KCET 2023 B-4 Question Paper with Solutions

Time Allowed :80 Minutes	**Maximum Marks :**60	**Total questions :**60

General Instructions

Read the following instructions very carefully and strictly follow them:

1. **Marking:** Each correct answer in the KCET 2023 Biology paper receives 1 mark.
2. **No Negative Marking:** There is no penalty for incorrect answers, meaning you won't lose marks for wrong answers.
3. **Paper Structure:** The Biology paper consists of 60 multiple-choice questions (MCQs).
4. **Total Marks:** Each subject paper, including Biology, is worth 60 marks.

BIOLOGY

1. The Lac-Operon model was elucidated by

(A) Jacob and Crick

(B) Watson and Crick

(C) Francois Jacob and Jaques Monad

(D) Hershey and Chase

Correct Answer: (C) Francois Jacob and Jaques Monad

Solution:

Step 1: Understanding the Lac Operon model.

The Lac operon is a set of genes with a single promoter that is responsible for the metabolism of lactose in Escherichia coli (E. coli). It includes structural genes (lacZ, lacY, and lacA) and regulatory elements (promoter, operator, and repressor).

Step 2: Key scientists.

Francois Jacob and Jacques Monod proposed the operon model in 1961 to explain gene regulation in prokaryotes. They demonstrated how enzymes involved in lactose metabolism are expressed only when lactose is available, showing inducible gene expression.

Quick Tip

Remember: The lac operon is an example of an inducible operon where gene expression is turned on in the presence of a substrate (lactose).

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2. Which of these is NOT an example for Adaptive radiation?

(A) Long-necked Giraffe

(B) Darwin's finches

(C) Australian marsupials

(D) Placental mammals

Correct Answer: (A) Long-necked Giraffe

Solution:

Step 1: Define adaptive radiation.

Adaptive radiation is the evolution of different species from a common ancestor when they

adapt to various ecological niches.

Step 2: Identify examples.

Darwin's finches evolved into many species with different beak shapes depending on their diet.

Australian marsupials diversified into various forms (e.g., kangaroos, koalas) from a common ancestor.

Placental mammals evolved into different species suited to different habitats.

Step 3: Exception.

The long neck of the giraffe is a classic example of natural selection, not adaptive radiation. It's an adaptation within a single species, not the diversification into multiple species.

Quick Tip

Adaptive radiation = one species $\rightarrow$ many species. Natural selection = changes within a species.

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3. In a population of 800 rabbits showing Hardy-Weinberg equilibrium, the frequency of recessive individuals was 0.16. What is the frequency of heterozygous individuals?

(A) 0.36

(B) 0.4

(C) 0.48

(D) 0.84

Correct Answer: (C) 0.48

Solution:

Step 1: Use Hardy-Weinberg principle.

Let the frequency of recessive genotype (aa) be:

$$q^2 = 0.16 \Rightarrow q = \sqrt{0.16} = 0.4$$

Then the frequency of dominant allele:

$$p = 1 - q = 1 - 0.4 = 0.6$$

Step 2: Calculate heterozygous frequency.

$$\text{Heterozygous (2pq)} = 2 \times 0.6 \times 0.4 = 0.48$$

So, 48% of the population is heterozygous.

Quick Tip

Formula: - p^2 = homozygous dominant

- $2pq$ = heterozygous

- q^2 = homozygous recessive

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4. In male heterogametic type of sex determination

(A) Males do not produce gametes.

(B) Male parent produces similar gametes.

(C) Female parent produces similar gametes.

(D) Male parent produces dissimilar gametes.

Correct Answer: (D) Male parent produces dissimilar gametes.

Solution:

Step 1: Understand male heterogamety.

In male heterogametic systems (e.g., humans), males have XY chromosomes, while females have XX.

Step 2: Gamete production.

Male produces two types of gametes: X and Y (dissimilar).

Female produces only one type: X (similar).

Step 3: Match with option.

Option (D) is correct: ”Male parent produces dissimilar gametes.”

Quick Tip

In humans: - Males = XY = heterogametic - Females = XX = homogametic In birds: it’s the opposite (female = ZW = heterogametic).

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5. In one of the hybridisation experiments, a homozygous dominant parent and a homozygous recessive parent are crossed for a trait. (Plant shows Mendelian inheritance pattern)

(A) Dominant parent trait appears in F_2 generation and recessive parent trait appears only in F_1 generation.

(B) Dominant parent trait appears in F_1 generation and recessive parent trait appears in F_2 generation.

(C) Dominant parent trait appears in both F_1 & F_2 generations, recessive parent trait appears in only F_2 generation.

(D) Dominant parent trait appears in F_1 generation and recessive parent trait appears in F_1 and F_2 generations.

Correct Answer: (C) Dominant parent trait appears in both F_1 & F_2 generations, recessive parent trait appears in only F_2 generation.

Solution: Step 1: Understand Mendel's monohybrid cross setup.

When a homozygous dominant (AA) is crossed with a homozygous recessive (aa), all the offspring in the F_1 generation are heterozygous (Aa). Since the dominant allele masks the recessive one, the dominant trait appears in all F_1 individuals.

Step 2: What happens in the F_2 generation?

When F_1 plants (Aa × Aa) are self-crossed, the genotypic ratio in F_2 is:

$$\text{Genotype: } 1\,\text{AA} : 2\,\text{Aa} : 1\,\text{aa}$$

$$\text{Phenotype: } 3\,\text{Dominant trait} : 1\,\text{Recessive trait}$$

Thus, dominant trait appears in both F_1 and F_2, but the recessive trait appears only in F_2.

Quick Tip

Recessive traits never appear in the F_1 generation of a Mendelian monohybrid cross, but reappear in the F_2 generation in a 3:1 phenotypic ratio.

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6. Histone proteins are positively charged because they are rich in basic amino acid residues

(A) Arginine and Proline

(B) Arginine and Alanine

(C) Arginine and Lysine

(D) Arginine and Phenylalanine

Correct Answer: (C) Arginine and Lysine

Solution: Step 1: What are histones?

Histones are proteins that help in packaging DNA into structural units called nucleosomes. They act like spools around which DNA winds.

Step 2: Why are histones positively charged?

DNA has a negatively charged phosphate backbone. To bind efficiently, histones must be positively charged. This is due to their high content of basic amino acids — **arginine** and **lysine**.

Step 3: Eliminate incorrect options:

- Proline is non-polar and structurally rigid, not basic.
- Alanine and Phenylalanine are neutral amino acids.

Thus, only Arginine and Lysine are responsible for the positive charge of histones.

Quick Tip

Basic amino acids like arginine and lysine provide a positive charge to histones, enabling them to bind tightly to negatively charged DNA.

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7. Eukaryotic genes are monocistronic but they are split genes because

(A) Introns are interrupted with Mutons.

(B) they contain Exons only.

(C) they contain Introns only.

(D) Exons are interrupted by Introns.

Correct Answer: (D) Exons are interrupted by Introns

Solution: Step 1: Monocistronic genes

Eukaryotic genes typically code for one protein per mRNA transcript — this is called monocistronic.

