ForumIAS

Prelims Marathon

4th week April, 2026

HISTORY
ECONOMICS
POLITY
SCIENCE AND TECHNOLOGY
GEOGRAPHY AND ENVIRONMENT

INDEX

Cells and Tissues - II

1. Consider the following statements regarding respiratory mechanisms in the animal kingdom:

1. Aerobic respiration occurs in the presence of oxygen and is significantly more energy-efficient than anaerobic respiration, which produces lactic acid or alcohol.
2. Among vertebrates, the use of lungs is universal and exclusive, with no other organs participating in gaseous exchange.
3. Lower invertebrates, such as aquatic arthropods and mollusks, primarily utilize a tracheal network for direct atmospheric respiration.

How many of the statements given above are correct?

A. Only one
B. Only two
C. All three
D. None

Correct Answer: (a)

Explanation:

· **Statement 1 is correct:** Aerobic respiration yields high ATP, while anaerobic yields much less and produces byproducts like lactic acid.

- **Statement 2 is incorrect:** While vertebrates use lungs, some amphibians also respire through their moist skin (cutaneous respiration).
- **Statement 3 is incorrect:** Aquatic arthropods and mollusks use gills. Tracheal tubes are specific to insects.

2. Consider the following statements:

1. Oxidative stress represents a physiological state where Reactive Oxygen Species (ROS) overwhelm the body's antioxidant defenses, potentially damaging DNA and proteins.
2. Antioxidants are unstable molecules produced during metabolism that trigger neurodegenerative disorders and accelerate the aging process.

Which of the statements given above is/are correct?

A. 1 only
B. 2 only
C. Both 1 and 2
D. Neither 1 nor 2

Correct Answer: (a)

Explanation:

· **Statement 1 is correct:** It accurately describes the imbalance leading to cellular damage.

- **Statement 2 is incorrect:** This is the definition of Reactive Oxygen Species (ROS). Antioxidants are the defenders that neutralize ROS to prevent such damage.

3. With reference to circulatory patterns in organisms, consider the following statements:

1. In a closed circulatory system, typical of annelids and chordates, blood is pumped through a distinct and continuous network of vessels.
2. Arthropods and mollusks possess an open circulatory system where blood is confined strictly to arteries and veins to provide targeted nutrient delivery.

Which of the statements given above is/are correct?

A. 1 only

B. 2 only
C. Both 1 and 2
D. Neither 1 nor 2

Correct Answer: (a)
Explanation:
- **Statement 1 is correct:** Closed systems keep blood within vessels.
  - **Statement 2 is incorrect:** In open systems (arthropods/mollusks), blood is pumped into open spaces or sinuses, not a closed network of vessels.

4. Consider the following statements regarding human vascular biology:
1. Arteries invariably carry oxygen-rich blood, while veins exclusively transport deoxygenated blood throughout the human body.
2. Nitric Oxide (NO) serves as a vital regulator by relaxing smooth muscles in blood vessels, thereby facilitating vasodilation and improved flow.
3. Capillaries act as the primary site for material exchange between the blood and tissue cells due to their thin-walled structure.

How many of the statements given above are correct?
A. Only one
B. Only two
C. All three
D. None

Correct Answer: (b)
Explanation:
- **Statement 1 is incorrect:** The Pulmonary Artery carries deoxygenated blood, and the Pulmonary Vein carries oxygenated blood. They are the exceptions.
  - **Statement 2 is correct:** Nitric Oxide is a well-known vasodilator.
  - **Statement 3 is correct:** Capillaries are designed specifically for the exchange of O2, nutrients, and waste.

5. Consider the following statements regarding nitrogenous waste excretion:
1. Uricotelism, common in birds and reptiles, is an evolutionary adaptation to minimize water loss by excreting waste as a paste or pellet.
2. In mammals, the liver plays a critical role in the excretory process by converting toxic ammonia into urea before it reaches the kidneys.
3. Ammonotelism is the primary mode of excretion in terrestrial amphibians as it helps in the conservation of internal body fluids.

How many of the statements given above are correct?
A. Only one
B. Only two
C. All three
D. None

Correct Answer: (b)
Explanation:
- **Statement 1 is correct:** Uric acid requires very little water for excretion.

- **Statement 2 is correct:** Ammonia is converted to urea in the liver (Ornithine cycle) and then filtered by the kidneys.
- **Statement 3 is incorrect:** Ammonotelism (ammonia excretion) requires vast amounts of water and is seen in aquatic animals. Terrestrial amphibians are generally ureotelic (excrete urea).

6. Consider the following statements regarding the Master Gland and its regulation:

1. The hypothalamus produces hormones that act as direct regulators for the secretions of the anterior pituitary gland.
2. Growth Hormone (GH) is secreted by the posterior pituitary, and its over-secretion in adults leads to gigantism.
3. Luteinizing Hormone (LH) is an intercellular messenger produced in trace amounts to regulate reproductive cycles in females.

How many of the statements given above are correct?

A. Only one
B. Only two
C. All three
D. None

Correct Answer: (a)

Explanation:

· **Statement 1 is correct:** The hypothalamus controls the anterior pituitary via releasing/inhibiting hormones.

- **Statement 3 is correct:** Hormones are, by definition, produced in trace amounts.
- **Statement 2 is incorrect:** GH is secreted by the Anterior Pituitary. Over-secretion in adults causes acromegaly; gigantism occurs when over-secreted in children.

7. Match List-I (Gland) with List-II (Primary Function/Hormone):

List-I (Gland)	**List-II (Function/Hormone)**
A. Pineal Gland	1. T-cell production & Immune function
B. Thymus	2. Sleep-wake cycle (Melatonin)
C. Adrenal Glands	3. Glucose Homeostasis (Insulin)
D. Pancreas	4. Stress response (Epinephrine)

Select the correct answer using the code given below:

A. A-1, B-2, C-3, D-4
B. A-2, B-1, C-4, D-3
C. A-2, B-1, C-3, D-4
D. A-1, B-2, C-4, D-3

Correct Answer: b (A-2, B-1, C-4, D-3)

Explanation:

- **Pineal** = Melatonin (Sleep).
  - **Thymus** = Thymosin (Immunity/T-cells).
  - **Adrenal** = Epinephrine/Cortisol (Stress).
  - **Pancreas** = Insulin/Glucagon (Blood Sugar).

8. Consider the following statements regarding Endocrine Disrupting Chemicals (EDCs):

1. Bisphenol A is a dietary phytoestrogen naturally found in the food chain that mimics growth hormones to accelerate puberty.
2. DDT and its metabolites are pharmaceuticals specifically designed to regulate the anterior pituitary's response to stress.

Which of the statements given above is/are correct?

A. 1 only
B. 2 only
C. Both 1 and 2
D. Neither 1 nor 2

Correct Answer: (d)

Explanation:

- **Statement 1 is incorrect:** Bisphenol A is a plastic contaminant, not a dietary phytoestrogen.
  - **Statement 2 is incorrect:** DDT is a pesticide, not a pharmaceutical for the pituitary.

9. Which of the following best describes the Diffuse Nervous System?

A. A system found in vertebrates where the spinal cord coordinates reflex actions.
B. A network of neurons spread in a net-like arrangement lacking a centralized brain, typical of lower invertebrates.
C. The division of the nervous system responsible for transmitting impulses from the CNS to peripheral organs.
D. A specialized group of cells in the brain that conduct electrochemical stimuli to the heart.

Correct Answer: B

Explanation:

Lower invertebrates like Hydra have a diffuse nerve net. They lack the centralization (brain/spinal cord) found in higher organisms.

10. Match the Part of the Neuron with its specific characteristic:

Part of Neuron	**Characteristic**
A. Dendrites	1. Transmits signals away to other tissues
B. Axon	2. Contains Nissl's granules and organelles
C. Cell Body	3. Junction for communication (Synaptic cleft)

D. Synapse	4. Projections that receive incoming signals

Select the correct code:

A. A-4, B-1, C-2, D-3
B. A-4, B-2, C-1, D-3
C. A-1, B-4, C-2, D-3
D. A-2, B-1, C-4, D-3

Correct Answer: a (A-4, B-1, C-2, D-3)

Explanation:

- **Dendrites** receive signals.
- **Axon** carries signals away.
- **Cell Body** (Soma) contains the nucleus and Nissl's granules.
- **Synapse** is the communication junction.

