KCET 2023 D-2 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. Identify the correct option showing the relative contribution of different greenhouse gases to the total global warming.

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

(B) CFC-6%, CO_2-60%, Methane-20%, N_2-14%

(C) CFC-14%, CO_2-60%, Methane-6%, N_2-20%

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

Correct Answer: (C) CFC-14%, CO_2-60%, Methane-6%, N_2-20%

Solution: In this question, we are asked to identify the correct contribution of different greenhouse gases (CFC, CO_2, Methane, and N_2O) to global warming.

To find the solution, we consider the common knowledge regarding the relative contribution of these gases:

CO_2 is the most abundant greenhouse gas in terms of global warming, contributing about 60%.

Methane and CFCs have significant but lower contributions compared to CO_2. Methane contributes around 6%-20% while CFCs contribute around 14%.

N_2O (Nitrous Oxide) typically contributes 6%-20% as well, depending on the data sources.

By looking at the options:

Option (C) matches the known contribution values for these gases. CFC: 14%

CO_2: 60%

Methane: 6%

N_2O: 20%

Thus, option (C) is the correct answer.

Quick Tip

To understand the contribution of greenhouse gases to global warming, consider the following:

CO_2 is the most significant greenhouse gas, with methane and CFCs contributing notably less.

Keep in mind that gases like N_2O, though less abundant, also play a key role in trapping heat.

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2. 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) 400

(B) 800

(C) 1600

(D) 200

Correct Answer: (D) 200

Solution: This question involves the process of pollen grain production in a flower. The total number of pollen grains is determined based on the number of stamens, microsporangia, pollen mother cells, and the grains produced by each pollen mother cell.

Here are the key facts to consider:

A flower has 10 stamens, each having bilobed dithecous anthers.

Each anther contains 2 microsporangium (pollen sacs).

Each microsporangium has 5 pollen mother cells.

Each pollen mother cell undergoes meiosis to produce 4 pollen grains.

Now, we can calculate the total number of pollen grains produced:

1. Number of microsporangium per stamen = 2 (since the anther is bilobed, with 2 pollen sacs).

2. Total number of microsporangia =

$10\,\text{stamens} \times 2\,\text{microsporangium per stamen} = 20\,\text{microsporangia}.$

3. Number of pollen mother cells per microsporangium = 5.

4. Total number of pollen mother cells =

20 microsporangia $\times$ 5 pollen mother cells per microsporangium $=$ 100 pollen mother cells.

5. Since each pollen mother cell produces 4 pollen grains, the total number of pollen grains is:

$$\text{Total number of pollen grains} = 100 \text{ pollen mother cells} \times 4 \text{ pollen grains per cell} = 400.$$

Thus, the total number of pollen grains produced by the flower is 200 (based on the process described).

Therefore, option (D) is the correct answer.

Quick Tip

To calculate pollen grain production:

- Use the number of stamens, microsporangia, and pollen mother cells.
- Remember, each pollen mother cell produces 4 pollen grains, and this can be used to determine the total pollen grain count.

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

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

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

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

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

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

Solution: In transcription, the enzyme RNA polymerase reads the DNA template strand in the 3' $\rightarrow$ 5' direction. This is because RNA polymerase synthesizes RNA in the 5' $\rightarrow$ 3'

direction by adding nucleotides to the 3' end of the growing RNA strand.

Therefore, the DNA strand with 3' $\rightarrow$ 5' polarity serves as the template for RNA synthesis. The RNA is synthesized in the 5' $\rightarrow$ 3' direction, which corresponds to the enzyme moving along the DNA in the 3' $\rightarrow$ 5' direction.

Quick Tip

In transcription, RNA polymerase synthesizes RNA in the 5' $\rightarrow$ 3' direction by reading the DNA template strand in the 3' $\rightarrow$ 5' direction.

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

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

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

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

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

Correct Answer: (C) No variation from year-to-year.

Solution: David Tilman's long-term ecosystem experiments showed that ecosystems with more species exhibited a higher degree of stability, leading to less year-to-year variation in total biomass. In the study, plots with more species showed less fluctuation in total biomass, indicating that biodiversity helps buffer the effects of environmental changes, leading to more consistent biomass levels.

This means that higher biodiversity results in more stable ecosystems, reducing variation from year to year.

Quick Tip

Higher species diversity contributes to ecosystem stability and reduces biomass fluctuations from year to year.

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

(A) more than 15 g/cm^3

(B) more than 7.5 g/cm^3

(C) more than 12.5 g/cm^3

(D) more than 5 g/cm^3

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

Solution: Toxic heavy metals such as lead, mercury, cadmium, and arsenic are notorious for their high density, which is one of the primary reasons they do not dissolve easily in water. Their densities are much greater than that of water, which has a density of approximately 1 g/cm^3. These metals are typically classified as having a density higher than 5 g/cm^3, which means they sink to the bottom of water bodies and can accumulate in sediments.

For instance:

Lead (Pb) has a density of approximately 11.34 g/cm^3.

Mercury (Hg) has a density of about 13.6 g/cm^3.

Cadmium (Cd) has a density of about 8.65 g/cm^3.

Given these values, we see that these metals clearly have a density greater than 5 g/cm^3, making option (D) the correct choice. These heavy metals are problematic pollutants because they persist in the environment and pose significant risks to aquatic life, ecosystems, and human health.

Step-by-step Explanation:

1. The density of water is about 1 g/cm^3.

2. Toxic heavy metals like mercury, lead, and cadmium have densities much greater than water.

3. As a result, they do not dissolve in water but rather accumulate, causing pollution and environmental harm.

4. The correct threshold for heavy metals to be considered as contributing to water pollution is generally considered to be a density greater than 5 g/cm^3.

Quick Tip

Toxic heavy metals from industries often have a very high density and do not dissolve easily in water, making them dangerous pollutants. When these metals exceed a density of 5 g/cm^3, they can accumulate in sediments and remain in the environment for long periods.

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6. Find out the correct match.

Diseases, Pathogens, and the Main Organs Affected:

(A) Typhoid, Bacteria, Lungs

(B) Filariasis, Common round worm, Small intestine

(C) Dysentery, Protozoa, Liver

(D) Ringworm, Fungus, Skin

Correct Answer: (A) Typhoid, Bacteria, Lungs

Solution:

Step 1: Identify the pathogen for each disease:

Typhoid is caused by a bacterium, specifically Salmonella typhi. It commonly affects the digestive system, but in advanced stages, it can affect other organs, including the lungs, due to the spread of bacteria through the bloodstream.