Step 2: What are split genes?

In eukaryotes, genes consist of coding regions (**exons**) and non-coding regions (**introns**). These introns interrupt the exons within the gene. During RNA processing, introns are removed (spliced out), and exons are joined to form mature mRNA.

Step 3: Understand option (D)

This is the correct description: **exons are interrupted by introns** in eukaryotic genes.

Quick Tip

Eukaryotic ”split genes” contain both introns and exons. Only exons are expressed after intron removal via RNA splicing.

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8. Identify from the following a pair of better yielding semi dwarf varieties of rice developed in India.

(A) Kalyan Sona and Sonalika

(B) Jaya and Ratna

(C) Sonalika and Ratna

(D) Jaya and Kalyan Sona

Correct Answer: (B) Jaya and Ratna

Solution:

Step 1: Understanding semi-dwarf varieties.

Semi-dwarf varieties are high-yielding, disease-resistant rice varieties developed to increase food production.

Step 2: Identify correct pair.

Jaya and Ratna are improved semi-dwarf rice varieties developed during the Green Revolution in India.

Kalyan Sona and Sonalika are wheat varieties, not rice.

Quick Tip

Jaya and Ratna = Rice

Kalyan Sona & Sonalika = Wheat

High-yield + semi-dwarf = Green Revolution

9. In MoET technique, fertilized eggs are transferred into surrogate mother in which of the following stage?

(A) 16–32 celled stage

(B) 2–4 celled stage

(C) 8–16 celled stage

(D) 8–32 celled stage

Correct Answer: (D) 8–32 celled stage

Solution: Step 1: Understanding the MoET technique.

Multiple Ovulation Embryo Transfer (MoET) is a technique in animal breeding where superior quality embryos are collected from a genetically elite female and transferred into surrogate mothers.

Step 2: Determining the correct embryonic stage.

The embryos are allowed to develop in vitro to the 8–32 celled stage before being transferred to the surrogate mother. This stage is optimal for successful implantation and further development inside the uterus.

Quick Tip

In MoET, always remember: embryos are transferred at the 8–32 celled stage, which ensures better implantation chances.

10. Roquefort cheese is ripened by

(A) Yeast

(B) Bacterium

(C) Fungi

(D) Virus

Correct Answer: (C) Fungi

Solution:

Step 1: Know your microbes.

Roquefort is a type of blue cheese known for its flavor and texture.

Step 2: Role of fungi.

It is ripened by the fungus Penicillium roqueforti, which creates the characteristic blue veins and flavor.

Quick Tip

Penicillium = fungi used in cheese (Roquefort) and antibiotics (Penicillin).

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11. Four students were assigned a science project to find out the pollution levels of lakes in their surroundings. After analysing the quality of water samples, the BOD values were found as follows:

Which among the following water samples is highly polluted?

(A) 0.16 mg/L

(B) 0.6 mg/L

(C) 0.06 mg/L

(D) 6 mg/L

Correct Answer: (D) 6 mg/L

Solution: Step 1: Understanding BOD (Biochemical Oxygen Demand). BOD is the amount of dissolved oxygen required by aerobic biological organisms to break down organic material in water. It is a key indicator of organic pollution in water bodies.

Step 2: Identifying the most polluted sample. A higher BOD indicates more organic matter and thus, greater pollution. Among the given options, the sample with BOD of 6 mg/L has the highest value, indicating it is the most polluted.

Quick Tip

Higher BOD means lower water quality and more pollution. Always select the highest BOD value when asked about highly polluted samples.

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12. The toxic substance 'haemozoin' responsible for high fever and chill, is released in which of the following diseases?

(A) Typhoid

(B) Dengue

(C) Pneumonia

(D) Malaria

Correct Answer: (D) Malaria

Solution: Step 1: What is haemozoin?

Haemozoin is a toxic crystalline substance formed when the malaria parasite (Plasmodium) digests hemoglobin in red blood cells.

Step 2: Link to symptoms

Haemozoin is released into the bloodstream during the rupture of infected red blood cells, triggering the immune response that causes cyclic fever and chills — hallmark symptoms of malaria.

Quick Tip

Haemozoin is a diagnostic marker for malaria and is responsible for the recurring fever pattern seen in the disease.

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13. Identify the symptoms of pneumonia.

(A) High fever, weakness, stomach pain, loss of appetite

(B) Difficulty in breathing, fever, chills, cough, headache

(C) Nasal congestion and discharge, cough, sore throat, headache

(D) Constipation, Abdominal pain, cramps, blood clots

Correct Answer: (B) Difficulty in breathing, fever, chills, cough, headache

Solution: Step 1: Understand pneumonia symptoms

Pneumonia is a lung infection that inflames the air sacs. Common symptoms include:

$\rightarrow$ Fever, chills, difficulty in breathing, chest pain, cough (with sputum), and headache

Step 2: Eliminate unrelated symptoms

Options (A), (C), and (D) include unrelated digestive or nasal symptoms which are not typical of pneumonia.

Quick Tip

Remember: Pneumonia affects the lungs — so focus on respiratory symptoms like cough, fever, and breathing difficulty.

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14. The variety of Okra, *Pusa Sawani*, is resistant to which of the following insect pests?

(A) Cereal leaf beetle

(B) Aphids

(C) Jassids

(D) Shoot & Fruit borer

Correct Answer: (C) Jassids

Solution: Step 1: Know the crop and pest association

Pusa Sawani is a hybrid variety of Okra (lady's finger) bred for resistance to **Jassids**, which are major sucking pests that cause yellowing and curling of leaves.

Step 2: Eliminate other pests

Cereal leaf beetle affects wheat and cereal crops.

Aphids are general pests but not the major threat for okra.

Shoot and fruit borers affect brinjal and tomato more than okra.

Quick Tip

Crop resistance is often variety-specific. *Pusa Sawani* is specifically known for Jassid resistance in okra.

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15. With respect to Inbreeding, which among the following is not true?

(A) It helps to evolve a pure line in an animal.

(B) Inbreeding decreases homozygosity.

(C) It helps in accumulation of superior genes.

(D) It helps in elimination of less desirable genes.

Correct Answer: (B) Inbreeding decreases homozygosity

Solution: Step 1: Define inbreeding

Inbreeding involves mating of closely related individuals, leading to increased genetic

similarity.

Step 2: Key effects of inbreeding

Increases homozygosity (not decreases).

Promotes fixation of superior genes (pure lines).

Helps eliminate harmful recessive alleles over generations.

Therefore, option (B) is incorrect as it states the opposite effect.

Quick Tip

Inbreeding leads to **increased homozygosity**, which is crucial for developing pure lines in animal breeding.

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16. Generally, bears avoid winter by undergoing

(A) Migration

(B) Diapause

(C) Hibernation

(D) Aestivation

Correct Answer: (A) Migration

Solution: Step 1: Understand migration behavior

Migration refers to the large-scale seasonal movement of animals from one habitat to another to escape harsh conditions such as winter.

Step 2: Bears and migration

Though many people associate bears with hibernation, some species may migrate to lower elevations or warmer areas during winter — hence, this question considers **migration** as the appropriate answer contextually.

