CBSE 12 Biology (57/4/1) Question Paper with Solutions

Time Allowed :3 hours	**Maximum Marks :**100	**Total questions :**65

General Instructions

Read the following instructions very carefully and strictly follow them:

1. This question paper contains 33 questions. All questions are compulsory.
2. The question paper is divided into **five sections**: Sections **A, B, C, D, and E**.
3. **Section A** – questions number 1 to 16 are **multiple-choice type questions**. Each question carries 1 mark.
4. **Section B** – questions number 17 to 21 are **very short answer type questions**. Each question carries 2 marks.
5. **Section C** – questions number 22 to 28 are **short answer type questions**. Each question carries 3 marks.
6. **Section D** – questions number 29 and 30 are **case-based questions**. Each question carries 4 marks. Each question has subparts with **internal choice** in one of the subparts.
7. **Section E** – questions number 31 to 33 are **long answer type questions**. Each question carries 5 marks.
8. There is **no overall choice.** However, an internal choice has been provided in Sections **B, C, and D** of the question paper. A candidate has to write the answer for **only one of the alternatives** in such questions.
9. Kindly note that there is a separate question paper for **Visually Impaired candidates**.
10. Wherever necessary, **neat and properly labelled diagrams** should be drawn.

SECTION A

1. In a fertilized ovule of an angiosperm, the cells in which n, 2n, and 3n conditions respectively occur are:

(A) antipodal, zygote, and endosperm

(B) zygote, nucellus, and endosperm

(C) endosperm, nucellus, and zygote

(D) antipodals, synergids, and integuments

Correct Answer: (A) antipodal, zygote, and endosperm

Solution:

- In a fertilized ovule of an angiosperm:
  - **n (haploid):** Present in the antipodal cells.
  - **2n (diploid):** Present in the zygote formed through fertilization.
  - **3n (triploid):** Present in the endosperm formed via double fertilization.
- This pattern of ploidy levels is a defining feature of the angiosperm reproductive process.

Quick Tip

The process of double fertilization in angiosperms ensures the formation of both a diploid zygote and a triploid endosperm for nourishment.

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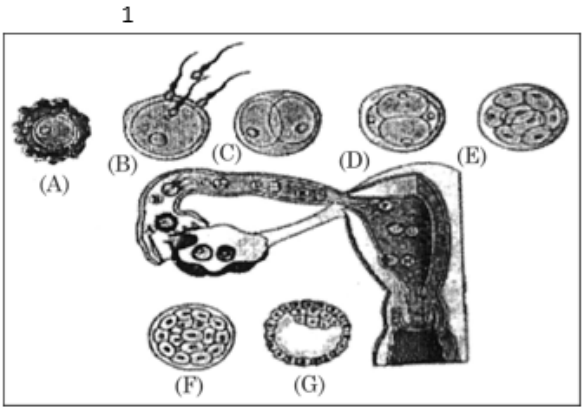
2. Select the option that gives the correct identification of ovum, morula, and blastocyst in a human female reproduction system as shown in the following diagram:



(A) Ovum – B, Morula – D, Blastocyst – F

(B) Ovum – A, Morula – B, Blastocyst – G

(C) Ovum – A, Morula – E, Blastocyst – G

(D) Ovum – B, Morula – D, Blastocyst – G

Correct Answer: (C) Ovum – A, Morula – E, Blastocyst – G

Solution:

- **Ovum:** The egg cell that has not been fertilized (A), as depicted in the diagram.
- **Morula:** A solid mass of cells (E) formed during the early cleavage stages after fertilization.
- **Blastocyst:** A hollow structure (G) that develops early in mammalian development and later implants into the uterine wall.

Quick Tip

The blastocyst stage is crucial for implantation into the uterine lining, marking the start of pregnancy.

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3. Study the table given below:

Contraceptive/Contraceptive Method	Mode of Action
A. The pill	I. Prevent sperm reaching cervix
B. Condom	II. Prevent implantation
C. Vasectomy	III. Inhibits ovulation
D. Copper-T	IV. Semen contains no sperm

Select the option where contraceptive/contraceptive method are correctly matched with their mode of action.

(A) A – III, B – II, C – I, D – IV

(B) A – II, B – III, C – I, D – IV

(C) A – III, B – I, C – IV, D – II

(D) A – III, B – I, C – II, D – IV

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

Solution:

- **A – The pill:** Functions by preventing ovulation (III).
- **B – Condom:** Stops sperm from reaching the cervix (I).
- **C – Vasectomy:** Involves cutting or tying the vas deferens, leading to semen without sperm (IV).
- **D – Copper-T:** Prevents the fertilized egg from implanting in the uterus (II).

Quick Tip

Contraceptive methods are designed to prevent fertilization or implantation, ensuring effective family planning.

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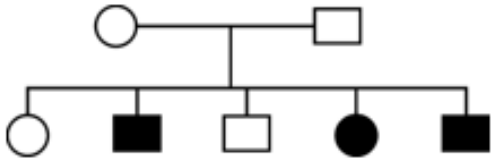
4. Identify the category of genetic disorder depicted in the pedigree chart given below:



(A) X-Linked recessive

(B) X-Linked dominant

(C) Autosomal recessive

(D) Autosomal dominant

Correct Answer: (C) Autosomal recessive

Solution: Examine the Pedigree Chart.

- Both males and females are affected, suggesting autosomal inheritance.

- The disorder manifests in siblings but not in the parents, which is typical of a recessive trait.

Final Answer: The genetic disorder shown is **autosomal recessive**.

Quick Tip

Autosomal recessive disorders often skip generations, as carriers do not exhibit symptoms.

