

NEET-UG Biology Sample Paper-16

Duration: 1 Hour

Maximum Marks: 360

Instructions

- This paper contains a total of 90 Multiple Choice Questions.
- Each correct answer carries **+4 marks**.
- Each incorrect answer carries **-1 mark**.
- No negative marking for unattempted questions.

Q1. Which of the following is an example of taxonomic category?

- (A) Herbarium
- (B) Family
- (C) Museum
- (D) Key

Q2. Binomial nomenclature was introduced by:

- (A) Aristotle
- (B) Linnaeus
- (C) Darwin
- (D) Mendel

Q3. Which kingdom includes organisms with chitinous cell wall?

- (A) Monera
- (B) Protista
- (C) Fungi
- (D) Plantae

Q4. Viruses are considered non-living because they:

- (A) Lack DNA



- (B) Cannot reproduce outside host
- (C) Have protein coat
- (D) Infect cells

Q5. Which phylum has a water vascular system?

- (A) Mollusca
- (B) Echinodermata
- (C) Arthropoda
- (D) Annelida

Q6. Which tissue transports water in plants?

- (A) Phloem
- (B) Xylem
- (C) Cambium
- (D) Cortex

Q7. Which epithelial tissue is involved in diffusion?

- (A) Cuboidal
- (B) Columnar
- (C) Squamous
- (D) Stratified

Q8. The Haversian canal is found in:

- (A) Cartilage
- (B) Bone
- (C) Muscle
- (D) Blood

Q9. Which muscle shows no striations?



- (A) Skeletal
- (B) Cardiac
- (C) Smooth
- (D) Voluntary

Q10. Neurotransmitters are released at:

- (A) Axon terminal
- (B) Dendrite
- (C) Cell body
- (D) Node

Q11. Which organelle is called suicidal bag?

- (A) Lysosome
- (B) Golgi body
- (C) Mitochondria
- (D) Ribosome

Q12. Protein synthesis occurs at:

- (A) Ribosome
- (B) Lysosome
- (C) Vacuole
- (D) Plastid

Q13. Which phase of cell cycle involves DNA replication?

- (A) G₁
- (B) S
- (C) G₂
- (D) M



- Q14.** Centrioles are involved in:
- (A) Photosynthesis
 - (B) Cell division
 - (C) Respiration
 - (D) Secretion
- Q15.** Which component forms spindle fibers?
- (A) Microtubules
 - (B) Microfilaments
 - (C) Intermediate filaments
 - (D) Actin
- Q16.** Which pathway fixes CO_2 in dark reaction?
- (A) Glycolysis
 - (B) Calvin cycle
 - (C) Krebs cycle
 - (D) ETC
- Q17.** Which mineral is a component of chlorophyll?
- (A) Iron
 - (B) Magnesium
 - (C) Zinc
 - (D) Copper
- Q18.** Opening and closing of stomata is controlled by:
- (A) Guard cells
 - (B) Epidermal cells
 - (C) Xylem



(D) Phloem

Q19. Which hormone inhibits growth?

(A) Auxin

(B) Cytokinin

(C) ABA

(D) Gibberellin

Q20. Which process converts glucose into pyruvate?

(A) Glycolysis

(B) Krebs cycle

(C) ETC

(D) Fermentation

Q21. Which component carries oxygen in blood?

(A) Plasma

(B) Hemoglobin

(C) Platelets

(D) WBC

Q22. Blood pressure is measured using:

(A) Thermometer

(B) Sphygmomanometer

(C) Barometer

(D) Hygrometer

Q23. Which organ filters blood?

(A) Heart

(B) Kidney



(C) Liver

(D) Lung

Q24. ADH hormone acts on:

(A) Liver

(B) Kidney

(C) Heart

(D) Brain

Q25. Which part controls reflex action?

(A) Brain

(B) Spinal cord

(C) Cerebellum

(D) Hypothalamus

Q26. Ovulation is induced by:

(A) FSH

(B) LH

(C) Estrogen

(D) Progesterone

Q27. Embryo development occurs in:

(A) Ovary

(B) Uterus

(C) Cervix

(D) Vagina

Q28. Which structure nourishes embryo?

(A) Placenta



- (B) Ovary
- (C) Cervix
- (D) Oviduct

Q29. Which reproductive method produces clones?

- (A) Sexual
- (B) Asexual
- (C) Fertilization
- (D) Meiosis

Q30. Which stage follows morula?

- (A) Blastula
- (B) Zygote
- (C) Gastrula
- (D) Embryo

Q31. Alleles are:

- (A) Genes at same locus
- (B) Chromosomes
- (C) Proteins
- (D) RNA

Q32. Which is a recessive trait?

- (A) Expressed in heterozygous
- (B) Expressed in homozygous
- (C) Always dominant
- (D) Always visible



Q33. mRNA carries information for:

- (A) DNA replication
- (B) Protein synthesis
- (C) Lipid formation
- (D) Digestion

Q34. Which structure carries genetic material?

- (A) Chromosome
- (B) Ribosome
- (C) Lysosome
- (D) Vacuole

Q35. Variation arises due to:

- (A) Mutation
- (B) Recombination
- (C) Both
- (D) None

Q36. Penicillin is obtained from:

- (A) Bacteria
- (B) Fungi
- (C) Virus
- (D) Algae

Q37. Biogas contains mainly:

- (A) CO₂
- (B) Methane
- (C) Oxygen



(D) Nitrogen

Q38. Plasmids are found in:

(A) Bacteria

(B) Plants

(C) Animals

(D) Fungi

Q39. Transgenic organisms are produced by:

(A) Mutation

(B) Recombinant DNA

(C) Selection

(D) Hybridization

Q40. Which enzyme joins DNA fragments?

(A) Ligase

(B) Polymerase

(C) Helicase

(D) Restrictase

Q41. Food chain starts with:

(A) Consumers

(B) Producers

(C) Decomposers

(D) Carnivores

Q42. Which level is secondary consumer?

(A) Herbivore

(B) Carnivore



- (C) Producer
- (D) Decomposer

Q43. Which pollutant causes acid rain?

- (A) CO₂
- (B) SO₂
- (C) O₂
- (D) N₂

Q44. Ozone layer protects from:

- (A) Infrared
- (B) UV radiation
- (C) X-rays
- (D) Visible light

Q45. Which biome has highest biodiversity?

- (A) Desert
- (B) Tundra
- (C) Tropical rainforest
- (D) Grassland

Q46. Which statement regarding living organisms is incorrect?

- (A) Metabolism is a defining feature
- (B) Growth in living organisms is intrinsic
- (C) Reproduction is universal in all living organisms
- (D) Cellular organization is essential

Q47. Which of the following is correctly matched?

- (A) Mycoplasma – Cell wall present



- (B) Diatoms – Siliceous cell wall
- (C) Dinoflagellates – Cellulose wall absent
- (D) Euglena – Rigid cell wall

Q48. Which structure is common to both plant and animal cells?

- (A) Cell wall
- (B) Chloroplast
- (C) Mitochondria
- (D) Plastids

Q49. In which phylum is pseudocoelom present?

- (A) Annelida
- (B) Nematoda
- (C) Platyhelminthes
- (D) Arthropoda

Q50. Which organism shows metamerism?

- (A) Hydra
- (B) Earthworm
- (C) Cockroach
- (D) Starfish

Q51. Which cell organelle is involved in detoxification?

