Date: 27/03/2026

Question Paper Code

57/2/2

Set-2

***Corporate Office*: Aakash Educational Services Limited,**
3rd Floor, Incuspaze Campus-2, Plot No. 13, Sector-18, Udyog Vihar, Gurugram, Haryana - 122015

Time: 3 hrs.

BIOLOGY (Theory)

Max. Marks: 70

CBSE Board Class-XII Exam (2026)

Answers & Solutions

GENERAL INSTRUCTIONS

Read the following instructions very carefully and strictly follow them:

(i) This question paper contains **33** questions. **All** questions are compulsory.

(ii) Question paper has five sections: Section **A**, Section **B**, Section **C**, Section **D** and Section **E**.

(iii) **Section A** contains sixteen questions, **12** Multiple Choice type questions (1-12) **(MCQs)** and **4** Assertion Reasoning **(A-R)** type questions (13-16) of **1 mark** each.

(iv) **Section B** contains **5** Very Short Answer (VSA) type questions (17-21) of **2 marks** each.

(v) **Section C** contains **7** Short Answer (SA) type questions (22-28) of **3 marks** each.

(vi) **Section D** contains **2** Case-Based Questions (CBQ) (29 & 30) of **4 marks** each. Each question has subparts with internal choice in **one** of the subparts.

(vii) **Section E** contains **3** Long Answer (LA) type questions (31-33) of **5 marks** each.

(viii) There is no overall choice. However, internal choices have been provided in some questions. A candidate has to attempt only **one** of the choices in such questions.

(ix) Wherever necessary, neat and properly labelled diagrams should be drawn.

SECTION-A

Question Nos. **1 to 16** are Multiple Choice type Questions, carrying 1 mark each. **16 × 1 = 16**

1. Genetically modified tobacco plants were produced using *Agrobacterium* vectors. Which property of *Agrobacterium* helps in carrying nematode specific genes into the host plant?

   (A) Infectious for monocot plant; has Ti plasmid

   (B) Infectious for dicot plant; has Ti plasmid

   (C) Infectious for plants and animals; has Ti plasmids

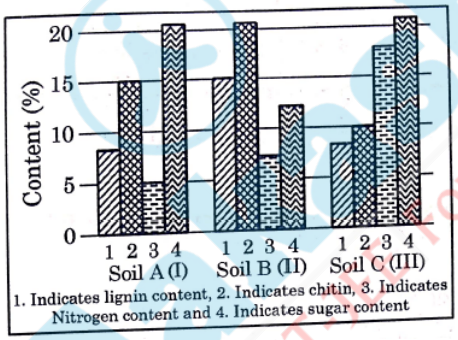
   (D) Infectious for monocot and dicot plants; has cry gene

Answer (B)

Sol. The correct answer is option (B) as *Agrobacterium tumefaciens*, a pathogen of several dicot plants, is able to deliver a piece of DNA known as 'T-DNA' to transform normal plant cells into a tumor and direct these cells to produce the chemicals required by the pathogen.

The tumor inducing plasmid of *Agrobacterium* has now been modified into a cloning vector which is no more pathogenic to the plants but is still able to use the mechanisms to deliver genes of our interest into a variety of plants.

2. Observe the contents 1, 2, 3 and 4 of soil samples I, II and III shown in the graph. If the temperature and moisture of all soil samples are identical, which soil sample(s) will show faster decomposition?



   (A) Soil Sample I

   (B) Soil Sample II

   (C) Soil Sample III

   (D) Both Soil Samples II and III

Answer (C)

Sol. Decomposition rate is slower if detritus is rich in lignin and chitin, and quicker, if detritus is rich in nitrogen and water soluble substances like sugar.

In the given graph, soil sample C(III) have more nitrogen and sugar as compare to soil sample A(I) and B(II). Soil A(I) and B(II) have more amount of chitin. Therefore, soil C(III) will show faster decomposition.

3. A woman having genes for haemophilia on one X chromosome and a gene for colour blindness on another X chromosome marries a normal man. The progeny will show

   (A) 50% haemophilic and colour-blind sons, 50% normal sons.

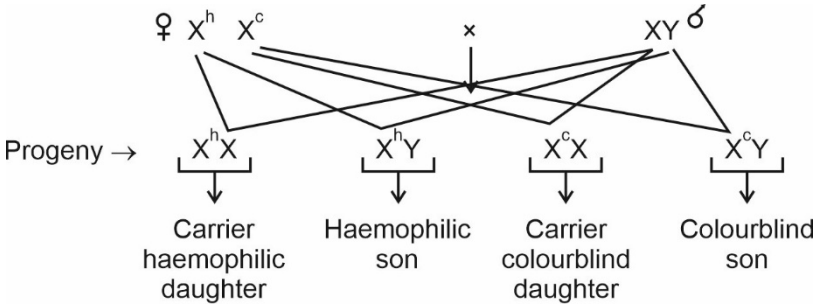
   (B) 50% haemophilic carrier daughter, 50% colour-blind carrier daughters.

   (C) All sons and daughters colour−blind and haemophilic.