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5. Which was the last of the 24 human chromosomes to be completely sequenced?

(A) Chromosome – 1

(B) Chromosome – 11

(C) Chromosome – 21

(D) Chromosome – X

Correct Answer: (A) Chromosome – 1

Solution: Review the Human Genome Project-

- Chromosome 1 was the final human chromosome to be fully sequenced due to its large size and complexity. It contains the greatest number of genes and numerous repetitive sequences, making sequencing particularly difficult.

Final Answer: The last chromosome to be entirely sequenced was **Chromosome 1**.

Quick Tip

Chromosome 1 sequencing was challenging due to its large size and complexity, as it carries the most genes among all human chromosomes.

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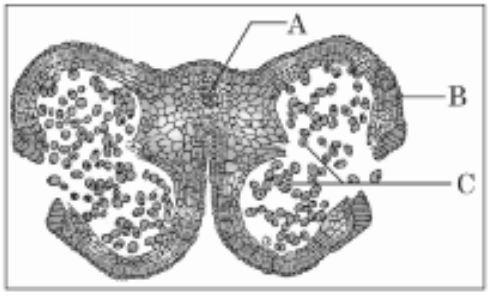
6. Study the following diagram of Transverse Section of a young anther of an angiosperm:



(A) A – Connective, B – Endothecium, C – Pollen grain.

(B) A – Endothecium, B – Connective, C – Pollen grain.

(C) A – Pollen grain, B – Connective, C – Endothecium.

(D) A – Endothecium, B – Pollen grain, C – Connective.

Correct Answer: (A) A – Connective, B – Endothecium, C – Pollen grain.

Solution: Interpret the Anther Diagram-

- Connective tissue joins the two lobes of the anther.

- Endothecium forms the outer wall of the pollen sac.

- Pollen grains are present inside the pollen sac.

Final Answer: The correct identification is **A – Connective, B – Endothecium, C – Pollen grain**.

Quick Tip

The anther structure includes connective tissue, endothecium, and pollen grains inside the pollen sacs.

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7. Turner's syndrome in humans occurs due to:

(A) Aneuploidy

(B) Euploidy

(C) Polyploidy

(D) Autosomal abnormality

Correct Answer: (A) Aneuploidy

Solution: About Turner's Syndrome:

- Turner's syndrome is a chromosomal disorder caused by the presence of a single X chromosome (45, XO) instead of two sex chromosomes and a form of aneuploidy, which refers to the loss or gain of chromosomes.

Final Answer: Turner's syndrome is caused by **aneuploidy**.

Quick Tip

Turner's syndrome affects females, leading to short stature, infertility, and other physical abnormalities.

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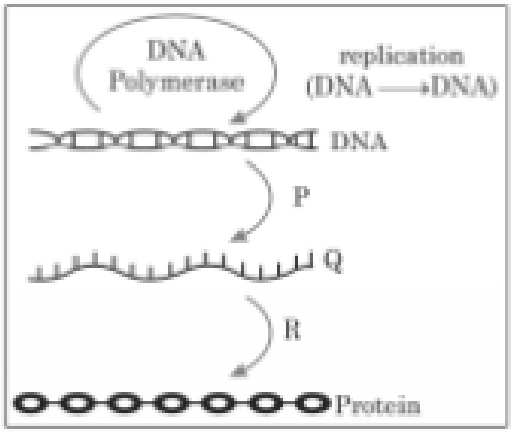
8. Which of the options has correct identification of 'P', 'Q' and 'R' in the illustration of 'Central Dogma' given below?



(A) P– Replication, Q – rRNA, R – Transcription.

(B) P – Translation, Q – mRNA, R – Transcription.

(C) P – Replication, Q – mRNA, R – Translation.

(D) P – Transcription, Q – mRNA, R – Translation.

Correct Answer: (D) P – Transcription, Q – mRNA, R – Translation.

Solution: The Central Dogma:

- Transcription (P): DNA to mRNA.

- mRNA (Q): Carries genetic information.

- Translation (R): mRNA to protein.

Final Answer: P – Transcription, Q – mRNA, R – Translation.

Quick Tip

The central dogma describes the flow of genetic information: DNA → RNA → Protein.

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9. Who proposed the mutation theory in favour of organic evolution?

(A) Weismann

(B) Louis Pasteur

(C) Darwin

(D) Hugo de Vries

Correct Answer: (D) Hugo de Vries

Solution: Evolutionary Theories are as follows-

Hugo de Vries proposed the mutation theory, which states that evolution occurs through sudden, heritable changes in an organism's genetic material and These mutations serve as raw material for natural selection.

Final Answer: The mutation theory was proposed by **Hugo de Vries**.

Quick Tip

Mutations are the source of genetic variation, critical for evolution and adaptation.

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10. Study the following list of bioactive substances and their action:

Bioactive Substance	Role
A. Statin	I.Removal of oil stains
B. Cyclosporin A	II. Removal of clots from blood vessels
C. Streptokinase	III. Lowering of blood cholesterol
D. Lipase	IV. Immuno-suppressive agent

(A) A – II, B – III, C – I, D – IV

(B) A – III, B – IV, C – II, D – I

(C) A – IV, B – I, C – II, D – III

(D) A – IV, B – III, C – I, D – II

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

Solution: Match Bioactive Substances to Their Actions-

- Statin: Lowers blood cholesterol (III).
- Cyclosporin A: Acts as an immuno-suppressive agent (IV).
- Streptokinase: Removes clots from blood vessels (II).
- Lipase: Removes oil stains (I).

Final Answer: A – III, B – IV, C – II, D – I.