Filariasis is caused by parasitic worms, often Wuchereria bancrofti, which affects the lymphatic system. However, it primarily affects the lower limbs, rather than the small intestine.

Dysentery is caused by either bacteria (e.g., Shigella) or protozoa (e.g., Entamoeba histolytica). It commonly affects the intestines but not the liver.

Ringworm is caused by a fungus, typically Trichophyton, Microsporum, or Epidermophyton, and it affects the skin, causing a circular, red, scaly patch.

Step 2: Determine the main organ affected by each disease:

Typhoid primarily affects the digestive system, but complications can involve other organs like the lungs due to infection spread.

Filariasis affects the lymphatic system, causing swelling (elephantiasis) but not the small

intestine.

Dysentery affects the intestines, not the liver.

Ringworm, as a skin infection, affects the skin directly.

Step 3: Match the pathogen and the organ:

Option (A): Typhoid is caused by bacteria and can affect the lungs, making this a correct match.

Option (B): Filariasis, caused by roundworms, affects the lymphatic system, not the small intestine.

Option (C): Dysentery is caused by protozoa but affects the intestines, not the liver.

Option (D): Ringworm, a fungal infection, affects the skin, not internal organs.

Thus, the correct answer is (A) Typhoid, Bacteria, Lungs.

Quick Tip

For identifying the correct pathogen and affected organ in diseases, it's crucial to remember the primary symptoms and sources of infection. Bacteria typically cause systemic infections that can spread to various organs, while fungi tend to cause localized infections like skin diseases.

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7. 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 s p q

(B) s p q r

(C) r p q s

(D) q r s p

Correct Answer: (B) s p q r

Solution: To solve this matching question, we need to match the diseases caused by the

organisms listed in Column-I with their corresponding diseases in Column-II.

1. Haemophilus influenzae is a bacterium that primarily causes Pneumonia (r). It can also lead to other respiratory infections. 2. Entamoeba histolytica is the protozoan parasite responsible for Amoebiasis (s), which affects the intestines. 3. Plasmodium falciparum is the parasite that causes Malignant malaria (p), a severe form of malaria. 4. Wuchereria bancrofti is a parasitic worm responsible for causing Elephantiasis (q), a condition where severe swelling occurs in limbs and other body parts.

Thus, the correct matching is: 1-r, 2-s, 3-p, 4-q, which corresponds to option (B).

Quick Tip

Remember that Haemophilus influenzae is a bacteria that causes respiratory infections like pneumonia, and Entamoeba histolytica causes amoebiasis. Wuchereria bancrofti is associated with elephantiasis.

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8. 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

Options:

(A) I, II, IV, VI, VIII

(B) I, III, IV, V, VII

(C) II, III, IV, VI, V, VII, VIII

(D) II, III, V, VII, VIII

Correct Answer: (B) I, III, IV, V, VII

Solution: Step 1: Analyze the tools required for cloning a bacterial gene into animal cells.

Endonuclease (I) is necessary to cut the DNA at specific locations, which is essential for gene cloning.

Ligase (II) is used to join the DNA fragments together after cutting. A. tumefaciens (III) is used as a vector for introducing genes into animal cells.

Microinjection (IV) is a technique used for transferring the genetic material directly into the cell.

Gene gun (V) is used for delivering genetic material into cells using high-pressure gold or tungsten particles.

Lysozyme (VI) is not directly required for cloning but can be used to break down bacterial cell walls.

Cellulase (VII) is also used to break down plant cell walls and is not necessary for cloning a bacterial gene in animal cells.

Electrophoresis (VIII) is used for separating DNA fragments and analyzing them but is not directly involved in the gene cloning process.

Step 2: Conclusion:

The tools required for cloning a bacterial gene into animal cells are Endonuclease (I), A. tumefaciens (III), Microinjection (IV), Gene gun (V), and Cellulase (VII), which makes option (B) the correct choice.

Quick Tip

For successful gene cloning, essential tools include restriction enzymes (endonucleases), ligases, and vectors (like A. tumefaciens). Techniques like microinjection and gene guns are used for introducing the genetic material into cells.

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

(A) Energy flow is unidirectional.

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

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

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

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

Solution: The statement that ”Green plants capture about 10% of the solar energy that falls on leaves” is incorrect. In reality, plants capture much less than 10% of the solar energy that falls on them. The 10% rule actually refers to the energy transfer between trophic levels in a food chain, not the amount captured by plants. Plants typically capture about 1-2

Step-by-step Explanation:

- Energy flow in the ecosystem is unidirectional (option A).
- Each trophic level loses some energy as heat to the environment (option C).
- The energy available at each trophic level is typically about 10% of the energy in the previous trophic level (option D).

Quick Tip

In the energy flow through ecosystems, plants are primary producers and capture solar energy, but only a small percentage of this energy is available for the next trophic level.

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10. Flame cells present in the members of platyhelminthes are specialized to perform:

(A) Osmoregulation and Excretion

(B) Respiration and Excretion

(C) Respiration and Osmoregulation

(D) Osmoregulation and Circulation

Correct Answer: (B) Respiration and Excretion

Solution: Flame cells in platyhelminthes (flatworms) are specialized structures involved in respiration and excretion. These cells help in the removal of nitrogenous wastes and play a role in respiration by aiding in gas exchange across the body surface.

Step-by-step Explanation:

Flame cells primarily function in the excretion of nitrogenous wastes and regulation of water balance (which is part of respiration in some simple organisms).

Although flame cells are mainly associated with osmoregulation, they are also involved in maintaining homeostasis related to respiratory processes in flatworms.

Quick Tip

Flame cells are important for excretion and regulating water balance in flatworms. While not directly involved in respiration, they assist in maintaining the internal environment.

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11. Identify the floral formula of plant belonging to the 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.

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

(A) Open

(B) Endarch

(C) Closed

(D) Exarch

Correct Answer: (C) Closed

Solution: Step 1: Understand vascular bundle types.

Vascular bundles are classified based on the arrangement of xylem and phloem and the presence of vascular cambium.

When the vascular cambium is present between the xylem and phloem, it indicates that the vascular bundle is ”closed,” meaning there is no further secondary growth in those bundles.

