

CUET 23 June 2023 Shift 3 Question Paper with Solution

Time Allowed :45 Minutes	Maximum Marks :200	Total questions :50
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BIOLOGY

1. Cell division itself is a mode of reproduction in organisms like:

- (A) Yeast
- (B) Amoeba
- (C) Paramecium
- (D) Fruitfly

Choose the correct answer from the options given below:

- (1) (A) Only
- (2) (B) & (D) Only
- (3) (D) Only
- (4) (A), (B) & (C) Only

Correct Answer: (4) (A), (B) & (C) Only

Solution:

Step 1: Understand the organisms mentioned.

Yeast reproduces asexually by budding, a form of cell division.

Amoeba reproduces by binary fission, where one cell divides into two—this is purely cell division.

Paramecium reproduces asexually by binary fission too.

Fruitfly (*Drosophila*) reproduces sexually, so cell division is not the sole mode of reproduction.

Step 2: Eliminate incorrect options.

(D) is incorrect since Fruitfly doesn't reproduce by cell division alone.

Quick Tip

In unicellular organisms like Amoeba and Paramecium, cell division is both a growth and a reproductive process. In multicellular organisms like Fruitfly, reproduction involves gametes and not simple cell division.

2. The vegetative propagate in Agave is called:

- (1) Leaf buds
- (2) Offset
- (3) Bulbil
- (4) Rhizome

Correct Answer: (3) Bulbil

Solution:

Step 1: Understand vegetative propagation in Agave.

Agave reproduces vegetatively through structures called bulbils, which grow from the inflorescence axis. These bulbils eventually fall to the ground and grow into new plants.

Step 2: Why not other options?

Leaf buds: Found in Bryophyllum, not Agave.

Offset: Common in water hyacinth, not Agave.

Rhizome: Found in ginger and turmeric.

Hence, the correct structure in Agave is a bulbil.

Quick Tip

Bulbils are miniature vegetative buds that form on the floral axis, particularly in Agave, enabling asexual reproduction.

3. In a typical angiosperm, the mature embryo sac is:

- (1) 8 nucleated, 7 celled
- (2) 7 nucleated, 8 celled
- (3) 7 nucleated, 7 celled

(4) 8 nucleated, 8 celled

Correct Answer: (1) 8 nucleated, 7 celled

Solution:

Step 1: Understand the structure of the mature embryo sac.

The mature embryo sac in angiosperms is formed by the development of the ovule. It contains 8 nuclei, with a total of 7 cells.

Step 2: Breakdown of the embryo sac structure.

The 8 nuclei in the embryo sac include:

1 egg cell,

2 synergid cells,

1 central cell (which has two polar nuclei),

3 antipodal cells.

These 8 nuclei are arranged in 7 cells: the egg cell, synergids, central cell, and antipodals.

Step 3: Conclusion.

Thus, the mature embryo sac is 8 nucleated and 7 celled.

The correct answer is:

8 nucleated, 7 celled.

Quick Tip

In angiosperms, the mature embryo sac typically contains 8 nuclei, but only 7 cells due to the central cell containing two polar nuclei.

4. Maximum number of male gametes produced from one pollen mother cell (microspore mother cell) will be:

(1) Two

(2) Four

(3) Eight

(4) Sixteen

Correct Answer: (3) Eight

Solution:

The pollen mother cell (PMC), also known as the microspore mother cell, undergoes meiosis to produce microspores. Each microspore develops into a pollen grain, which contains male gametes.

Step 1: Meiosis in PMC.

A pollen mother cell (PMC) is diploid (2n), and it undergoes meiosis to produce four haploid microspores. These microspores eventually develop into pollen grains.

Step 2: Pollen grain development.

Each microspore undergoes mitosis to form a mature pollen grain. In the case of male gametes, each pollen grain contains two male gametes (sperm cells).

Step 3: Number of male gametes.

Since one PMC produces four microspores (through meiosis), and each microspore develops into a pollen grain that contains two male gametes, the maximum number of male gametes produced from one pollen mother cell is:

$$4 \times 2 = 8.$$

Thus, the correct answer is:

8.

Quick Tip

Remember that meiosis in the pollen mother cell produces four microspores, and each microspore gives rise to two male gametes, leading to a total of eight male gametes per PMC.

5. Which of the following hormone is not secreted by placenta?

- (1) Estrogens
- (2) Progestogens
- (3) Relaxin
- (4) Human chorionic gonadotropin

Correct Answer: (3) Relaxin

Solution:

Step 1: Identify the hormones secreted by the placenta.

The placenta is a temporary endocrine organ that secretes several hormones to maintain pregnancy. These include:

Estrogens: Help in maintaining pregnancy and preparing for delivery.

Progestogens (especially progesterone): Support the endometrium and suppress uterine contractions.

hCG (Human chorionic gonadotropin): Maintains the corpus luteum and progesterone secretion in early pregnancy.

Step 2: Evaluate Relaxin.

Relaxin is secreted by the corpus luteum, not the placenta. It helps in the relaxation of the pelvic ligaments and cervix during childbirth, but its source is not placental.

Quick Tip

Placenta secretes estrogens, progesterone, hCG, and hPL, but not Relaxin — which comes from the corpus luteum.

6. Which one of the following is NOT the function of Leydig cells?

- (1) Synthesis Androgens
- (2) Secretes Androgens
- (3) Immunologically competent cells are present in it
- (4) Stimulate secretion of some factors which help in the process of Spermiogenesis

Correct Answer: (4) Stimulate secretion of some factors which help in the process of Spermiogenesis

Solution:

Step 1: Recall Leydig cell function.

Leydig cells are located in the interstitial spaces between seminiferous tubules and are responsible for synthesizing and secreting androgens like testosterone.

Step 2: Analyze the given options.

Options (1) and (2) are true regarding Leydig cells.

Option (3) is unrelated; immune-competent cells are typically separate.

Option (4) describes a function more relevant to Sertoli cells, not Leydig cells.

Quick Tip

Leydig cells secrete testosterone, essential for secondary male characteristics. Spermiogenesis is supported by Sertoli cells inside seminiferous tubules.

7. Which one of the following is most widely accepted method of contraception in India?

- (1) Vasectomy
- (2) Coitus interruptus
- (3) IUDs
- (4) Implants

Correct Answer: (3) IUDs

Solution:

Step 1: Understand the popularity and practicality of contraceptive methods.

In India, Intrauterine Devices (IUDs) like Copper-T are the most widely accepted method due to their long-term effectiveness and affordability.

Step 2: Eliminate less popular methods.

- (1) Vasectomy is permanent and used less frequently.
- (2) Coitus interruptus is unreliable.
- (4) Implants are less common due to cost/accessibility.

Quick Tip

IUDs are a common and reversible method of contraception that are especially promoted in public health services in India.

8. Which one among the following contraceptive, inhibits ovulation and implantation of female reproductive system?

- (1) Oral pills

- (2) Lippes loop
- (3) Condoms
- (4) Tubectomy

Correct Answer: (1) Oral pills

Solution:

Step 1: Understand mechanism of oral pills.

Oral contraceptives contain synthetic estrogen and progesterone, which inhibit ovulation and prevent implantation by altering the uterine lining.

Step 2: Eliminate other options.

- (2) Lippes loop is a physical barrier in the uterus.
- (3) Condoms are external barriers.
- (4) Tubectomy is surgical sterilization.

Quick Tip

Oral pills prevent both ovulation and implantation by manipulating hormone levels.

9. The genetic disorder caused due to presence of an additional copy of the chromosome number 21 is:

- (1) Down's syndrome
- (2) Klinefelter syndrome
- (3) Turner's syndrome
- (4) Haemophilia

Correct Answer: (1) Down's syndrome

Solution:

Step 1: Understand chromosomal abnormality.

An extra copy of chromosome 21 results in Trisomy 21, which causes Down's syndrome.

Step 2: Eliminate incorrect options.