Classification of Organisms and Tissues

1. Match List I (Brain Region) with List II (Primary Function):

List I (Region)	**List II (Function)**
I. Fore-brain	A) Control of eye movements and auditory processing
II. Mid-brain	B) Higher cognitive functions and sensory perception
III. Hind-brain	C) Regulation of basic survival functions (breathing/heart rate)

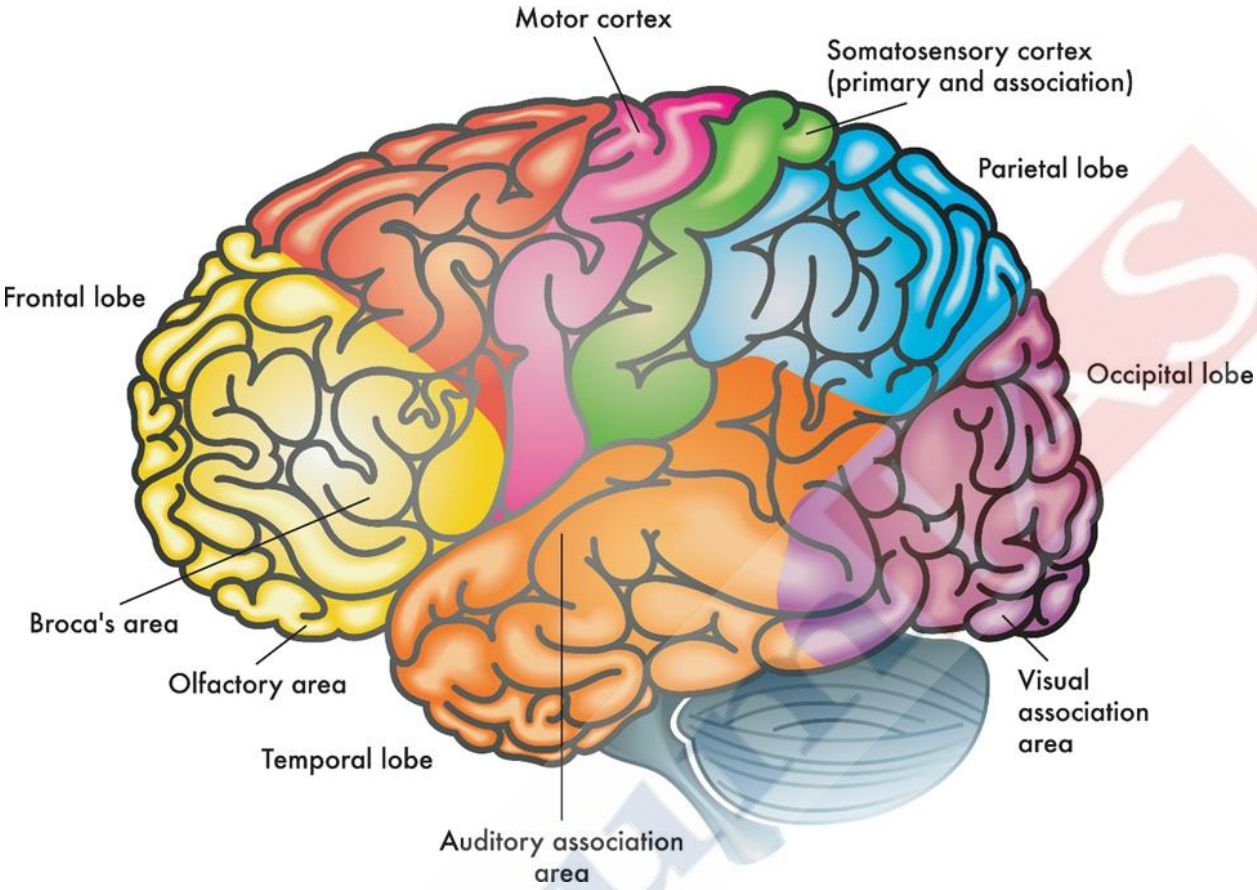
Select the correct match using the codes below:

(a) I-B, II-A, III-C
(b) I-A, II-B, III-C
(c) I-C, II-B, III-A
(d) I-C, II-A, III-B

Correct Answer: (a)

Explanation:

The brain is compartmentalized for specific tasks. The Fore-brain handles complex thinking. The Mid-brain acts as a relay for visual and auditory reflexes like eye movement. The Hind-brain (specifically the medulla) controls involuntary survival functions like heart rate.



2. Match List I (Type of Joint) with List II (Characteristic/Location):

List I (Joint Type)	**List II (Location/Feature)**
I. Fibrous Joint	A) Fluid-filled cavity allowing high mobility
II. Cartilaginous Joint	B) Sutures of the skull (immovable)
III. Synovial Joint	C) Intervertebral discs (limited movement)

Select the correct match using the codes below:

(a) I-B, II-C, III-A
(b) I-A, II-B, III-C
(c) I-C, II-A, III-B
(d) I-B, II-A, III-C

Correct Answer: (a)

Explanation:

Fibrous joints are fixed (like the skull bones). Cartilaginous joints allow slight movement (the spine). Synovial joints are the most mobile, containing synovial fluid to reduce friction (knees, shoulders). Infants have ~300 bones, which fuse into 206 by adulthood.

3. Match List I (Blood Component) with List II (Defining Feature):

List I (Component)	**List II (Feature)**
I. Plasma	A) Nucleated cells involved in immune defense
II. Erythrocytes	B) Liquid matrix containing clotting factors
III. Leucocytes	C) Non-nucleated cells for oxygen transport
IV. Platelets	D) Cell fragments essential for coagulation

Select the correct match using the codes below:
(a) I-B, II-C, III-A, IV-D
(b) I-C, II-B, III-D, IV-A
(c) I-B, II-A, III-C, IV-D
(d) I-D, II-C, III-B, IV-A

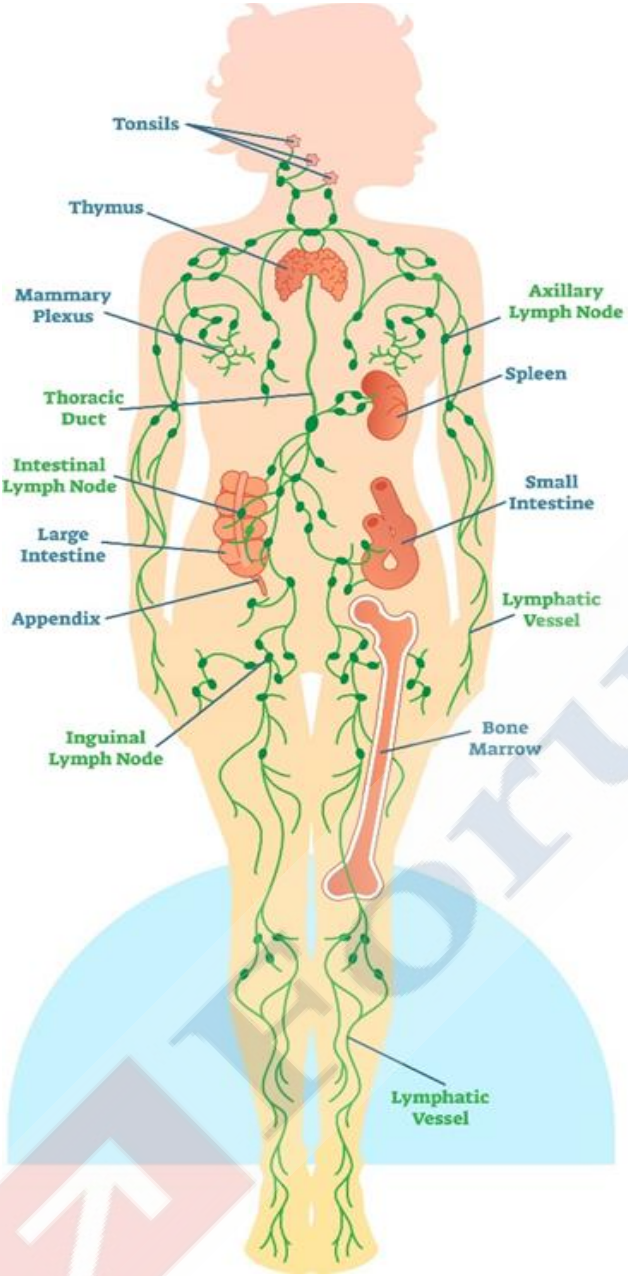
Correct Answer: (a)
Explanation:
Plasma is the matrix (55%). Erythrocytes (RBCs) lack a nucleus at maturity to carry more hemoglobin. Leucocytes (WBCs) have a nucleus and fight infection. Platelets are small fragments that plug leaks in vessels.