Quick Tip

Bioactive substances have diverse roles in medicine, industry, and healthcare.

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11. The 'molecular scissors' fall in the category of:

(A) Cleaving enzyme

(B) Endonuclease

(C) Exonuclease

(D) Restriction enzymes

Correct Answer: (D) Restriction enzymes

Solution: About Restriction Enzymes:

- Restriction enzymes, also known as molecular scissors, cut DNA at specific sequences.

- These enzymes are extensively used in genetic engineering and molecular biology.

Therefore, **Restriction enzymes** are referred to as molecular scissors.

Quick Tip

Restriction enzymes are indispensable in cloning and recombinant DNA technology.

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12. ELISA technique is based on the principle of:

(A) DNA replication

(B) Antigen-antibody interaction

(C) Pathogen–antigen interaction

(D) Antigen–protein interaction

Correct Answer: (B) Antigen-antibody interaction

Solution:

- ELISA (Enzyme-Linked Immunosorbent Assay) operates based on the principle of antigen-antibody binding to identify specific proteins or antibodies within a sample.
- The interaction between an enzyme-labeled antibody and its corresponding antigen is assessed by color change, which indicates the presence of the antigen.

Quick Tip

ELISA is widely used in diagnostics to detect diseases such as HIV and hepatitis by identifying antibodies or antigens.

Question No.s 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 and (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): A given fig species can be pollinated only by its partner wasp.
Reason (R): The wasp pollinates the fig inflorescence while searching for suitable egg-laying sites.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true and (R) is not the correct explanation of (A).
(C) (A) is true, but (R) is false.
(D) (A) is false, but (R) is true.
Correct Answer: (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
Solution:

- Fig and wasp share a mutualistic relationship where each depends on the other for survival and reproduction.
- Wasps pollinate fig flowers while laying eggs, ensuring mutual benefit.

Quick Tip

The fig-wasp interaction is a classic example of obligate mutualism.

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14. Assertion (A): Plasmids are autonomously replicating circular extra-chromosomal DNA.
Reason (R): Plasmids are usually present in eukaryotic cells.
(A) Both (A) and (R) are true and (R) is the correct explanation of (A).
(B) Both (A) and (R) are true and (R) is not the correct explanation of (A).
(C) (A) is true, but (R) is false.
(D) (A) is false, but (R) is true.
Correct Answer: (C) (A) is true, but (R) is false.

Solution:

- Plasmids are circular DNA molecules that can replicate independently.
- While they are found in prokaryotic cells, such as bacteria, they are not typically present in eukaryotic cells.
- These plasmids exist separately from chromosomal DNA in prokaryotes.
- Their ability to replicate autonomously allows for the transfer of genetic material between cells.
- Plasmids are essential tools in genetic engineering and biotechnology.

Quick Tip

Plasmids play a vital role in genetic engineering for cloning and gene expression studies.

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15. Assertion (A): Patents are granted by governments to an inventor.

Reason (R): Patents prevent others from commercial use of an invention.

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

(B) Both (A) and (R) are true and (R) is not the correct explanation of (A).

(C) (A) is true, but (R) is false.

(D) (A) is false, but (R) is true.

Correct Answer: (A) Both (A) and (R) are true and (R) is the correct explanation of (A).

Solution:

- Patents are legal rights granted to inventors for exclusive use of their inventions.
- The purpose of patents is to prevent unauthorized commercial use and ensure the protection of intellectual property, which directly explains the reason provided.

Quick Tip

Patents encourage innovation by ensuring intellectual property protection.

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16. Assertion (A): Some aquatic ecosystems have inverted biomass pyramids.

Reason (R): More energy is required by organisms occupying higher trophic levels.

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

(B) Both (A) and (R) are true and (R) is not the correct explanation of (A).

(C) (A) is true, but (R) is false.

(D) (A) is false, but (R) is true.

Correct Answer: (B) Both (A) and (R) are true, but (R) is not the correct explanation of (A).

Solution:

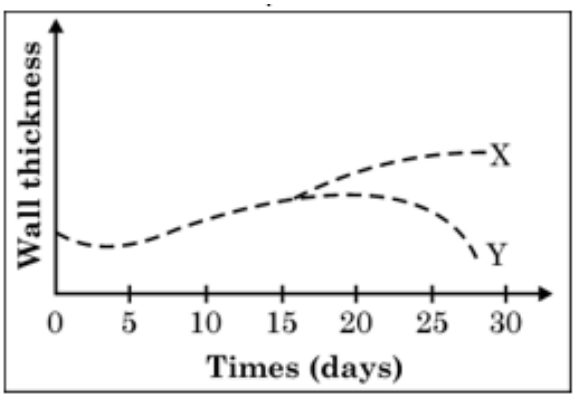
- Inverted biomass pyramids occur in aquatic ecosystems where the biomass of primary consumers exceeds that of producers.
- The energy transfer efficiency in trophic levels determines biomass, not the amount of energy required by higher trophic levels, which makes the reason valid but not explanatory for the assertion.

Quick Tip

In aquatic ecosystems, phytoplankton reproduce rapidly, sustaining higher consumer biomass despite low producer biomass.

SECTION B

17. Study the graph given below that represents the changes in the thickening of the uterine wall in women 'X' and women 'Y' over a period of one month:



What does the graph with respect to women 'X' and women 'Y' indicate? Give a suitable reason.

Correct Answer: Normal and lack of thickening

Solution:

- The graph shows:
  - Woman 'X': Normal thickening of the uterine wall due to regular hormonal activity.
  - Woman 'Y': Lack of thickening indicates a hormonal imbalance or insufficient estrogen/progesterone secretion.