   (D) Only haemophilic and colour—blind daughters

Answer (B)

Sol.



As both haemophilia and colour blindness are X-linked recessive disorder, the progeny is showing 50% haemophilic carrier daughter, 50% colour-blind carrier daughters, 50% sons haemophilic and 50% sons colour-blind.

4. Which of the following is an important parameter for assessing the impact of any biotic or abiotic factor on population growth?

(A) Birth rate
(B) K-carrying capacity
(C) Death rate
(D) r-Intrinsic rate of natural increase

Answer (D)

Sol. Intrinsic rate of natural increase(r) is a very important parameter chosen for assessing impacts of any abiotic or biotic factor on population growth.

5. If a sperm nucleus is injected into an oocyte then all of the following events are bypassed except

(A) The swimming of sperm to meet the egg in the oviduct.
(B) The sperm's acquisition of motility in the epididymis.
(C) A sperm comes in contact with the zona pellucida layer of the ovum.
(D) The complex process like cell division and cell differentiation.

Answer (D)

Sol. The correct option is (D) because

The process of directly injecting a single sperm in oocyte bypasses steps involving pre-fertilisation events such as :

- The sperm's acquisition of motility in the epididymis.
- Swimming of sperm to meet the egg in the oviduct.
- The reaction involving release of acrosomal enzymes to penetrate outer egg layers.
- Reaction when sperm comes in contact with the zona pellucida layer of the ovum.

Though, further processes like cell division and differentiation will occur after fertilization.

6. If A = species richness and B = Endemism then biodiversity hotspots have

(A) low degree of A and low degree of B.
(B) low degree of A and high degree of B.
(C) high degree of A and low degree of B.
(D) high degree of A and high degree of B.

Answer (D)

Sol. The key criteria for determining a hotspots are:

(1) Very high levels of species richness
(2) High degree of endemism (species confined to that region and not found anywhere else)
(3) Degree of threat, which is measured in terms of habitat loss.

7. Two plants whose DNA has been sequenced are

(A) Rice and Wheat

(B) Wheat and Maize

(C) Maize and Barley

(D) Rice and *Arabidopsis*

Answer (D)

Sol. Many non-human model organisms, such as bacteria, Yeast, *Caenorhabditis elegans* (a free-living non-pathogenic nematode), *Drosophila*, plants (rice and *Arabidopsis*), *etc.*, have been sequenced.

8. Antivenom injection is an example of

(A) Natural Active Immunity

(B) Artificial Active Immunity

(C) Natural Passive Immunity

(D) Artificial Passive Immunity

Answer (D)

Sol. The correct answer is option D because antivenom injection contains preformed antibodies.

Options A, B and C are incorrect.

Natural active immunity develops when a person is exposed to a live antigen/pathogen. When weakened or dead microbes or pathogens are intentionally introduced into the body, then the immunity that develops is called artificial active immunity.

Natural passive immunity develops when antibodies are transferred naturally from one individual to another.

9. To separate repetitive DNA from bulk genomic DNA, which of the following method is used?

(A) Elution

(B) Southern Blotting

(C) Polymerase Chain Reaction

(D) Density Gradient Centrifugation

Answer (D)

Sol. The repetitive DNA are separated from bulk genomic DNA as different peaks during density gradient centrifugation.

The bulk DNA forms the major peak while the other small peaks are referred to as satellite DNA.

10. What conclusion can be drawn if the forelimbs of an aquatic animal and a terrestrial animal have similar anatomical structure?

(A) Live in same habitat

(B) Share common ancestors

(C) Forelimbs perform same functions

(D) Forelimbs are analogous

Answer (B)

Sol. Option (B) is the correct answer because forelimbs of an aquatic animal and a terrestrial animal have similar anatomical structures, which shows that both of them have evolved from common ancestors. In these animals, the same structures developed along different directions due to adaptations to different needs. This is divergent evolution and these structures are homologus and homology indicates common ancestry.

11. Which of the following is used to visualize DNA bands under UV light after gel electrophoresis?

(A) Acetocarmine

(B) Safranine

(C) Ethidium Bromide

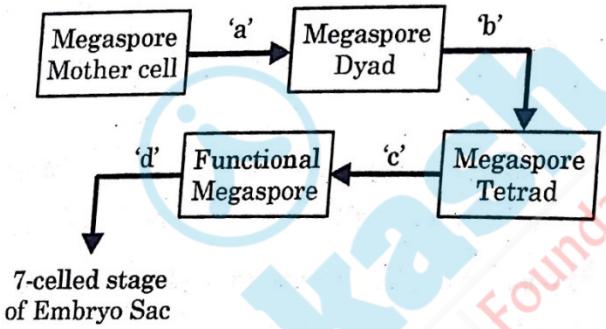
(D) Potassium Iodide

Answer (C)

Sol. The correct answer is option (C) as the separated DNA fragments (after gel electrophoresis) can be visualised only after staining the DNA with a compound known as ethidium bromide followed by exposure to UV radiation. We cannot see pure DNA fragments in the visible light and without staining. We can observe bright orange coloured bands of DNA in a ethidium bromide stained gel exposed to UV light.