- (A) SER
- (B) RER
- (C) Golgi
- (D) Ribosome



- Q52.** Which is the correct sequence of phases in mitosis?
- (A) Prophase → Metaphase → Anaphase → Telophase
 - (B) Metaphase → Prophase → Anaphase → Telophase
 - (C) Prophase → Anaphase → Metaphase → Telophase
 - (D) Telophase → Prophase → Metaphase → Anaphase
- Q53.** Which process occurs during S phase?
- (A) RNA synthesis
 - (B) DNA replication
 - (C) Protein synthesis
 - (D) Chromosome separation
- Q54.** Which enzyme removes RNA primer during replication?
- (A) DNA polymerase I
 - (B) DNA polymerase III
 - (C) Ligase
 - (D) Helicase
- Q55.** Which bond stabilizes DNA double helix?
- (A) Ionic
 - (B) Hydrogen
 - (C) Covalent
 - (D) Peptide
- Q56.** Which enzyme is involved in CO₂ fixation in C₃ plants?
- (A) RuBisCO
 - (B) PEP carboxylase
 - (C) ATP synthase



(D) NADP reductase

Q57. Photorespiration occurs in:

(A) Only chloroplast

(B) Chloroplast and mitochondria

(C) Chloroplast, mitochondria and peroxisome

(D) Only peroxisome

Q58. Which factor affects transpiration most?

(A) Humidity

(B) Light

(C) Temperature

(D) Wind

Q59. Which is the end product of glycolysis?

(A) Acetyl CoA

(B) Pyruvate

(C) Glucose

(D) Lactate

Q60. Which molecule acts as final electron acceptor in aerobic respiration?

(A) NAD^+

(B) Oxygen

(C) CO_2

(D) ATP

Q61. Which blood group is universal donor?

(A) A

(B) B



- (C) AB
- (D) O

Q62. Which valve prevents backflow into left atrium?

- (A) Tricuspid
- (B) Bicuspid
- (C) Semilunar
- (D) Aortic

Q63. Which part of nephron is impermeable to water?

- (A) PCT
- (B) DCT
- (C) Ascending limb
- (D) Descending limb

Q64. Which neurotransmitter is involved in muscle contraction?

- (A) Dopamine
- (B) Serotonin
- (C) Acetylcholine
- (D) GABA

Q65. Which hormone increases blood glucose level?

- (A) Insulin
- (B) Glucagon
- (C) Thyroxine
- (D) Estrogen

Q66. Which stage of spermatogenesis is haploid?

- (A) Spermatogonia



- (B) Primary spermatocyte
- (C) Secondary spermatocyte
- (D) Spermatogonia and primary spermatocyte

Q67. Which hormone triggers parturition?

- (A) Oxytocin
- (B) Estrogen
- (C) Progesterone
- (D) LH

Q68. Which method involves blocking vas deferens?

- (A) Tubectomy
- (B) Vasectomy
- (C) IUD
- (D) Pills

Q69. Which stage forms blastocyst?

- (A) Morula
- (B) Zygote
- (C) Gastrula
- (D) Embryo

Q70. Which genotype produces 1:2:1 ratio?

- (A) Monohybrid cross
- (B) Dihybrid cross
- (C) Test cross
- (D) Back cross



- Q71.** Which process produces variation?
- (A) Mutation
 - (B) Crossing over
 - (C) Independent assortment
 - (D) All
- Q72.** Which base pairs with adenine in DNA?
- (A) Uracil
 - (B) Cytosine
 - (C) Thymine
 - (D) Guanine
- Q73.** Which scientist proposed double helix model?
- (A) Darwin
 - (B) Mendel
 - (C) Watson and Crick
 - (D) Pasteur
- Q74.** Which type of RNA carries amino acids?
- (A) mRNA
 - (B) tRNA
 - (C) rRNA
 - (D) snRNA
- Q75.** Natural selection favors:
- (A) Weak individuals
 - (B) Fit individuals
 - (C) Random individuals



(D) None

Q76. Which disease is caused by bacteria?

(A) Malaria

(B) Tuberculosis

(C) AIDS

(D) Dengue

Q77. Which organism produces ethanol?

(A) Lactobacillus

(B) Yeast

(C) Algae

(D) Virus

Q78. Which enzyme cuts DNA at specific sites?

(A) Ligase

(B) Restriction enzyme

(C) Polymerase

(D) Helicase

Q79. Which product is obtained from transgenic plants?

(A) Insulin

(B) Golden rice

(C) Antibiotics

(D) Vaccine

Q80. Which technique separates DNA fragments?

(A) PCR

(B) Gel electrophoresis



- (C) Cloning
- (D) Hybridization

Q81. Which trophic level has least energy?

- (A) Producers
- (B) Primary consumers
- (C) Secondary consumers
- (D) Tertiary consumers

Q82. Energy flow in ecosystem is:

- (A) Cyclic
- (B) Unidirectional
- (C) Random
- (D) Bidirectional

Q83. Which gas is released during photosynthesis?

- (A) CO₂
- (B) O₂
- (C) N₂
- (D) CH₄

Q84. Which organism is a decomposer?

- (A) Grass
- (B) Tiger
- (C) Bacteria
- (D) Deer

Q85. Which pollutant causes biomagnification?

- (A) DDT



- (B) CO₂
- (C) SO₂
- (D) NO₂

Q86. Which type of succession occurs after forest fire?

- (A) Primary
- (B) Secondary
- (C) Tertiary
- (D) None

Q87. Which level shows maximum biomass in aquatic ecosystem?

- (A) Producers
- (B) Primary consumers
- (C) Secondary consumers
- (D) Tertiary consumers

Q88. Which interaction benefits both species?

- (A) Parasitism
- (B) Commensalism
- (C) Mutualism
- (D) Predation

Q89. Which gas is most abundant in atmosphere?

- (A) Oxygen
- (B) Nitrogen
- (C) Carbon dioxide
- (D) Hydrogen



Q90. Which region has maximum primary productivity?

- (A) Desert
- (B) Tundra
- (C) Tropical rainforest
- (D) Grassland



Detailed Solutions**Q1.****Solution**

Concept: The distinction between taxonomic categories (ranks) and taxonomic aids (tools).

Solution: Taxonomy is the science of classifying organisms into a hierarchical structure. This structure consists of a series of ranks or levels called taxonomic categories. The main categories, in descending order, are Kingdom, Phylum, Class, Order, Family, Genus, and Species.

- **Family (B)** is one of these obligatory taxonomic categories. For example, humans belong to the Family Hominidae.
- A **Herbarium (A)** is a collection of preserved plant specimens and is a taxonomic aid for identification and study.
- A **Museum (C)** houses preserved specimens of plants and animals and is also a taxonomic aid.
- A **Key (D)** is a tool consisting of a series of contrasting characters used for identifying unknown organisms. It is a taxonomic aid.

Therefore, 'Family' is the only option that represents a taxonomic category.

Final Answer : "Family"

Answer: (B)



Q2.

Solution

Concept: The history of biological classification and nomenclature.

Solution: Binomial nomenclature is the formal system of naming organisms where each species is given a unique two-part Latin name. The first part is the genus name (capitalized), and the second is the specific epithet (lowercase).

- This system was consistently introduced and popularized by the Swedish botanist **Carolus Linnaeus (B)** in the 18th century, particularly in his works *Species Plantarum* (1753) and *Systema Naturae* (10th edition, 1758). He is often called the "Father of Modern Taxonomy."
- **Aristotle (A)** was an early Greek philosopher who made significant contributions to biology but did not create this system.
- **Darwin (C)** developed the theory of evolution by natural selection.
- **Mendel (D)** is the father of genetics.