Quick Tip

A healthy uterine wall is essential for implantation of the embryo. Hormonal imbalances can disrupt this process.

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18. (a) Intensely lactating mothers generally do not conceive. Why?

Correct Answer: Lactational amenorrhea inhibits conception during intense lactation.

Solution:

- Lactational amenorrhea prevents ovulation during intense lactation.
- Prolactin, the hormone responsible for milk production, suppresses gonadotropin release, thereby preventing the onset of ovulation.

Quick Tip

Lactational amenorrhea is a natural contraceptive method but is not completely reliable for preventing pregnancy.

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18. (b) Why has our government intentionally imposed strict conditions for MTP (Medical Termination of Pregnancy)?

Correct Answer: To prevent misuse and ensure MTP is conducted only for genuine medical or legal reasons.

Solution:

- To prevent misuse and ensure MTP is conducted only for genuine medical or legal reasons.

- Protects the health and rights of women.

Quick Tip

It is important to ensure that MTP is only performed when medically necessary or legally justified to safeguard both the health of the woman and the ethical use of health-care resources.

19.(a) Name the source from which insulin was extracted in earlier times. Why is this insulin no more in use by the diabetic patients?

Correct Answer: Pancrea and Animal Insulin

Solution:

- Source: Pancreas of pigs and cows.
- Reason: Animal insulin caused allergic reactions in some patients due to structural differences from human insulin.

Quick Tip

Recombinant DNA technology allows the production of human insulin, minimizing allergic reactions.

19.(b) Why does the insulin synthesized in the human body undergo processing whereas the insulin produced by Eli Lilly company does not need to undergo any processing? Explain.

Correct Answer: Human insulin and Recombinant insulin

Solution:

- Human insulin is produced as proinsulin and requires processing to remove C-peptide.
- Eli Lilly produces ready-to-use recombinant insulin without requiring further processing.

Quick Tip

Recombinant and human insulin depending on their function undergo processing.

20.(a) Differentiate between grazing food chain and detritus food chain.

Correct Answer: Startes by producers and decomposers

Solution:

- Grazing food chain: Begins with producers consumed by herbivores. (e.g., Grass → Deer → Lion)
- Detritus food chain: Begins with decomposers breaking down organic matter. (e.g., Dead leaves → Fungi → Earthworm)

Quick Tip

Grazing and Detritus food chain varies according to their functions.

20.(b) Explain Brood parasitism with the help of a suitable example.

Correct Answer: Reproductive strategy and Cuckoo

Solution:

- Brood parasitism: A reproductive strategy where one species lays eggs in the nest of another species.
- Example: Cuckoo lays eggs in crow nests; cuckoo chicks outcompete crow chicks for food.

Quick Tip

Brood parasitism benefits the parasitic species by reducing parental investment.

21.(a) Biodiversity hotspots cover less than 2% of Earth's land area. Strict protection of these areas can reduce the rate of ongoing extinctions. Explain.

Correct Answer: In endemic Species

Solution:

- Biodiversity hotspots are regions rich in endemic species but threatened by habitat loss.
- Protecting hotspots helps conserve numerous species, ensuring ecosystem stability and reducing extinction rates.

Quick Tip

Biodiversity hotspots conserve different kind of speicies.

21.(b) Name any two hotspots in India.

Correct Answer: Western Ghats and Indo Burma

Solution:

- Western Ghats.
- Indo-Burma region.

Quick Tip

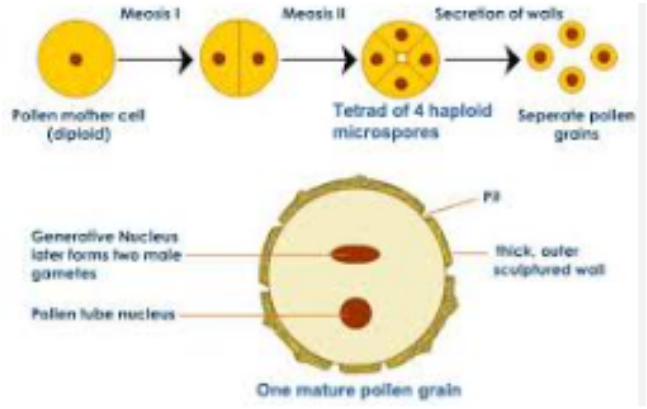
India has four biodiversity hotspots: Himalayas, Western Ghats, Indo-Burma, and Sundaland.

SECTION C

22. Draw a well-labelled diagram of sectional view of male gametophyte/microspore of an angiosperm and write the functions of any two parts labelled. (Any four labels).

Answer: The diagram of a male gametophyte/microspore of an angiosperm should include:

Solution:



Functions:

- Generative cell: Divides to form two male gametes.
- Tube cell: Grows into a pollen tube to facilitate fertilization.

Quick Tip

The male gametophyte of an angiosperm is responsible for the formation of male gametes, crucial for fertilization.

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23. (a) A man with blood group 'A' marries a woman with blood group 'AB'. The first child born to them has blood group 'B'. Work out a cross to find the genotype of the father. Give the possible blood groups and their genotypes of the children that could be born to this couple. (Use a Punnet square).

Correct Answer: Father's Genotype: I^Ai

Mother's Genotype: I^AI^B

Punnett Square:

	I^A	I^B
I^A	I^AI^A	I^AI^B
i	I^Ai	I^Bi

Solution: Children's Blood Groups:

- Blood Group A: I^AI^A, I^Ai
- Blood Group B: I^Bi
- Blood Group AB: I^AI^B

Quick Tip

The Children blood groups depend upon parents genotypes.

23.(b) State the basis of 'ABO' blood grouping in humans.