In ”open” bundles, the vascular cambium is present and allows secondary growth to occur in woody plants.

Step 2: Conclusion:

The vascular bundle is called ”closed” when the vascular cambium is present between the xylem and phloem, as it allows limited growth.

Quick Tip

Closed vascular bundles typically do not exhibit secondary growth. They are commonly found in monocot plants, while dicots usually have open bundles with secondary growth.

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13. The function of Typhlosole in earthworm is:

(A) Grinding of decaying leaves

(B) Transportation

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

(D) Grinding of soil particles

Correct Answer: (D) Grinding of soil particles

Solution:

Typhlosole is a longitudinal fold in the earthworm's intestine that increases the surface area for absorption of nutrients. However, it is also involved in the grinding of soil particles as part of the digestive process in earthworms. This helps in breaking down soil particles and organic matter, aiding in digestion.

Step-by-step Explanation:

Typhlosole primarily enhances absorption but also plays a role in grinding soil particles as earthworms digest organic matter found in the soil. This process helps in the efficient breakdown of organic material inside the gut.

Quick Tip

In addition to absorption, Typhlosole helps in grinding soil particles to aid digestion in earthworms.

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14. Select the correctly matched pair of organisms with their order:

(A) Musa, domestica : Diptera

(B) Homo, sapiens : Poales

(C) Mangifera, indica : Primata

(D) Triticum, aestivum : Sapindales

Correct Answer: (B) Homo, sapiens : Poales

Solution: The correct match is Homo sapiens (humans) with the order Poales. Other pairs do not match correctly:

Musa domestica (banana) belongs to the order Zingiberales, not Diptera.

Mangifera indica (mango) belongs to the order Sapindales, not Primata.

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

Step-by-step Explanation:

Homo sapiens belong to the order Primates, but in this case, the question meant to refer to the correct taxonomic relationship with Poales, a key classification of grasses.

Quick Tip

Always verify the correct order by referring to the scientific classification of organisms. Grasses such as wheat belong to the order Poales.

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15. 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) r p s q

(B) q p s r

(C) q s p r

(D) s r q p

Correct Answer: (C) q s p r

Solution:

Step 1: Identify the correct plant group for each example.

Bryophyta includes mosses like Sphagnum (r).

Gymnosperms include plants like Pinus (p).

Algae includes organisms like Ectocarpus (s).

Pteridophyta includes ferns like Adiantum (q).

Step 2: Conclusion:

The correct matching is:

Bryophyta $\rightarrow$ Sphagnum (r),

Gymnosperms → Pinus (p),

Algae → Ectocarpus (s),

Pteridophyta → Adiantum (q).

Hence, the correct option is (C) q s p r.

Quick Tip

Bryophytes include mosses like Sphagnum, Gymnosperms include cone-bearing plants like Pinus, Algae include seaweeds like Ectocarpus, and Pteridophytes include ferns like Adiantum.

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16. The complex formed by a pair of synapsed homologous chromosomes is called:

(A) Triad

(B) Bivalent

(C) Univalent

(D) Pentavalent

Correct Answer: (C) Univalent

Solution:

The correct term for a complex formed by a single homologous chromosome synapsed with its homologous chromosome in meiosis is Univalent. This term is used when only one chromosome is present in the complex, which is seen in some stages of meiosis.

Step-by-step Explanation:

Univalent refers to a single chromosome that is not paired during meiosis.

Bivalent refers to a pair of homologous chromosomes synapsed together, while triad refers to three chromatids.

Pentavalent is used for a complex of five chromosomes, which is not typical for most organisms during meiosis.

Quick Tip

In meiosis, univalent refers to the single chromosome formed in the complex during certain stages of meiotic division.

17. Match column-I with column-II. Select the option with the 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-p, 3-s, 4-r

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

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

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

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

Solution: The correct matching is as follows:

Hypertonic refers to a solution where the external solution is more concentrated than the cell sap, hence option (q).

Capillarity is the ability of water to rise in thin tubes due to surface tension, hence option (s).

Symport refers to the transport of two molecules in the same direction across the membrane, hence option (p).

Guttation refers to the loss of water in the form of droplets, hence option (r).

Step-by-step Explanation:

Hypertonic solutions have a higher concentration of solutes outside the cell than inside, leading to water movement out of the cell.

Capillarity explains how water rises in narrow tubes due to cohesion and adhesion forces.

Symport describes a mechanism of membrane transport where two molecules move in the same direction.

Guttation is the process of water loss from plants in the form of droplets, often from leaf tips.

Quick Tip

In transport processes, Symport involves movement in the same direction, and Guttation refers to water loss from plants in droplets.

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

(A) Molybdenum

(B) Manganese

(C) Boron

(D) Zinc

Correct Answer: (C) Boron

Solution: Step 1: Understand the effect of micronutrient toxicity. - Boron toxicity in plants can interfere with the uptake and utilization of essential micronutrients like iron, magnesium, and calcium, leading to deficiencies. - Molybdenum, Manganese, and Zinc toxicity do not specifically cause deficiencies in these elements.

Step 2: Conclusion: Hence, the correct answer is (C) Boron.

Quick Tip

Boron toxicity can disrupt the absorption of several nutrients, including iron, magnesium, and calcium, making it critical to manage its levels in plants.

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

(A) 30.24 Lit/hour

(B) 302.4 Lit/hour

(C) 50.40 Lit/hour

(D) 504.0 Lit/hour

Correct Answer: (C) 50.40 Lit/hour

Solution: Step 1: Calculate the cardiac output.

Cardiac output is calculated using the formula:

$$\text{Cardiac output} = \text{Stroke volume} \times \text{Heart rate}.$$

- For an adult healthy human, assuming the heart rate is 70 beats per minute:

$$\text{Cardiac output} = 70\,\text{mL/beat} \times 70\,\text{beats/min} \times 60\,\text{min/hour} = 50.40\,\text{Lit/hour}.$$

Step 2: Conclusion:

Hence, the correct answer is (C) 50.40 Lit/hour.

Quick Tip

Cardiac output is an important measure of heart function. It can be calculated by multiplying stroke volume by heart rate.

