludge digesters.
8. **(c)** DNA is the genetic material
   Explanation: DNA is the genetic material
9. **(b)** Green colour of pods
   Explanation: Green colour of pods
10. **(c)** IARI and KVIC
    Explanation: Cattle dung is used for the production of biogas, commonly called gobar gas. The technology of biogas production from cow dung was developed in India mainly due to the efforts of the Indian Agricultural Research Institute (IARI) and Khadi and Village Industries Commission (KVIC).
11. **(a)** UT - Sperms in uterus
    Explanation: UT - Sperms in uterus
12. **(b)** It causes mutations
    Explanation: EtBR or Ethidium Bromide is widely used nucleic acid stain and very strong mutagen and carcinogen. It causes mutation that cause variation or introduction of new traits.

13. **(b)** Both A and R are true but R is not the correct explanation of A.
Explanation: Beer, wine, gin, rum, vodka, etc. are fermentation products but beer and wine are formed without distillation. However, distillation of fermented broth is carried out in case rum, gin, etc. Distillation increases the alcohol concentration of the beverage. Thus, gin with 40% alcohol, rum with 40% alcohol and brandy with 60-70% alcohol are more alcoholic than beer (3-6% alcohol) and wine (9-12% alcohol).

14. **(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.

15. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation: Birds feed upon the pulpy or otherwise edible portion of the fruits. The fleshy part of the fruit gets digested in the alimentary canal and the seeds pass out along with the faeces, unharmed by the digestive juices. Such seeds then exploit the faeces as manure and germinate to establish plants of their parent kind. The birds are considered to be more probable agencies for the transportation of seeds across the natural barriers, such as water. The flight rate of some birds is as high as 180 km/per hour. Thus, the birds can disperse seeds over wide areas.

16. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation: The interstellar dust from which earth originated was especially rich in hydrogen. It readily combine with nitrogen forming ammonia, with carbon forming methane, and with oxygen forming water leaving no free oxygen. Thus, early atmosphere of primitive earth was strongly reducing, it contains hydrogen, methane, ammonia and water vapours.

Section B

17. The three options that can be thought for increasing food production are,
    - Agro-chemical based agriculture
    - Organic agriculture; and
    - Genetically engineered crop-based agriculture.

    The Green Revolution has succeeded in tripling the food supply but yet it was not enough to feed the growing human population. Scientists have decided that use of genetically modified crops is a possible solution. Plants, bacteria, fungi and animals whose genes have been altered by manipulation are called Genetically Modified Organisms (GMO).

18. **Ans-a)** Raj's mother was too judgemental while Raj had a Scientific attitude, approach and
sense of exploration.
Ans-b) Sensitive ones died leaving behind the resistant strains which multiplied to increase
their population.
Ans-c) i) Bacteria developing resistance towards antibiotics
ii) Pesticide resistance (DDT resistant mosquitoes)

19.

Incomplete Dominance	Co-dominance
Effect of one of the two alleles is more conspicuous.	The effect of both the dominant alleles is equally conspicuous.
It produces a fine mixture of the expression of two alleles in F_1.	There is no mixing of the effect of the two alleles in F_1.

Incomplete Dominance	Co-dominance
The effect in hybrid is intermediate of the expression of the two alleles.	Both the alleles produce their effect independently e.g., I^A and I^B, Hb^S & Hb^A

20. Sequence - The biogas plant consists of 10-15 feet deep tank in which the slurry of dung is fed. A floating cover is kept over the slurry which keeps on rising as the gas is produced in the tank by microbes.
    - An outlet connected to a pipe is present for the removal of gas.
    - The spent slurry is removed through another outlet which can be used a fertilizer
    - a - Sludge, b - Gasholder, c - During water

OR

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.

21. i. Progressive elaboration in the vertebrate heart. Fish-two chambered; Amphibian-three chambered; Reptile-three chambered, incomplete four-chambered (incomplete interventricular septum, in ventricles.) e.g., crocodile; Birds and Mammals four-chambered.
    ii. Elaboration found in olfactory lobes, cerebral hemispheres, optic lobes, cerebellum and medulla oblongata of fish, reptile, bird and mammals.