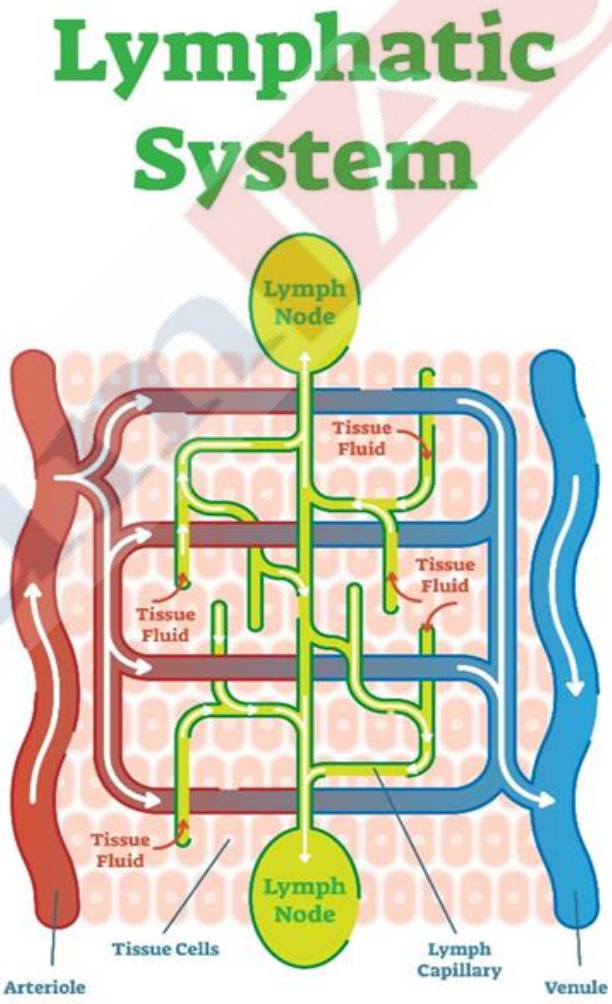
4. Consider the following statements regarding Lymph:
1. It is a colorless fluid containing specialized lymphocytes responsible for immune responses.
2. It acts as a carrier for nutrients and hormones, returning interstitial fluid to the major veins.
3. Fats are absorbed directly into the blood capillaries of the intestinal villi rather than the lymphatic system.

Which of the statements given above is/are incorrect?
(a) 1 only
(b) 3 only
(c) 1 and 2 only
(d) 2 and 3 only

Correct Answer: (b)
Explanation:
- **Statement 1 is correct:** Lymph is a colorless fluid because it lacks red blood cells and hemoglobin. It contains specialized lymphocytes (B cells and T cells), which are central to the body's immune responses by identifying and fighting foreign pathogens like bacteria and viruses.

- **Statement 2 is correct:** Lymph serves as a vital carrier for nutrients and hormones. It plays a key role in maintaining fluid balance by collecting interstitial fluid (the fluid that leaks out of blood capillaries into tissue spaces) and returning it to the major veins near the heart, thus preventing tissue swelling.
- **Statement 3 is incorrect.** Fats are too large to enter blood capillaries; they are absorbed through lacteals, which are specialized lymph vessels in the intestinal villi.





5. Consider the following statements regarding the Kingdom Monera:

1. Mycoplasmas are the smallest known living cells and are unique because they completely lack a cell wall.
2. The vast majority of bacteria are autotrophic, synthesizing their own food from inorganic substrates.
3. Bacteriophages are viruses that specifically infect bacteria and are found in high concentrations in marine environments.

Which of the statements given above is/are incorrect?

(a) 1 and 3 only
(b) 2 only
(c) 3 only
(d) 1, 2 and 3

Correct Answer: (b)
Explanation:
· **Statement 1 is correct.** They are unique among bacteria because they completely lack a rigid cell wall, possessing only a flexible, triple-layered plasma membrane.
· **Statement 2 is incorrect.** While some bacteria are autotrophic, the vast majority of bacteria are heterotrophs (they depend on other organisms or dead organic matter for food).
· **Statement 3 is correct.** Bacteriophages, or phages, are indeed specialized viruses that exclusively infect and kill bacteria, acting as the most abundant biological entities in marine ecosystems.

6. Consider the following statements regarding the Kingdom Protista:
1. It acts as a biological group that includes all single-celled eukaryotes.
2. Protist cells possess a well-defined nucleus and membrane-bound organelles like mitochondria.
3. Members of this kingdom are primarily terrestrial, found mostly in dry soil environments.

Which of the statements given above is/are incorrect?
(a) 1 and 3 only
(b) 2 only
(c) 3 only
(d) 1, 2 and 3

Correct Answer: (c)
Explanation:
· **Statement 1 is correct.** Kingdom Protista serves as a diverse, primarily single-celled eukaryotic group, encompassing organisms that are not classified as animals, plants, or fungi.
· **Statement 2 is correct**. As eukaryotes, protists possess a well-defined nucleus, which houses DNA, and membrane-bound organelles such as mitochondria for energy production, endoplasmic reticulum, and Golgi bodies.
· **Statement 3 is incorrect.** Members of Protista (like Amoeba and Plasmodium) are primarily aquatic, inhabitating fresh water, marine environments, or moist soil.

7. Consider the following statements regarding Kingdom Fungi:
1. Fungi are multicellular organisms with cell walls composed of chitin and lack chloroplasts.
2. Mycorrhizal fungi form symbiotic associations with plant roots, significantly improving nutrient uptake and water relations.
3. All fungi, including mushrooms, possess flagella or cilia for active locomotion throughout their life cycle.

Which of the statements given above is/are correct?
(a) 1 only
(b) 3 only
(c) 2 and 3 only
(d) 1 and 2 only

Correct Answer: (d)
Explanation:

Statement 1&2 is correct. Fungi are eukaryotic, mostly multicellular organisms (like molds) or single-celled (yeasts) with cell walls composed of chitin and lack chloroplasts, making them heterotrophic rather than photosynthetic. Mycorrhizal fungi form vital symbiotic relationships with plant roots, expanding root surface area to increase uptake of water and nutrients like phosphorus.
Statement 3 is incorrect. Fungi generally lack mechanisms for locomotion. They grow toward food sources rather than swimming or walking toward them.

8. Which of the following statements best describes Mucormycosis, often referred to in the news as Black Fungus?
(a) A contagious bacterial infection causing dark pigmentation of the liver.
(b) A serious fungal infection caused by mucormycetes, resulting in tissue necrosis that appears black.
(c) A viral respiratory disease characterized by the blackening of the lungs.
(d) A parasitic skin condition caused by protozoa found in stagnant water.

Correct Answer: (b)
Explanation:
Mucormycosis is caused by environmental moulds. It is called black fungus because it causes necrosis (death of tissue), which turns the skin or affected area black. It is rare but serious, especially in immunocompromised individuals.