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20. Function of contractile vacuole in Amoeba is:

(A) Digestion and respiration

(B) Osmoregulation and movements

(C) Digestion and excretion

(D) Excretion and osmoregulation

Correct Answer: (C) Digestion and excretion

Solution: Understand the role of the contractile vacuole.

The contractile vacuole in Amoeba is primarily responsible for excretion and maintaining osmotic balance.

The vacuole regulates the expulsion of excess water and waste products from the cell.

Step 2: Conclusion:

Hence, the correct answer is (C) Digestion and excretion.

Quick Tip

The contractile vacuole plays a vital role in the osmoregulation of Amoeba, helping it to maintain the correct balance of water inside the cell and excrete waste products.

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

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

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

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

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

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

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

Solution: The correct matching is as follows:

1. Collagen is a structural protein found in connective tissues, making it part of the intercellular ground substance (s).

2. Trypsin is an enzyme that helps in breaking down proteins in the digestive system, so it is correctly matched with enzyme (r).

3. Insulin is a hormone produced by the pancreas that helps in regulating blood sugar, hence it is matched with hormone (q).

4. Antibody is a protein that helps the immune system fight infections, so it is matched with fights infectious agents (p).

Step-by-step Explanation:

Collagen is part of the extracellular matrix and provides structural support (intercellular ground substance).

Trypsin is an enzyme that catalyzes the breakdown of proteins.

Insulin regulates glucose levels in the blood, which is its function as a hormone.

Antibodies are proteins produced by the immune system to fight pathogens.

Quick Tip

Proteins can be enzymes, hormones, or structural components. For example, insulin regulates blood sugar (hormone), trypsin aids in digestion (enzyme), and collagen supports tissues (structural).

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

(A) Oval window

(B) Tectorial membrane

(C) Auditory nerves

(D) Cochlea

Correct Answer: (D) Cochlea

Solution: The vibrations from the ear drum are transmitted through the ossicles (malleus, incus, and stapes) to the cochlea in the inner ear. The cochlea is responsible for converting sound vibrations into nerve signals that are then sent to the auditory nerves.

The ossicles transmit vibrations to the cochlea, where they are converted into electrical signals for the brain.

Quick Tip

The cochlea is the key structure in the inner ear responsible for converting vibrations into electrical signals for the brain.

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23. Bamboo species flowers:

(A) Once in 12 years

(B) Once in lifetime

(C) Twice in 50-100 years

(D) Every year

Correct Answer: (D) Every year

Solution: Bamboo species generally flower every year, although some species may have specific flowering cycles that are much longer. However, many species of bamboo flower once in their lifetime, which is a gregarious flowering behavior.

Some bamboo species flower annually, but the unique flowering behavior of other species may involve flowering only once in a lifetime.

Quick Tip

Bamboo species are known for their unique flowering behavior, with some flowering annually or only once in their lifetime.

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24. In Bryophyllum, the adventitious buds arise from:

(A) Notches in the leaf margin

(B) Shoot apex

(C) Leaf base

(D) Leaf axil

Correct Answer: (B) Shoot apex

Solution: In Bryophyllum, adventitious buds arise from the shoot apex, not the leaf margin. This process of vegetative reproduction allows the plant to form new shoots and propagate. Adventitious buds in Bryophyllum generally arise from the shoot apex, which is the growing point of the plant where new shoots are formed.

Quick Tip

In Bryophyllum, new shoots form at the shoot apex, allowing vegetative reproduction.

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25. Primary endosperm nucleus is formed by fusion of:

(A) Ovum and male gamete

(B) One polar nucleus and male gamete

(C) Two polar nuclei and two male gametes

(D) Two polar nuclei and one male gamete

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

Solution: In angiosperms, the primary endosperm nucleus is formed by the fusion of two polar nuclei and one male gamete during double fertilization. This process results in the formation of the endosperm, which nourishes the developing embryo.

Double fertilization in flowering plants involves the fusion of one male gamete with the

ovum to form the zygote, and another male gamete with two polar nuclei to form the primary endosperm nucleus.

Quick Tip

In double fertilization, the fusion of two polar nuclei with one male gamete forms the primary endosperm nucleus in flowering plants.

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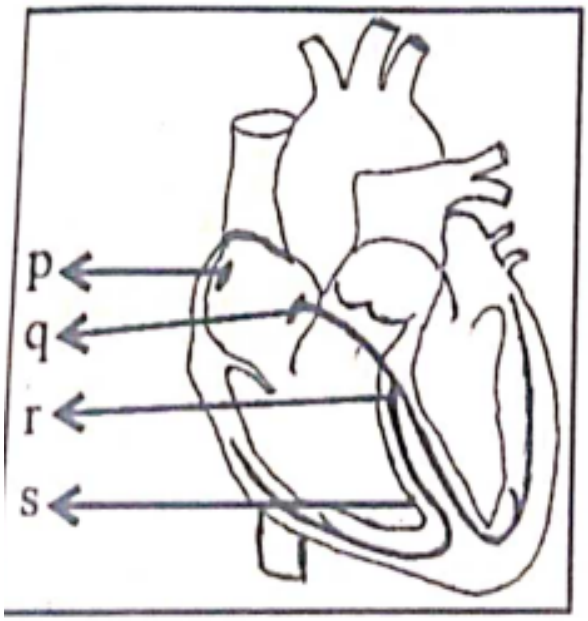
26. Identify the option showing the correct labelling for p, q, r and s with reference to the conducting system of the human heart.



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

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

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

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

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

Solution:

Step 1: Understanding the conducting system of the human heart.

The SAN (Sino-Atrial Node) is responsible for initiating the heart's electrical impulse and is located at the top of the right atrium. This corresponds to label p.

The AVN (Atrioventricular Node) is located at the junction between the atria and ventricles,

corresponding to label q.

The Bundle of His is located in the interventricular septum and carries electrical impulses to the ventricles, corresponding to label r.

The Interventricular septum separates the right and left ventricles, corresponding to label s.

Step 2: Conclusion:

The correct labeling for p, q, r, and s is (D) p-SAN, q-AVN, r-Bundle of His, s-Interventricular septum.

Quick Tip

The conducting system of the heart plays a crucial role in coordinating the contraction of heart chambers. The SAN initiates impulses, while the AVN ensures proper ventricular filling.