Acetocarmine stain is commonly used in microscopy to colour chromosomes and nuclei. Safranine is a stain used in gram staining.

12. Given below are stages of embryo sac formation from megaspore mother cell. Identify the correct option for the cell division marked a, b, c and d.



(A) a-Meiosis-I, b-No division, c-Mitosis, d-Meiosis-II

(B) a-Meiosis-I, b-Meiosis-II, c-No division, d-Mitosis

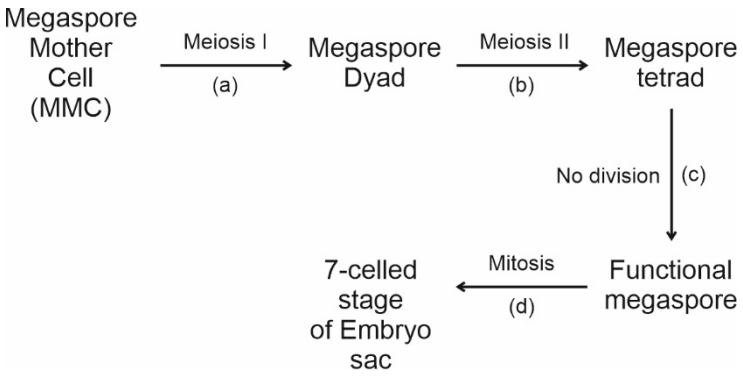
(C) a-Mitosis, b-Meiosis-I, c-Meiosis-II, d-No division

(D) a-No division, b-Mitosis, c-Meiosis-I, d-Meiosis-II

Answer (B)

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

Process of megasporogenesis in majority of angiosperms is as follows:-



Therefore, (a)-Meiosis I, (b)-Meiosis II, (c)-No division, (d)-Mitosis

Question Number **13** to **16** consists of two statements - Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

(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.

13. **Assertion (A):** Pollen grains have a mucilaginous covering on them in most of the water pollinating plants.

Reason (R): Mucilaginous covering help pollen grains to be submerged in water.

Answer (C)

Sol. In most of the water pollinated species, pollen grains are protected from wetting by a mucilaginous covering.

14. **Assertion (A):** Microbes are used for commercial production of alcohol and beverages.

Reason (R): Yeast converts glucose into ethanol and carbon dioxide during fermentation.

Answer (A)

Sol. Yeast (*Saccharomyces cerevisiae*), is one of the microbes used for commercial production of alcohol and beverages because yeast converts glucose into ethanol and carbon dioxide during fermentation.

15. **Assertion (A):** IUCN Red List helps in identifying and protecting endangered species worldwide.

Reason (R): The list includes the species facing risk of extinction.

Answer (A)

Sol. Here, Both (A) and (R) are true and (R) is the correct explanation of (A).

The IUCN Red List (2004) documents the extinction of 784 species in the last 500 years.

It also helps in identifying and protecting endangered species worldwide because it includes the species facing risk of extinction.

It acts as a global inventory that identifies species facing extinction risks. It acts as a 'Barometer of life' to guide conservation action, policy and funding to protect biodiversity worldwide.

16. **Assertion (A):** DNA Ligase is used to join DNA fragments.

Reason (R): It catalyses the formation of glycosidic bonds between nucleotides.

Answer (C)

Sol. Assertion is true but Reason is false.

DNA ligase is used to join DNA fragments of the lagging strand during DNA replication.

This enzyme joins the DNA fragments by the formation of phosphodiester bond between the nucleotides.

SECTION-B

17. (a) Is it possible for a trait to be inherited by an organism but not expressed in its phenotype?

Justify and illustrate your answer with a suitable Mendelian Cross. **[2]**

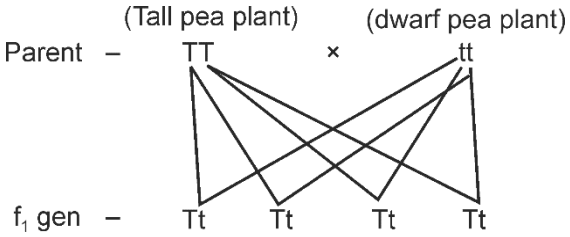
OR

(b) Explain the two major approaches used while sequencing the total DNA from a cell

Sol. (a) Yes, a trait can be inherited by an organism but not expressed in its phenotype.

In a pair of dissimilar factors, one dominates the other and hence one factor is called the dominant factor while the other factor is recessive. A recessive allele is expressed only when an individual is homozygous.

Justification:



In this Mendelian cross recessive allele inherited but not expressed its phenotype as dominant allele mask the expression of recessive allele.

OR

(b) There are two major approaches for sequencing the total DNA from a cell.

1. **Expressed sequence tags (ESTs):** This approach focused on identifying all the genes that are expressed as RNA.
2. **Sequence annotation:** It is the blind approach of simply sequencing the whole set of genome that contained all the coding and non-coding sequence, and later assigning different regions in the sequence with functions.

