KCET 2025 Biology Question Paper With Solutions

Time Allowed :1 Hour 20 minutes	**Maximum Marks :**180	**Total Questions :**60

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The test is of 1 hours 20 minutes duration.
2. The question paper consists of 60 questions. The maximum marks are 180.
3. There are in the question paper consisting of Physics, having 60 questions of equal weightage.

1. Which of the following are the techniques for detection of cancer of internal organs?

a) Radiography, MRI

b) MRI, computed tomography

c) Widal test, radiography

d) MRI, widal test

(1) b and c

(2) b and d

(3) a and b

(4) a and c

Correct Answer: (3) a and b

Solution:

- **Definition of Techniques:** The question asks for imaging techniques used to detect cancer in internal organs, which are non-invasive methods providing detailed internal visuals.
- **Option Analysis:**
  - **(a) Radiography, MRI:** Radiography uses X-rays to create images of internal structures, while MRI (Magnetic Resonance Imaging) uses magnetic fields and

radio waves for detailed soft tissue imaging. **Both are widely used for cancer detection.**

- **(b) MRI, Computed Tomography (CT):** MRI is already covered, and CT scans use X-rays to produce cross-sectional images, highly effective for identifying tumors. **This is a valid technique.**
- **(c) Widal Test, Radiography:** The Widal test is a blood test for diagnosing typhoid fever, not cancer. **This is irrelevant for cancer detection.**
- **(d) MRI, Widal Test:** Combining MRI with a typhoid test has no medical basis for cancer detection. **This is incorrect.**

- **Correct Combination:** Options (3) a and b include Radiography/MRI and CT, both of which are established cancer detection methods.
- **Conclusion:** The correct answer is (3) a and b, as they represent valid imaging techniques for cancer diagnosis.

Quick Tip

Focus on imaging: Radiography, MRI, and CT are primary tools for cancer detection. Tests like Widal are for infectious diseases, not oncology.

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2. Malignant malaria is caused by

(1) Plasmodium falciparum

(2) Plasmodium rubrum

(3) Plasmodium malariae

(4) Plasmodium vivax

Correct Answer: (1) Plasmodium falciparum

Solution:

- **Definition of Malignant Malaria:** Malignant malaria, or severe malaria, is a life-threatening form of the disease characterized by complications like cerebral malaria and organ failure.

- **Option Analysis:**
  - **(1) Plasmodium falciparum:** This parasite is known to cause severe malaria, leading to high mortality if untreated. **It is the primary cause of malignant malaria.**
  - **(2) Plasmodium rubrum:** This is not a recognized species of Plasmodium. **It is incorrect.**
  - **(3) Plasmodium malariae:** Causes a milder form of malaria with quartan fever, not severe or malignant malaria. **This is incorrect.**
  - **(4) Plasmodium vivax:** Causes relapsing malaria, which is generally less severe than falciparum malaria. **This is incorrect.**
- **Pathophysiology Insight:** Plasmodium falciparum infects red blood cells, leading to their adhesion to blood vessel walls, causing blockages and severe symptoms. **This distinguishes it from other species.**
- **Conclusion:** The correct answer is (1) Plasmodium falciparum, as it is the only species associated with malignant malaria.

Quick Tip

Plasmodium falciparum is the deadliest malaria parasite due to its ability to cause severe complications. Other species like vivax and malariae are less aggressive.

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3. The drug prescribed to the patients who have undergone organ transplant is __ and is produced by __.

(1) Cyclosporin-A, Trichoderma polysporum

(2) Stain, Trichoderma polysporum

(3) Cyclosporin-A, Monascus purpureus

(4) Stain, Monascus purpureus

Correct Answer: (1) Cyclosporin-A, Trichoderma polysporum

Solution:

- **Definition of Drug:** The drug in question is an immunosuppressant used to prevent organ rejection in transplant patients by suppressing the immune system.
- **Option Analysis:**
  - **(1) Cyclosporin-A, Trichoderma polysporum:** Cyclosporin-A is a well-known immunosuppressant derived from the fungus Trichoderma polysporum. **This is correct.**
  - **(2) Stain, Trichoderma polysporum:** ”Stain” is not a recognized drug for organ transplants, and while Trichoderma polysporum produces Cyclosporin-A, ”Stain” is irrelevant. **This is incorrect.**
  - **(3) Cyclosporin-A, Monascus purpureus:** Monascus purpureus is a fungus used to produce red yeast rice and food colorants, not Cyclosporin-A. **This is incorrect.**
  - **(4) Stain, Monascus purpureus:** Neither ”Stain” nor Monascus purpureus is associated with an immunosuppressant drug for transplants. **This is incorrect.**
- **Mechanism Insight:** Cyclosporin-A works by inhibiting T-cell activation, crucial for preventing rejection of transplanted organs.
- **Conclusion:** The correct answer is (1) Cyclosporin-A, Trichoderma polysporum, as it accurately identifies the drug and its fungal source.

Quick Tip

Cyclosporin-A, produced by Trichoderma polysporum, is a cornerstone immunosuppressant in organ transplantation.

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4. Read the following statements and select the correct option. Statement-I: Biocontrol refers to the use of biological methods for controlling plant diseases and pests. Statement-II: Trichoderma species are effective biocontrol agents for several plant pathogens.

(1) Statement-I is incorrect but statement-II is correct

(2) Both statement-I and statement-II are correct

(3) Statement-I and statement-II is incorrect

(4) Both statement-I and statement-II are incorrect

Correct Answer: (2) Both statement-I and statement-II are correct

Solution:

- **Definition of Biocontrol:** Biocontrol involves using natural enemies or biological agents to manage plant diseases and pests, reducing reliance on chemical pesticides.
- **Statement-I Analysis:** Biocontrol indeed refers to the use of biological methods (e.g., fungi, bacteria, or predators) to control plant diseases and pests. **Statement-I is correct.**
- **Statement-II Analysis:** Trichoderma species, such as Trichoderma harzianum, are well-documented biocontrol agents that parasitize plant pathogens like Fusarium and Rhizoctonia, enhancing plant health. **Statement-II is correct.**
- **Option Analysis:**
  - **(1) Statement-I is incorrect but statement-II is correct:** This is incorrect as Statement-I is true.
  - **(2) Both statement-I and statement-II are correct:** Both statements align with scientific understanding of biocontrol. **This is correct.**
  - **(3) Statement-I and statement-II is incorrect:** Both statements are valid, so this is incorrect.
  - **(4) Both statement-I and statement-II are incorrect:** Both are factually accurate, so this is incorrect.
- **Conclusion:** The correct answer is (2) Both statement-I and statement-II are correct, as both reflect established principles in biocontrol.

Quick Tip

Trichoderma species are widely used in agriculture for their ability to combat plant pathogens naturally.

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5. Match the column-I with column-II. Choose the correct option given below.

Column-I	Column-II
a) Streptococcus	i) Free living nitrogen fixing bacteria
b) *Penicillium*	ii) Colt buster
c) Methanogens	iii) Source of antibiotic
d) Anabaena	iv) Biogas production

(1) a-iv, b-iii, c-i, d-ii

(2) a-iv, b-i, c-iii, d-ii

(3) a-ii, b-iii, c-iv, d-i

(4) a-i, b-iv, c-iii, d-i

Correct Answer: (3) a-ii, b-iii, c-iv, d-i

Solution:

- **Definition of Matching:** The task is to pair each organism in Column-I with its correct biological function or product in Column-II.
- **Option Analysis:**
  - **(a) Streptococcus:** Known for producing streptokinase, used as a ”clot buster” in medicine. Matches with **ii) Colt buster**.
  - **(b) Penicillium:** This fungus is the source of the antibiotic penicillin. Matches with **iii) Source of antibiotic**.
  - **(c) Methanogens:** These archaea produce methane gas during anaerobic decomposition, used in biogas production. Matches with **iv) Biogas production**.
  - **(d) Anabaena:** A cyanobacterium that performs free-living nitrogen fixation. Matches with **i) Free living nitrogen fixing bacteria**.
- **Correct Pairing:** The correct matching is a-ii, b-iii, c-iv, d-i, which corresponds to option (3).
- **Conclusion:** The correct answer is (3) a-ii, b-iii, c-iv, d-i, as it accurately aligns each organism with its function.

Quick Tip

Penicillium revolutionized medicine with antibiotics, while Anabaena contributes to nitrogen cycling in ecosystems.

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6. Match the contents of List-I with List-II

List-I	List-II
a) Bioreactors	i) Insulin produced by rDNA technology
b) Downstream processing	ii) Vessels which convert raw material into specific product
c) Recombinant protein	iii) Detect mutated genes in suspected cancer patient
d) PCR	iv) Involves separation and purification

(1) a-i, b-ii, c-iv, d-iii

(2) a-i, b-i, c-iii, d-iv

(3) a-ii, b-iv, c-i, d-iii

(4) a-iv, b-ii, c-iii, d-i

Correct Answer: (3) a-ii, b-iv, c-i, d-iii

Solution:

- **Definition of Matching:** The task is to pair each biotechnological term in List-I with its correct description or application in List-II.
- **Option Analysis:**
  - **(a) Bioreactors:** These are vessels designed to convert raw materials into specific products (e.g., insulin, enzymes) through controlled biological processes. Matches with **ii) Vessels which convert raw material into specific product**.

- **(b) Downstream processing:** This involves the separation and purification of products (e.g., proteins) after biosynthesis. Matches with **iv) Involves separation and purification**.
- **(c) Recombinant protein:** Proteins like insulin produced using recombinant DNA (rDNA) technology, often in bioreactors. Matches with **i) Insulin produced by rDNA technology**.
- **(d) PCR:** Polymerase Chain Reaction is used to amplify DNA, including detecting mutated genes in cancer patients. Matches with **iii) Detect mutated genes in suspected cancer patient**.

- **Correct Pairing:** The correct matching is a-ii, b-iv, c-i, d-iii, which corresponds to option (3).
- **Conclusion:** The correct answer is (3) a-ii, b-iv, c-i, d-iii, as it accurately aligns each term with its application.

Quick Tip

Bioreactors and downstream processing are critical steps in biotechnology, while PCR is essential for genetic diagnostics.

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7. The part of plasmid that codes for proteins involved in the replication of the pBR322 plasmid is

(1) ”rop”

(2) cloning site

(3) Ori site

(4) Selectable marker

Correct Answer: (1) ”rop”

Solution:

- **Definition of pBR322:** pBR322 is a commonly used plasmid vector in molecular biology, and its replication involves specific proteins encoded by its genetic elements.

- **Option Analysis:**
  - **(1) ”rop”:** The ”rop” gene in pBR322 codes for a protein that stabilizes the plasmid by controlling its copy number, aiding in replication. **This is correct.**
  - **(2) cloning site:** This is a region where foreign DNA is inserted, not involved in replication. **This is incorrect.**
  - **(3) Ori site:** The origin of replication (Ori) is the DNA sequence where replication begins, but it does not code for proteins; it is a regulatory site. **This is incorrect.**
  - **(4) Selectable marker:** These are genes (e.g., antibiotic resistance) for selecting transformed cells, not directly involved in replication. **This is incorrect.**
- **Mechanism Insight:** The ”rop” protein enhances plasmid stability by reducing the copy number, ensuring efficient replication and maintenance in host cells.
- **Conclusion:** The correct answer is (1) ”rop”, as it encodes proteins essential for pBR322 replication control.