9. Consider the following statements regarding Kingdom Plantae:
1. While most plants are autotrophic, some species like Bladderwort and Venus Flytrap are partially heterotrophic insectivores.
2. Parasitic plants, such as *Cuscuta* (Amarbel), lack chlorophyll and derive nutrients directly from a host plant.

Which of the statements given above is/are correct?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Correct Answer: (c)
Explanation:
Both statements are correct. Insectivorous plants trap insects to supplement nitrogen. *Cuscuta* is a total parasite that uses haustoria to suck nutrients from other plants.

10. Consider the following statements regarding Thallophytes:
1. They are simple, non-vascular plants with an undifferentiated body called a thallus, lacking true roots or leaves.
2. They contribute to nearly 50% of the total carbon dioxide fixation on Earth through photosynthesis.
3. *Sargassum* and *Spirogyra* are common examples of organisms belonging to this group.

Which of the statements given above are correct?
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Correct Answer: (d)
Explanation:

All statements are correct. Algae are the simplest plants. Due to their massive presence in oceans, they are the planet's primary CO2 fixers. *Spirogyra* (freshwater) and *Sargassum* (marine) are classic examples.

Classification of Organisms-II

1. Consider the following statements regarding primitive terrestrial plants:

1. Bryophytes are termed the "amphibians of the plant kingdom" because they require water for sexual reproduction despite living on land.
2. Pteridophytes are evolutionary milestones as they were the first terrestrial plants to develop vascular tissues (xylem and phloem).
3. Both Bryophytes and Pteridophytes possess true roots, stems, and leaves for efficient nutrient transport.

Which of the statements given above is/are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Correct Answer: (a)

Explanation:

· **Statement 1 is correct:** Bryophytes (mosses/liverworts) need water for their flagellated sperm to reach the egg.

- **Statement 2 is correct:** Pteridophytes (ferns) are the first vascular plants.
- **Statement 3 is incorrect:** Bryophytes lack true roots, stems, and leaves (they have root-like rhizoids). Pteridophytes do possess true roots, stems, and leaves.

2. Consider the following statements regarding Gymnosperms:

1. They are characterized by ovules that are enclosed within an ovary wall, which protects them before and after fertilization.
2. Examples of this group include Cycas, Pinus, and the living fossil Ginkgo.

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Correct Answer: (b)

Explanation:

· **Statement 1 is incorrect:** The word Gymnosperm means naked seed. Their ovules are not enclosed by an ovary wall and remain exposed.

- **Statement 2 is correct:** Cycas and Pinus are classic gymnosperms.

3. Consider the following statements regarding Angiosperms:

1. They are the only group of plants where the seeds are enclosed within a fruit.
2. The primary male sex organ in an angiosperm flower is the pistil, while the stamen represents the female organ.

Which of the statements given above is/are correct?

(a) 1 only

(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Correct Answer: (a)
Explanation:

- **Statement 1 is correct:** Enclosed seeds (within a fruit) is the defining feature of angiosperms.
  - **Statement 2 is incorrect:** It is the opposite the Stamen is the male organ and the Pistil (or Carpel) is the female organ.

4. Match List I (Phylum) with List II (Key Feature/Example):

List I (Phylum)	**List II (Feature/Example)**
I. Arthropoda	A) Water vascular system; Starfish
II. Annelida	B) Segmented body; Earthworm
III. Echinodermata	C) Chitinous exoskeleton; Largest Phylum
IV. Porifera	D) Asymmetrical; Filter feeders (Sponges)

Select the correct match:
(a) I-C, II-B, III-A, IV-D
(b) I-B, II-C, III-D, IV-A
(c) I-C, II-A, III-B, IV-D
(d) I-D, II-B, III-A, IV-C

Correct Answer: (a)
Explanation:
Arthropoda (insects/crustaceans) is the largest phylum. Annelida is known for segmentation. Echinoderms (Starfish) use a unique water vascular system for movement. Porifera (Sponges) are the simplest multicellular animals.

5. Consider the following statements:
1. Hibernation is a state of winter dormancy characterized by a significant drop in metabolic rate and body temperature.
2. Aestivation is a physiological response to survive cold and freezing conditions, commonly observed in Polar Bears.

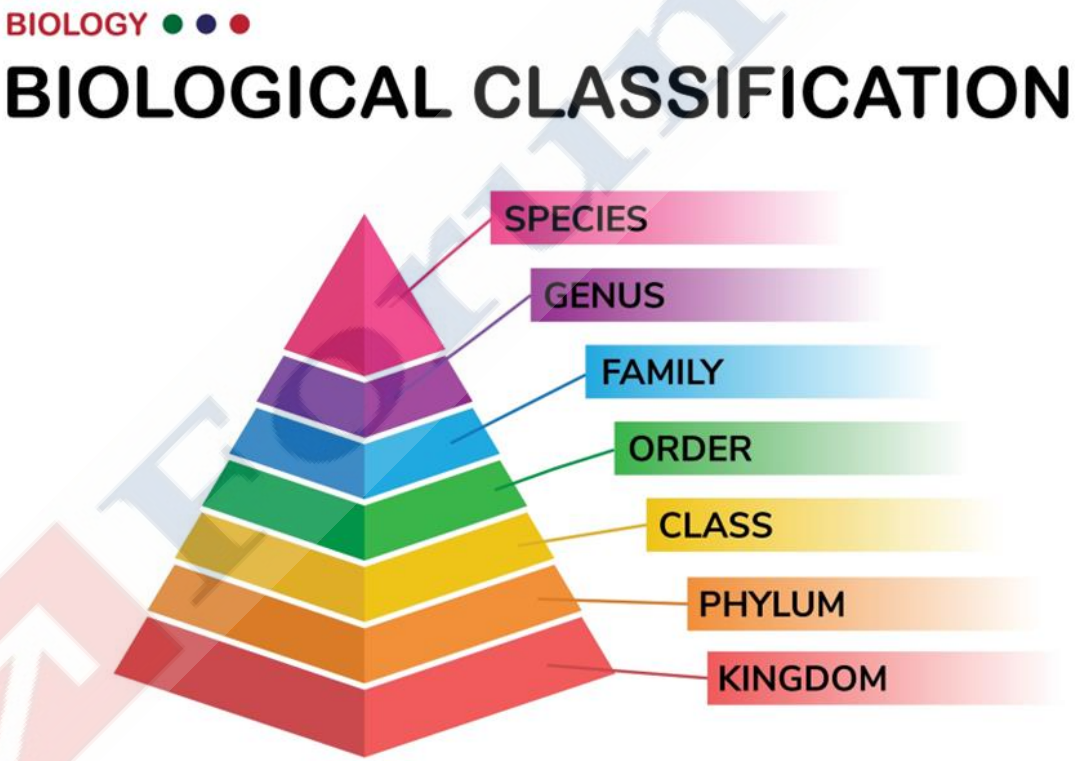
Which of the statements given above is/are correct?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Correct Answer: (a)
Explanation:

- **Statement 1 is correct:** Hibernation helps animals survive winter.
- **Statement 2 is incorrect:** Aestivation is summer sleep used to survive hot and dry conditions (observed in snails/slugs). Bears hibernate, they do not aestivate.

6. Which of the following sequences correctly depicts the ascending order (smallest to largest) of biological classification in the taxonomic hierarchy?
(a) Genus → Species → Order → Family
(b) Species → Genus → Family → Order
(c) Species → Order → Genus → Class
(d) Family → Genus → Species → Kingdom

Correct Answer: (b)
Explanation:
The correct ascending hierarchy is:
Species → Genus → Family → Order → Class → Phylum → Kingdom.



7. Which of the following are examples of carnivorous (insectivorous) plants?
1. Sundews (Drosera)
2. Cobra Lily (Darlingtonia)
3. Corkscrew Plant (Genlisea)

4. Water Lily (Nymphaea)

Select the correct answer using the code given below:

(a) 1 and 2 only
(b) 1, 2 and 3 only
(c) 2, 3 and 4 only
(d) 1, 2 and 3 only

Correct Answer: (b)

Explanation:

Sundews, Cobra Lilies, and Corkscrew plants are all carnivorous. Water Lily is a typical aquatic autotrophic plant, not a carnivore.