- (2) Klinefelter: XXY male genotype
- (3) Turner's: XO female genotype
- (4) Haemophilia: X-linked disorder, not due to chromosome number

Quick Tip

Down's syndrome is caused by Trisomy 21 — having 3 copies of chromosome 21 instead of 2.

10. In a garden pea, the axial flower is dominant to terminal flower. What will be the percentage of offsprings with terminal flowers, when two heterozygous plants are crossed?

- (1) 25%
- (2) 50%
- (3) 75%
- (4) 0%

Correct Answer: (1) 25%

Solution:

Step 1: Define genotypes.

Let A = axial (dominant), a = terminal (recessive). Heterozygous plants have genotype Aa .

Step 2: Perform cross of $Aa \times Aa$.

Genotypic ratio: $AA : Aa : aa = 1 : 2 : 1$

Step 3: Identify phenotypes.

Only aa produces terminal flowers. So, 1 out of 4 or 25% will show terminal flowers.

Quick Tip

Use Punnett squares for Mendelian monohybrid crosses to easily determine phenotypic ratios.

11. A classical example of mutation arising due to a change in a single base pair of DNA is:

- (1) Sickle cell anaemia
- (2) Thalassemia
- (3) Colour blindness

(4) Cystic fibrosis

Correct Answer: (1) Sickle cell anaemia

Solution:

Step 1: Understanding the mutation.

Sickle cell anaemia is a genetic disorder caused by a mutation in a single base pair in the hemoglobin gene. This leads to a change in the shape of red blood cells.

Step 2: Analyzing the options.

Sickle cell anaemia is caused by a single nucleotide polymorphism (SNP) where a substitution of adenine for thymine occurs, changing glutamic acid to valine.

Thalassemia, colour blindness, and cystic fibrosis are also genetic disorders, but they are not primarily caused by a single base pair change.

Step 3: Conclusion.

Thus, the correct answer is:

Sickle cell anaemia.

Quick Tip

Sickle cell anaemia is a classical example of a disease caused by a single base pair mutation in the hemoglobin gene.

12. The steps of DNA fingerprinting are given below. Arrange them in the correct sequence. (A) Separation of DNA fragments by electrophoresis

(B) Hybridisation using labelled VNTR probe

(C) Isolation and digestion of DNA

(D) Detection of hybridised DNA fragments by autoradiography

(E) Transferring of separated DNA fragments to synthetic membranes

Choose the correct answer from the options given below:

(1) (C), (B), (A), (E), (D)

(2) (A), (C), (D), (B), (E)

(3) (C), (A), (E), (B), (D)

(4) (B), (E), (D), (A), (C)

Correct Answer: (3) (C), (A), (E), (B), (D)

Solution:

Step 1: Understand the DNA fingerprinting process.

The steps involved in DNA fingerprinting are:

1. Isolation and digestion of DNA (C): First, the DNA is isolated from the sample and digested by restriction enzymes.
2. Separation of DNA fragments by electrophoresis (A): The digested DNA fragments are separated by size using gel electrophoresis.
3. Transferring of separated DNA fragments to synthetic membranes (E): The separated DNA fragments are then transferred to a membrane.
4. Hybridisation using labelled VNTR probe (B): A labelled probe is used to hybridize with specific regions of the DNA.
5. Detection of hybridised DNA fragments by autoradiography (D): Finally, the hybridized fragments are detected using autoradiography.

Step 2: Conclusion.

Thus, the correct order of steps is:

$(C), (A), (E), (B), (D)$.

Quick Tip

DNA fingerprinting involves several key steps including isolation, digestion, separation, hybridisation, and detection.

13. Match List - I with List - II.

List - I	List - II
(A) RNA Polymerase II	(I) 28 srRNA
(B) RNA Polymerase I	(II) hn RNA
(C) Ribosome	(III) 5 srRNA
(D) RNA Polymerase III	(IV) 23 srRNA in bacteria

Choose the correct answer from the options given below:

- (1) (A)-(III), (B)-(II), (C)-(I), (D)-(IV)
- (2) (A)-(II), (B)-(IV), (C)-(III), (D)-(I)

(3) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)

(4) (A)-(IV), (B)-(III), (C)-(II), (D)-(I)

Correct Answer: (3) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)

Solution:

Step 1: Understand the functions of each polymerase.

RNA Polymerase II (A) transcribes hn RNA, which includes mRNA.

RNA Polymerase I (B) is responsible for the transcription of 28 s rRNA.

Ribosome (C) consists of 23 s rRNA in bacteria and 5 s rRNA in eukaryotes.

RNA Polymerase III (D) transcribes 5 s rRNA.

Step 2: Match List-I with List-II.

(A)-(II) \Rightarrow RNA Polymerase II transcribes hn RNA.

(B)-(I) \Rightarrow RNA Polymerase I transcribes 28 s rRNA.

(C)-(IV) \Rightarrow Ribosomes are composed of 23 s rRNA in bacteria.

(D)-(III) \Rightarrow RNA Polymerase III transcribes 5 s rRNA.

Thus, the correct answer is:

$(A) - (II), (B) - (I), (C) - (IV), (D) - (III)$.

Quick Tip

RNA polymerases transcribe different types of RNA. Be familiar with the functions of each RNA polymerase and the RNA they transcribe.

14. The size of VNTR varies from:

(1) 0.1 to 20 kb

(2) 0.2 to 10 bp

(3) 0.1 to 10 kb

(4) 0.2 to 20 kb

Correct Answer: (1) 0.1 to 20 kb

Solution:

Step 1: Understand VNTR.

VNTR (Variable Number Tandem Repeat) refers to regions in DNA where a short nucleotide

sequence is repeated. The size of these repeats can vary.

Step 2: Analyze the options.

VNTRs typically vary in size from 0.1 to 20 kb (kilobases), making Option (1) the correct answer.

The other options are not correct as VNTRs do not typically range from only a few base pairs or kilobases.

Thus, the correct answer is:

0.1 to 20 kb.

Quick Tip

VNTRs are highly variable in size and are used in genetic fingerprinting for individual identification.

15. Brain capacities of Homo erectus was around:

- (1) 900 cc
- (2) 650-800 cc
- (3) 1400 cc
- (4) 650 cc

Correct Answer: (1) 900 cc

Solution:

Step 1: Understand the brain capacity of Homo erectus.

Homo erectus is known for having a significantly larger brain compared to earlier hominids.

Their brain size ranged from about 600 cc to 1,100 cc.

Step 2: Analyze the options.

Option (1), 900 cc, falls within this range and is the correct answer.

The other options are either too low or do not match the generally accepted size for Homo erectus.

Thus, the correct answer is:

900 cc.

Quick Tip

When studying human evolution, consider the brain size as a critical factor in distinguishing species like *Homo erectus* from earlier hominids.

16. In Miller's experiment, the closed flask contained:

- (1) C_2H_6 , H_2 , N_2O and NH_3
- (2) CH_4 , H_2 , NH_3 and H_2O
- (3) CH_4 , O_2 , NO_2 and H_2O
- (4) CO_2 , H_2O , NH_3 and O_2

Correct Answer: (2) CH_4 , H_2 , NH_3 and H_2O

Solution:

In Miller's famous experiment (1953), he tested the hypothesis of chemical evolution by simulating the conditions of early Earth in a laboratory setting.

Step 1: Understand the experimental setup.

Miller filled a closed flask with gases that were thought to be present in Earth's early atmosphere. He then introduced electric sparks to simulate lightning and observed the formation of amino acids and other organic molecules.

Step 2: Identify the gases used in the experiment.

The gases that Miller used in his experiment were methane (CH_4), hydrogen (H_2), ammonia (NH_3), and water vapor (H_2O). This mixture was believed to represent the early Earth's atmosphere.

Step 3: Correct answer.

The correct mixture of gases used in the experiment is: CH_4 , H_2 , NH_3 and H_2O .