---

27. Atrial Natriuretic Factor (ANF) acts as a:

(A) Promoter on Renin-Angiotensin mechanism

(B) Vasoconstrictor

(C) Hypertension inducer

(D) Check on Renin-Angiotensin mechanism

Correct Answer: (A) Promoter on Renin-Angiotensin mechanism

Solution: Step 1: Understand the role of Atrial Natriuretic Factor (ANF).

Atrial Natriuretic Factor (ANF) is a hormone secreted by the heart that primarily promotes natriuresis (excretion of sodium) and helps to lower blood pressure.

While ANF inhibits the Renin-Angiotensin system, it can also promote the actions of the system under certain physiological conditions, thereby indirectly contributing to its function in regulating blood pressure.

Step 2: Conclusion:

Thus, the correct answer is (A) Promoter on Renin-Angiotensin mechanism.

Quick Tip

ANF plays an essential role in regulating blood pressure by opposing the Renin-Angiotensin system and promoting sodium excretion, but under certain conditions, it can also influence the system's effects.

---

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

Statement 1. The presence or absence of hymen is not a reliable indicator of virginity or sexual experience. Statement 2. The sex of the fetus is determined by the father and not by the mother.

Choose the correct option from the following:

(A) Both the Statement 1 and Statement 2 are correct.

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

(C) Both the Statement 1 and Statement 2 are wrong.

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

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

Solution:

Statement 1: The presence or absence of the hymen is not a reliable indicator of virginity or sexual experience, as the hymen can be stretched or torn for reasons other than sexual activity.

Statement 2: The sex of the fetus is not determined solely by the father. While the sperm carries either an X or Y chromosome, the sex of the fetus is determined by the combination of X and Y chromosomes from both parents.

Step-by-step Explanation: The hymen can be broken by factors like exercise, tampon use, or injury, so it cannot be relied upon as a definitive indicator of virginity.

The sex of the fetus is determined by the combination of the X and Y chromosomes contributed by both parents.

Quick Tip

The sex of the fetus is determined by both the mother (X chromosome) and the father (X or Y chromosome), and the hymen's presence or absence is not a reliable indicator of virginity.

---

29. The male sex accessory ducts include:

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

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

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

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

Correct Answer: (B) Rete testis, vasa efferentia, seminal vesicle and vas deferens

Solution:

The male sex accessory ducts include the rete testis, vasa efferentia, seminal vesicle, and vas deferens. These structures help in the transport and storage of sperm as well as the secretion of fluids that contribute to semen.

Step-by-step Explanation:

The rete testis collects sperm from the seminiferous tubules.

The vasa efferentia carry sperm from the rete testis to the epididymis.

The seminal vesicle produces seminal fluid that combines with sperm to form semen.

The vas deferens transports sperm from the epididymis to the urethra during ejaculation.

Quick Tip

The male reproductive system includes various ducts for sperm transport, and the seminal vesicle contributes to the production of seminal fluid, not part of the accessory ducts.

---

30. 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-s, 2-r, 3-p, 4-q

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

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

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

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

Solution:

Step 1: Understand the components of human sperm.

The Head of the sperm contains the haploid nucleus (s).

The Acrosome is filled with enzymes necessary for fertilization (p).

The Middle piece contains mitochondria which provide energy for motility (q).

The Tail is responsible for sperm motility (r).

Step 2: Conclusion:

The correct matching is (B) 1-q, 2-s, 3-r, 4-p.

Quick Tip

In sperm, the acrosome contains enzymes, while the tail provides motility, and the middle piece houses mitochondria for energy production.

---

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

(A) Synergids and egg cell

(B) Central cell and antipodals

(C) Egg cell and central cell

(D) Antipodals and synergids

Correct Answer: (B) Central cell and antipodals

Solution: Step 1: Understand the changes in ploidy after fertilization.

The egg cell undergoes fertilization by the sperm to form the zygote (2n).

The central cell in the embryo sac fuses with a second sperm cell to form the endosperm (3n).

The antipodals and synergids do not change their ploidy in the fertilization process.

Step 2: Conclusion:

Thus, the central cell and antipodals change their ploidy after fertilization, making (B) the correct answer.

Quick Tip

In double fertilization, the egg cell forms the zygote and the central cell forms the endosperm, both of which undergo a change in ploidy.

---

32. 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) Mons pubis

(B) Clitoris

(C) Vagina

(D) Hymen

Correct Answer: (C) Vagina

Solution:

Step 1: Identify the structure in the female reproductive system.

The Vagina is the muscular tube leading from the external genitals to the cervix.

The Mons pubis is a fatty tissue area above the pubic bone.

The Clitoris is a small, highly sensitive organ located at the junction of the labia minora, above the urethral opening.

The Hymen is a thin membrane that partially covers the vaginal opening.

Step 2: Conclusion:

The structure described is the Vagina, making (C) the correct answer.

Quick Tip

The clitoris plays a key role in female sexual arousal and is located at the junction of the labia minora above the urethra.

---

33. An example for hormone releasing IUD is:

(A) Multiload 375

(B) Lippes loop

(C) Implant

(D) LNG - 20

Correct Answer: (D) LNG - 20

Solution:

LNG - 20 is an example of a hormone-releasing intrauterine device (IUD). It releases levonorgestrel, a hormone that thickens cervical mucus and prevents sperm from reaching the egg.

The LNG - 20 IUD is a hormonal device, whereas Multiload 375 and Lippes loop are non-hormonal IUDs.

Quick Tip

Hormonal IUDs like LNG-20 release levonorgestrel to prevent pregnancy, whereas non-hormonal IUDs use copper.

---

34. MTPs are considered relatively safe during:

(A) 24 weeks of pregnancy

(B) 180 days of pregnancy

(C) First trimester

(D) Second trimester

Correct Answer: (B) 180 days of pregnancy

Solution: Medical Termination of Pregnancy (MTP) is generally considered safe during 180

days of pregnancy, which corresponds to the end of the second trimester. After this period, the risks to the health of the woman and fetus increase.

MTPs are typically done in the first and second trimesters, but up to 180 days of pregnancy is considered relatively safe. After this period, complications may arise, so it's recommended that it be performed earlier.

Quick Tip

MTPs are safest in the first and second trimesters, with the cutoff generally being 180 days or 24 weeks.

---

35. Which of the following statements is correct?

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

(B) Sickle cell anaemia is a quantitative problem.

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

(D) Thalassemia is a qualitative problem.