18. Briefly describe the process of DNA extraction from a fungal cell. Name the chemicals used in the process. **[2]**

Sol. Since the DNA is enclosed within the membranes, we need to break the cell open to release DNA along with other macromolecules such as RNA, proteins, polysaccharides and also lipids.

Thus, for the extraction of the genetic material from a fungal cell, the following steps should be followed:

1. Take the fungal cell and perform lysis of its cell wall using the enzyme chitinase.
2. Then, purify the mixture obtained after cell lysis by using enzymes such as:
   - Proteases – For removal of proteins
   - RNases – For removal of RNAs
   - Lipases – For removal of lipid
3. After purification, the pure DNA obtained needs to be isolated and for that, chilled ethanol is used.

   Chilled ethanol precipitates the DNA, which can be extracted *via* spooling.

19. Differentiate between opioids and cannabinoids on the basis of their

(a) Receptor site in human body. **[½+½]**

(b) Mode of action in human body. **[½+½]**

Sol. (a) **<u>Difference between opioids and cannabinoids</u>**

On the basis of receptor site in human body

Opioids	Cannabinoids
Receptors precent in our central nervous system and gastrointestinal tract	Receptors present principally in the brain

(b) On the basis of mode of action in human body

Opioids	Cannabinoids
The mode of action involves sedation, painkiller and act as a depressant and slows down body function	Effects seen on cardiovascular system of the body

20. (a) (i) Name the organ that forms a connection between foetus and the uterus of a pregnant human female. **[0.5]**

(ii) How does it support both nutrition and hormonal regulation? **[1.5]**

OR

(b) Give reasons for:

(i) All copulations do not lead to pregnancy. **[1]**

(ii) Meiosis I in spermatogenesis and oogenesis are markedly different. **[1]**

Sol. (a) (i) The organ that forms a connection between foetus and the uterus of a pregnant human female is placenta

(ii) The placenta is connected to the embryo through umbilical cord which helps in transport of nutrients such as glucose, amino acids, fatty acids and vitamins from mother to foetus.

The placenta also functions as endocrine organ as it secretes important hormones such as

- hCG – human chorionic gonadotropin
- Progesterone
- Estrogen
- hPL – human placental lactogen

OR

(b) (i) All copulations do not lead to pregnancy because fertilisation can only occur if the ovum and sperms are transported simultaneously to the ampullary region of fallopian tube.

(ii) Meiosis-I in spermatogenesis and oogenesis are markedly different because meiosis I in oogenesis starts during embryonic development stage while in spermatogenesis meiosis I starts at puberty.

21. (a) In some cases, measuring population density by counting individuals may not be feasible. Mention two other parameters that can be used and justify their use with suitable examples. **[2]**

OR

(b) What factors contribute to the Amazonian rain forests in South America being the most biodiverse regions on Earth? **[2]**

Sol. (a) Although total number is generally the most appropriate measure of population density, but in some cases, it is either meaningless or difficult to determine

In such cases other parameters like

- Biomass or percent cover can be used

  Example: In an area, if there are 200 *Parthenium* plants but only a single huge banyan tree with a large canopy, stating that the population density of banyan is low relative to that of *Parthenium* amounts to underestimating the enormous role of the Banyan tree in that community. In such case, the percent cover or biomass is a more meaningful measure of population density

- **Indirect count :** Population size can also be carried out indirectly without seeing the organism

  Example: The tiger census in national parks and tiger reserves in India is often based on pug marks or fecal pellets.

OR

(b) Amazonian rain forest in south America is located in tropical latitude.

Ecologists and evolutionary biologists have proposed various hypothesis to explain the cause of high diversity in tropics. Some important ones are as follows:

- Speciation is function of time, unlike temperate areas that have undergone frequent glaciations in the past, tropical latitudes have remained relatively undisturbed for millions of years and thus, had a long evolutionary time for species diversification.
- Tropical environments, unlike temperate ones, are less seasonal, relatively more constant and predictable. Such constant environments promote niche specialisation and lead to greater species diversity.
- There is more solar energy available in the tropics, which contributes to higher productivity; this in turn might contributes indirectly to greater diversity.

SECTION-C

22. (a) A person inhales dust and pathogens but does not always fall sick. Explain how the body protects against such infections. **[1]**

(b) Name and describe any two barriers involved in this protection. **[2]**

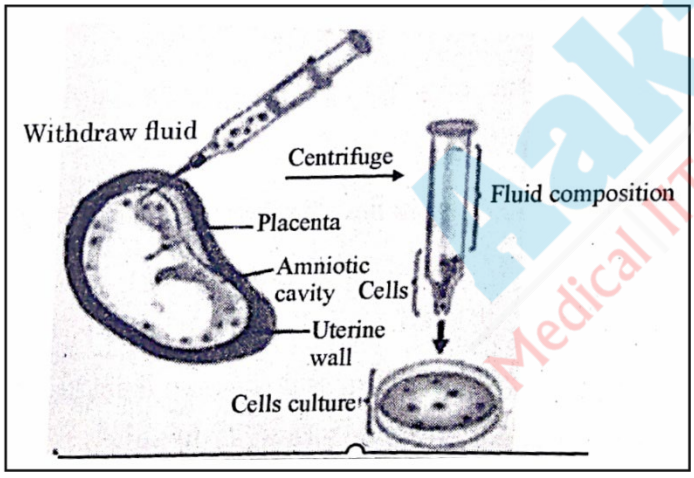
Sol. (a) Every day we are exposed to large number of infectious agents but do not always fall sick due to the fact that the body is able to defend itself from most of foreign agents, this overall ability of host to fight the disease-causing organisms, is conferred by the immune system called immunity.