Correct Answer: Absence or presence of antigens on RBCs.

Solution: The ABO blood grouping is based on:

- The presence or absence of antigens (A and B) on the surface of red blood cells.
- The presence of antibodies (anti-A and anti-B) in the plasma.

Quick Tip

The ABO blood grouping system is crucial for safe blood transfusions and organ transplants.

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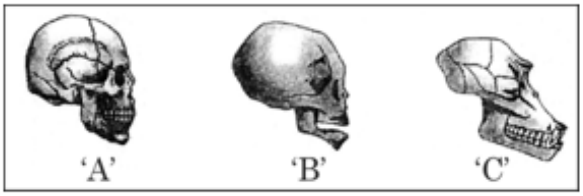
24. (a) Whose skulls 'A', 'B', and 'C' are shown below? Which of the two are more similar to each other?



Correct Answer: Homosapiens, Neanderthals and Australopithecus

Solution:

- Skull A: Homo sapiens
- Skull B: Neanderthals
- Skull C: Australopithecus
- Skulls A and B are more similar to each other.

Quick Tip

The type of skull depends upon the figure given. See carefully and learn these.

24.(b) Name the (i) ape-like (ii) man-like primates that existed 1.5 million years ago.

Correct Answer: Both Australopithecus Homo erectus

Solution:

- (i) Australopithecus (ape-like)
- (ii) Homo erectus (man-like)

Quick Tip

The evolutionary study of skulls provides insights into the development of human and primate features.

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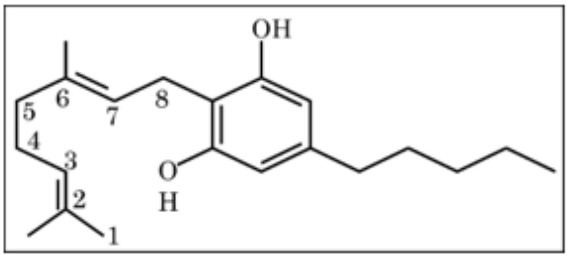
25. (a) (i) Name the group of drugs whose skeletal molecule is shown below:



Answer: Steroids.

Solution: -Steroids are the drugs whose skeletal molecule is given.

-They are characterized by a four-ring carbon structure.

-Steroids can be classified into anabolic steroids, which promote muscle growth, and corticosteroids, which are used to treat inflammation and immune disorders.

Quick Tip

The steroids are drugs which is surrounded by four-ring structure.

(ii) How are such drugs consumed?

Correct Answer: These drugs are consumed orally, injected, or applied topically.

Solution: -These drugs are consumed orally, injected, or applied topically.

-They can have various therapeutic uses, such as treating inflammation, hormone imbalances, and autoimmune diseases.
-However, prolonged or excessive use can lead to side effects, including liver damage, hormonal imbalances, and increased risk of cardiovascular diseases.
-Steroids should only be used under medical supervision to minimize potential risks.

Quick Tip

The drugs depending on the treatment taken orally, injected or applied topically.

(iii) Name the human body organ affected by the consumption of these drugs.

Correct Answer: Liver.

Solution: Liver is affected by the consumption of steroids.

Prolonged use of steroids can lead to liver toxicity, causing conditions like jaundice, liver damage, and in severe cases, liver failure.

Steroids can also increase the risk of developing liver tumors or cysts due to their impact on liver function and metabolism.

Quick Tip

Steroids drugs are classified into different types and injected or orally. Liver is most affected by these drugs.

OR

(b) Draw a schematic diagram of an antibody molecule and label any 4 parts. Mention their chemical nature. Name the cells which produce them.

Correct Answer: Y-shaped

Solution:

- Antibodies are Y-shaped molecules produced by B-lymphocytes.
- Chemical Nature: Proteins made of light and heavy polypeptide chains.

Quick Tip

Antibodies are crucial for immune defense, targeting specific antigens.

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26. Explain the role of the following during the sewage treatment:

(a) Flocs

(b) Anaerobic sludge digester

Correct Answer: Aggregates and organic matter

Solution:

- **Flocs:** Aggregates of bacteria and fungi used in the secondary treatment to degrade organic matter in sewage.
- **Anaerobic sludge digester:** Breaks down organic matter into methane, CO_2, and water during the anaerobic digestion of sludge.

Quick Tip

Sewage treatment plants play a vital role in water purification and waste management.

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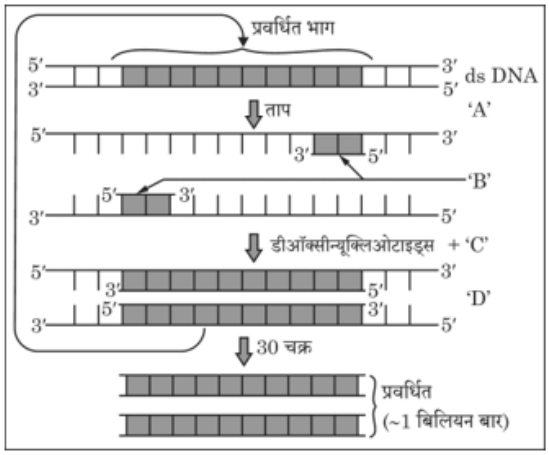
27. Study the steps shown below, that are carried during a specific technique:



(a) Identify the steps 'A' and 'D' in the diagram.

Correct Answer: Denaturation and Amplification

Solution:

- **A:** Denaturation of DNA at high temperatures.

- **D:** Amplification of DNA after 30 cycles.

Quick Tip

Remember the types of DNA and temperature conditions.

(b) What does 'B' represent?