Final Answer : "Linnaeus"

Answer: (B)

Q3.

Solution

Concept: The defining characteristics of the five kingdoms of life, particularly cell wall composition.

Solution: The composition of the cell wall is a key criterion used in the five-kingdom classification system.

- **Fungi (C):** The cell walls of organisms in the Kingdom Fungi are primarily composed of a complex polysaccharide called chitin. This distinguishes them from plants. They are also heterotrophic, obtaining nutrients by absorption.
- **Monera (A):** Includes prokaryotes like bacteria, whose cell walls are made of peptidoglycan.
- **Protista (B):** A diverse kingdom where some organisms have cell walls (e.g., cellulose in algae), while others do not (e.g., Amoeba).
- **Plantae (D):** Includes multicellular, autotrophic organisms whose cell walls are made of cellulose.

Final Answer : "Fungi"

Answer: (C)



Q4.

Solution

Concept: The characteristics of viruses that place them at the boundary of living and non-living entities.

Solution: Viruses exhibit characteristics of both living and non-living things. They are considered non-living when outside a host cell because they are inert and lack the machinery for metabolic processes.

- The key feature that defines their non-living nature is that they are obligate intracellular parasites. This means they **cannot reproduce outside a host cell (B)**. They completely lack their own ribosomes, enzymes, and other cellular machinery required for replication and protein synthesis. They must hijack the host cell's machinery to create new virus particles.
- They do have genetic material, which can be either DNA or RNA, so (A) is incorrect.
- Having a protein coat (C) and the ability to infect cells (D) are characteristics of viruses but do not explain why they are considered non-living. Their dependence on a host for reproduction is the critical reason.

Final Answer : "Cannot reproduce outside host"

Answer: (B)

Q5.

Solution

Concept: Unique and defining characteristics of major animal phyla.

Solution: The water vascular system is a unique and distinctive feature found exclusively in the phylum **Echinodermata (B)**, which includes organisms like starfish, sea urchins, and sea cucumbers.

- This system is a network of water-filled canals derived from the coelom. It is connected to the outside through a sieve-like plate called the madreporite.
- It functions as a hydraulic system, operating numerous small, flexible tube feet that are used for locomotion, food capture, and gas exchange.
- **Mollusca (A)** have a mantle and muscular foot. **Arthropoda (C)** have jointed appendages and an exoskeleton. **Annelida (D)** are characterized by body segmentation.

Final Answer : "Echinodermata"

Answer: (B)



Q6.

Solution

Concept: The structure and function of vascular tissues in plants.

Solution: Plants have a specialized vascular system for the transport of substances throughout the plant body. It consists of two main complex tissues: xylem and phloem.

- **Xylem (B):** This tissue is responsible for the transport of water and dissolved minerals from the roots up to the stems and leaves. This process is known as the ascent of sap. Xylem also provides mechanical support to the plant.
- **Phloem (A):** This tissue transports organic food materials, primarily sugars (like sucrose) produced during photosynthesis, from the leaves to other parts of the plant where they are needed for growth or storage. This process is called translocation.
- **Cambium (C)** is a meristematic tissue responsible for secondary growth (increase in girth).
- **Cortex (D)** is a region of ground tissue between the epidermis and the vascular cylinder.

Final Answer : “Xylem”

Answer: (B)

Q7.

Solution

Concept: The relationship between the structure and function of different types of epithelial tissue.

Solution: Epithelial tissues are classified based on the shape of their cells and the number of layers. Their structure is closely related to their function.

- **Squamous epithelium (C)** consists of a single layer of thin, flattened cells with irregular boundaries. This extreme thinness creates a very short path for substances to cross, making it ideally suited for forming boundaries where diffusion of gases or filtration of fluids occurs. It is found lining the alveoli of the lungs (for gas exchange) and blood vessels (endothelium).
- **Cuboidal (A)** and **Columnar (B)** epithelia are thicker and are typically involved in secretion and absorption.
- **Stratified epithelium (D)** consists of multiple layers of cells and its primary function is protection against mechanical and chemical stress.

Final Answer : “Squamous”

Answer: (C)



Q8.

Solution

Concept: The microscopic structure (histology) of compact bone.

Solution: Compact bone, the dense outer layer of bones, is organized into structural units called osteons or Haversian systems.

- Each Haversian system consists of concentric layers of calcified matrix, called lamellae, arranged around a central canal.
- This central canal is known as the **Haversian canal**. It runs longitudinally through the bone and contains blood vessels, nerves, and lymphatic vessels that supply the bone cells (osteocytes).
- Therefore, the Haversian canal is a characteristic feature found exclusively in **Bone (B)**.
- Cartilage (A) is avascular (lacks blood vessels), and muscle (C) and blood (D) have entirely different structures.

Final Answer : “Bone”

Answer: (B)

Q9.

Solution

Concept: The classification and microscopic appearance of the three types of muscle tissue.

Solution: Muscle tissues are classified into three types based on their structure, location, and function.

- **Skeletal muscle (A)** and **Cardiac muscle (B)** exhibit striations. These are alternating light and dark bands visible under a microscope, which result from the highly organized, repeating arrangement of contractile proteins (actin and myosin) into units called sarcomeres.
- **Smooth muscle (C)** lacks these striations because its actin and myosin filaments are not arranged in such a regular, repeating pattern. This gives it a "smooth" appearance. It is found in the walls of internal organs like the stomach, intestines, and blood vessels, and its contractions are involuntary.
- **Voluntary muscle (D)** is a functional term for skeletal muscle, which is striated.

Final Answer : “Smooth”

Answer: (C)



Q10.

Solution

Concept: The process of synaptic transmission between neurons.

Solution: Communication between neurons occurs at a specialized junction called a synapse. Information is transmitted from a presynaptic neuron to a postsynaptic neuron via chemical messengers called neurotransmitters.

- When an action potential (nerve impulse) travels down the axon of the presynaptic neuron, it reaches the end of the axon, known as the **axon terminal (A)** or synaptic knob.
- The arrival of the action potential at the axon terminal triggers the opening of voltage-gated calcium channels. The influx of calcium ions causes synaptic vesicles, which are filled with neurotransmitters, to fuse with the presynaptic membrane.
- This fusion releases the neurotransmitters into the synaptic cleft, the small gap between the two neurons.
- The dendrite (B) is typically the receiving part of the postsynaptic neuron.

Final Answer : “Axon terminal”

Answer: (A)

Q11.

Solution

Concept: The functions of various organelles within a eukaryotic cell.

Solution: Lysosomes are membrane-bound organelles that function as the cell’s waste disposal and recycling system.

- They contain a wide array of powerful hydrolytic enzymes that can break down various biomolecules like proteins, nucleic acids, carbohydrates, and lipids.
- They are nicknamed "suicidal bags" because of their role in autolysis (self-digestion). If a cell is damaged, old, or stressed beyond repair, the **lysosomal (A)** membranes may rupture, releasing these digestive enzymes into the cytoplasm.
- The enzymes then digest the cell’s own components, leading to programmed cell death.
- The Golgi body (B) is for packaging, Mitochondria (C) for respiration, and Ribosomes (D) for protein synthesis.

Final Answer : “Lysosome”

Answer: (A)



Q12.

Solution

Concept: The location of translation (protein synthesis) within the cell.

Solution: Protein synthesis is the process where the genetic information encoded in messenger RNA (mRNA) is used to create a specific sequence of amino acids, forming a polypeptide chain.