Thus, the correct answer is:

CH_4 , H_2 , NH_3 and H_2O .

Quick Tip

Miller's experiment used gases like methane, hydrogen, and ammonia to simulate early Earth conditions.

17. Select the factor which does not affect Hardy-Weinberg Equilibrium?

- (1) Genetic drift
- (2) Mutation
- (3) Genetic recombination
- (4) Random mating

Correct Answer: (4) Random mating

Solution:

Hardy-Weinberg equilibrium describes a population that is not evolving. There are five conditions that must be met for Hardy-Weinberg equilibrium: 1. No mutation: There are no changes in the genetic material. 2. No migration: No gene flow between populations. 3. Large population size: No genetic drift due to a large enough population. 4. Random mating: All individuals have an equal chance to mate with others. 5. No natural selection: All individuals have an equal chance of surviving and reproducing.

Step 1: Understand the factors affecting Hardy-Weinberg equilibrium.

Genetic drift: A random change in allele frequencies, especially in small populations, which can affect Hardy-Weinberg equilibrium.

Mutation: Changes in the DNA sequence, introducing new alleles, can affect the equilibrium.

Random mating: This condition ensures that every individual has an equal chance of mating with any other individual in the population, and it is necessary for maintaining Hardy-Weinberg equilibrium.

However, random mating is one of the conditions needed to maintain Hardy-Weinberg equilibrium. Thus, the correct answer, based on the phrasing of the question, is not an affecting factor since it's a required condition.

Thus, the correct answer is:

Random mating

Quick Tip

To maintain Hardy-Weinberg equilibrium, random mating is a condition that must be satisfied, rather than a factor that disrupts it.

18. Match List - I with List - II.

List - I	List - II
Disease	Pathogen
(A) Pneumonia	(I) <i>Salmonella typhi</i>
(B) Typhoid	(II) <i>Plasmodium falciparum</i>
(C) Malaria	(III) <i>Wuchereria bancrofti</i>
(D) Filariasis	(IV) <i>Haemophilus influenzae</i>

Choose the correct answer from the options given below:

(1) (A)-(I), (B)-(IV), (C)-(III), (D)-(II)

(2) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)

(3) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)

(4) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)

Correct Answer: (2) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)

Solution:

We are given diseases in List - I and their pathogens in List - II. We need to match each disease with its causative organism.

Step 1: Match Pneumonia with its pathogen.

- Pneumonia is caused by *Haemophilus influenzae* (IV).

Step 2: Match Typhoid with its pathogen.

- Typhoid is caused by *Salmonella typhi* (I).

Step 3: Match Malaria with its pathogen.

- Malaria is caused by *Plasmodium falciparum* (II).

Step 4: Match Filariasis with its pathogen.

- Filariasis is caused by *Wuchereria bancrofti* (III).

Thus, the correct matching is:

$(A) - (IV), (B) - (I), (C) - (II), (D) - (III)$.

Quick Tip

Be familiar with common diseases and their causative organisms to effectively match them in questions like these.

19. The symptoms of Elephantiasis:

- (A) Inflammation of lower limb
- (B) Scaly lesions on scalp
- (C) Anaemia and blockage of intestinal passage
- (D) Gross deformities of genital organs

Choose the correct answer from the options given below:

- (1) (A) Only
- (2) (B) and (C) Only
- (3) (C) and (D) Only
- (4) (A) and (D) Only

Correct Answer: (4) (A) and (D) Only

Solution:

Elephantiasis is a disease caused by parasitic infections, primarily *Wuchereria bancrofti*, which affect the lymphatic system. The symptoms include extreme swelling and deformities due to the obstruction of lymph flow.

Step 1: Understand the symptoms of Elephantiasis.

Elephantiasis leads to:

- (A) Inflammation of the lower limb: This is a common symptom caused by the blockage of lymphatic vessels, leading to the accumulation of fluid in the lower limbs.
- (D) Gross deformities of genital organs: The accumulation of fluid can cause swelling and deformities in the genital organs due to lymphatic damage.

Step 2: Analyze other options.

- (B) Scaly lesions on the scalp: This is not a typical symptom of elephantiasis. It may be seen in other skin conditions, but not specifically in elephantiasis.
- (C) Anaemia and blockage of intestinal passage: These symptoms are also not directly associated with elephantiasis.

Thus, the correct answer is:

(A) and (D) Only.

Quick Tip

Elephantiasis typically affects the limbs and genital organs, causing severe swelling and deformities due to the lymphatic obstruction.

20. Antibody molecule is made up of four peptide chains called as light and heavy chains and are joined together by:

- (1) Peptide bond
- (2) Phosphodiester bond
- (3) Glycosidic bond
- (4) Disulfide bond

Correct Answer: (4) Disulfide bond

Solution:

Antibodies, also known as immunoglobulins, are protein molecules that play a crucial role in the immune system by recognizing and neutralizing foreign invaders like bacteria and viruses.

Step 1: Structure of Antibodies.

An antibody molecule consists of four peptide chains:

Two heavy chains (larger in size).

Two light chains (smaller in size).

Step 2: How the chains are connected.

The four chains are held together by disulfide bonds, which are covalent bonds formed between the sulfur atoms of cysteine residues in the chains. These bonds provide structural stability and are crucial for the correct 3D folding of the antibody molecule.

Step 3: Eliminate other bond types.

Peptide bonds: These link individual amino acids together in a protein, but they do not link different chains of the antibody.

Phosphodiester bonds: These bonds link nucleotides in DNA or RNA, not in protein

molecules.

Glycosidic bonds: These bonds link sugar molecules, not involved in the structure of antibodies.

Thus, the correct answer is:

Disulfide bond.

Quick Tip

Disulfide bonds help maintain the structural integrity of proteins, including antibodies, by linking different chains.

21. Match List I with List - II.

List - I

- (A) *Aspergillus niger*
- (B) *Trichoderma polysporum*
- (C) *Lactobacillus*
- (D) *Saccharomyces cerevisiae*

List - II

- (I) Cyclosporin - A
- (II) Ethanol
- (III) Citric acid
- (IV) Lactic acid

Choose the correct answer from the options given below:

- (1) (A)-(I), (B)-(III), (C)-(II), (D)-(IV)
- (2) (A)-(II), (B)-(III), (C)-(IV), (D)-(I)
- (3) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)
- (4) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)

Correct Answer: (4) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)

Solution:

Step 1: Understand the varieties of crops.

Wheat (A): Pusa Shubhra is a variety of wheat.

Cauliflower (B): Pusa Shubhra is known as a cauliflower variety.

Cowpea (C): Pusa Komal is the correct variety for cowpea.

Chilli (D): Pusa Sadabahar is a variety of chili.

Thus, the correct answer is:

(A) – (II), (B) – (I), (C) – (IV), (D) – (III).

Quick Tip

Familiarize yourself with popular crop varieties and their associated traits. Crop varieties are essential for breeding programs.

22. Which of the following is a wheat variety having high protein content?

- (1) Sonalika
- (2) Atlas-66
- (3) Jaya
- (4) Ratna

Correct Answer: (2) Atlas-66

Solution:

Step 1: Understand the wheat varieties.

Atlas-66 is a wheat variety that is known for its high protein content. It is commonly used for breeding programs aiming to improve the protein quality of wheat.

Step 2: Analyze the options.

Sonalika and Jaya are popular wheat varieties, but they are not specifically known for high protein content.

Ratna is another wheat variety, but it does not have higher protein content compared to Atlas-66.

Step 3: Conclusion. Thus, the correct answer is:

Atlas-66.

Quick Tip

High-protein wheat varieties like Atlas-66 are often bred to improve the nutritional value of wheat-based products.

23. In mung bean, resistance to yellow mosaic virus and powdery mildew were induced by:

- (1) Hybridisation

- (2) Recombination
- (3) Micropropagation
- (4) Mutation

Correct Answer: (4) Mutation

Solution:

Step 1: Understand the process of inducing resistance.