(b) Two types of barriers involved in innate immunity are:

(i) **Physical barrier:** Skin on our body is the main barrier which prevents entry of the micro-organisms. Other examples are mucus coating of the epithelium lining the respiratory and gastrointestinal tracts.

(ii) **Physiological barrier:** Acid in the stomach, saliva in the mouth, tears from eyes-all are secretions of the body which prevent microbial growth.

23. Study the diagram given below:



(a) Name and explain the procedure shown in the diagram. Mention one of its advantage and one disadvantage. **[2]**

(b) How is 'Saheli' different from other oral pills in terms of its composition and advantage? **[1]**

Sol. (a) The name of the procedure is amniocentesis

In amniocentesis some of the amniotic fluid of the developing foetus is taken to analyse the fetal cells and dissolved substances.

Advantage: This procedure is used to test for the presence of certain genetic disorders such as down syndrome, haemophilia, sickle cell anaemia, etc., and determine the survivability of the foetus.

Disadvantage: Sex determination followed by female foeticides.

(b) Saheli is different from other oral pills as it is a non-steroidal preparation, taken 'once a week'

It has very few side effects and high contraceptive value in comparison to other steroidal oral contraceptive pills.

24. Chasmogamous flowers remain open and expose their reproductive parts. Explain how this structural feature supports different types of pollination. **[3]**

Sol.
- Chasmogamous flowers with exposed anthers and stigma allows pollinating agents like insects, wind, water, bees, etc. to bring pollen from a different plant's flower (of same species) to stigma [promoting xenogamy]
- The open structure allows pollinating agent to travel between different flowers on the same plant (promoting geitonogamy)
- These chasmogamous flowers can be having colourful petals, producing scents and nectar to attract the animal pollinators.
- These flowers can also exhibit self pollination (autogamy) if the maturation time of male and female reproductive part is same or these are present very close to each other.

25. (a) What is a genetic code? **[1]**

(b) Why did scientists feel the need to propose a genetic code? **[1]**

(c) Genetic code is said to be 'Universal'. Why? **[1]**

Sol. (a) **Genetic code:** It refers to the three-letter combination of nucleotides for a particular amino acid and can direct the sequence of amino acids during the synthesis of proteins.

(b) The process of translation requires transfer of genetic information from a polymer of nucleotides to synthesise a polymer of amino acids. There existed ample evidences to support that change in nucleic acids were responsible for change in amino acids in proteins. This led to the proposition of a genetic code that could direct the sequence of amino acids during protein synthesis.

(c) The genetic code is said to be universal because the same codon codes for the same amino acid in all the living organisms.

26. There are limitations of traditional breeding techniques that led to promotion of micro-propagation?

(a) Mention two advantages of micropropagation. **[2]**

(b) Give two examples where it is commercially adopted. **[1]**

Sol. (a) (i) By using micro-propagation it is possible to achieve propagation of a large number of plants in very short durations.

(ii) The plants produced using this method will be genetically identical to the original plant from which they are grown. These plants are called somaclones.

(b) Many important food plants like tomato, banana, apple etc., have been produced on commercial scale using micro-propagation.

27. (a) Give the scientific name of the organism used by Morgan to study sex-linked traits. **[1]**

(b) Write any four reasons why this organism made it an ideal experimental model. **[2]**

Sol. (a) T.H. Morgan carried out several dihybrid crosses in *Drosophila melanogaster* to study genes that were sex-linked.

(b) *Drosophila melanogaster* is an ideal experimental model because of the following reasons:

(i) They could be grown on simple synthetic medium in laboratory.

(ii) They complete their life cycle in about two weeks.

(iii) Single mating could produce a large number of progeny flies.

(iv) Clear differentiation of the sexes *i.e.*, male and female flies are easily distinguishable.

(v) Hereditary variations can be seen with low power microscope. **[Any Four]**

28. S.L. Miller conducted an experiment in 1953 to simulate the conditions of early earth in a laboratory setup.

Answer the following questions based on the experiment:

(a) What was the aim of his experiment? **[1]**

(b) Name the gases used and the source of energy. **[2]**

Sol. (a) S.L. Miller performed 'the simulation experiment' to prove the 'theory of chemical evolution' for origin of life, which was proposed by Haldane and Oparin.