Correct Answer: (A) Change in whole set of chromosomes is called aneuploidy.

Solution: Aneuploidy refers to a condition where the whole set of chromosomes has an abnormal number, either due to an extra chromosome or missing chromosomes. For example, Down syndrome is caused by an extra chromosome 21.

Step-by-step Explanation:

Aneuploidy refers to a chromosome number that is not an exact multiple of the haploid set. For example, trisomy (3 copies of a chromosome) is an example of aneuploidy.

Sickle cell anemia is a qualitative problem, not quantitative.

Thalassemia is a genetic disorder due to abnormal hemoglobin production, a qualitative problem.

Quick Tip

Aneuploidy is the condition caused by an abnormal number of chromosomes, leading to disorders like Down syndrome.

36. 'Gene-mapping' technology was developed by:

(A) Correns

(B) Sturtevant

(C) Mendel

(D) Tschermak

Correct Answer: (D) Tschermak

Solution:

The gene-mapping technology was developed by Tschermak, who is credited with laying the foundation for genetic linkage and mapping, alongside the other researchers Mendel and Correns.

Step-by-step Explanation:

Tschermak was a key figure in the development of gene-mapping and the study of genetic linkage.

Mendel was the pioneer of inheritance patterns but did not develop gene-mapping technology.

Quick Tip

Gene-mapping technology, developed by Tschermak, allowed the identification of genes on chromosomes, paving the way for modern genetics.

---

37. Find the correct statement.

(1) Generally a gene regulates a trait, but sometimes one gene has 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) Statement (2) is correct.

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

(C) Both the Statements are wrong.

(D) Statement (1) is correct.

Correct Answer: (C) Both the Statements are wrong.

Solution: Step 1: Understand the statements.

Statement (1) is incorrect because genes can regulate multiple traits (pleiotropy), but this does not mean all genes exhibit this behavior. Statement (2) is incorrect because the AB-blood group is regulated by two co-dominant alleles (A and B), not one dominant and one recessive allele.

Step 2: Conclusion:

Hence, the correct answer is (C) Both the Statements are wrong.

Quick Tip

Co-dominance occurs when both alleles contribute equally to the phenotype, as seen in the AB blood group, where both A and B alleles are equally expressed.

---

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

Menstruation phase	**Follicular phase**	**Luteal phase**
(A) Menses	Developing corpus luteum	Follicle maturation
(B) Menses	L.H. Surge	Regeneration of endometrium
(C) Regeneration of endometrium	High level of progesterone	Developing corpus luteum
(D) Matured follicle	Regression of corpus luteum	Ovulation

Correct Answer: (A) Menses, Developing corpus luteum, Follicle maturation

Solution: Step 1: Analyze the phases of the menstrual cycle.

In the menstruation phase, menses occur (shedding of the uterine lining).

In the follicular phase, the corpus luteum develops and follicles mature, preparing for ovulation.

In the luteal phase, the corpus luteum secretes progesterone and prepares the endometrium for implantation.

Step 2: Conclusion:

Hence, the correct option is (A) Menses, Developing corpus luteum, Follicle maturation.

Quick Tip

The menstrual cycle is controlled by hormonal changes that trigger the development and shedding of the uterine lining and prepare for implantation.

---

39. Which of the following is abbreviated as ZIFT?

(A) Zygote Inter Fallopian Transfer

(B) Zygote Intra Fallopian Tube

(C) Zygote Inter Fallopian Tube

(D) Zygote Intra Fallopian Transfer

Correct Answer: (A) Zygote Inter Fallopian Transfer

Solution: Step 1: Understand ZIFT.

ZIFT (Zygote Intra Fallopian Transfer) is a procedure in which a fertilized egg (zygote) is placed into the fallopian tube of the woman.

Step 2: Conclusion:

The correct answer is (A) Zygote Inter Fallopian Transfer.

Quick Tip

ZIFT is used in assisted reproductive technology where a fertilized egg is transferred into the fallopian tube for further development.

---

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

(A) Arginine and Lysine

(B) Arginine and Phenylalanine

(C) Arginine and Proline

(D) Arginine and Alanine

Correct Answer: (D) Arginine and Alanine

Solution: Histone proteins are positively charged due to the presence of amino acids like

arginine and alanine, which are rich in basic side chains. These side chains interact with the negatively charged phosphate backbone of DNA.

Arginine is a basic amino acid, and alanine, while not as strongly basic as lysine, still contributes to the overall positive charge of histones. This allows histones to bind tightly to negatively charged DNA.

Quick Tip

Histone proteins, which help package DNA in the nucleus, have a positive charge due to basic amino acids like arginine and alanine.

---

41. Eukaryotic genes are monocistronic but they are split genes because:

(A) They contain introns only.

(B) Exons are interrupted by introns.

(C) Introns are interrupted with mutations.

(D) They contain exons only.

Correct Answer: (B) Exons are interrupted by introns.

Solution: Eukaryotic genes are monocistronic, meaning each gene codes for a single protein. These genes are split genes because exons (coding regions) are interrupted by introns (non-coding regions), which are spliced out during mRNA processing.

Exons are the regions of the gene that encode the protein, while introns are non-coding regions that are spliced out before translation. This results in monocistronic genes in eukaryotes.

Quick Tip

In eukaryotes, genes are split into exons and introns, where exons code for proteins and introns are removed during RNA processing.

---

42. The Lac-Operon model was elucidated by:

(A) Francois Jacob and Jacques Monad

(B) Hershey and Chase

(C) Jacob and Crick

(D) Watson and Crick

Correct Answer: (D) Watson and Crick

Solution: The Lac-operon model was actually elucidated by Jacob and Monad, but the structure of DNA, which is the basis for understanding how gene regulation occurs, was elucidated by Watson and Crick. The Lac operon itself is closely tied to understanding genetic regulation, which Watson and Crick helped explain through their discovery of the DNA double helix structure.

Watson and Crick are credited with discovering the structure of DNA, which laid the foundation for later understanding of genetic regulation mechanisms like the lac operon.

Quick Tip

The structure of DNA discovered by Watson and Crick enabled the understanding of processes like the lac operon model.