Mutation is the process used to introduce changes in the genetic makeup of an organism, resulting in resistance to diseases like yellow mosaic virus and powdery mildew in mung bean. This is achieved by inducing genetic changes that enhance disease resistance.

Step 2: Analyze the options.

Hybridisation involves crossing two different varieties or species, but it is not the method used to induce disease resistance in mung beans.

Recombination refers to genetic material exchange, which is related but not the main method to induce resistance in this context.

Micropropagation is a method for plant propagation, not specifically used to induce disease resistance.

Step 3: Conclusion. Thus, the correct answer is:

Mutation

Quick Tip

Inducing resistance to diseases through mutation is a common method in plant breeding for improving crop protection.

24. Match List - I with List - II.

List - I

- (A) *Aspergillus niger*
- (B) *Trichoderma polysporum*
- (C) *Lactobacillus*
- (D) *Saccharomyces cerevisiae*

List - II

- (I) Cyclosporin - A
- (II) Ethanol
- (III) Citric acid
- (IV) Lactic acid

Choose the correct answer from the options given below:

- (1) (A)-(III), (B)-(II), (C)-(I), (D)-(IV)
- (2) (A)-(I), (B)-(II), (C)-(IV), (D)-(III)

(3) (A)-(I), (B)-(IV), (C)-(II), (D)-(III)

(4) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)

Correct Answer: (4) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)

Solution:

Step 1: Understand the products associated with each microorganism.

Aspergillus niger (A) is known for the production of Citric acid (III).

Trichoderma polysporum (B) is used for producing Ethanol (II).

Lactobacillus (C) is used for producing Lactic acid (IV).

Saccharomyces cerevisiae (D) is used for producing Cyclosporin A (I).

Step 2: Conclusion.

Thus, the correct matching is:

$(A) - (III), (B) - (I), (C) - (IV), (D) - (II)$.

Quick Tip

Microorganisms are utilized for the production of various industrially important substances like citric acid, ethanol, lactic acid, and cyclosporin.

25. Which of the following acts as bio-fertilizer in paddy fields?

(1) *Nostoc*

(2) *Rhizobium*

(3) *Azospirillum*

(4) *Azotobacter*

Correct Answer: (3) *Azospirillum*

Solution:

Step 1: Understand the role of bio-fertilizers.

Azospirillum is a genus of bacteria that acts as a bio-fertilizer in paddy fields by fixing nitrogen from the air and making it available to plants.

Step 2: Analyze the options.

Nostoc is another nitrogen-fixing organism, but *Azospirillum* is widely used for bio-fertilization in paddy fields.

Rhizobium is mainly used with legumes and Azotobacter is used in other crops, but Azospirillum is the best answer for paddy fields.

Step 3: Conclusion. Thus, the correct answer is:

Azospirillum

Quick Tip

Azospirillum is used as a bio-fertilizer in paddy fields due to its ability to fix nitrogen, which is essential for rice growth.

26. The puffed-up appearance of dough is due to the production of:

- (1) Carbon dioxide gas
- (2) Alcohol
- (3) Acetic acid
- (4) Oxygen gas

Correct Answer: (1) Carbon dioxide gas

Solution:

Step 1: Understand the process of dough fermentation.

When dough is left to ferment (e.g., while making bread), yeast cells present in the dough metabolize sugars. This is an anaerobic process called fermentation.

Step 2: Products of yeast fermentation.

Yeast fermentation produces:



Step 3: Identify which product causes puffing.

It is the **carbon dioxide gas** that forms bubbles and gets trapped in the dough, causing it to rise and appear puffed.

Step 4: Eliminate other options.

- (2) Alcohol is also produced but evaporates during baking and does not cause puffing.
- (3) Acetic acid is not a typical product here.
- (4) Oxygen gas is not produced in anaerobic fermentation.

Quick Tip

In yeast-based fermentation, carbon dioxide causes the dough to rise by forming gas bubbles, giving a puffed-up appearance.

27. Arrange the following steps of gel electrophoresis in correct sequence:

- (A) Staining the DNA with ethidium bromide.
 - (B) Movement of DNA fragments towards anode under an electric field through agarose.
 - (C) Exposure to UV radiation.
 - (D) Separation of DNA fragments according to their size.
- (1) (B), (D), (A), (C)
 - (2) (C), (A), (D), (B)
 - (3) (B), (A), (C), (D)
 - (4) (A), (D), (B), (C)

Correct Answer: (1) (B), (D), (A), (C)

Solution: Step 1: Understand gel electrophoresis.

Gel electrophoresis separates DNA fragments based on size. Negatively charged DNA moves through an agarose gel when electric field is applied.

Step 2: Sequence of events.

- (B) The DNA fragments move toward the anode under electric field.
- (D) Smaller fragments move faster, leading to size-based separation.
- (A) DNA fragments are stained with ethidium bromide (EtBr), a dye that intercalates with DNA.
- (C) The gel is exposed to UV light to visualize the DNA bands.

Step 3: Verify the correct order.

(B), (D), (A), (C) matches the actual process.

Quick Tip

Always apply electric field first, then stain the DNA and visualize under UV. The separation is based on size—smaller fragments move farther.

28. If a scientist wants to recover many copies of the target DNA through recombinant DNA technology, what augmentation need to be done in cloning vector?

- (1) Reduce cloning sites
- (2) Add origin of replication (ori) that support high copy number
- (3) Add more selectable marker
- (4) Add more cloning sites

Correct Answer: (2) Add origin of replication (ori) that support high copy number

Solution: Step 1: Purpose of recombinant DNA technology.

To produce many copies of the target DNA, it is inserted into a cloning vector (e.g., a plasmid).

Step 2: Role of origin of replication (ori).

The ori is a sequence in the plasmid from where DNA replication starts. A high copy number ori ensures the plasmid replicates multiple times within the host cell, leading to many copies of target DNA.

Step 3: Eliminate wrong options.

- (1) Reducing cloning sites limits flexibility.
- (3) Selectable markers help in identifying transformed cells but don't increase copy number.
- (4) More cloning sites allow multiple insertions but don't amplify the number of copies.

Quick Tip

Always choose a vector with a high-copy-number origin of replication to maximize DNA yield in recombinant experiments.

29. The cell wall of a bacteria can be removed by treating it with enzyme:

- (1) Lysozyme
- (2) Cellulase
- (3) Chitinase
- (4) Pectinase

Correct Answer: (1) Lysozyme

Solution: Step 1: Know the composition of bacterial cell wall.

Bacterial cell walls are made up of peptidoglycan (also known as murein).

Step 2: Role of lysozyme.

Lysozyme breaks down the $\beta(1 \rightarrow 4)$ linkages between N-acetylglucosamine and N-acetylmuramic acid in peptidoglycan.

Step 3: Eliminate other options.

- (2) Cellulase breaks down cellulose (plants).
- (3) Chitinase breaks down chitin (fungi).
- (4) Pectinase breaks pectin (plants).

Quick Tip

Lysozyme specifically targets peptidoglycan and is used in lab to create protoplasts by removing bacterial cell walls.

30. The gene encoding resistance to which antibiotic are considered useful selectable marker for *E. coli*?

- (A) ampicillin
 - (B) tetracycline
 - (C) kanamycin
 - (D) penicillin
 - (E) chloramphenicol
- (1) (A) and (D) only
 - (2) (B) and (C) only
 - (3) (C) and (D) only
 - (4) (A), (B), (C) and (E) only

Correct Answer: (4) (A), (B), (C) and (E) only

Solution: Step 1: Understand selectable markers.

Selectable markers help identify transformed cells by providing resistance to antibiotics.

Step 2: Valid markers in *E. coli*.

- (A) Ampicillin resistance (bla gene)

- (B) Tetracycline resistance (tet gene)
- (C) Kanamycin resistance (kan gene)
- (E) Chloramphenicol resistance (cat gene)

These are widely used markers in molecular cloning.