- This entire process, known as translation, is carried out by cellular structures called **ribosomes (A)**.
- Ribosomes are complex molecular machines made of ribosomal RNA (rRNA) and proteins. They read the sequence of codons on the mRNA molecule and facilitate the binding of transfer RNA (tRNA) molecules carrying the corresponding amino acids.
- Ribosomes can be found free in the cytoplasm or attached to the membrane of the endoplasmic reticulum.
- Lysosomes (B) are for digestion, Vacuoles (C) for storage, and Plastids (D) are involved in photosynthesis and storage in plants.

Final Answer : “Ribosome”

Answer: (A)

Q13.

Solution

Concept: The different phases of the eukaryotic cell cycle.

Solution: The cell cycle is an ordered series of events that leads to cell division and the production of two daughter cells. It is divided into two main stages: Interphase and the M (Mitotic) Phase. Interphase is the period of growth and preparation for division.

- Interphase is subdivided into three phases:
- **G₁ phase (A)** (Gap 1): The cell grows and carries out normal metabolic functions.
- **S phase (B)** (Synthesis): This is the phase during which the cell's **DNA is replicated**. At the beginning of S phase, each chromosome is single. By the end, each chromosome consists of two identical sister chromatids joined at the centromere.
- **G₂ phase (C)** (Gap 2): The cell continues to grow and prepares for mitosis.
- **M phase (D)** is when actual cell division (mitosis and cytokinesis) occurs.

Final Answer : “S”

Answer: (B)



Q14.

Solution

Concept: The role of centrioles in animal cell division.

Solution: Centrioles are small, cylindrical organelles found in the cytoplasm of most animal cells, located within a region called the centrosome. The centrosome acts as the primary microtubule-organizing center (MTOC) of the cell.

- The primary function of centrioles is their involvement in **cell division (B)**.
- Before mitosis begins, the centrioles replicate. The two resulting pairs of centrioles (each pair within a centrosome) move to opposite poles of the cell.
- From these poles, they organize the formation of the mitotic spindle, a structure made of microtubules. The spindle fibers are essential for attaching to and segregating the chromosomes correctly into the two daughter cells.
- Photosynthesis (A) occurs in chloroplasts, Respiration (C) in mitochondria, and Secretion (D) involves the ER and Golgi apparatus.

Final Answer : “Cell division”

Answer: (B)



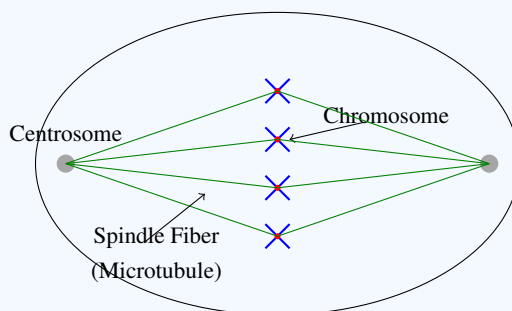
Q15.

Solution

Concept: The cytoskeleton is a network of protein filaments in the cytoplasm of eukaryotic cells that provides structural support and enables movement. Spindle fibers are a critical structure formed during cell division (mitosis and meiosis).

Solution: During cell division, spindle fibers are responsible for accurately segregating chromosomes to the daughter cells. These fibers are primarily composed of **microtubules**, which are hollow polymers of the protein tubulin. They emanate from organizing centers called centrosomes and attach to the chromosomes, pulling them apart.

- **Microfilaments**, made of the protein actin, are involved in other processes like muscle contraction, cell motility, and cytokinesis (the division of the cytoplasm).
- **Intermediate filaments** provide mechanical strength and support to cells and are not directly involved in forming the spindle.
- **Actin** is the protein subunit that forms microfilaments, not microtubules.



Final Answer : “Microtubules”

Answer: (A)



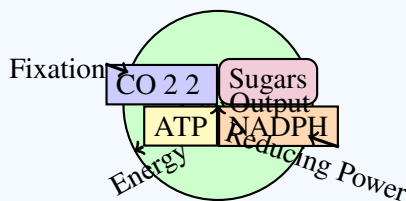
Q16.

Solution

Concept: Photosynthesis consists of two main stages: the light-dependent reactions, which capture light energy, and the light-independent reactions (dark reactions), which use that energy to synthesize sugars.

Solution: The **Calvin cycle** is the metabolic pathway that constitutes the dark reaction of photosynthesis. In this cycle, atmospheric carbon dioxide (CO_2) is captured and incorporated into organic molecules, a process known as carbon fixation. The cycle uses the energy (ATP) and reducing power (NADPH) produced during the light reactions to convert CO_2 into glucose and other sugars.

- **Glycolysis** is the initial step of cellular respiration, breaking down glucose.
- **Krebs cycle** is a central part of aerobic respiration, occurring after glycolysis.
- **ETC (Electron Transport Chain)** is used to generate ATP in both respiration and the light reactions of photosynthesis, but it does not fix CO_2 .



Final Answer : “Calvin cycle”

Answer: (B)



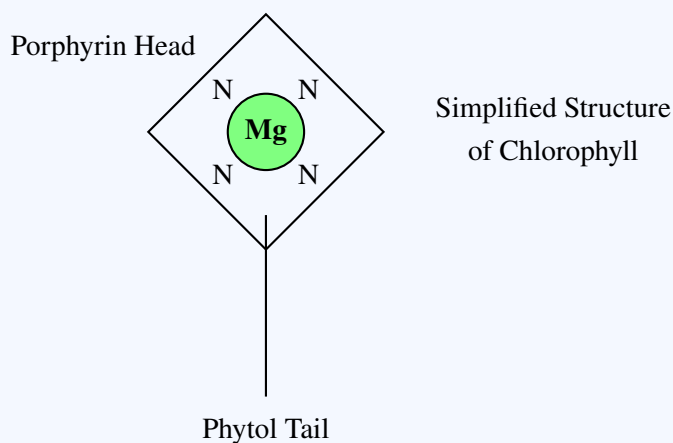
Q17.

Solution

Concept: Chlorophyll is the green pigment in plants that absorbs light energy for photosynthesis. Its molecular structure is key to this function.

Solution: The chlorophyll molecule has a complex structure called a porphyrin ring. At the center of this ring, coordinating with four nitrogen atoms, is a single ion of **Magnesium (Mg)**. This central magnesium atom is essential for the structure and electronic properties of the chlorophyll molecule, enabling it to absorb photons of light efficiently.

- **Iron (Fe)** is the central component of the heme group in hemoglobin, which carries oxygen in blood.
- **Zinc (Zn)** and **Copper (Cu)** serve as cofactors for many enzymes but are not the central atom in chlorophyll.



Final Answer : “Magnesium”

Answer: (B)



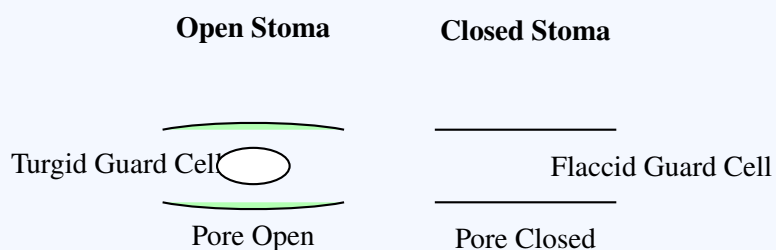
Q18.

Solution

Concept: Stomata (singular: stoma) are tiny pores on the surface of plant leaves that regulate gas exchange and transpiration.