Correct Answer: Primer annealing.

Solution: Primer annealing is the process where primers bind to their complementary sequences on the single-stranded DNA template.

This occurs during the cooling phase of the PCR cycle, allowing the primers to stabilize the DNA template for the extension step.

The temperature at which primer annealing occurs is crucial for the specificity and efficiency of the PCR amplification.

Quick Tip

Primer annealing process plays vital role in PCR amplification.

(c) Write what is 'C'? Name its source organism.

Correct Answer: DNA polymerase and aquaticus **Solution:**

- **C:** Taq DNA polymerase.
- **Source:** Thermus aquaticus.

Quick Tip

Learn the source of organisms and their functions.

(d) Mention the use of this technique in molecular diagnostics.

Correct Answer: Genetic testing, disease diagnosis, and forensic analysis **Solution:**

- Used in Polymerase Chain Reaction (PCR) to amplify DNA for genetic testing, disease diagnosis, and forensic analysis.

Quick Tip

PCR is a revolutionary technique for DNA amplification, enabling advancements in molecular biology and medicine.

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28. Explain the role of transgenic animals in: (a) Production of Biological Products

Correct Answer : Transgenic animals

Solution:

- Transgenic animals are engineered to produce important biological products like proteins and hormones.
- Example: Transgenic cows producing human lactoferrin, which has therapeutic applications.

Quick Tip

Transgenic technology helps produce safer and more effective biological products for human use.

(b) Studying Diseases Solution:

- Transgenic animals are used as models to study human diseases and their progression.
- Example: Transgenic mice are commonly used to study cancer, diabetes, and Alzheimer's disease.

Quick Tip

Transgenic animal models provide insights into disease mechanisms and potential treatments.

(c) Chemical Safety Testing Solution:

- Transgenic animals are used to test the safety of chemicals and drugs before they are approved for human use.

- Example: Transgenic mice are used to assess the toxicity of new pharmaceutical compounds.

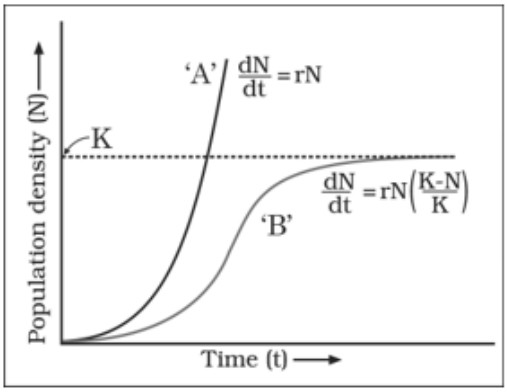
Quick Tip

Transgenic animals ensure that chemicals and drugs are safe for human application by providing reliable test models.

SECTION D

29. Populations evolve to maximise their reproductive fitness in the habitat in which they live.Ecologists suggest, the life history of organisms have evolved in relations to the constraints imposed by the biotic and abiotic components of the habitat in which they live. This gets reflected in the population growth pattern of all organisms including humans.

Study the population growth curves shown in the given graph and answer the questions that follow:



(a) Identify the growth curves 'A' and 'B' . Correct Answer: -Curve : Exponential growth curve.

- Curve : Logistic growth curve.

Solution: Exponential growth occurs under unlimited resources, showing a J-shaped curve. Logistic growth accounts for environmental constraints and levels off at the carrying capacity (K), forming an S-shaped curve.

Quick Tip

Exponential growth cannot sustain indefinitely due to limited resources, whereas logistic growth reflects real-world ecological scenarios.

(b) Mention what the dotted line in the graph indicates and state its importance also.

Correct Answer: Carrying capacity (K)

Solution:

- The dotted line represents the carrying capacity (K).
- **Importance:** Carrying capacity is the maximum population size that an environment can sustain indefinitely. It is determined by resource availability and environmental factors.

Quick Tip

The carrying capacity sets a limit on population size to prevent overuse of resources and ecological imbalance.

OR

(b) Growth curve 'B' shows a different pattern from that of growth curve 'A'. Justify giving one reason. **Correct Answer:** Logistic curves

Solution:

- Curve Ž2018BŽ2019 (logistic growth) differs from curve Ž2018AŽ2019 (exponential growth) because it incorporates the concept of limited resources and environmental resistance.
- Logistic growth considers population stabilization when reaching the carrying capacity, making it more realistic.

Quick Tip

Logistic growth aligns with natural population patterns where resources are limited and competition exists.

(c)(i) Which one of the two curves is more realistic and why? Correct Answer: A and B

Solution:

- Curve (logistic growth) is more realistic because populations are subject to resource limitations, predation, and environmental constraints.
- Curve (exponential growth) assumes unlimited resources, which is rarely the case in natural ecosystems.

Quick Tip

Logistic growth reflects real-world dynamics, highlighting the role of environmental resistance in stabilizing populations.

(ii) Which one of the two curves is relevant in present days with respect to human population in our country and why? Correct Answer: Exponential curve

Solution:

- The exponential growth curve (Curve Ž018AŽ019) is more relevant because the human population continues to grow at a rapid rate, often exceeding the carrying capacity temporarily.
- However, environmental resistance like resource depletion and climate change will eventually necessitate stabilization, transitioning to a logistic growth model.

Quick Tip

Human population trends often reflect exponential growth due to advancements in healthcare and technology, delaying resource exhaustion.

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30. Read the following passage and answer the questions that follow: Passage:

Generally, in eukaryotic cells the average length of a transcription unit along a DNA molecule is about 8,000 nucleotides, so the RNA product of the transcription is also that long. But it only takes about 1200 nucleotides from the above RNA product to translate average sized polypeptide of 400 Amino acids.