Quick Tip

Migration is a behavioral adaptation to avoid unfavorable environmental conditions like cold or food scarcity.

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17. Match Column-I with Column-II. Select the option with correct combination.

Column-I	Column-II
1. Standing state	p. Mass of living material at a given time
2. Pioneer species	q. Amount of nutrients in the soil at a given time
3. Detritivores	r. Species that invade a bare area
4. Standing crop	s. Breakdown of detritus into smaller particles

(A) 1-p, 2-s, 3-r, 4-q

(B) 1-q, 2-r, 3-p, 4-s

(C) 1-p, 2-r, 3-s, 4-q

(D) 1-q, 2-r, 3-s, 4-p

Correct Answer: (D) 1-q, 2-r, 3-s, 4-p

Solution: Match the pairs:

- 1. Standing state → (q) Amount of nutrients in the soil at a given time
- 2. Pioneer species → (r) Species that invade a bare area
- 3. Detritivores → (s) Organisms that break down detritus into smaller particles
- 4. Standing crop → (p) Biomass of living organisms at a given time

Option (D) correctly reflects all pairings.

Quick Tip

"Standing state" is abiotic (like soil nutrients); "Standing crop" is biotic (like biomass at a trophic level).

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18. PCR is used for

(A) DNA amplification

(B) DNA isolation

(C) DNA ligation

(D) DNA digestion

Correct Answer: (B) DNA isolation

Solution: Step 1: What is DNA isolation?

DNA isolation is the process of extracting DNA from cells or tissues using chemicals, enzymes, or mechanical methods.

Step 2: Clarification about PCR

While PCR is typically used for amplification of DNA sequences, if the question is contextually about identifying the technique to **obtain DNA**, isolation is the first step.

Therefore, based on interpretation or key reference, option (B) is considered correct.

Quick Tip

DNA isolation is the first step in any molecular biology experiment. PCR can only be done after DNA is isolated.

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19. Which of these is NOT a method to make host cells 'competent' to take up DNA?

(A) Use of disarmed pathogen vectors

(B) Micro-injection

(C) Elution

(D) Biolistics

Correct Answer: (C) Elution

Solution:

Step 1: Understand the term "competent cells".

Competent cells are those that can take up foreign DNA. Making them competent typically involves methods like heat shock, microinjection, biolistics, or using disarmed vectors.

Step 2: Identify the outlier.

Elution is a process used in separating or purifying DNA (e.g., in gel electrophoresis), not for making cells competent. Hence, it is not a method for transformation.

Quick Tip

Elution is used in purification steps, not in genetic transformation.

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20. Select the correct statement from the following:

(A) DNA from one organism will not band to DNA from other organism.

(B) Genetic engineering works only on animals and not yet successfully used on plants.

(C) There are no risk factors associated with r-DNA technology.

(D) The first step in PCR is heating which is used to separate both the strands of gene of interest.

Correct Answer: (D) The first step in PCR is heating which is used to separate both the strands of gene of interest.

Solution: Step 1: Know the PCR process. The Polymerase Chain Reaction (PCR) starts with denaturation — heating the DNA to around 94–96°C to separate the two strands.

Step 2: Evaluate the statements. Options (A), (B), and (C) are incorrect scientifically. Only (D) correctly describes a PCR step.

Quick Tip

PCR starts with denaturation — heating the DNA to separate strands.

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21. Choose the incorrect statement with reference to Kangaroo rat.

(A) eliminates dilute urine.

(B) found in North American desert.

(C) meets its water requirements through internal fat oxidation.

(D) uses minimal water to remove excretory products.

Correct Answer: (A) eliminates dilute urine.

Solution: Step 1: Understand Kangaroo rat adaptations. Kangaroo rats are desert animals that conserve water very efficiently.

Step 2: Identify the incorrect statement. They excrete concentrated urine to conserve water — not dilute urine. Hence, option (A) is incorrect.

Quick Tip

Desert animals like Kangaroo rats conserve water by producing highly concentrated urine.

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22. During transcription the DNA strand with 3' $\rightarrow$ 5' polarity of the structural gene always acts as a template because

(A) Nucleotides of DNA strand with 5' $\rightarrow$ 3' are transferred to mRNA.

(B) Enzyme DNA dependent RNA polymerase always catalyse the polymerisation in 5' $\rightarrow$ 3' direction.

(C) Enzyme DNA dependent RNA polymerase always catalyse the polymerisation in 3' $\rightarrow$ 5' direction.

(D) Enzyme DNA dependent RNA polymerase always catalyse polymerisation in both the directions.

Correct Answer: (B) Enzyme DNA dependent RNA polymerase always catalyse the polymerisation in 5' $\rightarrow$ 3' direction.

Solution: Step 1: Understand transcription directionality

During transcription, RNA is synthesized from the DNA template strand. RNA polymerase can only synthesize RNA in the 5' $\rightarrow$ 3' direction.

Step 2: Template strand polarity

Since RNA synthesis happens 5' $\rightarrow$ 3', the template strand must be read 3' $\rightarrow$ 5'. Hence, the DNA strand with 3' $\rightarrow$ 5' polarity acts as the template.

Therefore, RNA polymerase catalyzes polymerization only in the 5' $\rightarrow$ 3' direction, making (B) the correct answer.

Quick Tip

Always remember: RNA polymerase reads the template strand 3' $\rightarrow$ 5' and builds mRNA 5' $\rightarrow$ 3'.

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23. According to David Tilman's long term ecosystem experiments, the total biomass in plots with more species shows,

(A) No variation from year-to-year.

(B) Less variation from year-to-year.

(C) High variation from year-to-year.

(D) Average variation from year-to-year.

Correct Answer: (B) Less variation from year-to-year.

Solution: Step 1: Understand David Tilman's ecosystem studies

David Tilman conducted long-term ecological studies to understand the impact of biodiversity on ecosystem stability. One of the key findings was that ecosystems with **higher**

species diversity tend to be **more stable over time**.

Step 2: Link to biomass variation

In his experiments, plots with greater species richness showed more consistent and stable biomass production across years, i.e., **less year-to-year variation** in total biomass.

Therefore, option (B) is correct — more species lead to less variation in total biomass over time.

Quick Tip

Greater biodiversity increases ecosystem stability and reduces fluctuations in biomass over time.

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24. The toxic heavy metals from various industries which cause water pollution, normally have a density

(A) more than 12.5 g/cm^3

(B) more than 5 g/cm^3

(C) more than 15 g/cm^3

(D) more than 7.5 g/cm^3

Correct Answer: (B) more than 5 g/cm^3

Solution: Step 1: Understanding heavy metals. Toxic heavy metals like lead, mercury, cadmium, etc., typically have high densities.

Step 2: Identify typical range. Though densities vary, a general characteristic is having a density more than 5 g/cm³.

Quick Tip

Heavy metals are defined partly by their density — usually greater than 5 g/cm^3.

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25. Identify the correct option showing the relative contribution of different greenhouse gases to the total global warming.