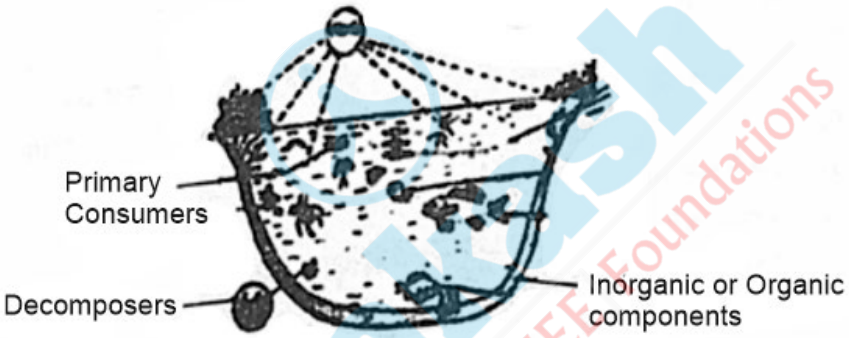
(b) The gases used in this experiment were CH_4 (methane), H_2 (hydrogen), NH_3 (ammonia) and water vapour.

He created electric discharge (using electrodes) in a closed flask containing the above mentioned gases at 800°C.

SECTION-D

Q. No. **29** and **30** are case based questions. Each question has 3 sub-questions with internal choice in one sub-question.

29. Below is shown a pond that represents a self-sustaining natural ecosystem with both biotic and abiotic components interacting in a balanced food wed.



Based on the diagram, answer the questions:

(a) Mention two abiotic components of a pond ecosystem. **[1]**

(b) Differentiate between the roles of producers and decomposers in such an ecosystem. **[2]**

(c) Draw a simple food chain operating in such an ecosystem and label each trophic level. **[1]**

OR

(c) Why is transfer of energy not 100% efficient between trophic levels? **[1]**

Sol. (a) In a pond ecosystem, the abiotic components are the water with all the dissolved inorganic and organic substances, and rich soil deposit at the bottom of pond.

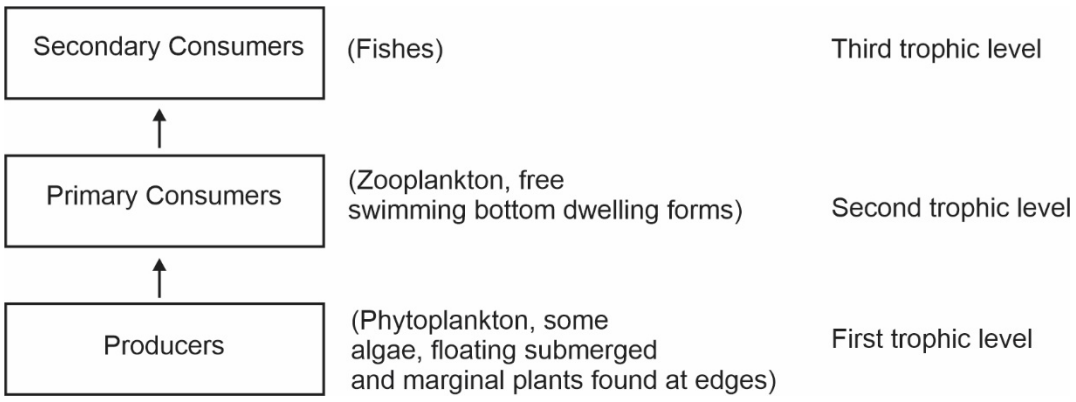
(b) **Role of producers**

- Conversion of inorganic material into organic material with the help of the radiant energy of the sun.
- Self nourishing (autotrophs)

Role of Decomposers

- Breakdown of complex organic matter into inorganic substances like carbon dioxide, water and nutrients, subsequently absorbed by them.
- Replenish the soil naturally with minerals.

(c)



OR

(c) There is unidirectional flow of energy towards the higher trophic levels from lower levels, during this flow, a significant amount of energy is always lost/dissipate as heat to the environment and other biological processes at each step.

30. Gene manipulation is a fast emerging science. It started with the development of recombinant DNA molecules. This technology which mostly involves cutting and pasting of desired DNA fragments is based on two most important discoveries in bacteria – presence of plasmid and restriction endonucleases. The science of r-DNA technology took birth when Cohen and Boyer (1973) were able to produce a piece of gene containing foreign DNA introduced into plasmid of *E.coli*.

(a) Name one core technique of biotechnology that alters the genetic material. **[1]**

(b) What is a plasmid? Mention its importance in biotechnology. **[2]**

(c) Which gene was isolated by Cohen and Boyer and from which bacteria? **[1]**

OR

(c) How is the action of exonuclease different from that of endonuclease? **[1]**

Sol. (a) The core technique of biotechnology that alters the genetic material is called genetic engineering.

(b) Plasmid is an autonomously replicating, double-stranded circular extra-chromosomal DNA.

It is also described as small ringlets of dsDNA which floats about freely in the cytoplasm of certain bacterial cells.

In biotechnology, plasmids are used as vectors for gene cloning, genetic engineering, *etc*., because they are easy to isolate, manipulate and re-insert into cells.

(c) Cohen and Boyer isolated the gene encoding antibiotic resistance from the plasmid of *Salmonella sp*.

OR

(c) Endonucleases cut within the DNA molecule, whereas exonucleases remove nucleotides from the ends of the DNA molecule.