Quick Tip

The ”rop” gene is crucial for regulating plasmid copy number, distinguishing it from Ori, which initiates replication.

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8. To isolate DNA from fungal cells, bacterial cells and plant cells, the enzymes required are respectively

(1) Chitinase, Lysozyme and Cellulase

(2) Cellulase, Protease and Lysozyme

(3) Lysozyme, Cellulase and Chitinase

(4) Lysozyme, Proteases and Ribonuclease

Correct Answer: (1) Chitinase, Lysozyme and Cellulase

Solution:

- **Definition of DNA Isolation:** Enzymes are used to break down cell walls specific to different cell types to release DNA.

- **Option Analysis:**
  - **(1) Chitinase, Lysozyme and Cellulase:** Chitinase degrades the chitin in fungal cell walls, Lysozyme breaks down the peptidoglycan in bacterial cell walls, and Cellulase hydrolyzes cellulose in plant cell walls. **This is correct.**
  - **(2) Cellulase, Protease and Lysozyme:** Cellulase is for plants, Protease degrades proteins (not specific to cell walls), and Lysozyme is for bacteria. This mix is incorrect for fungal cells. **This is incorrect.**
  - **(3) Lysozyme, Cellulase and Chitinase:** Lysozyme is for bacteria, Cellulase for plants, and Chitinase for fungi, but the order is wrong (should be Chitinase, Lysozyme, Cellulase). **This is incorrect.**
  - **(4) Lysozyme, Proteases and Ribonuclease:** Lysozyme is for bacteria, Proteases for proteins, and Ribonuclease for RNA (not cell walls). This is unsuitable for fungi and plants. **This is incorrect.**
- **Mechanism Insight:** Each enzyme targets the unique cell wall component: chitin (fungi), peptidoglycan (bacteria), and cellulose (plants).
- **Conclusion:** The correct answer is (1) Chitinase, Lysozyme and Cellulase, as it matches the cell wall composition of each cell type.

Quick Tip

Use Chitinase for fungi, Lysozyme for bacteria, and Cellulase for plants to effectively isolate DNA by breaking cell walls.

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9. In mature insulin, which of the peptide is not present?

(1) C-peptide

(2) A and B peptides

(3) A-peptide

(4) B-peptide

Correct Answer: (1) C-peptide

Solution:

- **Definition of Insulin:** Insulin is a hormone composed of A and B peptide chains linked by disulfide bonds, formed after processing of proinsulin.
- **Option Analysis:**
  - **(1) C-peptide:** Proinsulin contains A, B, and C peptides; during maturation, the C-peptide is cleaved and removed, leaving only A and B peptides in mature insulin. **This is correct.**
  - **(2) A and B peptides:** These are the active components of mature insulin. **This is incorrect.**
  - **(3) A-peptide:** This is part of mature insulin. **This is incorrect.**
  - **(4) B-peptide:** This is also part of mature insulin. **This is incorrect.**
- **Mechanism Insight:** The C-peptide is excised by proteases during insulin maturation, and its presence indicates proinsulin, not the active hormone.
- **Conclusion:** The correct answer is (1) C-peptide, as it is absent in mature insulin.

Quick Tip

C-peptide is removed during insulin maturation, serving as a marker of insulin production rather than being part of the active molecule.

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10. A scientist wants to produce virus-free plant in tissue culture. Which part of the plant will he use as an explant? a) mature stem b) axillary meristem c) apical meristem d) mesophyll cell Choose the correct option from the following.

(1) b only

(2) c and d

(3) a only

(4) b and c

Correct Answer: (4) b and c

Solution:

- **Definition of Virus-Free Plant:** Virus-free plants are produced in tissue culture using explants that are typically free of viral infections due to their rapid cell division and lack of vascular connections.
- **Option Analysis:**
  - **(a) mature stem:** Mature stems often contain vascular tissues where viruses can reside, making them unsuitable. **This is incorrect.**
  - **(b) axillary meristem:** These are regions of active cell division in the axils of leaves, often free from viruses due to their isolation from vascular tissues. **This is correct.**
  - **(c) apical meristem:** Located at the shoot and root tips, apical meristems have high mitotic activity and are typically virus-free, making them ideal explants. **This is correct.**
  - **(d) mesophyll cell:** These are parenchyma cells in leaves with vascular connections, prone to viral presence. **This is incorrect.**
- **Mechanism Insight:** Meristems (apical and axillary) are preferred because viruses do not easily infect rapidly dividing cells, and they lack established vascular systems.
- **Conclusion:** The correct answer is (4) b and c, as both axillary and apical meristems are used to produce virus-free plants.

Quick Tip

Apical and axillary meristems are preferred for virus elimination in tissue culture due to their active cell division.

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11. Some strains of Bacillus thuringiensis produce proteins that kill insects. Which one of the following is not killed by proteins of Bacillus thuringiensis?

(1) Cotton bollworm

(2) Tapeworm

(3) Tobacco budworm

(4) Armyworm

Correct Answer: (2) Tapeworm

Solution:

- **Definition of Bt Proteins:** Bacillus thuringiensis (Bt) produces crystal proteins (Cry toxins) that target the digestive systems of specific insects, particularly lepidopterans, coleopterans, and dipterans.
- **Option Analysis:**
  - **(1) Cotton bollworm:** A lepidopteran pest, susceptible to Bt toxins. **This is incorrect (killed).**
  - **(2) Tapeworm:** A parasitic flatworm (platyhelminth) that lives in the intestines of vertebrates, not targeted by Bt proteins which are specific to insects. **This is correct (not killed).**
  - **(3) Tobacco budworm:** Another lepidopteran pest, killed by Bt toxins. **This is incorrect (killed).**
  - **(4) Armyworm:** A lepidopteran larva, also susceptible to Bt. **This is incorrect (killed).**
- **Mechanism Insight:** Bt toxins bind to receptors in the midgut of susceptible insects, causing paralysis and death, but have no effect on non-insect parasites like tapeworms.
- **Conclusion:** The correct answer is (2) Tapeworm, as it is not an insect and thus not affected by Bt proteins.

Quick Tip

Bt toxins are effective against insects like bollworms and armyworms but not against parasitic worms like tapeworms.

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12. Which one of the following population attributes, contributes to increase in population density?

(1) Natality and Emmigration

(2) Mortality and Immigration

(3) Natality and Immigration

(4) Mortality and Emmigration

Correct Answer: (3) Natality and Immigration

Solution:

- **Definition of Population Density:** Population density increases when the number of individuals in a given area rises, influenced by birth (natality) and entry (immigration) rates, and decreases with death (mortality) and exit (emigration) rates.
- **Option Analysis:**
  - **(1) Natality and Emmigration:** Natality increases population, but emigration (leaving) decreases it, leading to a net neutral or negative effect. **This is incorrect.**
  - **(2) Mortality and Immigration:** Mortality decreases population, while immigration increases it, resulting in a net neutral or negative effect. **This is incorrect.**
  - **(3) Natality and Immigration:** Both natality (births within the population) and immigration (new individuals entering) add to the population, increasing density. **This is correct.**
  - **(4) Mortality and Emmigration:** Both mortality (deaths) and emigration (leaving) reduce population size, decreasing density. **This is incorrect.**
- **Mechanism Insight:** Population growth occurs when the birth rate (natality) and influx of individuals (immigration) exceed death rate (mortality) and outflow (emigration).
- **Conclusion:** The correct answer is (3) Natality and Immigration, as both contribute to an increase in population density.

Quick Tip

Natality (births) and Immigration (influx) are the primary factors that boost population density.

13. If 8 individuals in a laboratory population of 80 fruit flies died during a specified time interval, the death rate in the population during that period is

(1) 0.1 individual/time interval

(2) 1 individual/time interval

(3) 0.01 individual/time interval

(4) 0.001 individual/time interval

Correct Answer: (1) 0.1 individual/time interval

Solution:

- **Definition of Death Rate:** The death rate is the number of individuals dying divided by the total population over a specific time interval.
- **Calculation:**
  - Total population = 80 fruit flies.
  - Number of deaths = 8 individuals.
  - Death rate = Number of deaths / Total population = 8 / 80 = 0.1 individual/time interval.
- **Option Analysis:**
  - **(1) 0.1 individual/time interval:** Matches the calculated death rate. **This is correct.**
  - **(2) 1 individual/time interval:** This would imply all 80 died, which is incorrect.
  - **(3) 0.01 individual/time interval:** This is too low (1/100 of the population).
  - **(4) 0.001 individual/time interval:** This is even lower, not reflecting the data.
- **Conclusion:** The correct answer is (1) 0.1 individual/time interval, as it accurately represents the proportion of deaths.

Quick Tip

Death rate is calculated as (number of deaths / total population), expressed per time interval.

14. Choose the correct sequence of steps involved in decomposition

(1) Fragmentation → Mineralisation → Humification → Leaching → Catabolism

(2) Fragmentation → Leaching → Catabolism → Humification → Mineralisation

(3) Fragmentation → Catabolism → Leaching → Humification → Mineralisation

(4) Fragmentation → Leaching → Catabolism → Mineralisation → Humification

Correct Answer: (2) Fragmentation → Leaching → Catabolism → Humification → Mineralisation

Solution:

- **Definition of Decomposition:** Decomposition is the process by which organic matter is broken down into simpler substances, involving several sequential steps.
- **Step-by-Step Analysis:**
  - **Fragmentation:** Physical breakdown of detritus into smaller pieces by detritivores.
  - **Leaching:** Water-soluble nutrients are washed away from the detritus.
  - **Catabolism:** Decomposers (e.g., bacteria, fungi) break down complex compounds into simpler ones through enzymatic action.
  - **Humification:** Formation of humus, a dark, stable organic material, from partially decomposed matter.
- **Option Analysis:**
  - **(1) Fragmentation → Mineralisation → Humification → Leaching → Catabolism:** Incorrect sequence; mineralisation occurs last.
  - **(2) Fragmentation → Leaching → Catabolism → Humification → Mineralisation:** Follows the natural progression of decomposition. **This is correct.**
  - **(3) Fragmentation → Catabolism → Leaching → Humification → Mineralisation:** Catabolism precedes leaching, which is unnatural.
  - **(4) Fragmentation → Leaching → Catabolism → Mineralisation → Humification:** Humification occurs before mineralisation, which is incorrect.

- **Conclusion:** The correct answer is (2) Fragmentation → Leaching → Catabolism → Humification → Mineralisation, as it reflects the ecological sequence.

Quick Tip

Decomposition follows Fragmentation → Leaching → Catabolism → Humification → Mineralisation for nutrient cycling.

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15. With respect to limitation of Ecological pyramids, which of the following statements are correct? a) It does not take into account the same species belonging to two or more trophic levels. b) It assumes a simple food chain, something that almost never existed in nature. c) It accommodates saprophytes. d) It does not accommodate a food web. Choose the correct answer from the options given below.