8. With reference to Microalgae, consider the following statements:

1. They are photosynthetic organisms found in both freshwater and marine ecosystems.
2. They contribute to water purification by consuming excess nutrients and absorbing pollutants.
3. Their lack of complex structural components like lignin makes them attractive for biofuel production.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Correct Answer: (d)

Explanation:

All statements are correct. Microalgae are versatile, eco-friendly, and highly efficient at converting CO_2 and sunlight into biomass, which can be processed into energy.

9. Consider the following pairs regarding root modifications and their examples:

1. Prop roots : Arise from aerial branches for support (Banyan tree)
2. Stilt roots : Arise from lower stem nodes for support (Sugarcane)
3. Climbing roots : Help plants twin around support (Money plant/Betel)

How many of the pairs given above are correctly matched?

(a) Only one
(b) Only two
(c) All three
(d) None

Correct Answer: (c)

Explanation:

All are correctly described. In the original table, Climbing and Clinging were slightly confused; climbing roots (like in Betel or Black Pepper) emerge from nodes to help the plant climb.

10. In the context of plant cell structure, what is the 'tonoplast'?

(a) The outer rigid layer protecting the cell.
(b) The membrane that encloses the central vacuole and regulates ion transport.
(c) The structural framework of the mitochondria.
(d) The double-membrane surrounding the chloroplast.

Correct Answer: (b)
Explanation:
The tonoplast is the membrane of the vacuole. It is crucial for maintaining turgor pressure in the plant cell and for storing waste or nutrients.

Classification of Organisms-II

1. Consider the following statements regarding primitive terrestrial plants:
4. Bryophytes are termed the "amphibians of the plant kingdom" because they require water for sexual reproduction despite living on land.
5. Pteridophytes are evolutionary milestones as they were the first terrestrial plants to develop vascular tissues (xylem and phloem).
6. Both Bryophytes and Pteridophytes possess true roots, stems, and leaves for efficient nutrient transport.

Which of the statements given above is/are correct?
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(b) 2 and 3 only
(c) 1 and 3 only
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Correct Answer: (a)
Explanation:
· **Statement 1 is correct:** Bryophytes (mosses/liverworts) need water for their flagellated sperm to reach the egg.
- **Statement 2 is correct:** Pteridophytes (ferns) are the first vascular plants.
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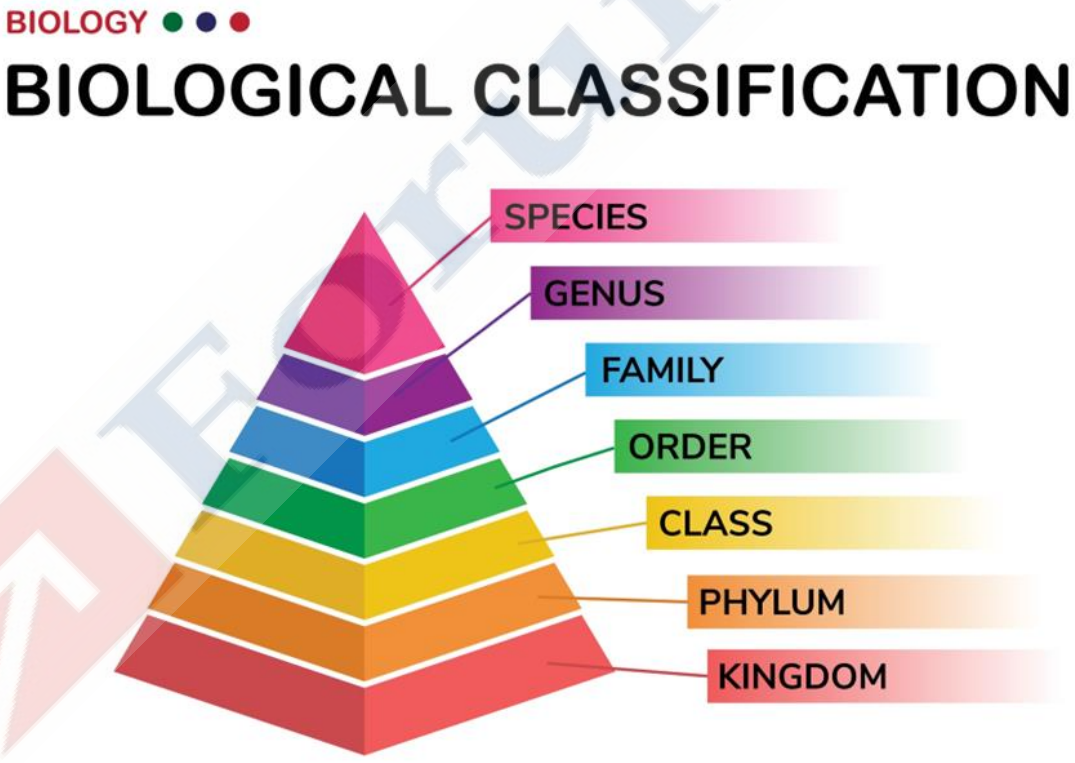
6. Which of the following sequences correctly depicts the ascending order (smallest to largest) of biological classification in the taxonomic hierarchy?
(a) Genus → Species → Order → Family
(b) Species → Genus → Family → Order
(c) Species → Order → Genus → Class
(d) Family → Genus → Species → Kingdom

Correct Answer: (b)
Explanation:
The correct ascending hierarchy is:
Species → Genus → Family → Order → Class → Phylum → Kingdom.



7. Which of the following are examples of carnivorous (insectivorous) plants?
5. Sundews (Drosera)

6. Cobra Lily (Darlingtonia)
7. Corkscrew Plant (Genlisea)
8. Water Lily (Nymphaea)

Select the correct answer using the code given below:

(a) 1 and 2 only
(b) 1, 2 and 3 only
(c) 2, 3 and 4 only
(d) 1, 2 and 3 only

Correct Answer: (b)

Explanation:

Sundews, Cobra Lilies, and Corkscrew plants are all carnivorous. Water Lily is a typical aquatic autotrophic plant, not a carnivore.

8. With reference to Microalgae, consider the following statements:

1. They are photosynthetic organisms found in both freshwater and marine ecosystems.
2. They contribute to water purification by consuming excess nutrients and absorbing pollutants.
3. Their lack of complex structural components like lignin makes them attractive for biofuel production.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Correct Answer: (d)

Explanation:

All statements are correct. Microalgae are versatile, eco-friendly, and highly efficient at converting CO2 and sunlight into biomass, which can be processed into energy.

9. Consider the following pairs regarding root modifications and their examples:

1. Prop roots : Arise from aerial branches for support (Banyan tree)
2. Stilt roots : Arise from lower stem nodes for support (Sugarcane)
3. Climbing roots : Help plants twin around support (Money plant/Betel)

How many of the pairs given above are correctly matched?

(a) Only one
(b) Only two
(c) All three
(d) None

Correct Answer: (c)

Explanation:

All are correctly described. In the original table, Climbing and Clinging were slightly confused; climbing roots (like in Betel or Black Pepper) emerge from nodes to help the plant climb.

10. In the context of plant cell structure, what is the 'tonoplast'?

(a) The outer rigid layer protecting the cell.
(b) The membrane that encloses the central vacuole and regulates ion transport.
(c) The structural framework of the mitochondria.

(d) The double-membrane surrounding the chloroplast.

Correct Answer: (b)
Explanation:
The tonoplast is the membrane of the vacuole. It is crucial for maintaining turgor pressure in the plant cell and for storing waste or nutrients.

Biotechnology

1. Consider the following statements regarding Genes and DNA:
1. A gene is a specific segment of DNA that contains instructions for producing a functional product, usually a protein.
2. In the DNA double helix, the four nucleotide bases pair specifically: Adenine with Thymine, and Cytosine with Guanine.
3. The nitrogenous base Uracil is a primary component of the DNA molecule, providing the code for replication.