SECTION-E

31. (a) A 30 year old man was admitted to a hospital with recurrent infections, weight loss, prolonged fever. His blood report showed a decline in count of T-Lymphocytes thus affecting immune system.

(i) Identify the disease and its causative agent. **[2]**

(ii) How did the pathogen affect the immune system once it entered the body? Explain. **[2]**

(iii) Mention two major modes of its transmission. **[1]**

OR

(b) (i) Why are microbes considered effective biocontrol agents in sustainable agriculture? **[1]**

(ii) Explain the role of the following as biocontrol agents naming the pests or diseases they help to control:

(1) A Bacterium **[1½]**

(2) A Fungus **[1]**

(3) Virus **[1½]**

Sol. (a) (i) The condition described is AIDS and it is caused by Human immunodeficiency virus (HIV)

(ii) One HIV enters the body, it specifically targets $CD4^+$ cells/T-helper lymphocytes which are crucial for immunity.

Stepwise mechanism:

1. Attachment and entry : Viral envelope fuses with host cell membrane and viral RNA enters into the cell.
2. Reverse transcription: Viral DNA is produced by reverse transcriptase.
3. Integration : Viral DNA incorporates into host genome
4. Replication : New viral RNA is produced by the infected cell.

(iii) Major modes of transmission:

(a) Sexual contact with infected person

(b) By transfusion of contaminated blood and blood products

(c) By sharing infected needles as in the case of intravenous drug abusers.

(d) From infected mother to her child through placenta.

OR

(b) (i) Microbes are considered effective biocontrol agents in sustainable agriculture because they have potential to be applied as narrow spectrum insecticides and can be applied in a variety of ways such as spores and via genetic engineering.

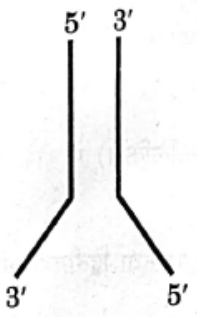
(ii) The role of certain biocontrol agents to control pests or diseases are as following.

(1) *Bacterium* : *Bacillus thuringiensis* is used in order to control butterfly caterpillars. They can be applied as dried spores or their Bt toxin gene can be introduced into plants such as Bt-cotton.

(2) *Fungus* : *Trichoderma* is a free living fungus commonly found in root ecosystems. They are effective biocontrol agents.

(3) Virus : Baculoviruses such as *Nucleopolyhedrovirus*. Viruses are excellent candidates for species specific, narrow spectrum insecticidal applications. They have been shown to have no negative impact on non-target organisms. This is especially desirable when biocontrol is applied in ecologically sensitive areas.

32. (a)



(i) Identify the structure shown above and name the process taking place. **[1]**

(ii) Write the source of energy for the process and list the enzymes involved. **[2]**

(iii) Mention the difference in the process based on polarity. What terms are used for such synthesis? **[2]**

(iv) Redraw the structure after completion of the process and label the newly synthesised parts. **[1]**

OR

(b) (i) How would you find out whether a given tall garden pea plant is homozygous or heterozygous?

Substantiate your answer with the help of Punnett square. **[1]**

(ii) Given below are F_2 phenotypic ratios of two independently carried monohybrid crosses. **[3]**

(1) 1 : 2 : 1

(2) 3 : 1

Mention what does each ratio suggest. **[½+½]**

Sol. (a) (i) The structure mentioned in the question represents replication fork. The process in which the structure mentioned in the question, is formed, is DNA replication.

(ii) Deoxyribonucleoside triphosphates provide energy for the polymerisation process occurs during replication.

DNA dependent DNA polymerase and DNA ligase are involved in the process of replication along with helicase, topoisomerase, phosphorylase and primase.

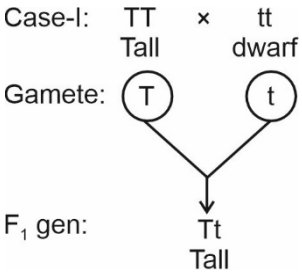
(iii) The strand having polarity 3′→5′ will show continuous synthesis and is known as leading strand as DNA dependent DNA polymerase synthesise the daughter strand in 5′→3′ direction.

The strand having polarity 5′→3′ will show discontinuous synthesis and is known as lagging strand as DNA polymerase can only polymerise in 5′→3′ direction. The discontinuously synthesised fragments are known as Okazaki fragments.

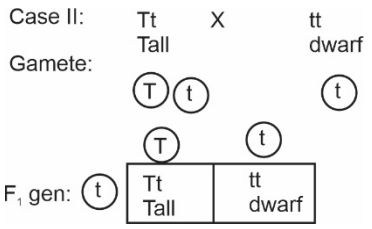
(iv) After completion of the process, following structures will be observed.

OR

(b) (i) In order to determine the genotype of the organism, test cross is performed, in which the organism showing dominant phenotype (homozygous or heterozygous) is crossed with homozygous recessive individual.