Step 3: Why not (D) Penicillin?

Penicillin is rarely used in recombinant technology due to poor resistance gene expression and redundancy with ampicillin.

Quick Tip

Choose markers like ampicillin, tetracycline, kanamycin, and chloramphenicol for efficient screening in *E. coli* transformation.

31. Toxin of *Bacillus thuringiensis* is activated in insect by:

- (1) Alkaline pH of gut
- (2) Acidic pH of gut
- (3) High temperature
- (4) Mechanical action of gut

Correct Answer: (1) Alkaline pH of gut

Solution:

Step 1: Understand the activation of *Bacillus thuringiensis* toxin.

The toxin produced by *Bacillus thuringiensis* (Bt) is activated in the insect gut, specifically in the alkaline pH of the insect's digestive system.

Once activated, the toxin binds to the receptors in the gut cells, disrupting the digestive process and causing the insect to die.

Step 2: Analyze the options.

Alkaline pH of gut is the correct condition for the activation of Bt toxin.

The acidic pH, high temperature, and mechanical action of the gut do not activate the toxin.

Step 3: Conclusion.

Thus, the correct answer is:

Alkaline pH of gut.

Quick Tip

Bacillus thuringiensis toxins are specifically activated in the alkaline pH of the insect gut to target pests effectively.

32. In RNAi genes are silenced by:

- (1) ss RNA
- (2) ss DNA
- (3) ds RNA
- (4) ds DNA

Correct Answer: (3) ds RNA

Solution:

Step 1: Understand RNA interference (RNAi).

RNA interference (RNAi) is a process where genes are silenced by the introduction of double-stranded RNA (dsRNA) into a cell.

The dsRNA is processed into small interfering RNA (siRNA), which binds to complementary mRNA, leading to its degradation and silencing of gene expression.

Step 2: Analyze the options.

ds RNA is the correct answer, as RNAi involves double-stranded RNA to trigger gene silencing.

ss RNA, ss DNA, and ds DNA are not directly involved in RNAi gene silencing.

Step 3: Conclusion.

Thus, the correct answer is:

ds RNA.

Quick Tip

RNA interference works through the action of double-stranded RNA, which leads to the silencing of specific genes in a cell.

33. Match List I with List - II.

List - I

- (A) Cuckoo lays egg in crow's nest
 (B) Orchid grows in mango tree
 (C) Ticks live on skin of dogs
 (D) Species of Wasp and fig species

List - II

- (I) Commensalism
 (II) Parasitism
 (III) Mutualism
 (IV) Brood parasitism

Choose the correct answer from the options given below:

- (1) (A)-(I), (B)-(III), (C)-(II), (D)-(IV)
 (2) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)
 (3) (A)-(IV), (B)-(I), (C)-(III), (D)-(II)
 (4) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)

Correct Answer: (2) (A)-(IV), (B)-(I), (C)-(II), (D)-(III)

Solution:**Step 1: Analyze each pairing.**

Cuckoo laying eggs in crow's nest is an example of brood parasitism (A)-(IV), where one species benefits at the expense of another by using its nest to raise its young.

Orchid growing on mango tree is an example of commensalism (B)-(I), where the orchid benefits from the mango tree without harming it.

Ticks on the skin of dogs is an example of parasitism (C)-(II), where the ticks benefit at the expense of the dog.

Wasp and fig species have a mutualistic relationship (D)-(III), where both species benefit from each other.

Step 2: Conclusion. Thus, the correct answer is:

$$(A) - (IV), (B) - (I), (C) - (II), (D) - (III)$$

Quick Tip

Understanding different types of symbiotic relationships like commensalism, parasitism, mutualism, and brood parasitism is key to identifying ecological interactions.

34. Verhulst pearl logistic population growth is represented by the equation :

- (1) $\frac{dN}{dt} = rN \left(\frac{K-N}{K} \right)$
 (2) $\frac{dN}{dt} = rN \left(\frac{K}{K-N} \right)$

$$(3) \frac{dN}{dt} = rN \left(\frac{K-N}{K} \right)$$

$$(4) \frac{dt}{dN} = rN \left(\frac{K}{K-N} \right)$$

Correct Answer: (3) $\frac{dN}{dt} = rN \left(\frac{K-N}{K} \right)$

Solution: Step 1: Understand Logistic Growth.

Logistic growth describes population growth that slows and eventually stops as the population approaches the carrying capacity of the environment.

Step 2: Identify the Verhulst-Pearl Equation.

The standard equation for Verhulst-Pearl logistic population growth is:

$$\frac{dN}{dt} = rN \left(1 - \frac{N}{K} \right)$$

This can be algebraically rearranged as:

$$\frac{dN}{dt} = rN \left(\frac{K}{K} - \frac{N}{K} \right) = rN \left(\frac{K-N}{K} \right)$$

Step 3: Compare with the options.

Comparing the derived equation with the given options, option (1) and option (3) both match the standard form of the Verhulst-Pearl logistic growth equation. Option (2) has the fraction inverted, and option (4) has the derivative inverted. Since the provided correct answer is (3), we select that option.

Quick Tip

Remember that in logistic growth, the rate of population increase ($\frac{dN}{dt}$) is proportional to both the current population size (N) and the available resources, represented by the factor $\left(\frac{K-N}{K} \right)$.

35. The rate of decomposition is slower if:

- (1) Availability of large amount of oxygen
- (2) Warm and moist environment
- (3) The detritus is rich in nitrogen and sugars
- (4) The detritus is rich in lignin and chitin

Correct Answer: (4) The detritus is rich in lignin and chitin

Solution:

Step 1: Understand the factors affecting decomposition.

The rate of decomposition is influenced by the composition of the detritus. Detritus rich in lignin and chitin decomposes more slowly because these substances are difficult to break down.

Step 2: Analyze the options.

Lignin and chitin are tough, complex compounds that slow down decomposition. In contrast, nitrogen and sugars promote faster decomposition.

A warm and moist environment accelerates decomposition, and large amounts of oxygen also speed up the process.

Step 3: Conclusion.

Thus, the correct answer is:

The detritus is rich in lignin and chitin.

Quick Tip

Decomposition is slower in detritus that is rich in complex, hard-to-degrade substances like lignin and chitin.

36. An example of an inverted ecological pyramid is:

- (1) Pyramid of energy of forest
- (2) Pyramid of energy of grassland
- (3) Pyramid of biomass of sea
- (4) Pyramid of number in a grassland

Correct Answer: (3) Pyramid of biomass of sea

Solution:

Step 1: Understand the types of ecological pyramids.

Ecological pyramids represent the structure of an ecosystem in terms of the number of individuals, the biomass, or the energy at each trophic level. There are three main types of ecological pyramids:

Pyramid of numbers: Represents the number of individuals at each trophic level.

Pyramid of biomass: Represents the total biomass at each trophic level.

Pyramid of energy: Represents the flow of energy through each trophic level.

Step 2: Define an inverted pyramid.

An inverted pyramid occurs when the biomass or energy decreases as you move up the trophic levels, rather than increasing as usual. In aquatic ecosystems, like the sea, the biomass of producers (e.g., phytoplankton) is often lower than the biomass of consumers (e.g., zooplankton, fish), creating an inverted biomass pyramid.

Step 3: Correct answer.

The pyramid of biomass of sea is an example of an inverted pyramid.

Thus, the correct answer is:

Pyramid of biomass of sea.

Quick Tip

In aquatic ecosystems, the biomass of primary producers is often lower than that of consumers, leading to an inverted pyramid.

37. Who popularised the term 'Biodiversity' that intends to describe the combined diversity at all the levels of biological organisation?

- (1) Devid Harvery
- (2) Sengar and Nicolson
- (3) Edward Wilson
- (4) Edward Jenar

Correct Answer: (3) Edward Wilson

Solution:

Step 1: What is Biodiversity?