Which of the statements given above are correct?
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Correct Answer: (a)
Explanation:
- **Statements 1 and 2 are correct.** A gene is a segment of DNA that contains the necessary information to produce a functional product, typically a protein. The sequence of these bases encodes genetic information. The specific pairing of the bases (A with T, and C with G) allows for the replication of DNA.
- **Statement 3 is incorrect** because Uracil is found only in RNA. DNA uses Thymine instead of Uracil.

2. Consider the following statements regarding Chromosomes:
1. Chromosomes are thread-like structures made of DNA and proteins, primarily found within the nucleus of eukaryotic cells.
2. The number of chromosomes is universal across all living species; for instance, both humans and complex primates possess exactly 46 chromosomes.

Which of the statements given above is/are correct?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Correct Answer: (a)
Explanation:
- **Statement 1 is correct.** Chromosomes are condensed, thread-like structures composed of DNA and proteins (primarily histones) that reside within the nucleus of eukaryotic cells. They package long DNA molecules into compact structures, making them visible during cell division.

- **Statement 2 is incorrect: T**he number of chromosomes is species-specific. While humans have 46 (23 pairs), other species have different characteristic numbers (e.g., chimpanzees have 48).

3. Consider the following pairs:

Disorder	**Genetic Cause & Chromosome**
1. Down's Syndrome	Trisomy involving an extra copy of Chromosome 21
2. Turner's Syndrome	Monosomy (XO) occurring in females
3. Klinefelter's Syndrome	Deletion of a segment of the Y chromosome in males
4. Cri-du-chat Syndrome	Deletion of a part of the short arm of Chromosome 5

How many of the pairs given above are correctly matched?
(a) Only one pair
(b) Only two pairs
(c) Only three pairs
(d) All four pairs

Correct Answer: (c)
Explanation:

- **Pair 1 is correctly matched: Down's Syndrome** is the result of Trisomy 21, where an individual has three copies of chromosome 21 instead of the usual two.
- **Pair 2 is correctly matched: Turner's Syndrome** is a condition that affects only females, resulting when one of the X chromosomes (sex chromosomes) is missing or partially missing (45, X instead of 46, XX).
- **Pair 3 is incorrectly matched: Klinefelter's Syndrome** is not caused by a deletion. It is caused by an extra X chromosome in a male (47, XXY). This results in a male who may have reduced muscle mass, facial hair, and body hair.
- **Pair 4 is correctly matched:** Cri-du-chat Syndrome (French for cry of the cat) is a rare genetic disorder caused by a deletion of genetic material on the small arm (p arm) of chromosome 5. Infants with this condition often have a high-pitched cry that sounds like that of a cat.

4. **Consider the following statements regarding RNA:**
1. RNA is typically a single-stranded molecule that uses ribose sugar and the nitrogenous base Uracil instead of Thymine.
2. Unlike DNA, RNA is found exclusively within the cytoplasm and cannot enter the nucleus of a cell.

Which of the statements given above is/are correct?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Correct Answer: (a)

Explanation:

Statement 1 is correct. Statement 2 is incorrect because RNA is synthesized in the nucleus (during transcription) before it moves to the cytoplasm (for translation).

5. Consider the following statements regarding the flow of genetic information:

1. Transcription is the process where a DNA segment is copied into messenger RNA (mRNA) within the nucleus.
2. Translation is the process by which ribosomes in the cytoplasm use mRNA instructions to assemble amino acids into proteins.
3. According to the Central Dogma, genetic information flows in a multi-directional path: primarily from Proteins back to DNA.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Correct Answer: (a)

Explanation:

Statements 1 and 2 are correct. Transcription and translation are the two main steps of gene expression, forming the basis of protein synthesis. Transcription copies DNA into mRNA within the nucleus, while translation uses that mRNA at cytoplasmic ribosomes to assemble amino acids into proteins. This central dogma moves genetic information from DNA to functional proteins.

Statement 3 is incorrect. The Central Dogma states that information flow is unidirectional: DNA RNA Protein. It does not flow from proteins back to DNA.

6. Consider the following statements regarding Dark DNA:

1. Dark DNA refers to genomic regions that are easily identified using standard sequencing but have no known biological function.
2. Recent research suggests these regions may influence gene regulation and species adaptation, despite being traditionally labeled as "junk DNA."

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Correct Answer: (b)

Explanation:

Statement 2 is correct. Recent research has overturned the traditional view of junk DNA non-coding, repetitive, or intergenic sequences—revealing that these regions are actually essential for gene regulation and species adaptation.

Statement 1 is incorrect: Because Dark DNA is characterized by being difficult to detect or interpret using standard methods, often due to high mutation rates.

7. Consider the following pairs based on the table provided:

Pair	Description of Viral Characteristics
1.	Adenoviruses possess a DNA genome and replicate in the host cell nucleus without integrating into the host genome.
2.	Retroviruses utilize the enzyme Reverse Transcriptase to convert their RNA genome into DNA for integration into the host genome.
3.	HIV is a primary example of an Adenovirus, typically causing acute respiratory infections.
4.	Adenovirus Vectors are commonly used in gene therapy because they do not permanently alter the host's genetic code.

How many of the pairs given above are correctly matched?
(a) Only one
(b) Only two
(c) Only three
(d) All four

Correct Answer: (c)
Explanation:

- **Pair 1 is correctly matched:** Adenoviruses are non-enveloped viruses with a double-stranded DNA genome. Unlike retroviruses, their genetic material remains episomal, meaning it stays in the nucleus but does not fuse with the host's DNA.
- **Pair 2 is correctly matched:** Retroviruses (like HIV) carry RNA. They use an enzyme called Reverse Transcriptase to back-copy their RNA into DNA, which is then spliced into the host cell's own DNA using the enzyme Integrase.
- **Pair 3 is incorrectly matched: HIV** (Human Immunodeficiency Virus) is a Retrovirus, not an Adenovirus. Adenoviruses are typically responsible for the common cold, conjunctivitis, or bronchitis.
- **Pair 4 is correctly matched:** Because Adenoviruses do not integrate into the host genome (as noted in Pair 1), they are preferred as vectors (delivery vehicles) for certain vaccines and gene therapies where permanent genetic modification is not desired or could be risky.

8. Consider the following statements regarding the Human Genome Project:
1. The HGP was an international effort launched in 1990 with the goal of sequencing all 3.2 billion nucleotide pairs in the human genome.
2. The project achieved its primary goal of sequencing all 24 human chromosomes by the year 1995, ahead of its initial schedule.

Which of the statements given above is/are correct?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Correct Answer: (a)

Explanation:

- **Statement 1 is correct.** The Human Genome Project (HGP) was a monumental 13-year international research effort formally launched in October 1990 to map and sequence the entire human genome. Led by the NIH and DOE in the U.S. along with international partners, it aimed to determine the exact order of roughly 3 billion nucleotide base pairs (A,T,C,G) and identify all human genes.
- **Statement 2 is incorrect**. The initial target for completion was 2005 (though a high-quality draft was finished in 2003). Sequencing was not finished as early as 1995.

9. Consider the following statements regarding the Genome India Project:

1. Initiated in 2020, its goal is to sequence the genomes of 10,000 individuals to represent the diverse genetic grid of India.
2. The project is being carried out exclusively by private foreign biotechnology firms to ensure rapid data processing.

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Correct Answer: (a)

Explanation:

Statement 1 is correct. Statement 2 is incorrect, the project is a government-led initiative by the Department of Biotechnology, involving 20 Indian institutions led by the IISc Bengaluru.

10. Consider the following statements regarding the Earth Bio-Genome Project:

1. The project aims to sequence, characterize, and catalogue the genomes of all eukaryotic biodiversity on Earth within a decade.
2. It is a three-phase initiative that intends to sequence approximately 1.5 million known species.
3. The EBP is limited to sequencing human-pathogenic viruses and bacteria to prevent future pandemics.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Correct Answer: (a)

Explanation:

Statements 1 and 2 are correct. Statement 3 is incorrect, the EBP focuses on eukaryotic biodiversity (plants, animals, fungi, protists), not just viruses or bacteria. It is often called the Digital Library of Life.