(1) c and d

(2) a, b and d

(3) a and b

(4) b and c

Correct Answer: (2) a, b and d

Solution:

- **Definition of Ecological Pyramids:** Ecological pyramids represent the trophic structure and energy flow, but they have limitations in reflecting complex ecosystems.
- **Statement Analysis:**
  - **(a) It does not take into account the same species belonging to two or more trophic levels:** True, as pyramids assume fixed trophic levels, ignoring omnivores or species with dual roles. **This is correct.**
  - **(b) It assumes a simple food chain, something that almost never existed in nature:** True, as natural ecosystems are complex with interwoven food webs, not linear chains. **This is correct.**
  - **(c) It accommodates saprophytes:** False, as saprophytes (decomposers) are not

typically included in energy pyramids, which focus on producers, consumers, and sometimes decomposers separately. **This is incorrect.**

  - **(d) It does not accommodate a food web:** True, as pyramids simplify ecosystems into single trophic levels, ignoring the complexity of food webs. **This is correct.**

- **Option Analysis:**

  - **(1) c and d:** Includes incorrect (c). **This is incorrect.**
  - **(2) a, b and d:** Includes all correct statements. **This is correct.**
  - **(3) a and b:** Omits correct (d). **This is incorrect.**
  - **(4) b and c:** Includes incorrect (c). **This is incorrect.**

- **Conclusion:** The correct answer is (2) a, b and d, as these statements accurately highlight the limitations of ecological pyramids.

Quick Tip

Ecological pyramids oversimplify ecosystems by ignoring food webs and dual trophic roles, unlike the complex reality.

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16. The 'Sixth Extinction' of species, presently in progress, is __ times faster than the previous five episodes of mass extinctions.

(1) 1000 to 10000

(2) 1 to 10

(3) 10 to 100

(4) 100 to 1000

Correct Answer: (4) 100 to 1000

Solution:

- **Definition of Sixth Extinction:** The current mass extinction, driven by human activities, is considered significantly faster than the five previous mass extinctions (e.g., Permian, Cretaceous).

- **Scientific Evidence:** Studies suggest the current extinction rate is 100 to 1000 times higher than the background rate observed in the fossil record, due to habitat loss, climate change, and pollution.
- **Option Analysis:**
  - **(1) 1000 to 10000:** This is an overestimate based on current data. **This is incorrect.**
  - **(2) 1 to 10:** This is too low, as the rate exceeds background levels significantly. **This is incorrect.**
  - **(3) 10 to 100:** This underestimates the severity compared to scientific estimates. **This is incorrect.**
  - **(4) 100 to 1000:** Aligns with estimates from conservation biology (e.g., IUCN reports). **This is correct.**
- **Conclusion:** The correct answer is (4) 100 to 1000, reflecting the accelerated extinction rate today.

Quick Tip

The Sixth Extinction's speed (100-1000 times faster) is linked to human-induced factors, outpacing natural extinction events.

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17. Species diversity __ as we move away from the __ towards __.

(1) Decreases, Poles, Equator

(2) Stable, Equator, Poles

(3) Increases, Equator, Poles

(4) Decreases, Equator, Poles

Correct Answer: (4) Decreases, Equator, Poles

Solution:

- **Definition of Species Diversity:** Species diversity refers to the variety and abundance of species in an ecosystem, influenced by environmental factors like climate.

- **Geographical Trend:** Biodiversity is highest near the equator due to favorable conditions (e.g., warm temperatures, high rainfall) and decreases toward the poles where conditions are harsher (e.g., cold, limited resources).
- **Option Analysis:**
  - **(1) Decreases, Poles, Equator:** Incorrect direction (should be Equator to Poles). **This is incorrect.**
  - **(2) Stable, Equator, Poles:** Diversity is not stable; it varies with latitude. **This is incorrect.**
  - **(3) Increases, Equator, Poles:** Incorrect, as diversity decreases moving from equator to poles. **This is incorrect.**
  - **(4) Decreases, Equator, Poles:** Correct, as species diversity decreases from the equator toward the poles. **This is correct.**
- **Mechanism Insight:** The equator supports tropical rainforests with high species richness, while polar regions have fewer species due to extreme conditions.
- **Conclusion:** The correct answer is (4) Decreases, Equator, Poles, accurately describing the latitudinal gradient of biodiversity.

Quick Tip

Species diversity peaks at the equator and declines toward the poles due to climatic and ecological gradients.

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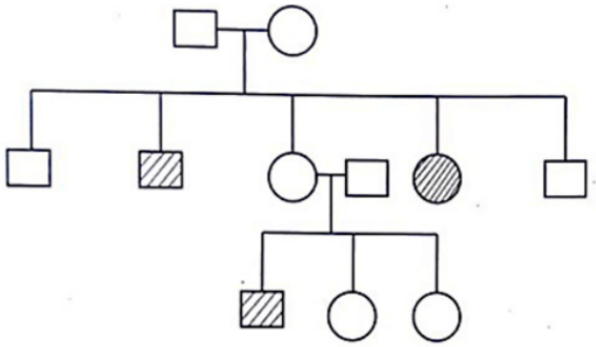
18. In a practical examination, the following pedigree chart was given as a spotter for identification. The students identify the given pedigree chart as



(1) Sex-linked dominant

(2) Sex-linked recessive

(3) Autosomal dominant

(4) Autosomal recessive

Correct Answer: (4) Autosomal recessive

Solution:

- **Pedigree Chart Analysis:** In this chart, affected individuals appear in both genders and tend to skip generations. These features suggest the inheritance of a recessive trait that can appear in individuals who inherit two copies of the recessive allele, one from each parent.
- **Sex-linked vs Autosomal:** The pattern observed in the chart does not exhibit a typical sex-linked pattern, as sex-linked traits would generally affect more males than females, which is not the case here.
- **Dominant vs Recessive:** Dominant traits usually appear in every generation, while recessive traits may skip generations, as seen here.
- **Conclusion:** Based on the analysis, the pedigree chart represents an autosomal recessive inheritance pattern.

Quick Tip

In autosomal recessive inheritance, the trait often skips generations, and both males and females can be equally affected.

19. A student observed the T.S. of a plant organ slide under microscope. He observed the vascular bundles in the stelar region as conjoint collateral and open. Based on these features of vascular bundle, identify the correct option from below.

(1) Monocot Root

(2) Monocot Stem

(3) Dicot Root

(4) Dicot Stem

Correct Answer: (4) Dicot Stem

Solution:

- **Vascular Bundle Types:** Vascular bundles can be arranged differently in monocots and dicots. In dicot stems, the vascular bundles are typically arranged in a ring and are conjoint (xylem and phloem occur together), collateral (phloem lies outside the xylem), and open (vascular cambium is present between xylem and phloem).
- **Monocots vs Dicots:** In monocots, vascular bundles are scattered throughout the stem and are usually closed, without a vascular cambium.
- **Conclusion:** The observation of conjoint, collateral, and open vascular bundles is characteristic of dicot stems.

Quick Tip

In dicot stems, vascular bundles are usually open and arranged in a ring. This is different from the scattered, closed bundles in monocots.

20. A student observed the slide of mitosis under the microscope and observed that the chromosomes were placed at the opposite poles. Which stage was the student observing?

(1) Metaphase

(2) Telophase

(3) Prophase

(4) Anaphase

Correct Answer: (4) Anaphase

Solution:

- **Mitosis Stages:** During anaphase, chromosomes are pulled to opposite poles by the spindle fibers.
- **Observation Analysis:** The placement of chromosomes at opposite poles indicates anaphase, not metaphase (chromosomes align at the equator), prophase (chromosomes condense), or telophase (nuclear envelopes reform).
- **Conclusion:** The correct stage is anaphase.

Quick Tip

Anaphase is marked by the separation of sister chromatids to opposite poles.

---

21. Identify the incorrect statement with respect to the rules of Binomial Nomenclature.

(1) Biological names are underlined separately when handwritten

(2) Biological names are printed in Italics to indicate their non-Latin origin.

(3) The first word represents the genus while second component denotes the specific epithet

(4) Biological names are generally in Latin or Latinised irrespective of their origin

Correct Answer: (2)

Solution:

- **Binomial Nomenclature Rules:** Biological names are italicized or underlined, with the genus as the first word and specific epithet as the second, typically in Latin or Latinized form.
- **Statement Analysis:**
  - (1) Correct. Underlining separately when handwritten is a rule.
  - (2) Incorrect. Italics indicate Latin or Latinized names, not non-Latin origin.

- (3) Correct. The genus and specific epithet follow this structure.
- (4) Correct. Names are standardized in Latin or Latinized form.

- **Conclusion:** Statement (2) is incorrect as italics denote Latin origin, not non-Latin.

Quick Tip

Binomial names use italics for Latinized terms, not to indicate non-Latin origin.

---

22. Match Column-I with Column-II and choose the correct option given below:

	Column-I (Bacteria)		**Column -II (Shape)**
a)	Coccus	i)	Rod-shaped
b)	Bacillus	ii)	Spiral
c)	Vibrium	iii)	Spherical
d)	Spirillum	iv)	Comma-shaped

(1) a-iii, b-ii, c-iv, d-i

(2) a-iv, b-ii, c-i, d-iii

(3) a-iv, b-i, c-ii, d-iii

(4) a-iii, b-i, c-iv, d-ii

Correct Answer: (4)

Solution:

- **Bacterial Shapes:** - Coccus: Spherical - Bacillus: Rod-shaped - Vibrium: Comma-shaped - Spirillum: Spiral
- **Matching Analysis:** - (a) Coccus → (iii) Spherical - (b) Bacillus → (i) Rod-shaped - (c) Vibrium → (iv) Comma-shaped - (d) Spirillum → (ii) Spiral
- **Option Analysis:** - (1) a-iii, b-ii, c-iv, d-i: Matches correctly. - (2) a-iv, b-ii, c-i, d-iii: Incorrect matches. - (3) a-iv, b-i, c-ii, d-iii: Incorrect matches. - (4) a-iii, b-i, c-iv, d-ii: Matches correctly.
- **Conclusion:** Option (4) correctly matches the bacterial shapes.

Quick Tip

Bacterial shapes like coccus (spherical) and bacillus (rod-shaped) are key for identification.

---

23. Read the given statements and choose the correct option:

Statement I: Gemmae are green unicellular sexual buds which develop in receptacles called gemma cups. Statement II: Protonema develops directly from a spore

(1) Statement I is false but Statement II is true

(2) Both Statement I and Statement II are false

(3) Both Statement I and Statement II are true

(4) Statement I is true but Statement II is false

Correct Answer: (1)

Solution:

- **Statement I Analysis:** Gemmae are reproductive structures found in some bryophytes (e.g., liverworts) and are involved in asexual reproduction. They are multicellular, green, and develop in specialized structures called gemma cups, not as unicellular sexual buds. The term ”sexual buds” is incorrect as gemmae are asexual. Thus, Statement I is false.
- **Statement II Analysis:** In bryophytes (e.g., mosses), a protonema is the initial filamentous structure that develops directly from a spore upon germination. This is a well-established fact in plant life cycles, making Statement II true.
- **Option Analysis:**
  - (1) Statement I is false but Statement II is true: Aligns with the analysis. Correct.
  - (2) Both Statement I and Statement II are false: Contradicts the truth of Statement II. Incorrect.
  - (3) Both Statement I and Statement II are true: Contradicts the falsity of Statement I. Incorrect.
  - (4) Statement I is true but Statement II is false: Contradicts the truth of Statement II and falsity of Statement I. Incorrect.