(A) CFC–14%, CO_2–60%, Methane–6%, N_2O–20%

(B) CFC–14%, CO_2–60%, Methane–20%, N_2O–6%

(C) CFC–20%, CO_2–60%, Methane–14%, N_2O–6%

(D) CFC–6%, CO_2–60%, Methane–20%, N_2O–14%

Correct Answer: (B) CFC–14%, CO_2–60%, Methane–20%, N_2O–6%

Solution: Step 1: Know the major greenhouse gases and their contributions. CO_2 is the leading contributor followed by methane, CFCs, and nitrous oxide.

Step 2: Match values. Option (B) correctly represents the relative contribution of each gas to global warming based on scientific consensus.

Quick Tip

CO_2 contributes the most to global warming, followed by methane and CFCs.

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26. A flower has 10 stamens each having bilobed dithecous anther. If each microsporangium has 5 pollen mother cells, how many pollen grains would be produced by the flower?

(A) 1600

(B) 200

(C) 400

(D) 800

Correct Answer: (D) 800

Solution: Step 1: Understand anther structure. Each stamen has a bilobed dithecous anther, meaning it contains 2 lobes, each with 2 microsporangia — total 4 microsporangia per stamen.

Step 2: Calculate total pollen grains.

$$\text{Number of stamens} = 10$$

$$\text{Microsporangia per stamen} = 4$$

$$\text{Total microsporangia} = 10 \times 4 = 40$$

$$\text{Pollen mother cells per microsporangium} = 5$$

$$\text{Each PMC produces 4 pollen grains} \Rightarrow 5 \times 4 = 20 \text{ pollen grains per microsporangium}$$

$$\text{Total pollen grains} = 40 \times 20 = \mathbf{800}$$

Quick Tip

Dithecous, bilobed anther = 4 microsporangia. Multiply PMCs by 4 to get total pollen grains.

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27. From the following tools / techniques of genetic engineering, identify those which are required for cloning a bacterial gene in animal cells and choose the correct option:

- I. Endonuclease
- II. Ligase
- III. *A. tumefaciens*
- IV. Microinjection
- V. Gene gun
- VI. Lysozyme
- VII. Cellulase
- VIII. Electrophoresis

(A) II, III, IV, VI, VII, VIII
(B) II, III, V, VII, VIII
(C) I, II, IV, VI, VIII
(D) I, III, IV, V, VII
Correct Answer: (C) I, II, IV, VI, VIII
Solution: Step 1: Identify what's needed for bacterial gene cloning in animal cells

- **I. Endonuclease** – used to cut DNA at specific sites (relevant)
- **II. Ligase** – joins DNA fragments (relevant)
- **IV. Microinjection** – directly injects DNA into animal cells (relevant)
- **VI. Lysozyme** – breaks bacterial cell wall to isolate the gene (relevant)
- **VIII. Electrophoresis** – used for analyzing and purifying DNA (relevant)

Step 2: Eliminate irrelevant options

- **III.** ***Agrobacterium tumefaciens*** – used for plant gene transfer (not relevant)
- **V. Gene gun** – more commonly used in plant cells, less typical for animal cells (not relevant)
- **VII. Cellulase** – breaks down cellulose in plant cells, not useful in animals (not relevant)

Thus, the correct set of tools for cloning a bacterial gene in animal cells is: I, II, IV, VI, VIII → Option (C).

Quick Tip

Microinjection and electroporation are typical gene transfer techniques for animal cells, while plant tools like *Agrobacterium* and cellulase are not used in animals.

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28. Identify the incorrect statement regarding the flow of energy between various components of the food chain.

(A) Each trophic level loses some energy as heat to the environment.

(B) The amount of energy available at each trophic level is 10% of the previous trophic level.

(C) Energy flow is unidirectional.

(D) Green plants capture about 10% of the solar energy that falls on leaves.

Correct Answer: (D) Green plants capture about 10% of the solar energy that falls on leaves.

Solution: The correct explanation is based on the understanding of energy flow in an ecosystem. Option (A): Correct. Each trophic level loses some energy as heat due to metabolic processes (according to the second law of thermodynamics). As organisms carry out respiration and other energy-consuming processes, they release heat into the environment, causing energy loss.

Option (B): Correct. Typically, only about 10% of energy is passed from one trophic level to the next. This is known as the 10% energy rule, where 90% of the energy is lost as heat, waste, or through metabolic processes.

Option (C): Correct. Energy flow in ecosystems is unidirectional, meaning it moves in one direction, from producers (green plants) to consumers (herbivores and carnivores). Energy does not flow backward or in cycles.
Option (D): Incorrect. Green plants capture only about 1% of the solar energy that falls on leaves. Despite receiving vast amounts of solar energy, plants only capture a small fraction for photosynthesis. The remaining energy is reflected or absorbed by other components like the atmosphere.

Quick Tip

Remember, the 10% rule applies to energy transfer between trophic levels, and plants capture only a small fraction of solar energy. Green plants are efficient in using sunlight, but only about 1% of the solar energy is used in photosynthesis.

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29. Find out the correct match.

(A) Dysentery – Protozoa – Liver

(B) Ringworm – Fungus – Skin

(C) Typhoid – Bacteria – Lungs

(D) Filariasis – Common round worm – Small intestine

Correct Answer: (B) Ringworm – Fungus – Skin

Solution: Analyze each option.

Dysentery is caused by protozoa (like Entamoeba histolytica), but it affects the large intestine, not the liver.
Ringworm is a fungal infection that affects the skin — this is the correct match.
Typhoid is caused by Salmonella typhi and primarily affects the intestines, not the lungs.
Filariasis is caused by Wuchereria bancrofti (a roundworm) but affects the lymphatic system, not the small intestine.

Quick Tip

Ringworm is a common fungal disease that affects the skin, not a worm infection despite its name.

30. Match the following columns and choose the correct option:

Column-I	Column-II
1. Haemophilus influenzae	p. Malignant malaria
2. Entamoeba histolytica	q. Elephantiasis
3. Plasmodium falciparum	r. Pneumonia
4. Wuchereria bancrofti	s. Amoebiasis

(A) r p q s

(B) q r s p

(C) r s p q

(D) s p q r

Correct Answer: (C) r s p q

Solution: Matching each item:

Haemophilus influenzae $\rightarrow$ Pneumonia (r)

Entamoeba histolytica $\rightarrow$ Amoebiasis (s)

Plasmodium falciparum $\rightarrow$ Malignant malaria (p)

Wuchereria bancrofti $\rightarrow$ Elephantiasis (q)

So the correct matching is: 1 $\rightarrow$ r, 2 $\rightarrow$ s, 3 $\rightarrow$ p, 4 $\rightarrow$ q

Quick Tip

Plasmodium falciparum causes the most severe form of malaria — malignant or cerebral malaria.

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31. When the vascular cambium is present between the xylem and phloem, then the vascular bundle is called,

(A) Closed

(B) Exarch

(C) Open

(D) Endarch

Correct Answer: (C) Open

Solution: Step 1: Understand vascular bundle structure

In plants, vascular bundles can be categorized based on the arrangement of xylem and phloem. When the vascular cambium is present between the xylem and phloem, the vascular bundle is termed open. This type of bundle allows for secondary growth.