Biotechnology-II

1. Consider the following statements:

1. The Transcriptome refers to the full library of DNA sequences, including both coding and non-coding regions, found within a single cell.
2. Aerial Metagenomics involve the collection and analysis of genetic material from airborne particles to study microbial diversity in the atmosphere.

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Correct Answer: (b)

Explanation:

- **Statement 1 is incorrect:** The Transcriptome refers to the complete set of RNA molecules (mRNA, tRNA, rRNA, etc.) expressed by a cell at a specific time, not the DNA library (which is the Genome).
- **Statement 2 is correct:** It is an emerging field that samples DNA/RNA from aerosols to monitor biodiversity or pathogens in the air.

2. Consider the following statements regarding the Somatic Cell Nuclear Transfer (SCNT) technique:

1. The process requires a somatic cell and an egg cell, where the genetic material of the donor somatic cell is removed and discarded.
2. An enucleated egg cell serves as the "host" into which the nucleus of the donor somatic cell is transplanted.
3. In SCNT, the reconstructed egg requires external fertilization by a sperm cell to begin the process of embryo development.

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 only
(c) 1 and 3 only
(d) 1, 2 and 3

Correct Answer: (b)

Explanation:

- **Statement 1 is incorrect:** The genetic material of the somatic cell is the one preserved and transferred; the genetic material of the egg cell is discarded.
- **Statement 2 is correct:** This is the core mechanism of Somatic Cell Nuclear Transfer (SCNT).
- **Statement 3 is incorrect:** Somatic Cell Nuclear Transfer (SCNT) bypasses sperm fertilization. The egg is activated artificially (electrically or chemically) to start dividing.

3. Consider the following statements regarding the applications of Somatic Cell Nuclear Transfer (SCNT):

1. SCNT can be used for reproductive cloning, a process famously demonstrated by the creation of Dolly the sheep.
2. Therapeutic cloning uses SCNT to produce stem cells that are genetically identical to the donor, reducing the risk of immune rejection in regenerative medicine.
3. SCNT is currently the primary and most cost-effective method used for the commercial mass production of food crops.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 2 and 3 only

(c) 1 and 3 only
(d) 1, 2 and 3

Correct Answer: (a)
Explanation:

- **Statements 1 and 2 are correct:** Somatic Cell Nuclear Transfer (SCNT) is used for both cloning whole organisms and creating patient-specific stem cells.
- **Statement 3 is incorrect:** Somatic Cell Nuclear Transfer (SCNT) is an animal biotechnology tool. Mass production of food crops relies on seed technology, tissue culture, or other genetic modifications, not nuclear transfer into egg cells.

4. Consider the following statements regarding the INDIgen Project:

1. It is an initiative launched by the CSIR to sequence the whole genomes of diverse Indian individuals.
2. The project aims to create a database to help understand how genetic variations in the Indian population influence drug responses.
3. The INDIgen Project focuses exclusively on mapping the genomes of extinct ancient Indian species to study evolution.

Which of the statements given above are correct?
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Correct Answer: (a)
Explanation:

- **Statements 1 and 2 are correct:** The project is about human genomics to improve precision healthcare in India.
- **Statement 3 is incorrect:** It focuses on living Indian individuals, not extinct species.

5. With reference to Genome Editing, consider the following statements:

1. It is a type of genetic engineering that allows for the precise insertion, deletion, or modification of DNA in a living organism.
2. Genome editing can only be performed on single-celled organisms like bacteria and is not applicable to complex multicellular eukaryotes.

Which of the statements given above is/are correct?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Correct Answer: (a)
Explanation:

- **Statement 1 is correct:** This is the standard definition of genome engineering.
- **Statement 2 is incorrect:** Genome editing (especially via CRISPR) is widely used in plants, animals, and human cells.

6. Consider the following statements regarding the CRISPR-Cas9 system:

1. CRISPR acts as a guide RNA molecule that identifies the target DNA sequence through complementary base-pairing.
2. The Cas9 protein acts as a molecular scissor that makes a site-specific cut in the DNA.

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Correct Answer: (c)

Explanation:

CRISPR-Cas9 is a precise gene-editing tool where the guide RNA (gRNA) component scans and identifies the target DNA sequence via complementary base-pairing. The Cas9 protein serves as a molecular scissor, creating a site-specific double-strand break in the DNA.

Key Aspects of CRISPR-Cas9 Technology:

- **Mechanism:** It consists of two components: the guide RNA (gRNA), which finds the specific DNA sequence, and the Cas9 enzyme, which cuts it.
- **Targeting:** The guide RNA binds to specific DNA bases, enabling precise gene identification.
- **Cleavage:** The Cas9 nuclease cuts the target DNA, allowing for the deletion, addition, or modification of genes.
- **Origin:** The system is derived from a natural defense mechanism in bacteria and archaea, which use it to fight viral attacks.
- **Applications:** It is used in biotechnology for genome editing, including in medicine for gene therapy and in agriculture for crop improvement.

7. Consider the following statements regarding gene editing nucleases:

1. TALENs utilize DNA-binding domains derived from transcription activator-like effectors.
2. Zinc-finger nucleases (ZFNs) are fusions of a DNA-binding protein and a DNA-cleavage domain.
3. Unlike CRISPR-Cas9, both TALENs and ZFNs rely on a guide RNA molecule to find their target DNA sequence.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Correct Answer: (a)

Explanation:

- **Statements 1 and 2 are correct.** TALENs (Transcription Activator-Like Effector Nucleases) use TALE DNA-binding domains to recognize specific sequences, while ZFNs (Zinc-Finger Nucleases) utilize zinc-finger domains. Both technologies fuse these, or similar, DNA-binding domains with the FokI endonuclease cleavage domain to introduce targeted double-strand breaks (DSBs) for gene editing.
- **Statement 3 is incorrect:** TALENs and ZFNs use protein-DNA interactions to recognize targets, not RNA-DNA base pairing like CRISPR.

8. Consider the following statements regarding Homing Endonucleases (Mega-nucleases):

1. These enzymes possess highly sequence-specific DNA binding properties.

2. Similar to ZFNs and TALENs, the binding and cleavage domains in mega-nucleases are modular and can be easily swapped.

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Correct Answer: (a)

Explanation:

- **Statement 1 is correct.** Homing endonucleases (HEs) are specialized DNA-cutting enzymes that act as selfish genetic elements, promoting their own proliferation within a genome.
- **Statement 2 is incorrect:** Mega-nucleases are not modular; their binding and cleavage functions are intertwined within the same protein structure, making them harder to re-engineer than ZFNs or TALENs.

9. Consider the following statements regarding the initiation of RNAi:

1. RNA interference is a natural cellular process used to regulate gene expression and provide defense against viral infections.
2. The process is typically triggered by the presence of single-stranded RNA (ssRNA) in the cytoplasm.
3. An enzyme called Dicer is responsible for cutting long double-stranded RNA into shorter fragments known as siRNA.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2 and 3

Correct Answer: (b)

Explanation:

- **Statements 1 and 3 are correct.** RNA interference (RNAi) is a conserved cellular mechanism for regulating gene expression and defending against viruses by degrading specific messenger RNA (mRNA) molecules. The process involves the enzyme Dicer, a ribonuclease III-type enzyme, which cleaves long double-stranded RNA (dsRNA) into short interfering RNA (siRNA) fragments, typically 21–23 base pairs long.
- **Statement 2 is incorrect:** RNAi is triggered by double-stranded RNA (dsRNA). Single-stranded RNA is the normal state for mRNA and does not trigger this defense/regulation mechanism.