- **Conclusion:** The correct option is (1), as Statement I is false (gemmae are multicellular and asexual) and Statement II is true (protonema develops directly from a spore).

Quick Tip

Gemmae are asexual, multicellular structures, while protonema is a key stage in the moss life cycle from spores.

---

24. During a field trip a student observed a marine organism with worm-like body. The cylindrical body was divisible into proboscis, collar and a long trunk. The organism may be __ .

(1) Pterophyllum

(2) Trygon

(3) Balanoglossus

(4) Ophiura

Correct Answer: (3) Balanoglossus

Solution:

- **Observation Analysis:** The organism has a worm-like, cylindrical body divisible into three distinct regions: proboscis, collar, and a long trunk. This description is characteristic of certain marine organisms with specific anatomical features.
- **Organism Identification:**
  - **Balanoglossus:** A marine acorn worm (Hemichordata) with a body divided into proboscis (used for feeding), collar (bearing gills), and a long trunk (for digestion and respiration). This matches the description perfectly.
  - **Pterophyllum:** A type of freshwater angelfish, which has a flattened, disc-like body, not worm-like or segmented into proboscis, collar, and trunk. Incorrect.
  - **Trygon:** A genus of stingrays with a flattened, disc-shaped body and a long tail, not matching the cylindrical, segmented description. Incorrect.
  - **Ophiura:** A brittle star with a central disc and long, flexible arms, lacking the proboscis, collar, and trunk structure. Incorrect.

- **Biological Context:** Balanoglossus is a hemichordate, often studied for its evolutionary link to chordates, and its body plan aligns with the student's observation of a marine, worm-like organism with the specified divisions.
- **Option Analysis:**
  - (1) Pterophyllum: Does not fit the description. Incorrect.
  - (2) Trygon: Does not match the body segmentation. Incorrect.
  - (3) Balanoglossus: Matches the anatomical features described. Correct.
  - (4) Ophiura: Lacks the proboscis, collar, and trunk structure. Incorrect.
- **Conclusion:** The organism is most likely Balanoglossus, as its body structure (proboscis, collar, and trunk) corresponds to the student's observation.

Quick Tip

Balanoglossus, an acorn worm, is identified by its three-part body: proboscis, collar, and trunk.

---

25. Identify the types of aestivation in corolla labelled as 'a', 'b', 'c' and 'd'

(1) a-Vexillary, b-Imbricate, c-Twisted, d-Valvate

(2) a-Vexillary, b-Imbricate, c-Valvate, d-Twisted

(3) a-Vexillary, b-Twisted, c-Imbricate, d-Valvate

(4) a-Imbricate, b-Valvate, c-Vexillary, d-Twisted

Correct Answer: (1)

Solution:

- **Aestivation Types:** Aestivation refers to the arrangement of petals in a flower bud. The diagrams represent different patterns: - Vexillary: One large petal (standard) overlaps two lateral petals, which overlap two smaller ones (e.g., pea family). Diagram 'a' shows

an asymmetrical overlap, typical of vexillary. - Imbricate: Petals overlap irregularly, with some outer and some inner (e.g., Cassia). Diagram 'b' shows overlapping petals in a circular pattern. - Twisted: Petals overlap each other like a spiral (e.g., cotton). Diagram 'c' suggests a twisted arrangement. - Valvate: Petals meet edge to edge without overlapping (e.g., mustard). Diagram 'd' shows petals touching without overlap.

- **Diagram Analysis:** - 'a' resembles vexillary due to the asymmetrical shape. - 'b' matches imbricate with overlapping petals. - 'c' aligns with twisted due to the spiral-like arrangement. - 'd' fits valvate with petals meeting edge to edge.
- **Option Analysis:** - (1) a-Vexillary, b-Imbricate, c-Twisted, d-Valvate: Matches the diagram interpretation. Correct. - (2) a-Vexillary, b-Imbricate, c-Valvate, d-Twisted: Incorrect order for 'c' and 'd'. - (3) a-Vexillary, b-Twisted, c-Imbricate, d-Valvate: Incorrect order for 'b' and 'c'. - (4) a-Imbricate, b-Valvate, c-Vexillary, d-Twisted: Incorrect assignment for 'a' and 'c'.
- **Conclusion:** Option (1) correctly identifies the aestivation types based on the diagrams.

Quick Tip

Vexillary aestivation is typical in papilionaceous flowers, while valvate shows no overlap.

---

26. Match the Column-I with Column-II and choose the correct option:

	Column–I (characteristics of vascular bundle		Column–II (Transverse section)
a)	Radial, tetrarch, cambial ring between xylem and phloem at later stages	i)	T.S of monocot stem
b)	Conjoint, open and endarch	ii)	T.S of dicot root
c)	Radial, Polyarch, large pith without cambial ring	iii)	T.S of monocot toot
d)	Conjoint, closed with sclerenchymatous bundle sheath	iv)	T.S of dicot stem

(1) a - ii, b - iv, c - iii, d - i

(2) a - iii, b - iv, c - i, d - ii

(3) a - i, b - ii, c - iii, d - iv

(4) a - ii, b - iii, c - iv, d - i

Correct Answer: (1)

Solution:

- **Vascular Bundle Characteristics:** - Radial, tetrarch, cambial ring between xylem and phloem at later stages: Indicates a dicot root with a tetrarch xylem arrangement and cambial activity, matching (ii) T.S of dicot root. - Conjoint, open and endarch: Refers to dicot stems with vascular bundles that are open (with cambium) and endarch (phloem outside xylem), matching (iv) T.S of dicot stem. - Radial, Polyarch, large pith without cambial ring: Typical of monocot roots with multiple xylem and phloem strands and a large pith, matching (iii) T.S of monocot root. - Conjoint, closed with sclerenchymatous bundle sheath: Characteristic of monocot stems with closed bundles (no cambium) and a sclerenchymatous sheath, matching (i) T.S of monocot stem.
- **Matching Analysis:** - (a) Radial, tetrarch, cambial ring → (ii) T.S of dicot root - (b)

Conjoint, open and endarch → (iv) T.S of dicot stem - (c) Radial, Polyarch, large pith → (iii) T.S of monocot root - (d) Conjoint, closed with sclerenchymatous bundle sheath → (i) T.S of monocot stem

- **Option Analysis:** - (1) a - ii, b - iv, c - iii, d - i: Matches the characteristics correctly. Correct. - (2) a - iii, b - iv, c - i, d - ii: Incorrect for 'a' and 'c'. - (3) a - i, b - ii, c - iii, d - iv: Incorrect for 'a' and 'b'. - (4) a - ii, b - iii, c - iv, d - i: Incorrect for 'b' and 'c'.
- **Conclusion:** Option (1) correctly matches the vascular bundle characteristics with their transverse sections.

Quick Tip

Monocot stems have closed vascular bundles, while dicot stems have open ones with cambium.

---

27. Which of the following statements are correct with respect to Frogs?

(1) Bidder's canals are present in male Frogs

(2) Copulatory pads are present in female Frogs

(3) Sound producing vocal sacs are present in male Frogs

(4) Cloaca is present in male Frog only

Correct Answer: (1) a and c

Solution:

- **Bidder's canals:** These canals are present in male frogs, not females. **This is correct.**
- **Copulatory pads:** These pads are present in male frogs, not female frogs. **This is incorrect.**
- **Vocal sacs:** Vocal sacs, which are responsible for sound production, are found in male frogs, typically used during mating calls. **This is correct.**
- **Cloaca:** The cloaca is present in both male and female frogs. **This is incorrect.**

Conclusion: The correct statements are a and c.

Quick Tip

Bidder's canals and vocal sacs are unique to male frogs, while copulatory pads are also found in males, not females. Both males and females have a cloaca.

---

28. The reserve material in prokaryotic cells are stored in the cytoplasm in the form of

(1) Exclusion and inclusion bodies

(2) Fat bodies

(3) Exclusion bodies

(4) Inclusion bodies

Correct Answer: (4) Inclusion bodies

Solution:

- **Prokaryotic Cells:** Prokaryotes, such as bacteria, lack membrane-bound organelles and store reserve materials in the cytoplasm.
- **Reserve Materials:** These include glycogen, polyphosphate, and polyhydroxybutyrate, which are stored as granules or inclusion bodies. Inclusion bodies are specialized structures that accumulate these reserve materials.
- **Option Analysis:** - (1) Exclusion and inclusion bodies: "Exclusion bodies" is not a recognized term; only inclusion bodies are relevant. Incorrect. - (2) Fat bodies: This term applies to eukaryotic organisms (e.g., insects) for fat storage, not prokaryotes. Incorrect. - (3) Exclusion bodies: Not a valid term for reserve material storage in prokaryotes. Incorrect. - (4) Inclusion bodies: Correctly identifies the structures where reserve materials are stored in prokaryotic cytoplasm.
- **Conclusion:** The correct answer is (4) Inclusion bodies, as they are the primary storage form for reserve materials in prokaryotes.

Quick Tip

Inclusion bodies in prokaryotes store nutrients like glycogen and polyphosphate.

29. The cell wall less prokaryote among the following is

(1) Cyanobacteria

(2) Mycoplasma

(3) Bacteria

(4) Blue-Green Algae

Correct Answer: (2) Mycoplasma

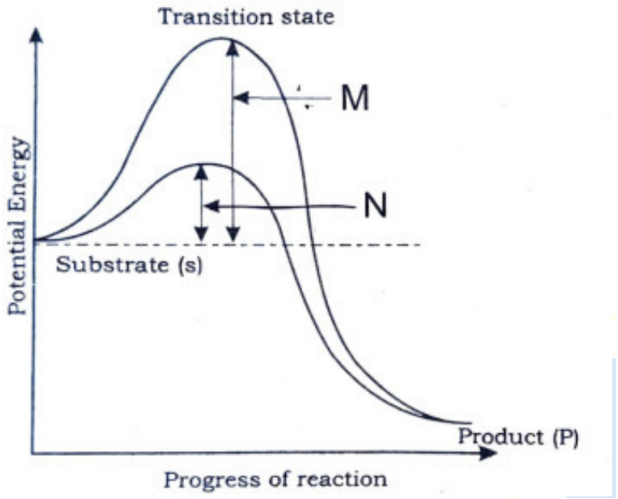
Solution:

- **Prokaryotes Overview:** Prokaryotes include bacteria and archaea, with most possessing cell walls. However, some lack cell walls.
- **Organism Analysis:** - (1) Cyanobacteria: Photosynthetic bacteria with a peptidoglycan cell wall. Incorrect. - (2) Mycoplasma: A genus of bacteria lacking a cell wall, surrounded only by a plasma membrane, making them unique among prokaryotes. Correct. - (3) Bacteria: A broad group, most of which have cell walls (e.g., peptidoglycan). Incorrect as a general category. - (4) Blue-Green Algae: Synonymous with cyanobacteria, which have cell walls. Incorrect.
- **Biological Context:** Mycoplasma's lack of a cell wall allows flexibility and resistance to antibiotics targeting cell wall synthesis (e.g., penicillin).
- **Option Analysis:** - (1) Cyanobacteria: Has a cell wall. Incorrect. - (2) Mycoplasma: No cell wall, fits the description. Correct. - (3) Bacteria: Most have cell walls. Incorrect. - (4) Blue-Green Algae: Has a cell wall. Incorrect.
- **Conclusion:** The correct answer is (2) Mycoplasma, as it is the only prokaryote listed without a cell wall.