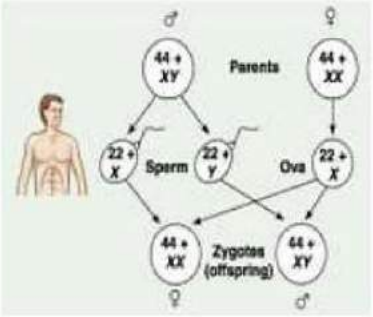
Section C

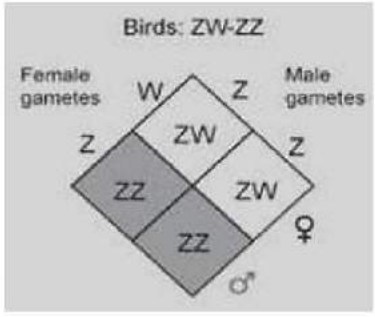
22. i. Three ways of measuring population density of a habitat.
    A- Per cent cover for trees with larger canopy
    B- Number of fishes caught per trap
    C- Pug marks or faecal pellets for tiger census.
    ii. The population density tells us about the status of a species, i.e., the outcome of competition, impact of predation or effect of pesticides, etc.
23. i. Yes. He protected the snake from being caught or killed by the snake charmer for his own selfish interest. Jazman showed values such as scientific attitude, kindness, obligation to maintain the biodiversity of nature.
    ii. Snake is an important member in the food chain and food web.
    iii. 2 & 3

24. i. Strong and determined personality with responsibility towards the family and respect for elders

ii. Sex chromosomes. In human males it is XY and in the female it is XX. In birds, the male is ZZ while the female is ZW.

iii. Human females are homogametic i.e. produces only one type of gametes containing 22+X chromosomes only. Males are heterogametic and produce two types of gametes 22+X and 22+Y. It is the type of male gamete which determines the sex of the foetus. If X chromosome containing sperm fuses with the egg, it produces a female child whereas if Y chromosome containing sperm fuses with the egg, it produces a male child.





25. When we consider a large area to assess the species-area curve, we need to understand the advantages offered by the large areas. A larger area means more resources and a higher number of plants. This will provide more food to sustain more individuals. Thus, species richness increases with an increase in the explored area. This explains the occurrence of the steeper slope when we draw the species-area curve for a large area.

OR

1. Biodiversity is essential for the stability of an ecosystem. Communities having more species tend to be more stable than those with less species. It is able to resist occasional disturbance.
2. Productivity of an ecosystem is directly influenced by its species richness. Ecosystem with higher biodiversity are more productive than ecosystem with lower biodiversity. For example, tropical forests are more productive than temperate forests.
3. More variety of food chain and complex food web is found in an area with rich biodiversity. This is essential for survival and continuation of species.
4. Biodiversity is essential for maintenance and health of ecosystem.

26. **Oral pills/Injections/Implants:** Hormonal preparations (Progestogens or progestogens and estrogen) inhibit ovulation and implantation. “Saheli", a new oral pill is used once-a-week". It's a steroid preparation with very fewer side effects and high contraceptive value developed by CDRI in Lucknow, India.

27. i. **Paleontology:** It is the study of fossils. The fossils are the remains or impressions of ancient animals and plants preserved in rocks. Paleontological studies provide the most direct evidence for evolution as it deals with the actual organisms of the past. Paleontological evidence has also enabled us to trace the phylogenetic history of many animals.

ii. **Phylogeny:** It is the study of the evolutionary history of an organism. It tells us how a species developed during the course of time and its relation with other genetically similar or close species.

iii. **Fossils:** These are the remains or impressions of the organisms from the remote past. Examination of various layers of earth from the deepest to the most

superficial strata for the fossil record can help in deduction of the story of life in correct historical sequence i.e., the geological timescale.

28. i. Deletion of the gene for ADA in an individual leads to ADA deficiency disorder Adenosine Deaminase (ADA) enzyme is crucial for immune system to function.
    ii. Gene therapy is helpful in the treatment of ADA deficiency.
    The treatment involves the following steps:
    a. Lymphocytes from the blood of patient are grown on a culture outside the body.
    b. A functional ADA, cDNA (using a retroviral vector) is then introduced into these lymphocytes.
    c. Such genetically engineered lymphocytes are returned to the blood of patient.
    d. Periodic infusion of such genetically engineered lymphocytes is required by the patient.