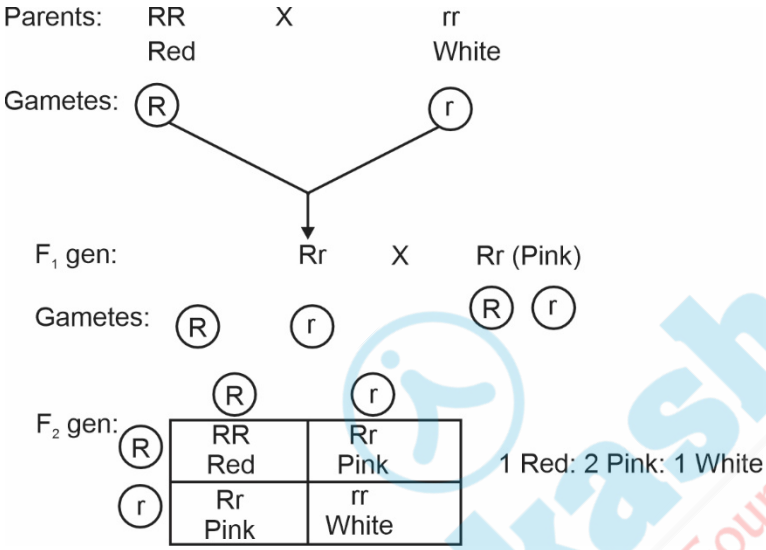


All tall species are obtained if the test organisms is homozygous.

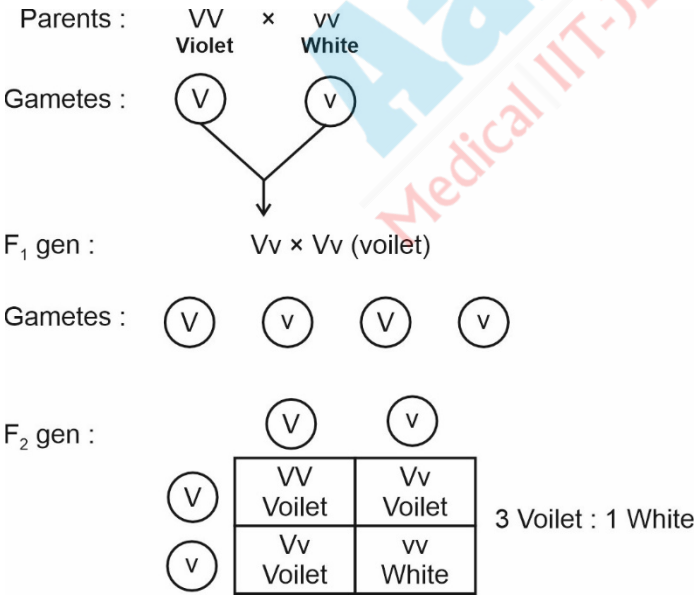


The phenotypic ratio comes out to be 1 : 1 if the organism is heterozygous.

(iii) F_2 phenotypic ratio if comes out to be 1:2:1 it shows incomplete dominance as can be seen during the inheritance of flower colour in snapdragon.



F_2 phenotypic ratio if comes out to be 3 : 1 it shows complete dominance as can be seen during the inheritance of flower color in garden pea.



33. (a) (i) Explain the role of stigma in pollen pistil interaction. **[1]**

(ii) Describe the post pollination events leading to double fertilization in angiosperms starting with 2-celled pollen grain. **[4]**

OR

(b) (i) Explain menstrual phase in the menstrual cycle of human female. **[1]**

(ii) Why is follicular phase also called proliferative phase? **[1]**

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

(iv) Draw a Graafian follicle and label – Antrum and secondary oocyte. **[1]**

Sol. (a) (i) During pollen-pistil interaction, stigma serves as a landing platform for pollen grains.

(ii) Post-pollination events leading to double fertilization in angiosperms, are as follow:

- After the pistil accepts the right type of pollen, the pollen grain germinates on stigma to produce a pollen tube.
- Generative cell divides and forms two male gametes during the growth of pollen tube in the stigma.
- Pollen tube, after reaching the ovary, enters the ovule through the micropyle and then enters one of the synergids through the filiform apparatus.
- After entering the synergid, pollen tube releases the two male gametes into the cytoplasm of the synergid.
- One of the male gametes fuses with the polar nuclei, located in the central cell, to produce a triploid primary endosperm nucleus. The other male gamete fuses with the egg cell nucleus, thus completing syngamy.

Since two types of fusion take place in the embryo sac, the phenomenon is termed as double fertilization.

OR

(b) (i) The menstrual cycle starts with menstrual phase, when menstrual flow occurs and it lasts for 3-5 days.

(ii) During follicular phase the endometrium of uterus regenerates through proliferation. Hence, follicular phase is also called proliferative phase.

(iii) During follicular phase primary follicles in ovary grow to become fully mature Graafian follicle. Both LH and FSH attain peak level about 14th day of menstrual cycle. Rapid LH secretion, *i.e.*, LH surge induces rupture of Graafian follicle and thereby release of ovum called ovulation. The ovulation is followed by luteal phase during which the remaining parts of Graafian follicle transform as corpus luteum. The corpus luteum secretes large amounts of progesterone which is essential for maintenance of the endometrium.

(iv) 

❑ ❑ ❑