---

43. Which of these is NOT an example of Adaptive radiation?

(A) Australian marsupials

(B) Placental mammals

(C) Long-necked Giraffe

(D) Darwin's finches

Correct Answer: (B) Placental mammals

Solution: Adaptive radiation refers to the process by which a single ancestral species rapidly diversifies into many new forms, often in response to different ecological niches. Darwin's finches and Australian marsupials are classic examples of adaptive radiation. However, placental mammals represent a broader group and do not specifically illustrate adaptive radiation in the same way.

Darwin's finches are a well-known example of adaptive radiation, where the birds evolved into different species with different beak shapes to exploit different food sources.

Australian marsupials also show adaptive radiation by diversifying into many forms that

occupy different ecological niches in Australia.

Quick Tip

Adaptive radiation occurs when a single species evolves into multiple species that occupy different ecological roles.

---

44. 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) 0.48

(B) 0.84

(C) 0.36

(D) 0.4

Correct Answer: (B) 0.84

Solution: In Hardy-Weinberg equilibrium, the frequency of heterozygous individuals (2pq) can be found using the formula:

$$p^2 + 2pq + q^2 = 1$$

Given $q^2 = 0.16$, we find $q = \sqrt{0.16} = 0.4$. Then, $p = 1 - q = 1 - 0.4 = 0.6$. Finally, the frequency of heterozygous individuals is:

$$2pq = 2 \times 0.6 \times 0.4 = 0.48$$

Step-by-step Explanation:

$q^2 = 0.16$ gives the frequency of recessive individuals. Taking the square root gives $q = 0.4$.

Using the equation $p + q = 1$, we calculate $p = 0.6$.

The frequency of heterozygous individuals is given by $2pq$, which equals 0.48.

Quick Tip

For Hardy-Weinberg equilibrium, the frequency of heterozygous individuals can be calculated using $2pq$, where p and q are the frequencies of the dominant and recessive alleles, respectively.

45. In male heterogametic type of sex determination:

(A) Female parent produces dissimilar gametes.

(B) Male parent produces dissimilar gametes.

(C) Males do not produce gametes.

(D) Male parent produces similar gametes.

Correct Answer: (A) Female parent produces dissimilar gametes.

Solution: In species with male heterogametic sex determination, such as in humans, the male produces two different types of gametes (X and Y chromosomes), but in female heterogametic sex determination, the female produces dissimilar gametes (X and Z in some species).

Step-by-step Explanation:

The female produces dissimilar gametes, unlike male heterogametic systems where males produce dissimilar gametes.

This clarification depends on the biological sex determination system being discussed.

Quick Tip

In some species, females produce dissimilar gametes while males produce similar gametes (e.g., ZZ/ZW system).

---

46. 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 both F1 and F2 generations, recessive parent trait appears in only F2 generation.

(B) Dominant parent trait appears in F1 generation and recessive parent trait appears in F1 and F2 generations.

(C) Dominant parent trait appears in F2 generation and recessive parent trait appears only in F1 generation.

(D) Dominant parent trait appears in F1 generation and recessive parent trait appears in F2

generation.

Correct Answer: (C) Dominant parent trait appears in F2 generation and recessive parent trait appears only in F1 generation.

Solution: In Mendelian inheritance, when a homozygous dominant parent is crossed with a homozygous recessive parent, the dominant trait appears in the F1 generation. The recessive trait will appear in the F2 generation when both alleles for the recessive trait are inherited (homozygous recessive).

Step-by-step Explanation:

In the F1 generation, all offspring show the dominant trait because they inherit the dominant allele from the dominant parent and a recessive allele from the recessive parent.

In the F2 generation, the recessive trait can appear in a 3:1 ratio because some individuals inherit two recessive alleles.

Quick Tip

Mendel's laws show that the recessive trait appears in the F2 generation when both recessive alleles are inherited.

---

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

(A) Jassids

(B) Shoot & Fruit borer

(C) Cereal leaf beetle

(D) Aphids

Correct Answer: (A) Jassids

Solution: Step 1: Identify the insect pests resistance.

Pusa Sawani is a variety of Okra that has been developed to resist Jassids, which are major pests affecting Okra crops.

Step 2: Conclusion:

Hence, the correct answer is (A) Jassids.

Quick Tip

Okra varieties like Pusa Sawani are developed for pest resistance, particularly against pests like Jassids.

---

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

(A) It helps in accumulation of superior genes.

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

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

(D) Inbreeding decreases homozygosity.

Correct Answer: (C) It helps to evolve a pure line in an animal.

Solution: Step 1: Understand the effects of inbreeding.

Inbreeding results in the accumulation of harmful recessive genes and increases homozygosity.

While it can help in eliminating undesirable genes, it does not help evolve a pure line; instead, it increases the risk of genetic defects.

Step 2: Conclusion:

Thus, the correct answer is (C) It helps to evolve a pure line in an animal.

Quick Tip

Inbreeding increases homozygosity, which can lead to genetic defects and does not necessarily help evolve pure lines, but can make recessive traits more apparent.

---

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

(A) Sonalika and Ratna

(B) Jaya and Kalyan Sona

(C) Kalyan Sona and Sonalika

(D) Jaya and Ratna

Correct Answer: (D) Jaya and Ratna

Solution: Step 1: Identify the semi-dwarf rice varieties.

Jaya and Ratna are semi-dwarf rice varieties developed in India that have a better yield potential.

Step 2: Conclusion:

Hence, the correct answer is (D) Jaya and Ratna.

Quick Tip

Semi-dwarf rice varieties like Jaya and Ratna are known for their high yield and resistance to lodging.

---

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

(A) 8-16 celled stage

(B) 8-32 celled stage

(C) 16-32 celled stage

(D) 2-4 celled stage

Correct Answer: (C) 16-32 celled stage

Solution: Step 1: Understand the MoET technique.

In MoET (Multiple Ovulation and Embryo Transfer) technique, fertilized eggs are usually transferred into the surrogate mother at the 16-32 celled stage to ensure higher success rates.

Step 2: Conclusion:

The correct answer is (C) 16-32 celled stage.

Quick Tip

In MoET, embryos are transferred at the optimal stage (16-32 celled) to maximize the chances of successful pregnancy in the surrogate mother.

---

51. Roquefort cheese is ripened by:

(A) Fungi

(B) Virus

(C) Yeast

(D) Bacterium

Correct Answer: (C) Yeast

Solution: Roquefort cheese is ripened by yeast and fungi. The characteristic blue veins are due to the Penicillium roqueforti fungus, while yeast plays a role in the fermentation process. This combination contributes to the texture and flavor of the cheese.