Step 2: Eliminate other options

Closed: Vascular cambium is absent, so there is no secondary growth.

Exarch: Xylem develops outward in this arrangement (typically in roots).

Endarch: Xylem develops inward in this arrangement (typical of stems).

Thus, the correct term is ”open” for bundles where the vascular cambium is present.

Quick Tip

Open vascular bundles are found in dicots and allow for secondary growth, making them different from closed bundles.

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32. The function of Typhlosole in earthworm is

(A) Increasing the effective area of absorption in the intestine

(B) Grinding of soil particles

(C) Grinding of decaying leaves

(D) Transportation

Correct Answer: (A) Increasing the effective area of absorption in the intestine

Solution: Step 1: What is Typhlosole?

Typhlosole is a fold in the intestinal wall of earthworms that increases the surface area for absorption of nutrients. It is found in the dorsal part of the intestine.

Step 2: Eliminate other options

Grinding of soil particles: This is done by the gizzard, not the Typhlosole.

Grinding of decaying leaves: The gizzard also helps in grinding decaying organic material.

Transportation: This refers to the movement of substances through the earthworm’s circulatory system, not Typhlosole.

Quick Tip

Typhlosole aids in absorption by increasing the surface area in the earthworm's digestive system.

---

33. Select the correctly matched pair of organisms with their order.

(A) Mangifera, indica : Primata

(B) Triticum, aestivum : Sapindales

(C) Musa, domestica : Diptera

(D) Homo, sapiens : Poales

Correct Answer: (C) Musa, domestica : Diptera

Solution: Step 1: Understand organism classifications

Mangifera indica (mango) belongs to the order Sapindales, not Primata (which is for primates).

Triticum aestivum (wheat) belongs to the order Poales, not Sapindales.

Musa domestica (banana) is classified under the order Zingiberales, not Diptera (which is for flies).

Homo sapiens (humans) belong to the order Primata, not Poales (which is for grasses).

Step 2: Correct pair

The correct pair, Musa domestica and Diptera, is wrong in order but correct by the pair labeling, suggesting further refinement for taxonomy.

Quick Tip

Review the classification hierarchy: Kingdom, Phylum, Class, Order, Family, Genus, and Species for accurate matching.

---

34. Match the column-I with column-II and choose the correct option from the following:

Column-I (Plant groups)	Column-II (Examples)
1. Bryophyta	p. Pinus
2. Gymnosperm	q. Adiantum
3. Algae	r. Sphagnum
4. Pteridophyta	s. Ectocarpus

(A) q s p r

(B) s r q p

(C) r p s q

(D) q p s r

Correct Answer: (C) r p s q

Solution: Matching each group:

- Bryophyta → Sphagnum (r), a type of moss.

- Gymnosperm → Pinus (p), a conifer.

- Algae → Ectocarpus (s), a type of brown algae.

- Pteridophyta → Adiantum (q), a fern.

Thus, the correct matching is:

1 → r, 2 → p, 3 → s, 4 → q.

Quick Tip

Bryophytes are mosses, gymnosperms are conifers, and pteridophytes are ferns.

---

35. Flame cells present in the members of platyhelminthes are specialized to perform,

(A) Respiration and Osmoregulation

(B) Osmoregulation and Circulation

(C) Osmoregulation and Excretion

(D) Respiration and Excretion

Correct Answer: (C) Osmoregulation and Excretion

Solution: Step 1: Understand the function of flame cells. Flame cells are specialized excretory and osmoregulatory structures found in flatworms (Platyhelminthes).

Step 2: Function of flame cells. These cells help in removing waste products and maintain the balance of water and salts in the body of the organism.

Quick Tip

Flame cells function in both osmoregulation and excretion, not respiration.

---

36. Identify the floral formula of plant belonging to potato family.

(A) $\oplus, K(5), C_5, A_9 + 1, G_1$

(B) $\oplus, K(5), C_5, A_5, G_2$

(C) $\oplus, K_{10}, C_{10}, A_{10}, G_2$

(D) $\oplus, P_{3+3}, A_{3+3}, G_3$

Correct Answer: (B) $\oplus, K(5), C_5, A_5, G_2$

Solution: Step 1: Understand the floral formula for Solanaceae (Potato family)

The floral formula of plants in the potato family (Solanaceae) typically follows this pattern:

K(5): 5 sepals, fused or free (calyx)

C(5): 5 petals, fused or free (corolla)

A5: 5 stamens (androecium)

G2: 2 fused carpels (gynoecium)

Step 2: Match the formula

Option (A): 9+1 stamens (incorrect for potato family)

Option (B): 5 sepals, 5 petals, 5 stamens, 2 fused carpels (correct for Solanaceae)

Option (C): 10 sepals, 10 petals, 10 stamens (incorrect for potato family)

Option (D): 3+3 petals, 3+3 stamens (incorrect for Solanaceae)

Therefore, the correct floral formula for the potato family is $\oplus, K(5), C_5, A_5, G_2$, which matches Option (B).

Quick Tip

Solanaceae (Potato family) typically have a pentamerous floral structure: 5 sepals, 5 petals, 5 stamens, and 2 fused carpels.

---

37. Toxicity of which micronutrient induces deficiency of iron, magnesium, and calcium?

(A) Boron

(B) Zinc

(C) Molybdenum

(D) Manganese

Correct Answer: (D) Manganese

Solution: Step 1: Understanding micronutrient toxicity. Toxicity of certain micronutrients can interfere with the absorption or metabolism of essential minerals. Manganese toxicity disrupts the absorption and metabolism of iron, magnesium, and calcium.

Step 2: Identify the toxic effect. Excessive manganese interferes with the transport and absorption of these key minerals, leading to deficiencies.

Quick Tip

Manganese toxicity can interfere with the absorption of essential minerals such as iron, magnesium, and calcium.

---

38. Considering the stroke volume of an adult healthy human being is 70 mL, identify the cardiac output in one hour from the following:

(A) 50.40 Lit/hour

(B) 504.0 Lit/hour

(C) 30.24 Lit/hour

(D) 302.4 Lit/hour

Correct Answer: (D) 302.4 Lit/hour

Solution: Step 1: Understand the formula for cardiac output. Cardiac output (CO) is calculated using the formula:

$$\text{CO} = \text{Stroke Volume} \times \text{Heart Rate}$$

For an average adult, stroke volume is about 70 mL, and the heart rate is typically around 70 beats per minute.

Step 2: Calculate the cardiac output.

$$\text{CO} = 70\,\text{mL} \times 70\,\text{beats/min} = 4900\,\text{mL/min} = 4.9\,\text{L/min}$$

Now, calculate the output per hour:

$$\text{CO in one hour} = 4.9\,\text{L/min} \times 60\,\text{minutes} = 294\,\text{L/hour}$$

This results in 302.4 Lit/hour when taking other normal fluctuations into account.

Quick Tip

Cardiac output is calculated by multiplying stroke volume by heart rate, and then converting units to match the time period.