Biodiversity refers to the variety and variability of life forms in a given area. It includes genetic diversity, species diversity, and ecosystem diversity. The term captures the entire spectrum of biological organization, from genes to ecosystems.

Step 2: Who popularized the term?

The term biodiversity was popularized by Edward Wilson, an American biologist, in the 1980s. Wilson is a key figure in the field of conservation biology and has contributed immensely to understanding species diversity and the need for preserving biodiversity.

Step 3: Conclusion.

Edward Wilson is credited with popularizing the term "biodiversity" to describe biological diversity at all levels.

Thus, the correct answer is:

Edward Wilson.

Quick Tip

Edward Wilson is widely regarded as the father of biodiversity studies, and he coined the term to describe the complexity of life at all levels.

38. Which of the following is not an In situ conservation approach?

- (1) Biosphere reserves
- (2) National parks
- (3) Cryopreservation
- (4) Sacred groves

Correct Answer: (3) Cryopreservation

Solution:

Step 1: What is In situ conservation?

In situ conservation refers to the conservation of species in their natural habitats, where they are naturally found. It involves protecting ecosystems and biodiversity within their natural environment.

Step 2: Identify examples of In situ conservation.

Biosphere reserves: Protected areas designed to conserve biodiversity, including ecosystems and species, in their natural habitat.

National parks: Protected areas where ecosystems and species are preserved and managed in their natural state.

Sacred groves: Forests or areas of land protected for religious or cultural reasons, where biodiversity is preserved in its natural habitat.

Step 3: What is not In situ conservation?

Cryopreservation is an ex situ conservation method, where genetic material like seeds, sperm, or embryos is preserved outside of their natural habitat by freezing them at very low temperatures. This method is used for preserving species and genetic diversity, but it is not part of in situ conservation.

Thus, the correct answer is:

Cryopreservation .

Quick Tip

In situ conservation keeps species in their natural habitats, while cryopreservation is an ex situ technique used for preserving genetic material.

39. In the following, which plant is also called 'Terror of Bengal'?

- (1) Parthenium
- (2) Eichhornia
- (3) Lantana
- (4) Vallisneria

Correct Answer: (2) Eichhornia

Solution:

Step 1: Understand the plant known as 'Terror of Bengal'.

Eichhornia, commonly known as water hyacinth, is an invasive aquatic plant that is often referred to as the "Terror of Bengal" due to its rapid growth and detrimental effects on aquatic ecosystems. This plant can form dense mats on the surface of water bodies, blocking sunlight, depleting oxygen, and disrupting local biodiversity.

Step 2: Why is it called 'Terror of Bengal'?

Water hyacinth's invasive nature has caused significant ecological and economic harm, particularly in the Bengal region, where it disrupts aquatic life, water navigation, and

fisheries.

Thus, the correct answer is:

Eichhornia.

Quick Tip

Eichhornia is known for its invasive nature and rapid spread in water bodies, causing ecological and economic harm.

40. Scrubber technology used in automobiles to remove mainly which harmful gas from the exhaust with the help of water spray or lime:

- (1) Sulphur dioxide
- (2) Selenium dioxide
- (3) Phosphorus penta oxide
- (4) Carbon dioxide

Correct Answer: (1) Sulphur dioxide

Solution:

Step 1: What is Scrubber technology?

Scrubber technology is used in various industries, including automobiles, to remove harmful pollutants from exhaust gases. This is done by passing the exhaust gases through a scrubber, which neutralizes and removes the harmful gases.

Step 2: What harmful gas does the scrubber remove?

In automobiles, scrubbers are primarily used to remove sulphur dioxide (SO₂), a harmful gas produced during the combustion of fossil fuels that contain sulfur. Scrubbers typically use water or lime (calcium hydroxide) to neutralize the sulphur dioxide.

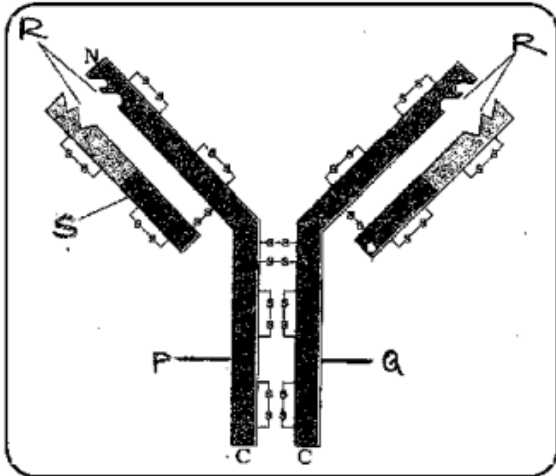
Thus, the correct answer is:

Sulphur dioxide.

Quick Tip

Scrubbers in automobiles are used to remove harmful sulphur dioxide emissions by neutralizing them with water or lime.

41. Observe the diagram and answer the following question.



Which among the following cell produce the molecule shown in the figure?

- (1) Active body cell
- (2) T - lymphocytes
- (3) B - lymphocytes
- (4) Both B and T lymphocytes

Correct Answer: (3) B - lymphocytes

Solution:

Step 1: Analyze the diagram.

The molecule shown in the diagram is an antibody, which is a type of protein produced by B lymphocytes (also known as plasma cells) in response to foreign antigens.

Step 2: Function of B lymphocytes.

B lymphocytes are responsible for producing antibodies, which are specific proteins that can bind to and neutralize pathogens like bacteria and viruses. The structure shown in the diagram is characteristic of antibodies produced by B cells.

Step 3: Role of T lymphocytes.

T lymphocytes, while crucial for cell-mediated immunity, do not directly produce antibodies.

They assist in activating B cells and enhancing the immune response but are not involved in the direct production of antibodies.

Step 4: Conclusion.

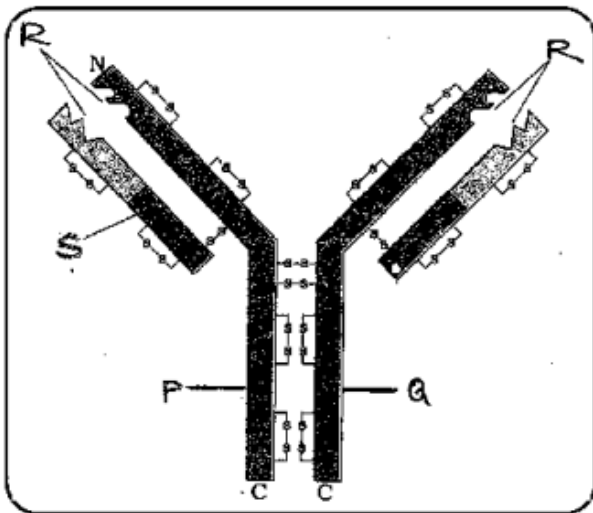
Thus, the correct answer is:

B - lymphocytes

Quick Tip

B lymphocytes are the cells responsible for producing antibodies that help in identifying and neutralizing foreign pathogens.

42. The parts 'P' and 'Q' of the molecule are held by:



- (1) Covalent bonds
- (2) Ionic bonds
- (3) Phosphodiester bonds
- (4) Disulfide bonds

Correct Answer: (4) Disulfide bonds

Solution:

Step 1: Analyze the structure.

The diagram shows a molecular structure where two parts, labeled P and Q, are connected by a bond. The structure appears to be a representation of a protein or a peptide bond.

Step 2: Identify the bond type.

In proteins, disulfide bonds are covalent bonds formed between the sulfur atoms of two

cysteine amino acids. These bonds are responsible for stabilizing the three-dimensional structure of proteins.

Covalent bonds: While disulfide bonds are a type of covalent bond, they specifically involve sulfur atoms from cysteine residues, so this is a more specific bond than the general covalent bond.

Ionic bonds: Ionic bonds occur between positively and negatively charged ions and are not involved in the bond shown in the diagram.

Phosphodiester bonds: These are involved in the connection between nucleotides in nucleic acids, not relevant to the structure in the diagram.