Quick Tip

Mycoplasma lacks a cell wall, making it distinct among prokaryotes.

30. The graph showing the concept of activation energy of enzyme is given below. Observe the graph and choose the correct option for M and N.



(1) M-High temperature, High activation energy, N-Low temperature, Low activation energy

(2) M-High substrate, High activation energy, N-Low substrate, Low activation energy

(3) M-Activation energy without enzyme, N-Activation energy with enzyme

(4) M-Activation energy with enzyme, N-Activation energy without enzyme

Correct Answer: (3)

Solution:

- **Graph Analysis:** The graph depicts two energy curves. The higher curve (M) represents the energy barrier without a catalyst (enzyme), while the lower curve (N) shows a reduced energy barrier with an enzyme.
- **Activation Energy Concept:** Activation energy is the energy required to reach the transition state. Enzymes lower this energy, as shown by the difference between M and N.
- **Option Analysis:**

  - (1) M-High temperature, High activation energy, N-Low temperature, Low activation energy: Temperature affects reaction rate, not directly the activation energy curves shown. Incorrect.

  - (2) M-High substrate, High activation energy, N-Low substrate, Low activation energy: Substrate concentration influences rate, not the energy barrier itself. Incorrect.

- (3) M-Activation energy without enzyme, N-Activation energy with enzyme: Matches the graph, where M is the higher barrier (no enzyme) and N is the lower barrier (with enzyme). Correct.

- (4) M-Activation energy with enzyme, N-Activation energy without enzyme: Reverses the graph interpretation. Incorrect.

- **Conclusion:** The correct option is (3), as M represents the activation energy without an enzyme, and N represents the reduced activation energy with an enzyme.

Quick Tip

Enzymes reduce activation energy, lowering the energy barrier for reactions.

---

31. Match the stages of prophase I given in Column-I with their features in Column-II and choose the correct options from the choices given below:

Column-I	**Column-II**
a) Leptotene	i) Exchange of genetic materials between non-sister chromatids of the homologous chromosomes
b) Zygote	ii) Chromosomes visible under light microscope
c) Pachytene	iii) Dissolution of synaptonemal complex
d) Diplotene	iv) Chromosomes start pairing together
e) Diakinesis	v) Terminalisation of chiasmata

(1) a-iv, b-i, c-ii, d-iii, e-v

(2) a-ii, b-iv, c-i, d-iii, e-v

(3) a-i, b-ii, c-iii, d-iv, e-v

(4) a-v, b-iv, c-i, d-iii, e-ii

Correct Answer: (2)

Solution:

- **Prophase I Stages:** Prophase I of meiosis I involves five sub-stages with distinct features.

- **Stage Analysis:**

  - (a) Leptotene: Chromosomes begin to condense and become visible under a light microscope. Matches (ii).

  - (b) Zygote: This is not a stage of prophase I; it is the fertilized egg. The intended stage might be a mislabel (possibly meant to be Zygotene). In Zygotene, chromosomes start pairing (synapsis), matching (iv).

  - (c) Pachytene: Crossing over occurs, involving the exchange of genetic material between non-sister chromatids of homologous chromosomes, matching (i).

  - (d) Diplotene: The synaptonemal complex dissolves, and homologous chromosomes begin to separate, matching (iii).

  - (e) Diakinesis: Terminalisation of chiasmata occurs as the final step before metaphase I, matching (v).

- **Correction Note:** The term ”Zygote” appears to be a mistake. In meiosis context, ”Zygotene” is the correct stage where chromosome pairing begins. Assuming this typo, the matching proceeds with Zygotene.

- **Option Analysis:**

  - (1) a-iv, b-i, c-ii, d-iii, e-v: Incorrect for a (should be ii) and b (should be iv if Zygotene).

  - (2) a-ii, b-iv, c-i, d-iii, e-v: Correct if b is interpreted as Zygotene (chromosome pairing). Matches the sequence.

  - (3) a-i, b-ii, c-iii, d-iv, e-v: Incorrect for a (should be ii) and b (should be iv).

  - (4) a-v, b-iv, c-i, d-iii, e-ii: Incorrect for a (should be ii) and e (should be v).

- **Conclusion:** The correct option is (2), assuming ”Zygote” is a typo for ”Zygotene,” where a-ii (Leptotene: chromosomes visible), b-iv (Zygotene: chromosomes pair), c-i (Pachytene: genetic exchange), d-iii (Diplotene: synaptonemal complex dissolution), e-v (Diakinesis: chiasmata terminalisation) align with prophase I features.

Quick Tip

Zygotene involves synapsis, while Pachytene is the stage for crossing over in prophase I.

---

32. Read the given statements and choose the correct option:

Statement-I: In Calvin cycle, Carboxylation is catalysed by PEP Carboxylase

Statement-II: In Hatch-Slack pathway, Carboxylation is catalysed by RuBP Carboxylase.

(1) Statement I is false but Statement II is true

(2) Both Statement I and Statement II are false

(3) Both Statement I and Statement II are true

(4) Statement I is true but Statement II is false

Correct Answer: (1) or (2)

Solution:

- **Statement I Analysis:** In the Calvin cycle (C3 pathway), carboxylation is catalyzed by RuBP carboxylase (Rubisco), not PEP Carboxylase. PEP Carboxylase is involved in the C4 pathway (e.g., Hatch-Slack pathway) for initial CO_2 fixation. Thus, Statement I is false.
- **Statement II Analysis:** In the Hatch-Slack pathway (C4 pathway), the initial carboxylation is catalyzed by PEP Carboxylase in mesophyll cells, while RuBP Carboxylase catalyzes carboxylation in bundle sheath cells during the Calvin cycle phase. The statement implies RuBP Carboxylase as the sole catalyst, which is inaccurate for the Hatch-Slack pathway's initial step. Thus, Statement II is false.
- **Option Analysis:**
  - (1) Statement I is false but Statement II is true: Incorrect, as Statement II is also false.
  - (2) Both Statement I and Statement II are false: Correct, as both contain inaccuracies.
  - (3) Both Statement I and Statement II are true: Incorrect, as both are false.
  - (4) Statement I is true but Statement II is false: Incorrect, as Statement I is false.

- **Conclusion:** The answer is (1) or (2). However, given the ambiguity in the answer key (1 or 2), (2) is more consistent if Statement II's intent was misunderstood. Typically, (1) would apply if Statement II were true, but here both are false due to misattribution of enzymes.

Quick Tip

PEP Carboxylase is key in C4 plants, while Rubisco dominates in C3 Calvin cycle.

---

33. The TCA cycle starts with the condensation of acetyl group with

(1) α-Ketoglutaric acid

(2) Succinic acid

(3) Oxaloacetic acid

(4) Citric acid

Correct Answer: (3) Oxaloacetic acid

Solution:

- **TCA Cycle Overview:** The tricarboxylic acid (TCA) cycle, also known as the Krebs cycle, begins with the condensation of an acetyl group (from acetyl-CoA) with a four-carbon compound.
- **Reaction Analysis:** The first step involves the combination of acetyl-CoA (2 carbons) with oxaloacetic acid (4 carbons) to form citric acid (6 carbons), catalyzed by citrate synthase.
- **Option Analysis:**

  - (1) α-Ketoglutaric acid: An intermediate later in the cycle, not the starting compound. Incorrect.

  - (2) Succinic acid: Another intermediate, not involved in the initial condensation. Incorrect.

  - (3) Oxaloacetic acid: The correct four-carbon acceptor that condenses with acetyl-CoA. Correct.

  - (4) Citric acid: The product of the initial condensation, not the reactant. Incorrect.

- **Conclusion:** The correct answer is (3) Oxaloacetic acid, as it is the compound that initiates the TCA cycle.

Quick Tip

Oxaloacetic acid accepts the acetyl group to start the TCA cycle, forming citric acid.

---

34. Match the plant growth hormones of Column-I with suitable chemical derivatives present Column-II and choose the correct option given below:

Column-I	Column-II
a) Abscisic acid	i) Adenine derivative
b) Gibberellins	ii) Indole acetic acid
c) Kinetin	iii) Carotenoid derivative
d) Auxin	iv) Terpenes

(1) a-iii, b-iv, c-i, d-ii

(2) a-iii, b-i, c-ii, d-iv

(3) a-i, b-ii, c-iii, d-iv

(4) a-iii, b-i, c-iv, d-ii

Correct Answer: (1)

Solution:

- **Hormone Derivatives:**
  - (a) Abscisic acid: Derived from carotenoids, a plant stress hormone. Matches (iii).
  - (b) Gibberellins: Terpenoid compounds that promote growth. Matches (iv).
  - (c) Kinetin: A synthetic cytokinin, an adenine derivative. Matches (i).
  - (d) Auxin: Primarily indole-3-acetic acid (IAA), an indole derivative. Matches (ii).
- **Option Analysis:**
  - (1) a-iii, b-iv, c-i, d-ii: Correctly matches Abscisic acid (carotenoid), Gibberellins (terpenes), Kinetin (adenine), and Auxin (indole). Correct.
  - (2) a-iii, b-i, c-ii, d-iv: Incorrect for b (Gibberellins are not adenine derivatives) and c, d.

- (3) a-i, b-ii, c-iii, d-iv: Incorrect for a (Abscisic acid is not adenine) and b, c, d.
- (4) a-iii, b-i, c-iv, d-ii: Incorrect for b (Gibberellins are not adenine) and c.

- **Conclusion:** The correct option is (1), as it accurately pairs the plant hormones with their chemical derivatives.

Quick Tip

Auxin is an indole derivative, while Gibberellins are terpenoids.

---

35. The respiratory mechanism controlled by medulla oblongata can be altered by

(1) Both Pneumotaxic and Chemoreceptive areas of pons and medulla oblongata

(2) Corpus callosum of brain

(3) Pneumotaxic center in the pons

(4) Chemoreceptive area in the medulla

Correct Answer: (1)

Solution:

- **Respiratory Control:** The medulla oblongata regulates basic respiratory rhythm, influenced by inputs from other brain regions.
- **Region Analysis:**
  - (1) Both Pneumotaxic and Chemoreceptive areas of pons and medulla oblongata: The pneumotaxic center in the pons fine-tunes breathing rate, while chemoreceptive areas in the medulla and pons detect CO2 and pH changes, altering respiration. This is correct.
  - (2) Corpus callosum of brain: Connects the two hemispheres, not involved in respiratory control. Incorrect.
  - (3) Pneumotaxic center in the pons: Modulates breathing but alone does not fully alter medullary control. Incorrect as it's partial.
  - (4) Chemoreceptive area in the medulla: Detects chemical changes but works with pons areas for full regulation. Incorrect as it's incomplete.
- **Conclusion:** The correct answer is (1), as both pneumotaxic and chemoreceptive areas collectively influence medullary respiratory control.