Solution: The opening and closing of each stoma are controlled by a pair of specialized cells called **guard cells**. These cells can change their shape by altering their internal water pressure (turgor pressure). When guard cells absorb water and become turgid, they bow outwards, opening the pore between them. When they lose water and become flaccid, they shrink and come together, closing the pore. This mechanism allows the plant to balance its need for CO₂ for photosynthesis with the need to conserve water.

- **Epidermal cells** make up the outer layer of the leaf but do not control the stomatal aperture.
- **Xylem** and **Phloem** are vascular tissues for transport, not for controlling stomata.



Final Answer : “Guard cells”

Answer: (A)



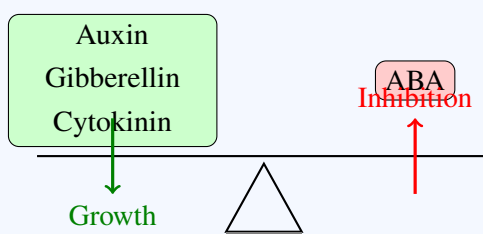
Q19.

Solution

Concept: Plant growth and development are regulated by a class of signaling molecules called phytohormones. These can act as either growth promoters or growth inhibitors.

Solution: **Absciscic acid (ABA)** is the primary growth-inhibiting hormone among the choices. It plays a crucial role in plant responses to environmental stress, such as drought. ABA promotes dormancy in seeds and buds and induces the closure of stomata to prevent water loss. It generally acts to slow down or stop growth processes.

- **Auxin, Cytokinin, and Gibberellin** are all well-known growth-promoting hormones. Auxin promotes cell elongation, cytokinin promotes cell division, and gibberellin promotes stem elongation and germination.



Final Answer : “ABA”

Answer: (C)



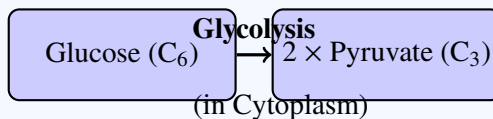
Q20.

Solution

Concept: Cellular respiration is the process cells use to break down glucose and other food molecules to generate ATP (energy). It begins with a key initial pathway.

Solution: **Glycolysis** is the universal metabolic pathway that converts a 6-carbon glucose molecule into two 3-carbon molecules of pyruvate. This process occurs in the cytoplasm of all living cells and generates a small amount of ATP and NADH. It is the first stage of cellular respiration and does not require oxygen. The pyruvate produced can then enter the Krebs cycle (if oxygen is present) or undergo fermentation (if oxygen is absent).

- **Krebs cycle** and **ETC** are later stages of aerobic respiration that occur after glycolysis.
- **Fermentation** is an anaerobic process that follows glycolysis.



Final Answer : “Glycolysis”

Answer: (A)



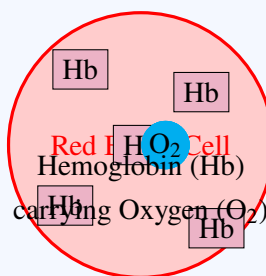
Q21.

Solution

Concept: Blood is responsible for transporting oxygen from the lungs to the tissues throughout the body. This is accomplished by a specialized protein.

Solution: Hemoglobin is the iron-containing protein found in red blood cells that is responsible for transporting the vast majority of oxygen in the blood. Each hemoglobin molecule can bind up to four oxygen molecules. This binding is reversible, allowing hemoglobin to pick up oxygen in the high-oxygen environment of the lungs and release it in the low-oxygen environment of the body's tissues.

- **Plasma**, the liquid component of blood, carries only a small amount of dissolved oxygen.
- **Platelets** are cell fragments involved in blood clotting.
- **WBCs (White Blood Cells)** are part of the immune system and fight infections.



Final Answer : “Hemoglobin”

Answer: (B)



Q22.

Solution

Concept: Blood pressure is a key vital sign indicating the force of blood pushing against artery walls. It is measured using a specific medical instrument.

Solution: The instrument used for measuring blood pressure is a **sphygmomanometer**. It consists of an inflatable cuff to collapse and then release the artery under the cuff in a controlled way, and a manometer (mercury or mechanical) to measure the pressure. The measurement is recorded as two numbers: systolic pressure over diastolic pressure, in units of millimeters of mercury (mmHg).

- A **thermometer** measures temperature.
- A **barometer** measures atmospheric pressure.
- A **hygrometer** measures humidity.

Final Answer : “Sphygmomanometer”

Answer: (B)



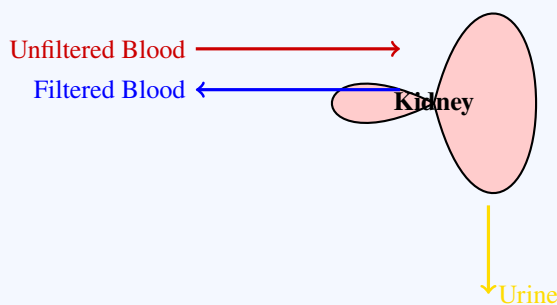
Q23.

Solution

Concept: The excretory system is responsible for removing metabolic wastes and excess substances from the body to maintain blood composition and volume.

Solution: The **kidneys** are a pair of bean-shaped organs that serve as the body's primary blood filtration system. Blood constantly flows through the kidneys, where millions of microscopic units called nephrons filter out waste products like urea, excess salts, and water. This waste fluid is collected as urine, while the purified blood is returned to circulation.

- The **Heart** is a muscular pump that circulates blood.
- The **Liver** has many metabolic functions, including detoxifying harmful substances, but it is not the primary filter for forming urine.
- The **Lungs** are organs for gas exchange (O and CO).



Final Answer : “Kidney”

Answer: (B)

Q24.

Solution

Concept: Hormones are chemical messengers that travel through the bloodstream to target specific organs and regulate physiological processes. ADH is crucial for water balance.

Solution: Antidiuretic Hormone (ADH), also known as vasopressin, is released from the posterior pituitary gland in response to dehydration or increased blood osmolarity. Its primary target organ is the **kidney**. ADH acts on the collecting ducts and distal tubules of the kidney's nephrons, increasing their permeability to water. This action promotes the reabsorption of water from the filtrate back into the blood, thereby conserving water, concentrating urine, and reducing its volume.

Final Answer : “Kidney”

Answer: (B)

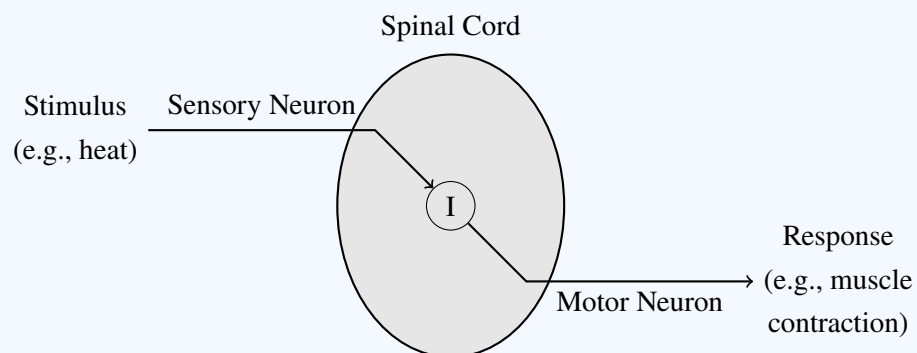


Q25.

Solution

Concept: A reflex action is an involuntary and nearly instantaneous movement in response to a stimulus. The neural circuit that directs this action is called a reflex arc.