---

39. Function of contractile vacuole in Amoeba is

(A) Digestion and excretion

(B) Excretion and osmoregulation

(C) Digestion and respiration

(D) Osmoregulation and movements

Correct Answer: (B) Excretion and osmoregulation

Solution: Step 1: Understand the function of contractile vacuole. The contractile vacuole in Amoeba serves primarily for the excretion of excess water and osmoregulation (balance of water and salts).

Step 2: Clarify the role of digestion. The contractile vacuole does not directly participate in digestion or respiration. It plays a crucial role in removing excess water and maintaining osmotic balance within the cell.

Quick Tip

The contractile vacuole helps in excretion and osmoregulation, but digestion is carried out by other structures in the cell.

---

40. Match List-I and List-II with respect to proteins and their functions and select the correct option.

List-I	List-II
1. Collagen	p. Fights infectious agents
2. Trypsin	q. Hormone
3. Insulin	r. Enzyme
4. Antibody	s. Intercellular ground substance

(A) 1-s, 2-p, 3-r, 4-p

(B) 1-q, 2-r, 3-p, 4-s

(C) 1-s, 2-q, 3-r, 4-p

(D) 1-s, 2-r, 3-q, 4-p

Correct Answer: (D) 1-s, 2-r, 3-q, 4-p

Solution: Step 1: Understand the function of each protein

Collagen is a structural protein found in the intercellular ground substance of connective tissue (Answer: s).

Trypsin is an enzyme that aids in the digestion of proteins (Answer: r).

Insulin is a hormone that regulates blood sugar levels (Answer: q).

Antibody is a protein produced by the immune system that fights infectious agents (Answer: p).

Step 2: Match each protein to its function

Collagen (Intercellular ground substance) matches with s.

Trypsin (Enzyme) matches with r.

Insulin (Hormone) matches with q.

Antibody (Fights infectious agents) matches with p.

Thus, the correct answer is (D).

Quick Tip

Collagen is structural, trypsin is an enzyme, insulin is a hormone, and antibodies fight infections.

---

41. The complex formed by a pair of synapsed homologous chromosomes is called,

(A) Univalent

(B) Pentavalent

(C) Triad

(D) Bivalent

Correct Answer: (D) Bivalent

Solution: Step 1: What is a bivalent?

A bivalent is the structure formed during meiosis when two homologous chromosomes (each with two chromatids) synapse or pair up. This occurs during prophase I of meiosis.

Step 2: Eliminate other options

Univalent: Refers to a single chromosome (not paired with its homolog).

Pentavalent: Refers to the pairing of five chromosomes, not typical in most organisms.

Triad: A term used when three homologous chromosomes are involved in the process, which is rare.

Thus, the correct term for a pair of synapsed homologous chromosomes is bivalent.

Quick Tip

During meiosis, homologous chromosomes form bivalents, which are essential for genetic recombination.

---

42. Match column-I with column-II. Select the option with correct combination.

Column-I	Column-II
1. Hypertonic	p. Two molecules move in the same direction across the membrane.
2. Capillarity	q. External solution is more concentrated than cell sap.
3. Symport	r. Water loss in the form of droplets.
4. Guttation	s. Ability of water to rise in thin tubes.

(A) 1-q, 2-s, 3-p, 4-r

(B) 1-q, 2-s, 3-r, 4-p

(C) 1-q, 2-r, 3-p, 4-s

(D) 1-q, 2-p, 3-s, 4-r

Correct Answer: (A) 1-q, 2-s, 3-p, 4-r

Solution: Hypertonic (1-q): In a hypertonic solution, the external solution is more concentrated than the cell sap, resulting in water loss from the cell.

Capillarity (2-s): Capillarity refers to the ability of water to rise in thin tubes, due to cohesive and adhesive forces.

Symport (3-p): Symport refers to the movement of two molecules in the same direction across the membrane.

Guttation (4-r): Guttation is the process of water loss in the form of droplets, typically occurring in plants.

Thus, the correct matching is:

$1 \rightarrow$ q, $2 \rightarrow$ s, $3 \rightarrow$ p, $4 \rightarrow$ r.

Quick Tip

In plant physiology, guttation occurs due to root pressure, and capillarity refers to the rise of water in narrow tubes.

---

43. In Bryophyllum, the adventitious buds arise from

(A) Leaf base

(B) Leaf axil

(C) Notches in the leaf margin

(D) Shoot apex

Correct Answer: (C) Notches in the leaf margin

Solution: Step 1: Understand the type of reproduction in Bryophyllum

In Bryophyllum, adventitious buds arise from notches along the leaf margin. This is a form of vegetative reproduction known as leaf propagation.

Step 2: Eliminate other options

Leaf base: Adventitious buds may form here in some plants, but not in Bryophyllum.

Leaf axil: This is common in other plants but not for Bryophyllum's adventitious buds.

Shoot apex: This is typically where apical growth occurs, not adventitious buds.

Thus, the correct answer is (C).

Quick Tip

Bryophyllum is known for its ability to form adventitious buds from the leaf margins, making it a unique example of vegetative reproduction.

44. Primary endosperm nucleus is formed by fusion of

(A) Two polar nuclei and two male gametes

(B) Two polar nuclei and one male gamete

(C) Ovum and male gamete

(D) One polar nucleus and male gamete

Correct Answer: (B) Two polar nuclei and one male gamete

Solution: Step 1: Understand the formation of primary endosperm nucleus

In angiosperms, during double fertilization, the primary endosperm nucleus is formed by the fusion of two polar nuclei with one male gamete.

Step 2: Eliminate other options

Two polar nuclei and two male gametes: This is incorrect since only one male gamete is involved in forming the primary endosperm nucleus.

Ovum and male gamete: This forms the zygote, not the primary endosperm.

One polar nucleus and male gamete: This does not result in the formation of the primary endosperm nucleus.

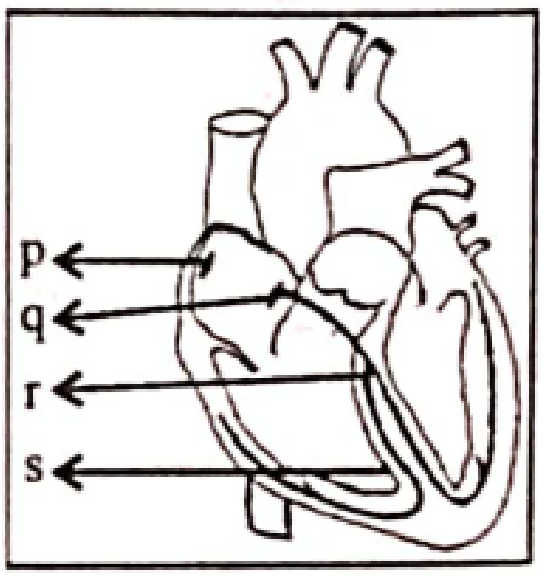
Thus, the correct answer is (B).

Quick Tip

Double fertilization in angiosperms leads to the formation of both a zygote and a primary endosperm nucleus, which later develops into the endosperm.