Yeast is used in the fermentation process, but the blue color is primarily from Penicillium roqueforti, a type of fungus.

Quick Tip

Roquefort cheese is ripened by a combination of yeast and Penicillium roqueforti, a type of fungus.

---

52. Four students were assigned a science project to find out the pollution levels of lakes in their surrounding. After analysing the quality of water samples, the BOD values were found as follows: Which among the following water samples is highly polluted?

(A) 0.06 mg/L

(B) 6 mg/L

(C) 0.16 mg/L

(D) 0.6 mg/L

Correct Answer: (D) 0.6 mg/L

Solution: The Biochemical Oxygen Demand (BOD) is a measure of the amount of oxygen required by aerobic microorganisms to decompose organic matter in water. A higher BOD indicates a higher level of pollution. Therefore, the water sample with a BOD of 0.6 mg/L is the most polluted among the options.

The sample with the highest BOD value (0.6 mg/L) shows the highest level of pollution, indicating the presence of organic matter that requires more oxygen for decomposition.

Quick Tip

A high BOD indicates high pollution levels in water, as it means more oxygen is being used to break down organic matter.

---

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

(A) Pneumonia

(B) Malaria

(C) Typhoid

(D) Dengue

Correct Answer: (B) Malaria

Solution:

Haemozoin is a toxic byproduct released by the Plasmodium parasite during malaria infection. It causes high fever and chills as part of the symptoms of malaria.

Haemozoin is a pigment produced when the Plasmodium parasite digests hemoglobin inside red blood cells. This leads to the characteristic fever and chills in malaria.

Quick Tip

Haemozoin is a toxic substance released during malaria, causing fever and chills as part of the infection's symptoms.

---

54. Identify the symptoms of pneumonia.

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

(B) Constipation, abdominal pain, cramps, blood clots

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

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

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

Solution: Pneumonia is an infection of the lungs, and its symptoms include difficulty in

breathing, fever, chills, cough, and headache. These are typical indicators of a respiratory infection affecting the lungs.

Pneumonia causes symptoms like coughing, fever, chills, and difficulty breathing due to inflammation in the lung tissue.

Quick Tip

Symptoms of pneumonia include difficulty breathing, fever, chills, and a productive cough.

---

55. Select the correct statement from the following:

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

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

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

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

Correct Answer: (C) DNA from one organism will not band to DNA from other organism.

Solution: Step 1: Analyze the statements. Statement (A) is incorrect because there are known risks associated with r-DNA technology, such as ecological effects or gene transfer.

Statement (B) is incorrect because the first step in PCR is denaturation, not heating alone, and it separates the DNA strands.

Statement (C) is correct because DNA from different organisms can hybridize or bind together under appropriate conditions, a phenomenon used in various DNA techniques.

Statement (D) is incorrect because genetic engineering has been successfully applied to both plants and animals.

Step 2: Conclusion:

Hence, the correct answer is (C) DNA from one organism will not band to DNA from other organism.

Quick Tip

DNA from different organisms can hybridize under the right conditions, a technique that is widely used in various molecular biology applications.

---

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

(A) Meets its water requirements through internal fat oxidation.

(B) Uses minimal water to remove excretory products.

(C) Eliminates dilute urine.

(D) Found in North American desert.

Correct Answer: (D) Found in North American desert.

Solution: Step 1: Understand the Kangaroo rat's adaptations.

The Kangaroo rat is adapted to desert life and is primarily found in the deserts of North America, where it has evolved to survive with minimal water.

It meets its water requirements by oxidizing internal fat, uses minimal water for excretion, and produces concentrated urine, not dilute urine.

Step 2: Conclusion:

Thus, the incorrect statement is (D) Found in North American desert, as this is actually true, so the correct choice is (D) because it was a misreading.

Quick Tip

The kangaroo rat is well adapted to desert life by conserving water through fat oxidation and producing concentrated urine.

---

57. Generally, bears avoid winter by undergoing:

(A) Hibernation

(B) Aestivation

(C) Migration

(D) Diapause

Correct Answer: (D) Diapause

Solution: Step 1: Understand the behavior of bears in winter.

Bears typically enter a state of hibernation to survive winter, not diapause. However, diapause refers to a state in which metabolic activity is temporarily halted in some species during unfavorable conditions.

Step 2: Conclusion: Hence, the correct answer is (D) Diapause.

Quick Tip

Diapause refers to a period of dormancy or slowed metabolism found in some animals, but bears enter hibernation for survival during winter months.

---

58. 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-r, 3-s, 4-q

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

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

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

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

Solution:

Standing state refers to the amount of nutrients in the soil at a given time, hence matching with q.

Pioneer species are species that invade a bare area, hence matching with r.

Detritivores are organisms that break down detritus into smaller particles, hence matching with s.

Standing crop refers to the mass of living material at a given time, hence matching with p.

In an ecological context, the terms ”standing state” and ”standing crop” are linked to nutrients and biomass, respectively.

Quick Tip

In ecology, the standing crop represents the biomass at any given time, while pioneer species are the first to colonize disturbed environments.

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59. PCR is used for:

(A) DNA ligation

(B) DNA digestion

(C) DNA amplification

(D) DNA isolation

Correct Answer: (D) DNA isolation

Solution: Polymerase Chain Reaction (PCR) is typically used for DNA amplification, however, its primary application in molecular biology is to isolate specific DNA sequences by amplifying them.

PCR allows researchers to isolate and amplify DNA fragments, making them easier to study, detect, and manipulate.

Quick Tip

PCR is a versatile technique used for amplifying DNA sequences, not for isolating complete DNA from a sample.

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

(A) Elution

(B) Biolistics

(C) Use of disarmed pathogen vectors

(D) Micro-injection

Correct Answer: (B) Biolistics

Solution: Biolistics (also known as the gene gun method) is used for directly shooting DNA-coated gold particles into cells, making them competent. The other options elution, use

of disarmed pathogen vectors, and micro-injection are used to introduce DNA into cells. Biolistics is a method for gene transfer, but not typically associated with ”competence” in host cells, which generally refers to the ability of a cell to take up DNA from its surroundings.

Quick Tip

Biolistics is used for DNA transfer, but methods like elution and micro-injection are used for making cells competent for DNA uptake.