Solution: While the brain is the center of conscious control, simple reflex actions are mediated primarily by the **spinal cord**. In a typical reflex arc (e.g., withdrawing your hand from a hot object), a sensory neuron transmits a signal from the point of stimulus directly to the spinal cord. Here, it synapses with an interneuron, which in turn activates a motor neuron. The motor neuron sends an impulse to a muscle, causing a contraction and response. This pathway is a shortcut that allows for an extremely rapid reaction, as the nerve impulse does not have to travel to the brain for processing before a response is initiated.



Final Answer : “Spinal cord”

Answer: (B)



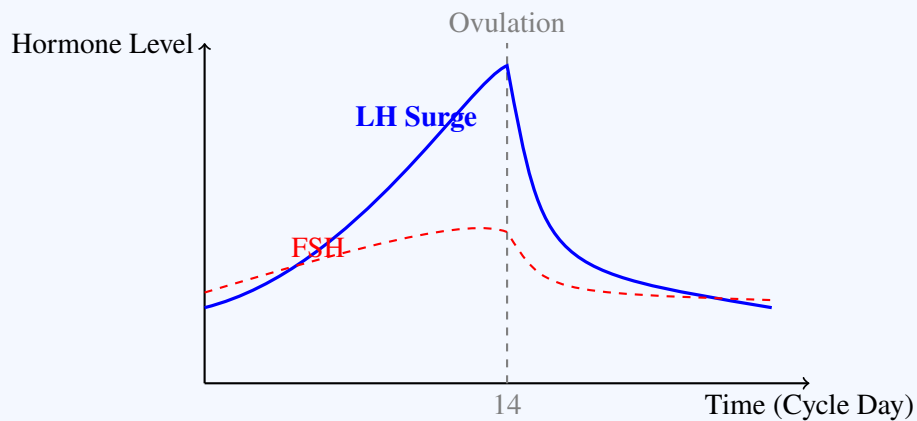
Q26.

Solution

Concept: Ovulation is the release of an egg from an ovary, a pivotal event in the female menstrual cycle regulated by hormones from the pituitary gland.

Solution: Ovulation is directly triggered by a sharp and sudden peak in the secretion of **Luteinizing Hormone (LH)** from the anterior pituitary gland. This event, known as the "LH surge," typically occurs around day 14 of a 28-day cycle. The surge is itself caused by high levels of estrogen produced by the maturing ovarian follicle. The LH surge provides the final signal for the egg to complete maturation and for the follicle to rupture and release the egg.

- **FSH (Follicle-Stimulating Hormone)** stimulates the initial growth of follicles.
- **Estrogen** levels rise as the follicle grows, preparing the uterus and eventually triggering the LH surge.
- **Progesterone** levels rise after ovulation to maintain the uterine lining.



Final Answer : "LH"

Answer: (B)

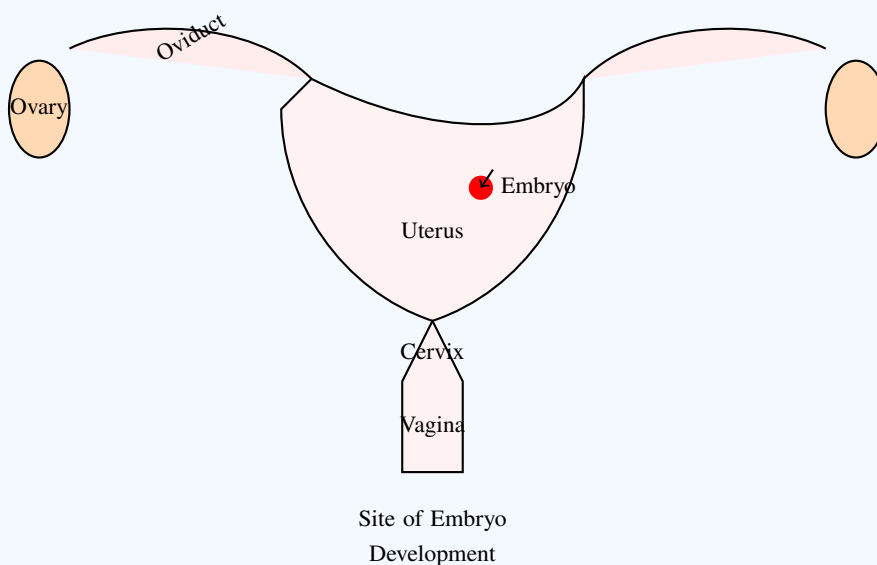


Q27.

Solution

Concept: Human embryonic and fetal development site.

Solution: In human reproduction, fertilization typically occurs in the oviduct (Fallopian tube). The resulting zygote undergoes several cell divisions to become an embryo as it travels towards the uterus. The embryo then implants into the wall of the uterus, known as the endometrium. The uterus is a muscular organ that provides a protected, nutrient-rich environment for the embryo to develop into a fetus and grow until birth. The ovary produces eggs, the cervix is the lower opening of the uterus, and the vagina is the birth canal.



Final Answer : “Uterus”

Answer: (B)

Q28.

Solution

Concept: Maternal-fetal nutrient exchange.

Solution: The placenta is a temporary organ that develops in the uterus during pregnancy. It is the vital link between the mother and the developing embryo (and later, fetus). The placenta attaches to the wall of the uterus, and the fetus’s umbilical cord arises from it. It facilitates the transport of oxygen and essential nutrients (like glucose, amino acids, vitamins) from the mother’s blood to the embryo and allows waste products (like carbon dioxide and urea) to pass from the embryo back to the mother’s blood for excretion. Thus, the placenta is the primary structure that nourishes the embryo.

Final Answer : “Placenta”

Answer: (A)



Q29.

Solution**Concept:** Modes of reproduction and genetic identity.**Solution:** Clones are organisms that are genetically identical. Asexual reproduction is a mode of reproduction that involves a single parent. The offspring arise from the cells of that one parent and inherit its genes directly without any fusion of gametes. As a result, the offspring are genetically identical to the parent and to each other, i.e., they are clones. Examples include binary fission in bacteria and budding in hydra. In contrast, sexual reproduction involves the fusion of gametes from two parents, leading to genetic recombination and producing genetically unique offspring.**Final Answer :** “Asexual”**Answer: (B)**

Q30.

Solution**Concept:** Sequence of early embryonic development.**Solution:** The development of an embryo begins with a single-celled zygote, formed after fertilization. The zygote undergoes a series of rapid mitotic divisions called cleavage. This process increases the cell number without significant overall growth. The first key stage is the morula, which is a solid ball of 16-32 cells. The cells of the morula then rearrange themselves to form a hollow, fluid-filled ball of cells called the blastula (or blastocyst in mammals). Therefore, the blastula stage directly follows the morula stage. The gastrula stage follows the blastula.

Zygote → Morula → Blastula → Gastrula

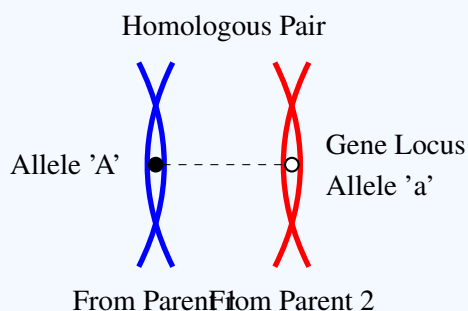
Final Answer : “Blastula”**Answer: (A)**

Q31.

Solution

Concept: Fundamental terminology of genetics.