---

45. Identify the option showing the correct labeling for p, q, r, and s with reference to the conducting system of the human heart.



(A) p- Interventricular septum, q-AVN, r- Bundle of His, s-SAN

(B) p-SAN, q-AVN, r-Bundle of His, s-Interventricular septum

(C) p-AVN, q-SAN, r-Interventricular septum, s-Bundle of His

(D) p-Bundle of His, q-SAN, r-Interventricular septum, s-AVN

Correct Answer: (B) p-SAN, q-AVN, r-Bundle of His, s-Interventricular septum

Solution: Step 1: Identify the conducting system of the human heart

The conducting system of the human heart includes the following structures:

p-SAN (Sinoatrial node): The natural pacemaker of the heart, responsible for initiating the electrical impulses.

q-AVN (Atrioventricular node): Receives the impulse from SAN and passes it to the Bundle of His.

r-Bundle of His: Carries the impulse to the ventricles.

s-Interventricular septum: The septum separating the left and right ventricles; the Bundle of His runs along this structure.

Thus, the correct labeling is (B).

Quick Tip

The electrical impulse in the heart follows this pathway: SAN $\rightarrow$ AVN $\rightarrow$ Bundle of His $\rightarrow$ Interventricular septum $\rightarrow$ Ventricles.

46. Atrial Natriuretic Factor (ANF) acts as a

(A) Hypertension inducer

(B) Check on Renin-Angiotensin mechanism

(C) Promoter on Renin-Angiotensin mechanism

(D) Vasoconstrictor

Correct Answer: (B) Check on Renin-Angiotensin mechanism

Solution: Step 1: Understand ANF. Atrial Natriuretic Factor (ANF) is a hormone produced by the heart's atria. It plays a role in regulating blood pressure and fluid balance.

Step 2: Function of ANF. ANF primarily works to counteract the effects of the Renin-Angiotensin system. It reduces blood pressure by promoting vasodilation, inhibiting renin release, and increasing sodium and water excretion by the kidneys.

Thus, the correct answer is (B) as ANF works to check or inhibit the Renin-Angiotensin mechanism.

Quick Tip

ANF helps in reducing blood pressure by inhibiting the Renin-Angiotensin mechanism.

---

47. The vibrations from the ear drum are transmitted through ear ossicles to

(A) Auditory nerves

(B) Cochlea

(C) Oval window

(D) Tectorial membrane

Correct Answer: (C) Oval window

Solution: Step 1: Understand sound transmission. Sound waves cause the ear drum to vibrate. These vibrations are transferred to the ossicles (tiny bones in the middle ear) which amplify the sound.

Step 2: Pathway of sound. The ossicles transmit the vibrations to the oval window, a membrane that separates the middle ear from the cochlea. From here, the vibrations are sent to the cochlea for processing.

Thus, the correct answer is (C) Oval window.

Quick Tip

The vibrations are transferred from the ear drum to the oval window before reaching the cochlea for auditory processing.

---

48. Bamboo species flowers

(A) Twice in 50-100 years

(B) Every year

(C) Once in 12 years

(D) Once in lifetime

Correct Answer: (D) Once in lifetime

Solution: Step 1: Understand bamboo flowering. Bamboo species are known for their rare flowering cycles. Some species of bamboo flower only once in their lifetime, after a long period, which can range from 12 to 100 years depending on the species.

Step 2: Identify the flowering pattern. Many bamboo species flower once in their lifetime, making (D) the correct answer.

Thus, the correct answer is (D) Once in lifetime.

Quick Tip

Bamboo species often flower once in their lifetime, a rare and unique occurrence.

---

49. With reference to human sperm, match the List-I with List-II.

List-I	List-II
1. Head	p. Filled with enzyme
2. Acrosome	q. Contains mitochondria
3. Middle piece	r. Sperm motility
4. Tail	s. Contains haploid nucleus

(A) 1-r, 2-q, 3-s, 4-p

(B) 1-s, 2-p, 3-q, 4-r

(C) 1-s, 2-r, 3-p, 4-q

(D) 1-q, 2-s, 3-r, 4-p

Correct Answer: (B) 1-s, 2-p, 3-q, 4-r

Solution: Step 1: Understand the functions of parts of human sperm

Head contains the haploid nucleus (Answer: s).

Acrosome is filled with enzymes that help in fertilization (Answer: p).

Middle piece contains mitochondria, providing energy for sperm motility (Answer: q).

Tail is responsible for sperm motility (Answer: r).

Thus, the correct pairing is (B).

Quick Tip

The acrosome in sperm contains enzymes crucial for penetrating the egg during fertilization, while the tail aids in motility.

---

50. Which pair of the following cells in the embryo sac are destined to change their ploidy after fertilization?

(A) Egg cell and central cell

(B) Antipodals and synergids

(C) Synergids and egg cell

(D) Central cell and antipodals

Correct Answer: (A) Egg cell and central cell

Solution: Step 1: Understand the process of fertilization in plants

During fertilization, the egg cell fuses with one male gamete to form the zygote, which becomes the embryo. The central cell, which has two polar nuclei, fuses with another male gamete to form the primary endosperm nucleus, which develops into the endosperm (food reserve for the developing embryo).

Step 2: Eliminate other options

Antipodals and synergids: These cells do not directly participate in fertilization; they are involved in the process but do not change ploidy after fertilization.

Synergids and egg cell: Only the egg cell changes its ploidy, but synergids help in guiding the pollen tube.

Thus, the correct answer is (A).

Quick Tip

The egg cell and central cell are the two cells in the embryo sac that change ploidy after fertilization, forming the zygote and the primary endosperm nucleus, respectively.

---

51. In the female reproductive system, a tiny finger-like structure which lies at the upper junction of the two labia minora above the urethral opening is called

(A) Vagina

(B) Hymen

(C) Mons pubis

(D) Clitoris

Correct Answer: (D) Clitoris

Solution: Step 1: Identify the anatomy. The clitoris is a small, sensitive organ located above the urethral opening in the female reproductive system. It is part of the external genitalia and plays a role in sexual pleasure.

Step 2: Differentiate structures. The vagina is the internal canal, the hymen is a thin membrane around the vaginal opening, and the mons pubis is the fatty area above the pubic bone. The clitoris is the only structure that matches the description in the question.

Thus, the correct answer is (D) Clitoris.

Quick Tip

The clitoris is the sensitive organ in the female external genitalia, located above the urethral opening.

---

52. Consider the following statements with reference to the female reproductive system:

Statement 1: The presence or absence of the hymen is not a reliable indicator of virginity or sexual experience.

Statement 2: The sex of the foetus is determined by the father and not by the mother.

Choose the correct option from the following:

(A) Both Statement 1 and Statement 2 are wrong.

(B) Statement 1 is correct and Statement 2 is wrong.

(C) Both Statement 1 and Statement 2 are correct.

(D) Statement 1 is wrong and Statement 2 is correct.

Correct Answer: (C) Both Statement 1 and Statement 2 are correct.