Quick Tip

The medulla oblongata's respiratory control is modulated by pons and chemoreceptive feedback.

---

36. Which among the three layers of blood vessel wall-Tunica intima, Tunica media and Tunica Externa is comparatively thin in the veins?

(1) Tunica externa

(2) Both tunica media and tunica externa

(3) Tunica media

(4) Tunica intima

Correct Answer: (3) Tunica media

Solution:

- **Blood Vessel Structure:** Veins have three layers: Tunica intima (inner endothelium), Tunica media (middle smooth muscle), and Tunica externa (outer connective tissue).
- **Vein Characteristics:** Veins have thinner walls and less muscle compared to arteries due to lower pressure. The Tunica media, which contains smooth muscle for vessel constriction, is significantly thinner in veins than in arteries.
- **Option Analysis:**
  - (1) Tunica externa: Thicker in veins to support low pressure, not thin. Incorrect.
  - (2) Both tunica media and tunica externa: Tunica externa is thicker, not thin. Incorrect.
  - (3) Tunica media: Comparatively thin in veins due to reduced muscle layer. Correct.
  - (4) Tunica intima: Similar thickness in veins and arteries, not the primary difference. Incorrect.
- **Conclusion:** The correct answer is (3) Tunica media, as it is thinner in veins compared to arteries.

Quick Tip

Veins have a thin Tunica media due to lower blood pressure.

37. In nephron, transport of substances like sodium chloride and urea is facilitated by the special arrangement called counter current mechanism that comprises of

(1) Vasa Recta and collecting duct

(2) Ascending limb and collecting duct

(3) Henle's loop and Vasa Recta

(4) Henle's loop and glomerulus

Correct Answer: (3)

Solution:

- **Counter Current Mechanism:** In the nephron, the countercurrent mechanism maintains the concentration gradient in the medulla, aiding reabsorption of water, sodium chloride, and urea.
- **Component Analysis:**
  - (1) Vasa Recta and collecting duct: Vasa Recta aids in maintaining the gradient, but the collecting duct is involved in water reabsorption, not the primary countercurrent pair. Incorrect.
  - (2) Ascending limb and collecting duct: The ascending limb (of Henle's loop) contributes to the mechanism, but the collecting duct is secondary. Incorrect.
  - (3) Henle's loop and Vasa Recta: Henle's loop (descending and ascending limbs) and Vasa Recta work together to create and maintain the osmotic gradient, facilitating countercurrent exchange. Correct.
  - (4) Henle's loop and glomerulus: The glomerulus filters blood, not part of the countercurrent mechanism. Incorrect.
- **Conclusion:** The correct answer is (3) Henle's loop and Vasa Recta, as they are the key components of the countercurrent mechanism.

Quick Tip

Henle's loop and Vasa Recta create a countercurrent gradient for efficient reabsorption.

38. In the mechanism of muscle contraction or shortening of muscle, the __ get reduced whereas the __ retain the length.

(1) Z line, I bands

(2) A bands, Z line

(3) A bands, I bands

(4) I bands, A bands

Correct Answer: (4)

Solution:

- **Muscle Contraction:** During muscle contraction, the sarcomere shortens due to the sliding filament theory.
- **Structure Analysis:**
  - I bands (light bands) contain only actin filaments and shorten as actin and myosin filaments slide past each other.
  - A bands (dark bands) contain the full length of myosin filaments and remain constant in length.
  - Z lines (Z discs) anchor actin filaments and move closer together but are not the primary focus of length change.
- **Option Analysis:**
  - (1) Z line, I bands: Z lines move, but I bands reduce, not vice versa. Incorrect.
  - (2) A bands, Z line: A bands retain length, Z lines move. Incorrect.
  - (3) A bands, I bands: A bands retain length, but I bands reduce, not the other way. Incorrect.
  - (4) I bands, A bands: I bands reduce in length, A bands retain length during contraction. Correct.
- **Conclusion:** The correct answer is (4) I bands, A bands, as I bands shorten while A bands remain constant.

Quick Tip

I bands shorten during muscle contraction, while A bands stay the same length.

39. Identify the correct sequence of action potential as it arrives at the axon terminal from the choices given below:

(1) Axon terminal → Post-synaptic membrane → Synaptic cleft → Synaptic vesicles Post-synaptic neuron

(2) Axon terminal → Synaptic vesicles → Post-synaptic membrane → Synaptic cleft → Post-synaptic neuron

(3) Axon terminal → Synaptic vesicles → Synaptic cleft → Post-synaptic membrane → Post-synaptic neuron

(4) Axon terminal → Synaptic cleft → Synaptic vesicles → Post-synaptic neuron → Post-synaptic membrane

Correct Answer: (3)

Solution:

- **Synaptic Transmission:** The action potential triggers neurotransmitter release at the axon terminal.
- **Sequence Analysis:**
  - Action potential reaches the axon terminal.
  - Synaptic vesicles release neurotransmitters into the synaptic cleft.
  - Neurotransmitters cross the synaptic cleft and bind to receptors on the post-synaptic membrane.
  - This depolarizes the post-synaptic neuron.
- **Option Analysis:**
  - (1) Axon terminal → Post-synaptic membrane → Synaptic cleft → Synaptic vesicles Post-synaptic neuron: Incorrect order, vesicles release before cleft interaction.
  - (2) Axon terminal → Synaptic vesicles → Post-synaptic membrane → Synaptic cleft → Post-synaptic neuron: Incorrect, vesicles release into cleft first.
  - (3) Axon terminal → Synaptic vesicles → Synaptic cleft → Post-synaptic membrane → Post-synaptic neuron: Correct sequence of vesicle release, cleft crossing, and membrane activation.

- (4) Axon terminal → Synaptic cleft → Synaptic vesicles → Post-synaptic neuron → Post-synaptic membrane: Incorrect, vesicles release before cleft.

- **Conclusion:** The correct answer is (3), as it follows the proper sequence of synaptic transmission.

Quick Tip

Synaptic vesicles release neurotransmitters into the cleft after the action potential arrives.

---

40. Identify the statement/s given below that does not correspond to the functions of cortisol

i) Maintains cardiovascular system and kidney functions

ii) Produces anti-inflammatory reactions

iii) Maintains electrolyte balance, osmosis and blood pressure

iv) Suppresses immune response

v) Stimulates RBC production

(1) iii only

(2) iv only

(3) i and ii only

(4) iii and iv only

Correct Answer: (1)

Solution:

- **Cortisol Functions:** Cortisol, a glucocorticoid, is a stress hormone with specific roles.

- **Statement Analysis:**

  - (i) Maintains cardiovascular system and kidney functions: True, cortisol helps regulate blood pressure and kidney function.

  - (ii) Produces anti-inflammatory reactions: True, cortisol reduces inflammation.

  - (iii) Maintains electrolyte balance, osmosis and blood pressure: False, this is primarily a function of aldosterone (a mineralocorticoid), not cortisol.

- (iv) Suppresses immune response: True, cortisol has immunosuppressive effects.
- (v) Stimulates RBC production: False, erythropoietin (not cortisol) stimulates RBC production.

- **Option Analysis:**
  - (1) iii only: Correct, as only (iii) does not correspond to cortisol's functions.
  - (2) iv only: Incorrect, (iv) is a true function.
  - (3) i and ii only: Incorrect, both (i) and (ii) are true.
  - (4) iii and iv only: Incorrect, (iv) is true.
- **Conclusion:** The correct answer is (1) iii only, as maintaining electrolyte balance is not a primary function of cortisol.

Quick Tip

Cortisol regulates stress and inflammation, not electrolyte balance (that's aldosterone).

---

41. When pollen grains of a flower of plant pollinate the stigma flower of another plant, it is called

(1) Dichogamy

(2) Geitonogamy

(3) Xenogamy

(4) Autogamy

Correct Answer: (3) Xenogamy

Solution:

- **Pollination Types:**
  - (1) Dichogamy: Temporal separation of male and female parts in the same flower, not relevant here.
  - (2) Geitonogamy: Transfer of pollen from one flower to another on the same plant, not cross-plant.
  - (3) Xenogamy: Transfer of pollen from the flower of one plant to the stigma of a flower on a different plant, matching the description.

- (4) Autogamy: Self-pollination within the same flower, not applicable.

- **Option Analysis:**

  - (1) Dichogamy: Incorrect, as it's about timing, not cross-plant pollination.

  - (2) Geitonogamy: Incorrect, as it involves the same plant.

  - (3) Xenogamy: Correct, as it involves different plants.

  - (4) Autogamy: Incorrect, as it's self-pollination.

- **Conclusion:** The correct answer is (3) Xenogamy, as it describes pollination between different plants.

Quick Tip

Xenogamy ensures genetic diversity by cross-pollination between different plants.

---

42. Fusion of a male gamete with the central cell in the embryo sac of an angiosperm is called

(1) Syngamy

(2) Apomixis

(3) Double fertilization

(4) Triple fusion

Correct Answer: (4) Triple fusion

Solution:

- **Angiosperm Reproduction:** In angiosperms, double fertilization involves two sperm cells. One fuses with the egg to form the zygote (syngamy), and the other fuses with the two polar nuclei in the central cell to form the endosperm (triple fusion).

- **Option Analysis:**

  - (1) Syngamy: Refers to the fusion of male and egg gametes to form the zygote, not the central cell. Incorrect.

  - (2) Apomixis: Asexual reproduction without fertilization. Incorrect.

  - (3) Double fertilization: The overall process involving syngamy and triple fusion, not specific to the central cell. Incorrect.

- (4) Triple fusion: Specifically describes the fusion of a male gamete with the central cell's two polar nuclei. Correct.

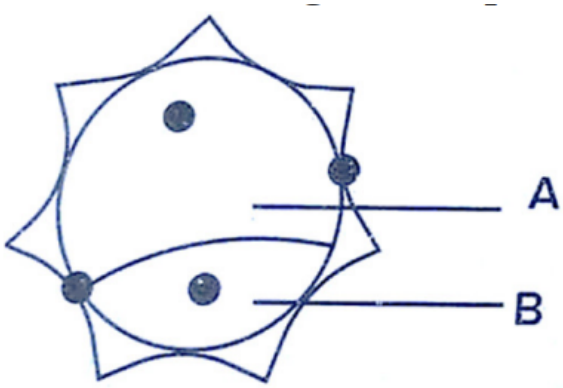
- **Conclusion:** The correct answer is (4) Triple fusion, as it defines the fusion with the central cell.

Quick Tip

Triple fusion in angiosperms forms the endosperm, distinct from syngamy.