Solution: An allele is one of two or more alternative forms of a gene that arise by mutation and are found at the same place (locus) on a chromosome. For each gene, an individual inherits two alleles, one from each parent. These alleles can be the same (homozygous) or different (heterozygous). For example, the gene for pea plant flower color has a purple allele (P) and a white allele (p). These are different versions of the same gene located at the same locus on homologous chromosomes.



Final Answer : “Genes at same locus”

Answer: (A)

Q32.

Solution

Concept: Mendelian inheritance patterns (Dominance and Recessiveness).

Solution: In genetics, traits are determined by alleles. A recessive allele only produces its characteristic trait or phenotype when the individual has two identical copies of that allele; that is, they are homozygous recessive (e.g., 'aa'). If the individual is heterozygous (e.g., 'Aa'), the dominant allele ('A') will mask the effect of the recessive allele ('a'), and the dominant trait will be expressed. Therefore, a recessive trait is only visible or expressed in the homozygous state.

Final Answer : “Expressed in homozygous”

Answer: (B)

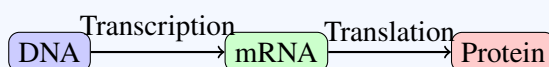


Q33.

Solution

Concept: The Central Dogma of Molecular Biology.

Solution: The flow of genetic information in a cell is described by the central dogma: DNA is transcribed into messenger RNA (mRNA), and mRNA is translated into protein. The DNA holds the permanent genetic blueprint. To create a protein, the relevant gene sequence on the DNA is copied into a temporary mRNA molecule (transcription). This mRNA molecule then travels from the nucleus to a ribosome in the cytoplasm. The ribosome reads the information on the mRNA in three-letter codes (codons) and assembles the corresponding amino acids in the correct order to build a specific protein (translation). Thus, mRNA carries the information for protein synthesis.



Final Answer : “Protein synthesis”

Answer: (B)

Q34.

Solution

Concept: Organization of genetic material within a eukaryotic cell.

Solution: The genetic material of an organism is DNA (Deoxyribonucleic acid). In eukaryotic cells (like those in plants and animals), the vast majority of DNA is located in the cell nucleus. To fit within the nucleus and to be managed during cell division, this long DNA molecule is highly organized and compacted. It is wrapped around proteins called histones to form a complex called chromatin. During cell division, chromatin condenses further to form distinct, visible structures called chromosomes. Therefore, chromosomes are the structures that carry the genetic material. Ribosomes synthesize proteins, lysosomes digest waste, and vacuoles are for storage.

Final Answer : “Chromosome”

Answer: (A)



Q35.

Solution**Concept:** Sources of genetic variation in a population.**Solution:** Genetic variation is the diversity in gene frequencies and is essential for evolution by natural selection. There are two primary sources of genetic variation: 1. **Mutation:** A change in the DNA sequence. This is the ultimate source of new alleles in a population, creating novel genetic material. 2. **Recombination:** The shuffling of existing alleles into new combinations during sexual reproduction. This occurs mainly through crossing over between homologous chromosomes and independent assortment during meiosis. Since both mutation (creation of new alleles) and recombination (shuffling of existing alleles) contribute to the overall genetic variation, the correct answer is 'Both'.**Final Answer :** "Both"**Answer:** (C)

Q36.

Solution**Concept:** Origin of antibiotics.**Solution:** Penicillin is one of the first and most famous antibiotics. It was discovered in 1928 by Scottish scientist Alexander Fleming. He observed that on a contaminated petri dish, the growth of *Staphylococcus* bacteria was inhibited in the area surrounding a mold. This mold was later identified as *Penicillium rubens* (previously *P. notatum* or *P. chrysogenum*), which is a type of fungus. The substance produced by the fungus that killed the bacteria was isolated and named penicillin. Many antibiotics are naturally produced by microorganisms, especially fungi and bacteria, as a means of competing with other microbes.**Final Answer :** "Fungi"**Answer:** (B)

Q37.

Solution**Concept:** Composition of biogas.

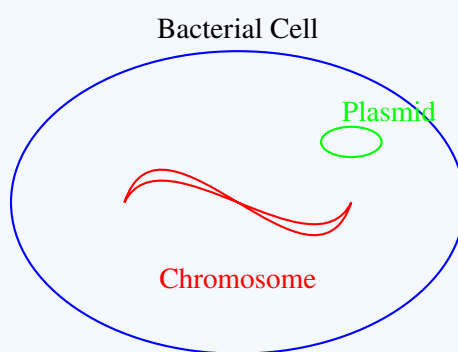
Solution: Biogas is a renewable fuel produced from the breakdown of organic matter (such as agricultural waste, manure, and sewage) in the absence of oxygen, a process called anaerobic digestion. It is a mixture of gases, but its primary and most valuable component is methane (CH₄), which typically makes up 50-75% of the total volume. Methane is a potent greenhouse gas but is also the main component of natural gas, making biogas a useful fuel for heating, cooking, and electricity generation. The other major component is carbon dioxide (CO₂), with smaller amounts of other gases.

Final Answer : “Methane”**Answer:** (B)

Q38.

Solution**Concept:** Extrachromosomal DNA elements in prokaryotes.

Solution: Plasmids are small, circular, double-stranded DNA molecules that are separate from the main chromosomal DNA. They are most commonly found in bacteria, but can also be present in some archaea and eukaryotes like yeast. In bacteria, plasmids replicate independently and often carry genes that provide a selective advantage, such as antibiotic resistance, toxin production, or resistance to heavy metals. Because of their ability to be easily transferred and manipulated, plasmids are fundamental tools in molecular biology and genetic engineering, where they are used as vectors to carry and clone foreign DNA.

**Final Answer :** “Bacteria”**Answer:** (A)

Q39.

Solution

Concept: Genetic engineering and genetically modified organisms (GMOs).

Solution: A transgenic organism is one that has had foreign DNA artificially introduced into its genome. This process is achieved through genetic engineering, specifically using recombinant DNA technology. This technology allows scientists to cut a specific gene from one organism and paste it into the DNA of another organism. The resulting combined DNA is called recombinant DNA. When an organism incorporates this recombinant DNA into its own genetic material, it becomes transgenic. This is different from mutation (random DNA changes), traditional hybridization, and selection (breeding for desired traits without direct DNA manipulation).

Final Answer : “Recombinant DNA”

Answer: (B)

Q40.

Solution

Concept: Enzymes used in recombinant DNA technology.

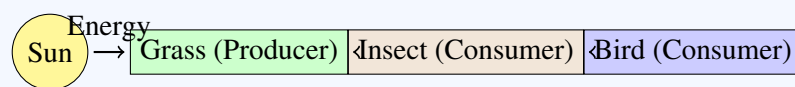
Solution: In molecular cloning and genetic engineering, several enzymes play crucial roles. Restriction enzymes (restrictases) act as 'molecular scissors' to cut DNA at specific sequences. After a desired DNA fragment (e.g., a gene) is cut and isolated, it is inserted into a vector (like a plasmid) that has been cut with the same restriction enzyme. To permanently join the DNA fragment into the vector, the enzyme DNA ligase is used. DNA ligase acts as 'molecular glue' by forming phosphodiester bonds, which seals the nicks in the DNA backbone, creating a single, continuous, recombinant DNA molecule. Polymerase synthesizes DNA, and helicase unwinds it.

Final Answer : “Ligase”

Answer: (A)



Q41.