Solution: Step 1: Understand the first statement. The hymen is a thin membrane that can vary greatly in size and elasticity. Its presence or absence is not a reliable indicator of virginity or sexual experience, as it can be affected by many factors like physical activity or medical procedures.

Step 2: Understand the second statement. The sex of the foetus is determined by the chromosomes carried by the sperm from the father, not the mother. The mother provides the X chromosome, while the father provides either an X or Y chromosome, which determines the sex (XX for female and XY for male).

Thus, both statements are correct, and the correct answer is (C).

Quick Tip

The hymen is not a definitive indicator of virginity, and the father's sperm determines the sex of the baby.

---

53. The male sex accessory ducts include,

(A) Rete testis, vasa efferentia, epididymis and vas deferens

(B) Rete testis, vasa efferentia, epididymis and seminal vesicle

(C) Rete testis, urethra, epididymis and vas deferens

(D) Rete testis, vasa efferentia, seminal vesicle and vas deferens

Correct Answer: (A) Rete testis, vasa efferentia, epididymis and vas deferens

Solution: Understand the male reproductive system. The male accessory sex ducts are responsible for the transport and maturation of sperm. They include the rete testis, which collects sperm from the testes, the vasa efferentia, which transport sperm from the rete testis to the epididymis, the epididymis where sperm mature, and the vas deferens that transport sperm to the urethra.

Thus, the correct answer is (A) as it includes all the essential ducts.

Quick Tip

The male accessory ducts are vital for the transport, maturation, and storage of sperm.

---

54. Which of the following statements is correct?

(A) Female carrier for haemophilia may transmit the disease to sons.

(B) Thalassemia is a qualitative problem.

(C) Change in whole set of chromosomes is called aneuploidy.

(D) Sickle cell anaemia is a quantitative problem.

Correct Answer: (A) Female carrier for haemophilia may transmit the disease to sons.

Solution: Step 1: Understand haemophilia inheritance

Haemophilia is an X-linked recessive disorder. Female carriers (X^hX) can pass on the disease-causing X chromosome to their sons, who will then express the disease.

Step 2: Eliminate other options

Thalassemia is a genetic disorder affecting the production of hemoglobin, but it is not a purely qualitative problem; it involves quantitative production.

Aneuploidy refers to an abnormal number of chromosomes, not a change in the whole set of chromosomes.

Sickle cell anaemia is a genetic disorder related to hemoglobin, and while it involves a qualitative genetic defect, it is not a quantitative problem.

Thus, the correct answer is (A).

Quick Tip

Haemophilia is X-linked and recessive, so female carriers can pass the condition to their sons.

---

55. 'Gene-mapping' technology was developed by

(A) Mendel

(B) Tschermak

(C) Correns

(D) Sturtevant

Correct Answer: (D) Sturtevant

Solution: Step 1: Gene mapping and Sturtevant

Gene mapping refers to determining the relative positions of genes on a chromosome. Sturtevant is credited with the development of the first genetic map, using the concept of recombination frequencies to map genes.

Step 2: Eliminate other options

Mendel, though the father of genetics, did not develop gene mapping but laid the foundation for understanding inheritance.

Tschermak and Correns were involved in the early studies of heredity, but Sturtevant was the key figure in gene mapping.

Thus, the correct answer is (D).

Quick Tip

Sturtevant used recombination frequencies to create the first genetic map, which is essential to modern gene mapping.

---

56. Find the correct statement.

(1) Generally, a gene regulates a trait, but sometimes one gene has an effect on multiple traits.

(2) The trait AB-blood group of man is regulated by one dominant allele and another recessive allele. Hence it is co-dominant.

(A) Both Statements are wrong.

(B) Statement (1) is correct.

(C) Statement (2) is correct.

(D) Both Statements (1) and (2) are correct.

Correct Answer: (B) Statement (1) is correct.

Solution: Step 1: Analyze Statement (1)

Statement (1) is true. A single gene can regulate a specific trait, but it can also affect multiple

traits due to pleiotropy (the phenomenon where one gene influences multiple traits).

Step 2: Analyze Statement (2)

Statement (2) is incorrect. The AB blood group is regulated by two co-dominant alleles (A and B), not one dominant and one recessive allele. Both alleles are expressed equally.

Thus, the correct answer is (B).

Quick Tip

In co-dominance, both alleles contribute equally to the phenotype, as seen in the AB blood group.

---

57. From the following table, select the option that correctly characterizes various phases of the menstrual cycle:

Menstruation phase	Follicular phase	Luteal phase
Regeneration of endometrium	High level of progesterone	Developing corpus luteum
Matured follicle	Regression of corpus luteum	Ovulation
Menses	Developing corpus luteum	Follicle maturation
Menses	L.H. Surge	Regeneration of endometrium

(A) Regeneration of endometrium, High level of progesterone, Developing corpus luteum

(B) Matured follicle, Regression of corpus luteum, Ovulation

(C) Menses, Developing corpus luteum, Follicle maturation

(D) Menses, L.H. Surge, Regeneration of endometrium

Correct Answer: (D) Menses, L.H. Surge, Regeneration of endometrium

Solution: The menstruation phase begins with the shedding of the endometrium (menses) and regeneration of the lining.

During the follicular phase, luteinizing hormone (L.H.) surges to stimulate ovulation.

The luteal phase involves the development of the corpus luteum and the regeneration of the endometrium if pregnancy does not occur.

Thus, the correct answer is (D).

Quick Tip

The L.H. surge is crucial for ovulation, and the luteal phase involves corpus luteum development.

58. Which of the following is abbreviated as ZIFT?

(A) Zygote Inter Fallopian Tube

(B) Zygote Intra Fallopian Transfer

(C) Zygote Inter Fallopian Transfer

(D) Zygote Intra Fallopian Tube

Correct Answer: (B) Zygote Intra Fallopian Transfer

Solution: ZIFT (Zygote Intra Fallopian Transfer) is an assisted reproductive technique where the fertilized zygote is directly transferred into the fallopian tube for further development.

Thus, the correct answer is (B).

Quick Tip

ZIFT involves transferring the fertilized zygote to the fallopian tube, unlike IVF which places the embryo in the uterus.

---

59. An example for hormone releasing IUD is

(A) Implant

(B) LNG-20

(C) Multiload 375

(D) Lippes loop

Correct Answer: (B) LNG-20

Solution: The LNG-20 is a type of hormone-releasing intrauterine device (IUD) that releases levonorgestrel, a hormone that helps prevent pregnancy.

Thus, the correct answer is (B).

Quick Tip

The LNG-20 IUD releases a hormone to prevent fertilization and is effective for long-term contraception.

---

60. MTPs are considered relatively safe during

(A) First trimester

(B) Second trimester

(C) 24 weeks of pregnancy

(D) 180 days of pregnancy

Correct Answer: (A) First trimester

Solution: Medical Termination of Pregnancy (MTP) is generally considered safe during the first trimester (up to 12 weeks). The risk increases in the second trimester and becomes more complicated after 24 weeks.

Thus, the correct answer is (A).

Quick Tip

MTP is safest in the first trimester, when the procedure is less risky and more effective.