---

43. Which of these options is true in the context of the below diagram of pollen grain?



(1) 'A' is a generative cell which gives rise to pollen tube and 'B' is a vegetative cell which forms male gametes

(2) 'A' is a vegetative cell with abundant food reserve and 'B' is a generative cell which forms male gametes

(3) 'A' is a generative cell which forms male gametes and 'B' is a vegetative cell which produces pollen tube

(4) 'A' is a vegetative cell which gives rise to male gametes and 'B' is a generative cell which produces pollen tube

Correct Answer: (2)

Solution:

- **Pollen Grain Structure:** A pollen grain contains a vegetative cell and a generative cell. The vegetative cell forms the pollen tube, while the generative cell divides to produce male gametes.

- **Diagram Interpretation:** In the diagram, 'A' is depicted as the larger cell with abundant cytoplasm (suggesting food reserve), typically the vegetative cell. 'B' is the smaller cell, likely the generative cell that produces gametes.
- **Option Analysis:**

  - (1) 'A' is a generative cell which gives rise to pollen tube and 'B' is a vegetative cell which forms male gametes: Incorrect, generative cells produce gametes, not the pollen tube.

  - (2) 'A' is a vegetative cell with abundant food reserve and 'B' is a generative cell which forms male gametes: Correct, aligns with the roles of vegetative and generative cells.

  - (3) 'A' is a generative cell which forms male gametes and 'B' is a vegetative cell which produces pollen tube: Incorrect, reverses the functions.

  - (4) 'A' is a vegetative cell which gives rise to male gametes and 'B' is a generative cell which produces pollen tube: Incorrect, vegetative cells form the pollen tube, not gametes.
- **Conclusion:** The correct answer is (2), as 'A' is the vegetative cell (with food reserve) and 'B' is the generative cell (forming male gametes).

Quick Tip

The vegetative cell in pollen forms the pollen tube, while the generative cell produces sperm.

---

44. Match the hormone with its site of production:

Hormone	Site of production
a) hCG and hPL	i) Ovary
b) Progesterone	ii) Placenta
c) Androgens	iii) Corpus luteum
d) Relaxin	iv) Leydig cells

(1) a-iv, b-i, c-ii, d-iii

(2) a-i, b-ii, c-iv, d-iii

(3) a-ii, b-iii, c-iv, d-i

(4) a-iii, b-i, c-iv, d-ii

Correct Answer: (3)

Solution:

- **Hormone Production Sites:**

  - (a) hCG (human chorionic gonadotropin) and hPL (human placental lactogen): Produced by the placenta during pregnancy. Matches (ii).

  - (b) Progesterone: Primarily produced by the corpus luteum after ovulation. Matches (iii).

  - (c) Androgens: Produced by Leydig cells in the testes. Matches (iv).

  - (d) Relaxin: Produced by the ovary, especially during pregnancy. Matches (i).

- **Option Analysis:**

  - (1) a-iv, b-i, c-ii, d-iii: Incorrect, hCG/hPL are not from Leydig cells.

  - (2) a-i, b-ii, c-iv, d-iii: Incorrect, hCG/hPL are not from ovary.

  - (3) a-ii, b-iii, c-iv, d-i: Correct, matches placenta, corpus luteum, Leydig cells, and ovary respectively.

  - (4) a-iii, b-i, c-iv, d-ii: Incorrect, hCG/hPL are not from corpus luteum.

- **Conclusion:** The correct answer is (3) a-ii, b-iii, c-iv, d-i.

Quick Tip

hCG and hPL are placental hormones, while progesterone comes from the corpus luteum.

---

45. Choose the correct sequence of sperm transport during ejaculation

(1) Seminiferous tubules → vasa efferentia → rete testis → epididymis → vas deferens → ejaculatory duct

(2) Seminiferous tubules → rete testis → epididymis → vas deferens → vasa efferentia → ejaculatory duct

(3) Seminiferous tubules → rete testis → vasa efferentia → epididymis → vas deferens → ejaculatory duct
(4) Seminiferous tubules → rete testis → epididymis → vasa efferentia → vas deferens → ejaculatory duct

Correct Answer: (3)

Solution:

- **Sperm Transport Path:** Sperm travel from production to ejaculation through a specific route in the male reproductive system.
- **Sequence Analysis:**
  - Sperm are produced in seminiferous tubules.
  - They move to the rete testis, a network of tubules.
  - Vasa efferentia transport sperm from rete testis to the epididymis.
  - Epididymis stores and matures sperm.
  - Vas deferens conducts sperm to the ejaculatory duct.
  - Ejaculatory duct releases sperm during ejaculation.
- **Option Analysis:**
  - (1) Seminiferous tubules → vasa efferentia → rete testis → epididymis → vas deferens → ejaculatory duct: Incorrect, rete testis comes before vasa efferentia.
  - (2) Seminiferous tubules → rete testis → epididymis → vas deferens → vasa efferentia → ejaculatory duct: Incorrect, vasa efferentia precedes epididymis.
  - (3) Seminiferous tubules → rete testis → vasa efferentia → epididymis → vas deferens → ejaculatory duct: Correct, follows the anatomical sequence.
  - (4) Seminiferous tubules → rete testis → epididymis → vasa efferentia → vas deferens → ejaculatory duct: Incorrect, vasa efferentia is out of order.
- **Conclusion:** The correct answer is (3), as it accurately represents the sperm transport sequence.

Quick Tip

Sperm travel from seminiferous tubules to ejaculatory duct via rete testis, vasa efferentia, epididymis, and vas deferens.

---

46. Select the mismatched pair:

a) First month of pregnancy-Formation of heart

b) Second month of pregnancy-Movement of foetus

c) Third month of pregnancy-Formation of most of the major organ systems

d) Sixth month of pregnancy-Eye lids separate and eye lashes are formed

(1) c

(2) d

(3) a

(4) b

Correct Answer: (4)

Solution:

- **Pregnancy Development:**
  - (a) First month: Heart begins to form (correct).
  - (b) Second month: Foetal movement typically starts later (around 16-20 weeks, i.e., fourth month), not second month. Mismatched.
  - (c) Third month: Major organ systems are forming (correct).
  - (d) Sixth month: Eyelids separate, and eyelashes form (correct).
- **Option Analysis:**
  - (1) c: Correct pair, not mismatched.
  - (2) d: Correct pair, not mismatched.
  - (3) a: Correct pair, not mismatched.
  - (4) b: Mismatched, as foetal movement occurs later than the second month.
- **Conclusion:** The correct answer is (4) b, as the movement of the foetus does not occur in the second month.

Quick Tip

Foetal movement is typically felt by the mother in the fourth month, not the second.

---

47. Out of the following options, identify which one is NOT a natural method of contraception?

(1) Lactational amenorrhea

(2) Periodic abstinence

(3) Coitus interruptus

(4) Implants

Correct Answer: (4)

Solution:

- **Natural Contraception Methods:** These rely on natural physiological processes without artificial devices or chemicals.
  - (1) Lactational amenorrhea: Temporary infertility due to breastfeeding, a natural method.
  - (2) Periodic abstinence: Avoiding intercourse during fertile days, a natural method.
  - (3) Coitus interruptus: Withdrawal before ejaculation, a natural method.
  - (4) Implants: A hormonal contraceptive device inserted under the skin, an artificial method.
- **Option Analysis:**
  - (1) Lactational amenorrhea: Natural.
  - (2) Periodic abstinence: Natural.
  - (3) Coitus interruptus: Natural.
  - (4) Implants: Artificial, not a natural method.
- **Conclusion:** The correct answer is (4) Implants, as it is not a natural method of contraception.

Quick Tip

Implants are a medical contraceptive, unlike natural methods like abstinence.

---

48. In zygote intrafallopian tube transfer, the embryo upto __ stage is transferred into the fallopian tube

(1) 8 blastomeres

(2) 32 blastomeres

(3) 2 blastomeres

(4) 16 blastomeres

Correct Answer: (1)

Solution:

- **ZIFT Procedure:** In zygote intrafallopian tube transfer (ZIFT), the embryo is transferred into the fallopian tube at an early developmental stage.
- **Stage Analysis:** The embryo is typically transferred at the 6-8 cell stage (around 8 blastomeres), which occurs 2-3 days after fertilization.
- **Option Analysis:**
  - (1) 8 blastomeres: Matches the typical stage for ZIFT. Correct.
  - (2) 32 blastomeres: Occurs later (morula stage), not used in ZIFT.
  - (3) 2 blastomeres: Too early (4-cell stage), not standard.
  - (4) 16 blastomeres: Intermediate stage, but 8 is more common.
- **Conclusion:** The correct answer is (1) 8 blastomeres, as it aligns with the ZIFT protocol.

Quick Tip

ZIFT transfers the embryo at the 6-8 cell stage into the fallopian tube.

---

49. Read the following statements:

Statements - I : MTP is to get rid off wanted pregnancies due to causal unprotected intercourse or failure of contraceptives used during coitus or rapes

Statements - II: MTPs are performed legally by qualified doctors by giving proper medical justification

Choose the correct answer from the options given below:

(1) Statements - I is correct but Statements - II is incorrect

(2) Statements - I is incorrect but Statements - II is correct

(3) Statements - I and II are correct

(4) Statements - I and II are incorrect

Correct Answer: (2)

Solution:

- **Statement Analysis:**

  - Statements - I: Medical Termination of Pregnancy (MTP) is intended to terminate unwanted pregnancies, not ”wanted” pregnancies as stated. The mention of ”wanted” seems to be a typo or error; it should be ”unwanted.” Thus, this statement is incorrect as written.

  - Statements - II: MTPs are legally performed by qualified doctors with medical justification in many countries (e.g., under the MTP Act in India), making this statement correct.

- **Option Analysis:**

  - (1) Statements - I is correct but Statements - II is incorrect: Incorrect, as I is wrong and II is correct.

  - (2) Statements - I is incorrect but Statements - II is correct: Correct, aligns with the analysis.

  - (3) Statements - I and II are correct: Incorrect, as I contains an error.

  - (4) Statements - I and II are incorrect: Incorrect, as II is true.

- **Conclusion:** The correct answer is (2), as Statements - I is incorrect due to the ”wanted” error, while Statements - II is correct.

Quick Tip

MTP is for terminating unwanted pregnancies under legal medical supervision.

---

50. How may types of gametes will be formed by a parent with genotype 'AaBbCc'?

(1) 8

(2) 12

(3) 6

(4) 4

Correct Answer: (1)

Solution:

- **Gamete Formation:** The number of gamete types is determined by the formula 2^n, where n is the number of heterozygous gene pairs.
- **Genotype Analysis:** The genotype 'AaBbCc' has three heterozygous pairs (Aa, Bb, Cc), so $n = 3$.
- **Calculation:** $2^3 = 8$ possible gamete combinations (ABC, ABc, AbC, Abc, aBC, aBc, abC, abc).
- **Option Analysis:**
  - (1) 8: Matches the calculation. Correct.
  - (2) 12: Incorrect, exceeds the possible combinations.
  - (3) 6: Incorrect, does not fit 2^n for 3 pairs.
  - (4) 4: Incorrect, corresponds to 2^2 (two heterozygous pairs).
- **Conclusion:** The correct answer is (1) 8, as a parent with genotype AaBbCc can form 8 types of gametes.

Quick Tip

Gamete types = 2^n, where n is the number of heterozygous gene pairs.