(a) Name this RNA product transcribed from the DNA that subsequently translates into a polypeptide of 400 amino acids. Mention the enzyme responsible for transcribing this type of RNA from the DNA. Correct Answer : mRNA and polymerase

Solution:

- The RNA product is mRNA (messenger RNA).
- Enzyme responsible: RNA polymerase II.

Quick Tip

mRNA is the template for protein synthesis in the process of translation.

(b) Name and explain the process the RNA molecule transcribed from 8000 nucleotide long DNA undergoes to be able to translate a polypeptide of 400 amino acids. Correct Answer: Splicing

Solution:

- Process: Splicing.
- Explanation: During splicing, non-coding regions (introns) are removed from the pre-mRNA, leaving only coding regions (exons) to form mature mRNA. This ensures the correct sequence for translating into a 400 amino acid polypeptide.

Quick Tip

Splicing is essential in eukaryotes for producing functional mRNA.

(c) Write the number of RNA polymerases involved in the transcription of DNA in a prokaryote and eukaryotes.

Correct Answer: 3 RNA

Solution:

- **Prokaryotes:** One RNA polymerase is involved in transcription.
- **Eukaryotes:** Three RNA polymerases (RNA polymerase I, II, and III) are involved in transcription.

Quick Tip

Eukaryotic cells use three specialized RNA polymerases for different types of RNA, while prokaryotes rely on a single RNA polymerase.

OR

(c) Mention the difference in the site of transcription in a prokaryote and eukaryote cell.

Correct Answer: Cytoplasm and nucleus

Solution:

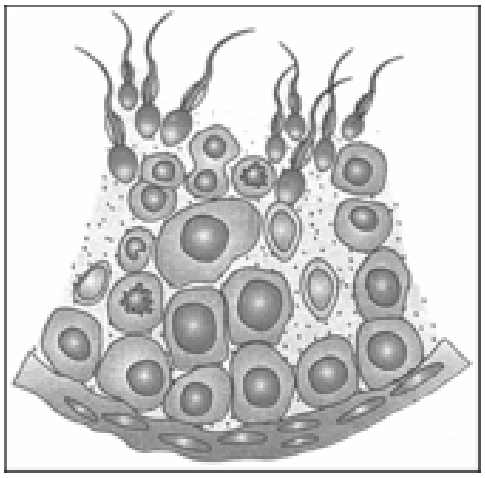
- **Prokaryotes:** Transcription occurs in the cytoplasm.
- **Eukaryotes:** Transcription occurs in the nucleus.

Quick Tip

In prokaryotes, transcription and translation occur simultaneously in the cytoplasm, while in eukaryotes, transcription is confined to the nucleus and translation occurs in the cytoplasm.

SECTION E

31. (a) The given diagram shows the sectional view of a seminiferous tubule of Human testis.



(i) Name and describe the process depicted in the diagram which results in the development of spermatozoa.

Correct Answer : Spermtogenesis

Solution:

- Process: Spermatogenesis.
- Description: Spermatogenesis is the process of formation of sperm cells (spermatozoa) from the spermatogonial cells in the seminiferous tubules of the testes. It includes the following stages:
  - Multiplication Phase: Mitotic division of spermatogonia to produce primary spermatocytes.
  - Growth Phase: Enlargement of primary spermatocytes.
  - Maturation Phase: Meiosis to produce haploid spermatids from secondary spermatocytes.
  - Differentiation Phase: Spermatids transform into spermatozoa.

Quick Tip

Spermatogenesis is regulated by hormones like FSH, LH, and testosterone.

(ii) Identify the cell where you are seeing a cluster of spermatozoa attached in the diagram. Write the function of the cell. Correct Answer: Sertoli cell

Solution:

- The cell is the Sertoli cell.
- Function: Sertoli cells provide nourishment and structural support to the developing sperm cells. They also secrete inhibin, which regulates spermatogenesis.

Quick Tip

Sertoli cells create a microenvironment essential for spermatogenesis.

OR

(b). Observe the picture of Commelina plant bearing two types of flowers:

(i) Identify the two types of flowers labelled 'A' and 'B' in the picture.

Correct Answer: Chasmogamous and Cleistogamous flower.

Solution:

- 'A': Chasmogamous flower.
- 'B': Cleistogamous flower.

Quick Tip

Chasmogamous flowers rely on external pollinators, while cleistogamous flowers ensure reproduction even in the absence of pollinators.

(ii) Compare the two types of flowers with reference to:

(1) Characteristic feature

(2) Modes of pollination

Correct Answer: Open and close flowers depending upon reproductive parts

Solution:

- Characteristic feature:
  - Chasmogamous flowers: Open flowers, reproductive parts exposed.

- Cleistogamous flowers: Closed flowers, reproductive parts not exposed.

- Modes of pollination:
  - Chasmogamous flowers: Cross-pollination facilitated by agents like wind, insects, or water.
  - Cleistogamous flowers: Self-pollination occurs as flowers never open.

Quick Tip

Cross-pollination promotes genetic diversity, while self-pollination ensures reproduction in unfavorable conditions.

(iii) List any two 'out breeding devices' in flowering plants. Explain why do plants develop such devices.

Correct Answer: Self-incompatibility and Production of unisexual flowers.

Solution:

- Out breeding devices:
  - Self-incompatibility.
  - Production of unisexual flowers.
- Explanation: These devices prevent self-pollination and promote cross-pollination, which enhances genetic diversity and adaptation.

Quick Tip

Out breeding devices ensure genetic recombination, which strengthens plants' adaptability and resilience against environmental changes.