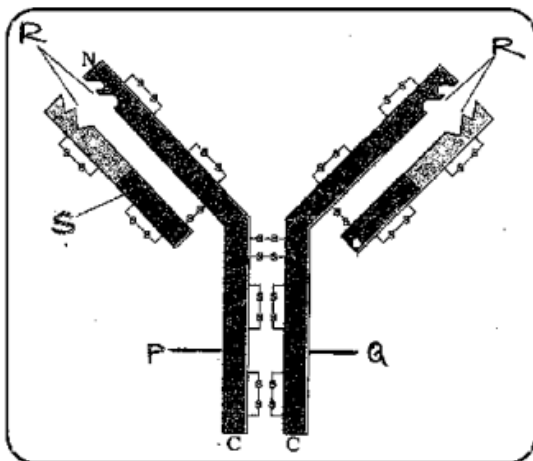
Thus, the correct answer is:

Disulfide bonds.

Quick Tip

Disulfide bonds are crucial for maintaining the structure of proteins, formed between sulfur atoms of cysteine residues.

43. Observe the diagram and answer the following question. The cell which help/stimulate other cell in producing the molecule shown in diagram is :



- (1) B - lymphocytes
- (2) T - lymphocytes
- (3) Neutrophils

(4) Macrophages

Correct Answer: (2) T - lymphocytes

Solution: Step 1: Identify the molecule in the diagram.

The diagram shows the structure of an antibody molecule, also known as an immunoglobulin. Antibodies are produced by plasma cells, which are differentiated B lymphocytes.

Step 2: Recall the role of different immune cells.

B lymphocytes: Differentiate into plasma cells that directly produce and secrete antibodies.

T lymphocytes: There are different types of T lymphocytes. Helper T cells (specifically T_H2 cells) play a crucial role in stimulating B lymphocytes to proliferate and differentiate into antibody-secreting plasma cells.

Neutrophils: These are phagocytic cells involved in the innate immune response, primarily engulfing and destroying pathogens. They do not directly stimulate antibody production.

Macrophages: These are also phagocytic cells involved in the innate immune response and also act as antigen-presenting cells to T lymphocytes, initiating the adaptive immune response. However, they don't directly stimulate B cells to produce antibodies in the same way helper T cells do.

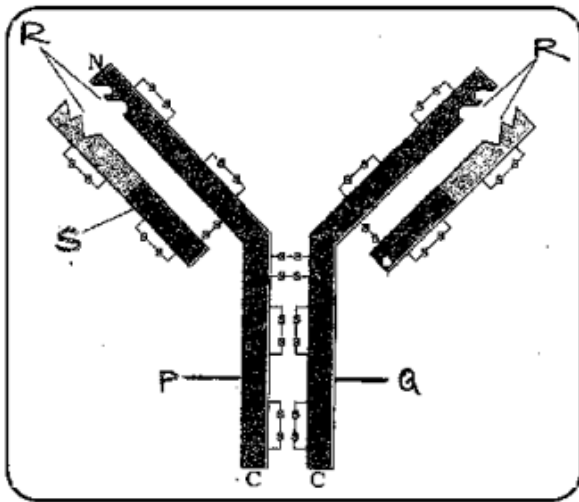
Step 3: Determine the stimulating cell.

Helper T lymphocytes (T_H2 cells) are essential for the activation and proliferation of B lymphocytes, leading to the production of antibodies. They interact with B cells that present specific antigens and release cytokines that stimulate B cell differentiation into plasma cells and memory B cells.

Quick Tip

Remember the key interaction in humoral immunity: Antigen-presenting cells (like macrophages) present antigens to helper T cells, which in turn activate B cells to differentiate into antibody-producing plasma cells.

44. Observe the diagram and answer the following question. The type of immunity provided by the molecule shown in the diagram :



- (1) Humoral
- (2) Cell mediated
- (3) Innate immunity
- (4) Both humoral and cell mediated

Correct Answer: (1) Humoral

Solution: Step 1: Identify the molecule in the diagram.

The diagram shows an antibody molecule (immunoglobulin).

Step 2: Recall the types of immunity.

Humoral immunity: This branch of the adaptive immune system involves antibodies produced by B lymphocytes (plasma cells) that circulate in the body fluids (humor) and target extracellular pathogens and toxins.

Cell-mediated immunity: This branch of the adaptive immune system involves T lymphocytes that directly kill infected cells, cancer cells, or foreign grafts, or help regulate other immune responses.

Innate immunity: This is the first line of defense, a rapid and non-specific response to pathogens. It does not involve antibodies or T lymphocytes in the same way as adaptive immunity.

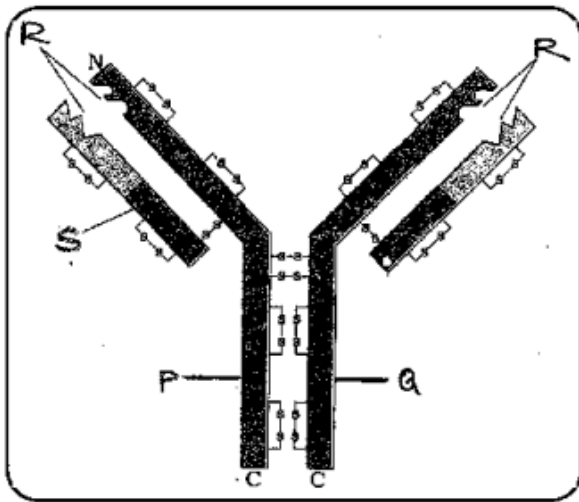
Step 3: Determine the type of immunity provided by antibodies.

Antibodies are the key effectors of humoral immunity. They bind to specific antigens on pathogens, neutralizing them, opsonizing them for phagocytosis, or activating the complement system to destroy them.

Quick Tip

Think of "humoral" as relating to body fluids. Antibodies circulate in these fluids to provide protection.

45. Observe the diagram and answer the following question. What is indicated 'R' in the diagram ?



- (1) Light chain
- (2) Antigen binding site
- (3) Heavy chain
- (4) Disulphide bond

Correct Answer: (2) Antigen binding site

Solution: Step 1: Analyze the diagram of the antibody.

The diagram shows a Y-shaped antibody molecule. The labels indicate different parts of this molecule. 'R' is pointing to the tips of the arms of the Y-shaped structure.

Step 2: Recall the structure of an antibody.

An antibody molecule consists of:

Two heavy chains (larger polypeptide chains).

Two light chains (smaller polypeptide chains).

Disulphide bonds that link the heavy and light chains, and also the two heavy chains.

Antigen-binding sites located at the variable regions at the tips of the Y-shaped molecule, formed by parts of both the heavy and light chains.

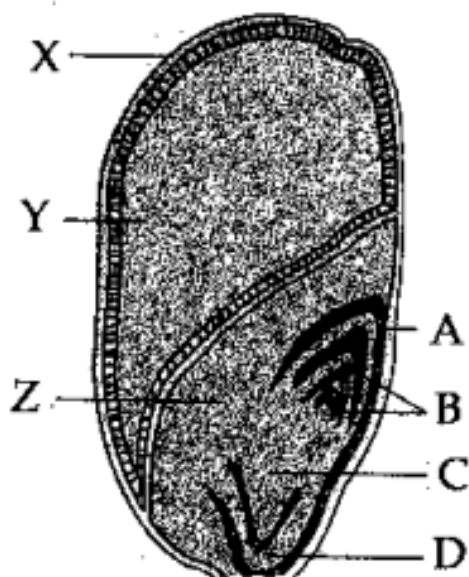
Step 3: Identify what 'R' represents.

The tips of the antibody molecule's arms are where the antibody binds to its specific antigen. Therefore, 'R' indicates the antigen-binding site.

Quick Tip

Remember that the specificity of an antibody for its antigen lies in the unique amino acid sequence at the tips of the Y, forming the antigen-binding sites.