---

51. When single gene exhibits multiple phenotypic expression, the phenomenon is called __

(1) Pleiotropy

(2) Co-dominance

(3) Polygenic inheritance

(4) Incomplete dominance

Correct Answer: (1) Pleiotropy

Solution:

- **Genetic Phenomena:**
  - Pleiotropy: A single gene influences multiple, seemingly unrelated phenotypic traits.
  - Co-dominance: Both alleles in a heterozygote are fully expressed.
  - Polygenic inheritance: Multiple genes contribute to a single trait.
  - Incomplete dominance: One allele is not fully dominant, resulting in an intermediate phenotype.
- **Option Analysis:**
  - (1) Pleiotropy: Correct, as it describes a single gene affecting multiple phenotypes.
  - (2) Co-dominance: Incorrect, relates to allele expression, not multiple traits.
  - (3) Polygenic inheritance: Incorrect, involves multiple genes, not one.
  - (4) Incomplete dominance: Incorrect, pertains to blending of traits, not multiple effects.
- **Conclusion:** The correct answer is (1) Pleiotropy.

Quick Tip

Pleiotropy is exemplified by conditions like Marfan syndrome, where one gene affects multiple systems.

---

52. A colourblind man marries a carrier woman. The percentage of their colourblind progeny in the next generation will be __

(1) 75%

(2) 100%

(3) 25%

(4) 50%

Correct Answer: (4) 50%

Solution:

- **Genetics of Colourblindness:** Colourblindness is an X-linked recessive trait. Let X^B be the normal allele and X^b be the colourblind allele.
  - Colourblind man: X^bY
  - Carrier woman: X^BX^b (has one normal and one colourblind allele)
- **Punnett Square:**

	X^B	X^b
X^b	X^BX^b (carrier female)	X^bX^b (colourblind female)
Y	X^BY (normal male)	X^bY (colourblind male)

- **Progeny Analysis:**
  - 25% carrier females (X^BX^b)
  - 25% colourblind females (X^bX^b)
  - 25% normal males (X^BY)
  - 25% colourblind males (X^bY)
  - Total colourblind progeny = 25% (females) + 25% (males) = 50%.
- **Option Analysis:**
  - (1) 75%: Incorrect.
  - (2) 100%: Incorrect.
  - (3) 25%: Incorrect.
  - (4) 50%: Correct.
- **Conclusion:** The correct answer is (4) 50%.

Quick Tip

X-linked recessive traits like colourblindness show a 50% chance of affected offspring when a carrier female mates with an affected male.

53. Identify which one of the given pair of options is correct with respect to Down's syndrome and Turner's syndrome

	Down's syndrome symptoms	Turner's syndrome symptoms
a)	Short -statured individual	Gynaecomastia in man
b)	Round head, partially open mouth	Overall masculine development
c)	Broad palm, physical and mental development retarded	Sterile females with rudimentary ovaries
d)	Additional copy of an X-chromosome	Absence of an X-chromosome

(1) c

(2) d

(3) a

(4) b

Correct Answer: (1) c

Solution:

- **Syndrome Characteristics:**

  - Down's syndrome: Caused by an extra chromosome 21 (trisomy 21), leading to short stature, broad face, and intellectual disability.

  - Turner's syndrome: Caused by the absence of one X chromosome (45,X), resulting in short stature, broad chest, and sterile females with underdeveloped ovaries.

- **Option Analysis:**

  - (a) Short-statured individual & Gynaecomastia in man: Down's fits short stature, but Turner's causes female characteristics, not gynaecomastia (male breast enlargement,

seen in Klinefelter's). Incorrect.

- (b) Round, partially open mouth & head, overall masculine development: Down's has round face, but Turner's females are not masculine. Incorrect.

- (c) Broad physical features and mental development retarded & palm, sterile females with rudimentary ovaries: Down's includes broad features and mental retardation, Turner's includes sterile females with underdeveloped ovaries. Correct.

- (d) Additional copy of an X-chromosome & Absence of an X-chromosome: Down's is due to an extra chromosome 21, not X; Turner's is due to the absence of one X chromosome. Incorrect.

- **Conclusion:** The correct answer is (1) (c), as it accurately matches the symptoms of Down's and Turner's syndromes.

Quick Tip

Down's syndrome involves trisomy 21, while Turner's involves a missing X chromosome.

---

54. RNA polymerase II is responsible for the transcription of __

(1) hnRNA

(2) snRNA

(3) tRNA

(4) rRNA

Correct Answer: (1) hnRNA

Solution:

- **RNA Polymerase Roles:** In eukaryotes, different RNA polymerases transcribe specific RNA types.

- RNA polymerase II: Transcribes heterogeneous nuclear RNA (hnRNA), which is the precursor to messenger RNA (mRNA).

- RNA polymerase I: Transcribes ribosomal RNA (rRNA).

- RNA polymerase III: Transcribes transfer RNA (tRNA) and small nuclear RNA (snRNA).

- **Option Analysis:**
  - (1) hnRNA: Correct, as RNA polymerase II synthesizes hnRNA.
  - (2) snRNA: Incorrect, transcribed by RNA polymerase III.
  - (3) tRNA: Incorrect, transcribed by RNA polymerase III.
  - (4) rRNA: Incorrect, transcribed by RNA polymerase I.

- **Conclusion:** The correct answer is (1) hnRNA.

Quick Tip

RNA polymerase II is specific for hnRNA, the precursor to mRNA in eukaryotes.

---

55. Which of the following enzymes increases the permeability of the bacterial cell to lactose?

(1) Transacetylase

(2) Amylase

(3) β-galactosidase

(4) Permease

Correct Answer: (4) Permease

Solution:

- **Lac Operon Function:** In the lac operon of E. coli, lactose metabolism involves several enzymes.
  - Permease (lacY gene product): Increases cell membrane permeability to lactose, allowing its entry into the cell.
  - β-galactosidase (lacZ gene product): Breaks down lactose into glucose and galactose.
  - Transacetylase (lacA gene product): Transfers acetyl groups to lactose derivatives, a minor role.
  - Amylase: Degrades starch, not involved in lactose metabolism.

- **Option Analysis:**
  - (1) Transacetylase: Incorrect, involved in acetylation, not permeability.
  - (2) Amylase: Incorrect, acts on starch, not lactose.
  - (3) β-galactosidase: Incorrect, hydrolyzes lactose, not involved in permeability.
  - (4) Permease: Correct, facilitates lactose uptake into the cell.
- **Conclusion:** The correct answer is (4) Permease.

Quick Tip

Permease is crucial for lactose transport in the lac operon system.

---

56. Which of the following statements are correct with reference to prokaryotic genome?

(1) Monocistronic structural genes

(2) Introns absent in structural genes

(3) Transcription and translation are coupled processes

(4) Primary transcript undergoes splicing

(5) Only one RNA polymerase is present

Correct Answer: (4) Only b, c and e are correct

Solution:

- **Monocistronic structural genes:** Prokaryotic genome usually has polycistronic genes, not monocistronic genes. **This is incorrect.**
- **Introns absent in structural genes:** In prokaryotes, structural genes generally lack introns. **This is correct.**
- **Transcription and translation are coupled processes:** In prokaryotes, transcription and translation occur simultaneously because both processes occur in the cytoplasm. **This is correct.**
- **Primary transcript undergoes splicing:** Prokaryotes do not have splicing of the primary transcript, which is typical of eukaryotes. **This is incorrect.**

- **Only one RNA polymerase is present:** Prokaryotes have a single RNA polymerase for transcription. **This is correct.**

Conclusion: The correct statements are b, c, and e.

Quick Tip

Remember, in prokaryotes, transcription and translation are coupled, and there is only one RNA polymerase present, unlike in eukaryotes.

---

57. When a change in the gene frequency of population occurs by chance, it is called

(1) Genetic recombination

(2) Genetic drift

(3) Founder effect

(4) Gene migration

Correct Answer: (2) Genetic drift

Solution:

- **Genetic Recombination:** Refers to the exchange of genetic material during sexual reproduction, but not by chance. **This is incorrect.**
- **Genetic Drift:** Refers to random changes in allele frequencies in a population, often due to chance events, such as the bottleneck effect or founder effect. **This is correct.**
- **Founder Effect:** A type of genetic drift that occurs when a small population colonizes a new area. **This is incorrect in this context.**
- **Gene Migration:** Refers to the movement of genes between populations, not random chance. **This is incorrect.**

Conclusion: The correct term is Genetic Drift, where gene frequency changes occur by chance.

Quick Tip

Genetic drift is the random fluctuation of allele frequencies in a small population due to chance events, while gene migration refers to the movement of genes between populations.

---

58. Darwin's finches represent one of the best examples of

(1) Chemical evolution

(2) Genetic equilibrium

(3) Seasonal migration

(4) Adaptive radiation

Correct Answer: (4) Adaptive radiation

Solution: Darwin's finches are a classic example of adaptive radiation, where a single ancestral species diversified into several species, each adapted to different ecological niches. This phenomenon is an important example of evolution by natural selection.

Quick Tip

Adaptive radiation occurs when a single species evolves into a variety of forms to occupy different ecological niches. Darwin's finches are a prime example of this.

---

59. Choose the correct statement from the following:

(1) Charles Darwin travelled around the world in a ship called HMS Beagle

(2) There has been gradual evolution of life forms

(3) According to Darwin, fitness refers to physical fitness only

(4) Fossils are remains of hard parts of life forms found in rocks

(5) Hugo De Vries, a naturalist worked in Malay Archipelago.

Correct Answer: (1) a, b and d are correct

Solution:

- **Charles Darwin's Journey:** Charles Darwin indeed travelled around the world on the HMS Beagle, which helped him gather evidence for his theory of evolution. **This is correct.**
- **Gradual Evolution of Life Forms:** Darwin's theory of evolution proposed that life forms evolved gradually over time. **This is correct.**
- **Darwin's View on Fitness:** Darwin defined fitness in the context of the ability to survive and reproduce in a specific environment, not just physical fitness. **This is incorrect.**
- **Fossils:** Fossils are indeed the remains of hard parts of life forms found in rocks, and they are important for understanding the history of life on Earth. **This is correct.**
- **Hugo De Vries:** Hugo De Vries was a Dutch botanist and naturalist who is associated with the theory of mutation, but he did not work in the Malay Archipelago. **This is incorrect.**

Conclusion: The correct statements are a, b, and d.

Quick Tip

Remember, Darwin's voyage on the HMS Beagle and his observations led to the formulation of his theory of evolution, and fossils provide important evidence of life's history on Earth.

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60. In which of the following, HIV replicates and produces its progeny viruses?

(1) Killer T-lymphocytes

(2) Suppressor T-lymphocytes

(3) Helper T-lymphocytes

(4) Memory T-lymphocytes

Correct Answer: (3) Helper T-lymphocytes

Solution: HIV specifically targets Helper T-lymphocytes, also known as CD4+ T cells. These cells are crucial for immune response, and once infected, HIV replicates inside these cells, using their machinery to produce new viral particles.

Quick Tip

Helper T-lymphocytes are the primary targets of HIV, leading to the weakening of the immune system as the virus replicates within them.