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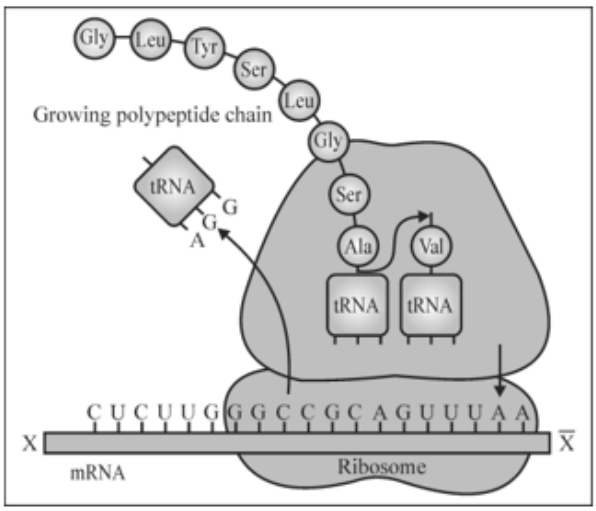
32 (a). Study the schematic diagram given below and answer the questions:



(i) Identify the polarity from 'X' to 'Y' in the mRNA segment shown. Mention how many more amino acids can be added to the polypeptide that is being translated and why.

Correct Answer: 5 to 3

Solution:

- Polarity: 5' to 3' direction.
- Number of additional amino acids: Depends on the number of codons left untranslated on the mRNA.
- Reason: Each codon corresponds to one amino acid, and translation stops when a stop codon is encountered.

Quick Tip

mRNA's polarity determines the direction of translation, with the ribosome reading it from 5' to 3'.

(ii) Write the initiating codon for translation, its anticodon, and the amino acid it codes for.

Correct Answer: AUG, UAC and Methionine

Solution:

- Initiating codon: AUG.

- Anticodon: UAC.
- Amino acid: Methionine.

Quick Tip

The codon AUG not only initiates translation but also codes for methionine, a crucial amino acid in protein synthesis.

(iii) Explain the charging of an adaptor molecule. Why this molecule needs to be charged?

Correct Answer: tRNA and synthetase

Solution:

- Charging of tRNA: Aminoacyl-tRNA synthetase attaches a specific amino acid to its corresponding tRNA, forming aminoacyl-tRNA.
- Importance: Charged tRNA ensures accurate addition of amino acids to the growing polypeptide chain during translation.

Quick Tip

Charged tRNA is essential for translating the genetic code into a functional protein.

OR

(b) Answer the following questions on sickle-cell anaemia:

(i) Why is sickle-cell anaemia, a human blood disorder, so named?

Correct Answer: RBCs

Solution:

- The disorder causes red blood cells to assume a sickle shape under low oxygen conditions, leading to its name.

Quick Tip

The sickle shape of red blood cells reduces their ability to carry oxygen efficiently, leading to severe health complications.

(ii) Explain the genetic basis that results in the expression of this disorder.

Correct Answer: Point mutation and mutated HB

Solution:

- It is caused by a point mutation in the -globin gene, where glutamic acid is replaced by valine at the sixth position of the haemoglobin protein.
- The mutated haemoglobin (HbS) polymerizes under low oxygen conditions, leading to cell deformation.

Quick Tip

Sickle-cell anaemia arises due to a single-point mutation, showcasing the profound impact of small genetic changes.

(iii) Work out a cross to explain how normal parents may have a sickle-cell anaemic child.

Correct Answer: 25 percentage

Solution:

- When both parents are carriers (HbA HbS), the offspring have a 25% chance of inheriting two sickle-cell alleles (HbS HbS), causing the disorder.

Quick Tip

A Punnett square can effectively illustrate inheritance patterns of sickle-cell anaemia and other genetic disorders.

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33. Describe the following:

(a) Describe the life cycle of HIV from the time of its entry into the human body till full blown AIDS sets in.

Correct Answer: Entry, Reverse transciption, Integration, Replication, Assembly and relaese.

Solution:

- Entry: HIV enters host cells (CD4+ T-cells) via surface receptors.
- Reverse transcription: Viral RNA is converted into DNA by reverse transcriptase.
- Integration: Viral DNA integrates into the host genome via integrase enzyme.
- Replication: Host machinery synthesizes viral components.
- Assembly and release: New viral particles are assembled and released, infecting other cells.
- Progression to AIDS: Gradual destruction of CD4+ cells leads to weakened immunity and opportunistic infections, culminating in AIDS.

Quick Tip

HIV attacks the immune system, specifically CD4+ T-cells, leaving the body vulnerable to infections.

OR

(b) Write the symptoms of malaria in humans and explain what causes these symptoms.

Correct Answer: High fever, Headache and vomiting

Solution:

- Symptoms:
  - High fever with chills.
  - Sweating and headache.
  - Nausea and vomiting.
- Cause: The symptoms are caused by the rupture of red blood cells during the release of merozoites and the immune response to parasitic toxins.

Quick Tip

Preventive measures like using insecticide-treated nets and timely medical intervention can reduce the risk of malaria.

(ii) Describe the different steps in the sexual mode of reproduction in the life cycle of a malarial parasite.

Correct Answer: Gametocytes

Solution:

- Gametocytes develop in human blood and are taken up by a mosquito during a blood meal.
- Fertilization occurs in the mosquito's gut, forming a zygote.
- The zygote develops into an ookinete and then an oocyst.
- Sporozoites are released from the oocyst and migrate to the salivary glands, ready to infect another human.

Quick Tip

The life cycle of Plasmodium alternates between humans (asexual phase) and mosquitoes (sexual phase).