Section D

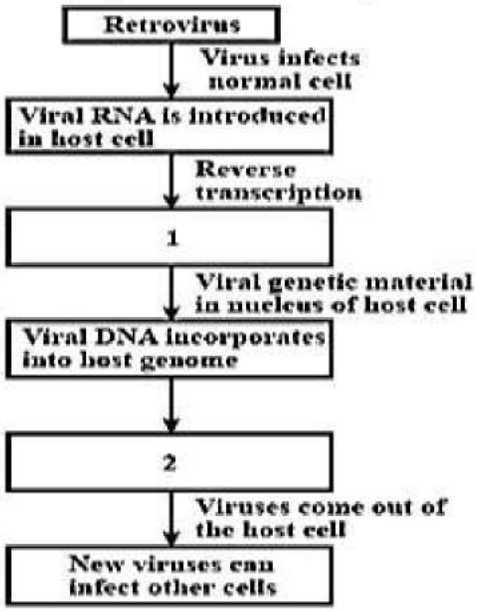
29. **Read the text carefully and answer the questions:**
    The first menstruation is called menarche that usually occurs between 12 and 15 years. In human females, menstruation is repeated at an average interval of about 28/29 days and is called menstrual cycle. It is regulated by certain hormones; as pituitary gland is stimulated by releasing factors produced in hypothalamus. The hormones produced by pituitary gland influence the ovaries. The hormones secreted by the ovaries affect the walls of uterus.
    (i) Menstrual phase
    (ii) 10-12 days after menstruation
    (iii)The endometrium (uterine lining) gets ready to support pregnancy. The cells of the lining make and release many types of chemicals. Progesterone level rises. This causes the uterine lining to thicken and prepare for implantation if an egg gets fertilized.

    OR

    i. Secondary oocyte- It enters fallopian tube for fertilization after second meiotic division if male gamete enters otherwise it disintegrates.
    ii. Polar body- it remains inside ovary and disintegrates.

30. **Read the text carefully and answer the questions:**

The diagram shows the replication of the retrovirus in the host.



(i) 1. Viral DNA is produced by reverse transcription.
2. New viral RNA is produced by the infected cell.

(ii) HIV has RNA genome; it produces DNA by reverse transcription.

(iii) Infected cell can survive and by releasing alpha-interferon.

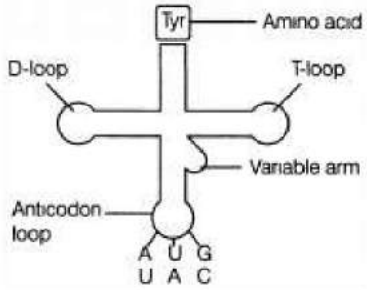
OR

Due to HIV infection immune system gets suppressed as decrease in T-lymphocytes occurs.

Section E

31. i. Francis Crick.

ii. A clover leaf structure of tRNA



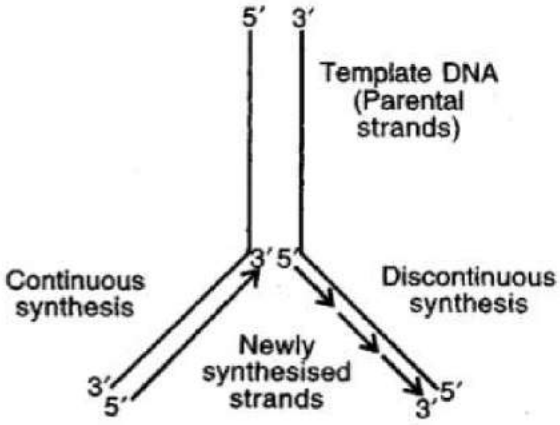
A tRNA functions as carrier of amino acids and participates in protein synthesis.

iii. The actual structure of tRNA looks like an inverted I.

OR

a. The diagram shown is of the replication fork.

b. **Fig: Labeled diagram of replication fork**



c. Activated deoxyribonucleotide triphosphate (dNTPs) act as substrate and also provides energy for polymerisation reaction, similar to ATP.

List of enzymes:

i. **Helicases:** It unwinds the two strands of DNA.

ii. **Single-stranded DNA binding proteins:** They bind to the single strands and stabilize them.

iii. **Topoisomerases:** They release tension in the uncoiled part by nicking and then resealing the straightened DNA strands.

iv. **RNA polymerase primase:** They are needed for primer synthesis to initiate the replication process.

v. **DNA polymerase:** It adds the new nucleotides thus replicating the DNA. (Prokaryotes have three major types of DNA polymerases III, II and I).

vi. **DNA ligase:** The Okazaki fragments are joined by this enzyme at the end of replication.