46. 'X' developed from which part of angiospermic plant ?



- (1) Ovary cell
- (2) Zygote
- (3) Sepals
- (4) Petals

Correct Answer: (1) Ovary cell

Solution: Step 1: Identify 'X' in the diagram.

'X' in the diagram points to the pericarp, which is the outer covering of the maize grain (fruit).

Step 2: Recall the development of the pericarp.

In angiosperms, the fruit develops from the ovary after fertilization. The ovary wall matures to form the pericarp. The ovary cell is the primary cell of the ovary that contributes to the

development of the ovary wall and subsequently the pericarp.

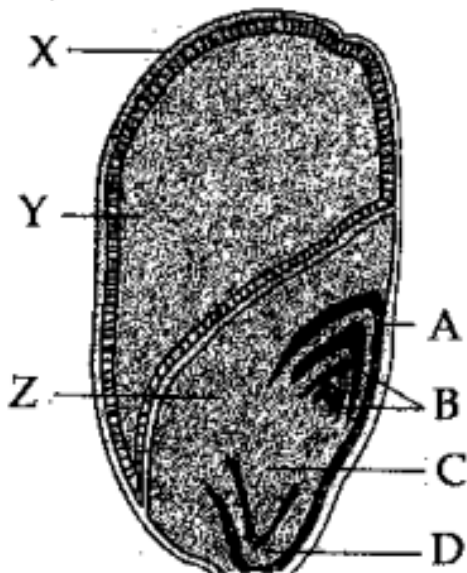
Step 3: Eliminate other options.

The zygote develops into the embryo (parts labeled A, B, C, D). Sepals and petals are parts of the flower (calyx and corolla, respectively) and do not directly develop into the fruit wall.

Quick Tip

Remember the general rule: Ovary develops into fruit, and ovules develop into seeds.
The pericarp is the wall of the fruit.

47. The part which provides nourishment to the developing embryo is :



- (1) A
- (2) Y
- (3) B
- (4) D

Correct Answer: (2) Y

Solution: Step 1: Identify the parts labeled in the diagram.

A: Plumule (embryonic shoot)

Y: Endosperm (nutritive tissue)

B: Radicle (embryonic root)

C: Coleorhiza (sheath covering the radicle)

D: Coleoptile (sheath covering the plumule)

Z: Scutellum (cotyledon)

X: Pericarp (fruit wall)

Step 2: Recall the function of the endosperm.

The endosperm is a triploid tissue that develops in the angiosperm seed after double fertilization. Its primary function is to store nutrients (mainly starch, but also proteins and oils) that are utilized by the developing embryo during germination and early seedling growth.

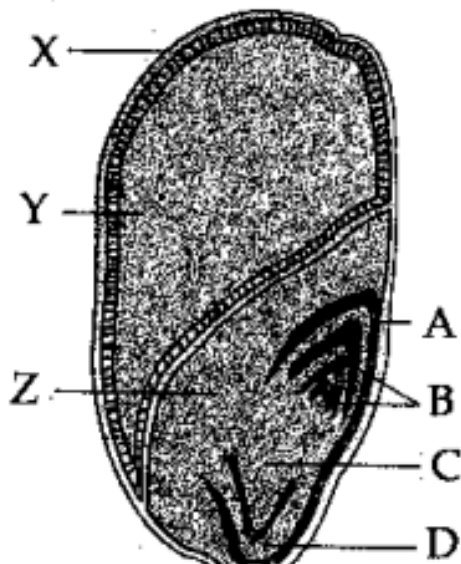
Step 3: Identify the part providing nourishment.

Based on the function, the endosperm (labeled Y) is the part that provides nourishment to the developing embryo.

Quick Tip

Remember that maize is an endospermic seed, meaning it retains a significant amount of endosperm at maturity.

48. In diagram the sheath which covers radicle is shown by ?



- (1) A
- (2) B
- (3) C

(4) D

Correct Answer: (4) D

Solution: Step 1: Identify the parts labeled in the diagram.

B: Radicle (embryonic root)

D: Coleorhiza (sheath covering the radicle)

Step 2: Recall the function of the coleorhiza.

The coleorhiza is a protective sheath that covers the radicle (embryonic root) in monocot seeds like maize. It protects the radicle as it grows through the soil during germination.

Step 3: Identify the sheath covering the radicle.

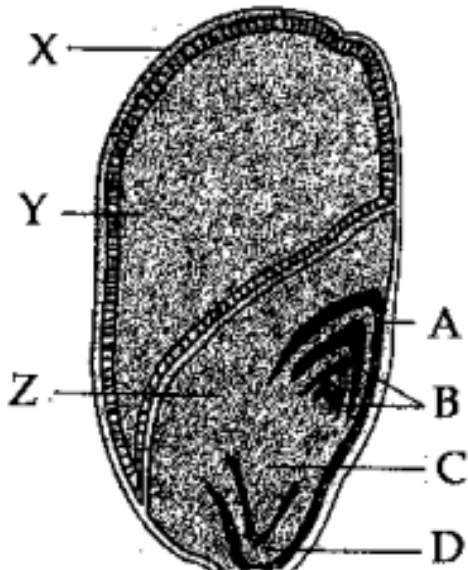
The diagram shows that 'D' is the sheath-like structure enclosing the radicle (labeled B).

Therefore, 'D' represents the coleorhiza.

Quick Tip

Think of "coleorhiza" as "root cover" (rhiza refers to root).

49. In diagram the scutellum is represented by :



(1) A

(2) Y

(3) Z

(4) D

Correct Answer: (3) Z

Solution: Step 1: Identify the parts labeled in the diagram.

Y: Endosperm (nutritive tissue)

Z: Scutellum (cotyledon)

Step 2: Recall the structure of a monocot seed.

Monocot seeds have one cotyledon. In grasses like maize, the cotyledon is a large, shield-shaped structure called the scutellum. The scutellum is specialized for absorbing nutrients from the endosperm and transferring them to the developing embryo.

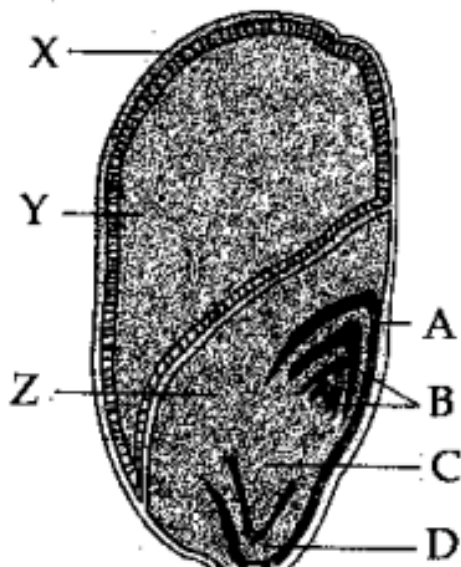
Step 3: Identify the scutellum in the diagram.

The diagram shows 'Z' as a prominent shield-shaped structure adjacent to the endosperm (Y) and the embryo.

Quick Tip

Remember that "scutellum" is the term for the cotyledon in grasses.

50. In diagram the sheath which covers plumule is shown by :



- (1) A
- (2) B
- (3) C
- (4) D

Correct Answer: (1) A

Solution: Step 1: Identify the parts labeled in the diagram.

A: Coleoptile (sheath covering the plumule)

A also points to the Plumule itself. Given the question, it's referring to the covering.

Step 2: Recall the function of the coleoptile.

The coleoptile is a protective sheath that covers the plumule (embryonic shoot) and the young leaves in monocot seeds like maize. It protects the delicate plumule as it emerges from the soil during germination.

Step 3: Identify the sheath covering the plumule.

The diagram shows that 'A' is the sheath-like structure enclosing the plumule. Therefore, 'A' represents the coleoptile.

Quick Tip

Think of "coleoptile" as "shoot cover" (ptile refers to leaf or shoot).