10. Consider the following statements regarding the RISC complex:

1. siRNA fragments are loaded into a protein complex known as the RNA-induced silencing complex (RISC).
2. The RISC complex retains both strands of the siRNA to ensure maximum binding efficiency with the target mRNA.
3. Once the antisense strand of the siRNA binds to the target mRNA, the mRNA is cleaved and destroyed, preventing protein synthesis.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only

(d) 1, 2 and 3

Correct Answer: (b)
Explanation:

- **Statements 1 and 3 are correct.** siRNA fragments are loaded into a protein complex known as the RNA-induced silencing complex (RISC), a crucial step in the RNA interference (RNAi) pathway. This process, which often involves Dicer processing of longer dsRNA, leads to the separation of strands, where one strand (the guide) directs RISC to complementary mRNA targets, causing their degradation.
- **Statement 2 is incorrect:** RISC removes one strand (the passenger strand) and keeps only one strand (the guide strand) to pair with the target mRNA.

Biotechnology Applications

1. Consider the following statements regarding Recombinant DNA (rDNA) technology:

1. Recombinant DNA is a molecule created in vitro by combining DNA segments from different biological sources.
2. It involves isolating a target gene, inserting it into a vector, transferring this new DNA into a host organism and cloning it.

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Correct Answer: (c)
Explanation:

- **Statement 1 is correct:** Recombinant DNA technology specifically involves combining DNA from different sources to modify genetic makeup.
- **Statement 2 is correct:** It involves isolating a target gene, inserting it into a vector (like a plasmid or virus), transferring this new DNA into a host organism (bacteria/yeast), and cloning it. The technology alters the genome of an organism by adding new genes, deleting, or editing existing genes to produce desirable traits (e.g., insulin production, drought-resistant crops).

2. Consider the following statements:

1. Restriction enzymes are used as molecular scissors to cut DNA at non-specific, random sequences to ensure genetic diversity.
2. Plasmids are large, linear DNA molecules found inside the chromosomal DNA of most bacteria.
3. Biolistics is a method where DNA-coated metal particles are shot into plant cells to achieve transformation.

Which of the statements given above is/are correct?

(a) 1 and 2 only
(b) 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Correct Answer: (b)
Explanation:

- **Statement 1 is incorrect:** Restriction enzymes cut DNA at specific sequences, not random ones.

- **Statement 2 is incorrect:** Plasmids are small, circular, and found outside the chromosomal DNA.
- **Statement 3 is correct:** Biolistics (gene gun) is a valid method for inserting DNA into plant cells.

3. Consider the following statements regarding Mitochondrial Replacement Therapy (MRT):

1. The technique is primarily used to prevent the inheritance of serious diseases passed through maternal mitochondrial DNA.
2. In this process, the mother's nuclear DNA is transferred into a donor's healthy egg which has had its own nucleus removed.
3. The resulting embryo carries genetic material from two biological mothers and one biological father in equal proportions (33% each).

Which of the statements given above is/are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 only
(d) 1, 2 and 3

Correct Answer: (a)

Explanation:

- **Statements 1 and 2 are correct:** The goal is to replace diseased mitochondria (from the mother) with healthy ones (from a donor) while keeping the parents' nuclear DNA.
- **Statement 3 is incorrect:** The child carries the nuclear DNA of the two parents (>99%) and only the mitochondrial DNA of the donor (<1%). It is not an equal split.

4. Consider the following statements:

1. Maternal Spindle Transfer (MST) and Pronuclear Transfer (PNT) are the two most common techniques for creating three-parent babies.
2. In these techniques, healthy mitochondria are donated by the father to replace the mother's diseased organelles.
3. Mitochondrial replacement can only be performed after the egg has been successfully fertilized in vitro.

Which of the statements given above is/are correct?

(a) 1 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2 and 3

Correct Answer: (a)

Explanation:

- **Statement 1 is correct:** MST and PNT are indeed the primary techniques used.
- **Statement 2 is incorrect:** Healthy mitochondria come from a female donor's egg, not the father.
- **Statement 3 is incorrect:** It can be done either before or after IVF (MST is done before fertilization, PNT is done after).

5. Consider the following statements regarding regenerative medicine:

1. Stem cell therapy involves manipulating cells in a lab to specialize into specific types like heart muscle or nerve cells before implantation.
2. During the process, chemotherapy may be used to intentionally wipe out the patient's existing bone marrow to prepare for new stem cells.

3. Adult stem cells are preferred over embryonic ones because they can specialize into any cell type in the body without limitation.

Which of the statements given above is/are correct?

(a) 1 only
(b) 1 and 2 only
(c) 2 and 3 only
(d) 1, 2 and 3

Correct Answer: (b)

Explanation:

- **Statements 1 and 2 are correct:** These are standard steps in stem cell therapy/transplants.
- **Statement 3 is incorrect:** It is Embryonic stem cells that are pluripotent (can become any cell type); adult stem cells are generally more limited in their specialization.

6. Consider the following sources of stem cells:

1. Umbilical cord blood and Wharton's jelly.
2. Genetically reprogrammed adult somatic cells (Induced Pluripotent Stem Cells).
3. Mature red blood cells circulating in the heart.

Which of the sources mentioned above can be utilized for stem cell therapy?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Correct Answer: (a)

Explanation:

- **Sources 1 and 2 are correct:** Fetal tissues (like the cord) and reprogrammed somatic cells are major sources.
- **Source 3 is incorrect:** Mature red blood cells are specialized (differentiated) and do not have a nucleus or the ability to act as stem cells.

7. Match List I (Crop/Technology) with List II (Feature/Timeline):

List I (Crop/Technology)	**List II (Feature/Timeline)**
I. Bollgard I	A) Double-gene technology approved in 2006
II. Bollgard II	B) India's first commercial biotech crop (2002)
III. Golden Rice	C) Biofortified with Vitamin A
IV. Bt Cotton	D) Engineered with Bacillus thuringiensis genes

Select the correct match using the codes below:

(a) I-B, II-A, III-C, IV-D
(b) I-A, II-B, III-D, IV-C
(c) I-C, II-D, III-A, IV-B
(d) I-D, II-C, III-B, IV-A

Correct Answer: (a)
Explanation:

- **Bollgard I** (single-gene) was the first approved in 2002.
- **Bollgard II** (double-gene) followed in 2006.
- **Golden Rice** is designed to combat Vitamin A deficiency.
- **Bt Cotton** provides resistance to bollworms using soil bacteria genes.

8. Consider the following statements:

1. Bt Brinjal was developed by introducing the cry1Ac gene to provide resistance against the Fruit and Shoot Borer.
2. Roundup Ready soybeans are an example of herbicide-resistant crops that allow weed control without damaging the crop.
3. Gene silencing techniques are useful for research but cannot be used to create commercial transgenic crops.

Which of the statements given above is/are correct?
(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 only
(d) 1, 2 and 3

Correct Answer: (a)
Explanation:

- **Statements 1 and 2 are correct:** These are standard examples of pest and herbicide resistance in GM crops.
- **Statement 3 is incorrect:** Gene silencing is actively used as a technique to create transgenic crops.

9. Consider the following statements:

1. Micropropagation is used to ensure the rapid production of uniform and disease-free planting material.
2. Biofertilizers increase chemical input in soil by using synthetic nitrogen-fixing crystals.

Which of the statements given above is/are correct?
(a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Correct Answer: (a)
Explanation:

- **Statement 1 is correct:** This is the primary benefit of tissue culture/micropropagation.
- **Statement 2 is incorrect:** Biofertilizers are eco-friendly and reduce chemical input by using microbial cultures (like bacteria or fungi) to fix nitrogen naturally.

10. Consider the following statements:

1. Biofortification involves increasing the nutritional value of crops during the growing stage rather than during post-harvest processing.
2. Food fortification is the practice of adding vitamins and minerals to food during processing to address micronutrient deficiencies.
3. Zinc biofortification has been successfully applied to crops like wheat, rice, and sweet potatoes.

Which of the statements given above are correct?

(a) 1 and 2 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Correct Answer: (d)

Explanation:

- **All statements are correct:**
- **Biofortification** happens in the field (breeding/genetic modification).
- **Fortification** happens in the factory (adding nutrients to flour, oil, etc.).
- Zinc and Iron are major targets for biofortification projects globally.