d. On the template strand with 3' $\longrightarrow$ 5' polarity (leading strand), the synthesis of new strand is continuous while on the other template strand with 5' $\longrightarrow$ 3' polarity (lagging strand), the synthesis of new strand is in discontinuous fashion forming **Okazaki fragments.**

32. Applications of Recombinant DNA Technology are as follows:

i. **Study of Molecular Events:** The technology is used in the study of molecular events of various development stages like cellular differentiation, morphogenesis, ageing, etc.

ii. **Gene Maps:** Recombinant DNA technology can be employed to make gene maps.

iii. **Development Stages:** A development stage can be stopped, delayed or quickened through manipulation of genes. Mutation of ageing genes in roundworms has shown an increase in the life of the animals by four times.

iv. **Antisense Therapy:** Extra-activity of genes of a particular region can be checked by introducing specific DNA fragments. The treatment is called antisense therapy.

v. **Foods with Extra Biochemicals:** With the help of *Agrobacterium tumefaciens* and viruses, genes for synthesis of various biochemicals can be introduced in plants e.g., Bananas producing vaccines.

vi. **Study of Defective Genes:** The technique can be used in the study of defective genes in the foetus stage.

vii. **Tailor-Made Organisms:** Useful plants, animals and microbes can be tailor-made to suit varied human needs.

viii. **Medical Diagnosis of Diseases:** Short segments of single-stranded DNA with attached fluorescent or radioactive marker are being used as probes for identification of infectious diseases like hepatitis, HIV, cystic fibrosis, muscular dystrophy, etc.

OR

i. Since, DNA molecules are hydrophilic, they cannot pass through cell membranes. For recombinant DNA to be integrated into the vector or host genome, it is necessary for the DNA to be inserted in the cell. Therefore, making the host cells competent is necessary for biotechnology experiments.
The two ways by which cells can be made competent to take up DNA are:
   a. **Chemical action** -The host cell is treated with a specific concentration of divalent cation, i.e. calcium which increases the pore size in the cell membrane. DNA is then incubated with the treated bacterial cell at 42°C, thereby increasing the efficiency of DNA entering through pores in the cell wall.
   b. **Heat shock treatment-** Incubating the cells with recombinant DNA on ice, followed by a brief treatment of heat at 42°C and again putting them back on ice.

ii. Biolistic guns or gene guns are used to bombarded rDNA loaded on gold or tungsten particles with high velocity. In this way, the rDNA is delivered to the desired host cells.

33. **Microsporogenesis** comprises the events which lead to the formation of the haploid unicellular microspores. During microsporogenesis, the diploid sporogenous cells differentiate as microsporocytes (pollen mother cells or meiocytes) which divide by meiosis to form four haploid microspores. Each diploid meiocyte gives rise to a tetrad of four haploid microspores and microsporogenesis is complete with the formation of distinct single-celled haploid microspores.

Microgametogenesis comprises events which lead to the progressive development of the unicellular microspores into mature microgametophytes containing the gametes. This phase begins with the expansion of the microspore which is commonly associated with the formation of a single large vacuole. Vacuolation is accompanied by the displacement of the microspore nucleus to an eccentric position against the microspore wall. In this position, the nucleus undergoes first pollen mitosis (pollen mitosis I) which results in the formation of two unequal cells, a large vegetative cell and a small generative cell each containing a haploid nucleus. The generative cell subsequently detaches from the pollen grain wall and is engulfed by the vegetative cell forming a unique 'cell within a cell' structure. The engulfed generative cell divides once more by mitosis (pollen mitosis II) to form the two sperm cells completely enclosed within the vegetative cell cytoplasm either before pollen is shed (tricellular pollen) or within the pollen tube (bicellular pollen).

OR

Soon after pollination, pollen grains absorb stigmatic secretions and start germinating. A pollen tube or germ tube emerges from one of germ pore and after passing through the stigma and style, reaches the ovule. In the meantime, the generative nucleus divides and forms two male gametes of it has not divided earlier. Finally, the pollen tube enters the embryo sac through micropyle sometimes through integuments or chlaza. One of the male gametes fuses with egg to form zygote which later gives rise to the embryo. The phenomenon is termed syngamy or generative fertilisation and the other male gamete fuses with the secondary nucleus to form the primary endosperm nucleus which later gives rise to endosperm-vegetative

fertilization.

In angiosperm two components egg and secondary nucleus are fertilized at the same time by two different male gametes and this phenomenon is termed double fertilization.