Solution**Concept:** Trophic structure and energy flow in ecosystems.**Solution:** A food chain illustrates the pathway of energy transfer in an ecosystem. The energy for almost all ecosystems on Earth originates from the sun. This light energy is captured and converted into chemical energy (food) by producers through photosynthesis. Producers, also known as autotrophs, are organisms like plants, algae, and some bacteria. They form the first trophic level and are the foundation of the food chain. Consumers (heterotrophs) obtain energy by eating other organisms. Primary consumers eat producers, secondary consumers eat primary consumers, and so on. Therefore, every food chain begins with a producer.**Final Answer :** “Producers”**Answer:** (B)

Q42.

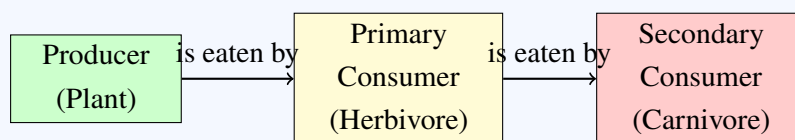
Solution

Concept: Trophic levels and energy flow in an ecosystem.

Solution: A food chain describes how energy is transferred from one organism to another. The levels are called trophic levels.

- **First Trophic Level:** Producers (e.g., plants) that produce their own food from sunlight.
- **Second Trophic Level:** Primary Consumers. These are herbivores that eat producers.
- **Third Trophic Level:** Secondary Consumers. These are carnivores or omnivores that eat primary consumers (herbivores).
- **Fourth Trophic Level:** Tertiary Consumers. These are carnivores that eat other carnivores (secondary consumers).

A herbivore is a primary consumer. A carnivore that eats a herbivore is a secondary consumer. Decomposers break down dead organic matter at all levels. Therefore, a carnivore occupies the level of a secondary consumer (and potentially higher levels as well).



Final Answer : “Carnivore”

Answer: (B)

Q43.

Solution

Concept: Chemical causes of acid rain.

Solution: Acid rain is a form of precipitation with high levels of nitric and sulfuric acids. It is primarily caused by industrial emissions of certain pollutants, mainly sulfur dioxide (SO) and nitrogen oxides (NO). These gases are released into the atmosphere from the burning of fossil fuels in power plants, factories, and vehicles. In the atmosphere, they react with water, oxygen, and other chemicals to form sulfuric acid (HSO) and nitric acid (HNO). These acids then mix with water and other materials before falling to the ground. While CO does form weak carbonic acid, SO is a major precursor to the strong acids that cause significant environmental damage known as acid rain.

Final Answer : “SO”

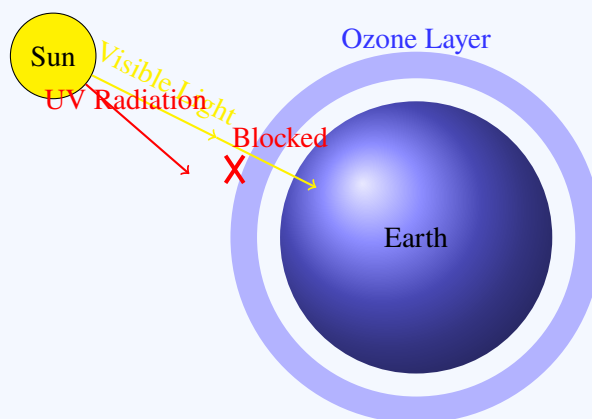
Answer: (B)



Q44.

Solution**Concept:** Function of the stratospheric ozone layer.

Solution: The ozone layer is a region of Earth's stratosphere that absorbs most of the Sun's harmful ultraviolet (UV) radiation. It contains a high concentration of ozone (O₃) in relation to other parts of the atmosphere. Specifically, the ozone layer is most effective at absorbing UVB radiation, which can cause skin cancer, cataracts, and immune system damage in humans, as well as harm to plants and aquatic life. It protects life on Earth by preventing this dangerous radiation from reaching the surface. Infrared radiation is mainly associated with heat, while X-rays are absorbed much higher in the atmosphere. Visible light passes through to the surface.

**Final Answer :** “UV radiation”**Answer:** (B)

Q45.

Solution**Concept:** Biodiversity across major terrestrial biomes.

Solution: Biodiversity refers to the variety of life in an ecosystem. The tropical rainforest biome exhibits the highest terrestrial biodiversity on the planet. These biomes are found near the equator and are characterized by consistently high temperatures and heavy rainfall throughout the year. This stable, warm, and wet environment provides ideal conditions for a vast array of plant species to thrive, which in turn supports an incredibly diverse range of animals, insects, fungi, and microorganisms. Other biomes like deserts and tundra have extreme climatic conditions (lack of water, extreme temperatures) that limit the number of species that can survive there. Grasslands have moderate biodiversity but are far less diverse than tropical rainforests.

Final Answer : “Tropical rainforest”**Answer:** (C)

Q46.

Solution

Concept: Defining characteristics of living organisms.

Solution: To be considered a defining feature of life, a characteristic must be present in all living organisms and absent in non-living things.

- **Metabolism** (the sum of all chemical reactions) is a defining feature as it occurs in all living cells and not in non-living objects.
- **Intrinsic growth** (growth from within) is a characteristic of living things, distinguishing it from the extrinsic growth (accretion) of non-living things.
- **Cellular organization** is a defining feature as all known life forms are composed of one or more cells.
- **Reproduction**, while a fundamental characteristic of life, is not universal for every individual living organism. For example, sterile individuals like mules or worker bees are alive but cannot reproduce. Therefore, reproduction is characteristic of living populations, but not a defining feature for every individual organism.

Thus, the statement that reproduction is universal in all living organisms is incorrect.

Final Answer : “Reproduction is universal in all living organisms”

Answer: (C)

Q47.

Solution

Concept: Cellular characteristics of different groups of microorganisms.

Solution:

- **A. Mycoplasma:** These are a genus of bacteria that are unique because they naturally lack a cell wall. So, the match is incorrect.
- **B. Diatoms:** These are a type of algae (Kingdom Protista) famous for their intricate cell walls, called frustules, which are composed of silica (silicon dioxide). This match is correct.
- **C. Dinoflagellates:** These are another group of protists that typically have a cell wall composed of stiff cellulose plates. The statement says the cellulose wall is absent, so it is incorrect.
- **D. Euglena:** This protist lacks a rigid cell wall. Instead, it has a flexible proteinaceous layer called a pellicle, which allows it to change shape. So, the match is incorrect.

Final Answer : “Diatoms – Siliceous cell wall”

Answer: (B)



Q48.

Solution

Concept: Comparison of eukaryotic plant and animal cell structures.

Solution: Both plant and animal cells are eukaryotic and share many organelles. However, there are key differences.

- **Cell wall:** Present in plant cells, providing structural support. Absent in animal cells.
- **Chloroplast:** Present in plant cells for photosynthesis. Absent in animal cells.
- **Plastids:** A group of organelles including chloroplasts, found in plants, but not in animals.
- **Mitochondria:** Known as the "powerhouses" of the cell, they are the site of cellular respiration and ATP production. They are essential for providing energy and are found in both plant and animal cells.

Therefore, mitochondria are a common structure to both cell types.

Final Answer : "Mitochondria"

Answer: (C)

Q49.

Solution

Concept: Types of body cavities (coelom) in animal phyla.

Solution: The coelom is the main body cavity in most multicellular animals. Its arrangement is a key feature for classifying animal phyla.

- **Acoelomates:** Have no body cavity. Example: Phylum Platyhelminthes (flatworms).
- **Pseudocoelomates:** Have a "false" body cavity called a pseudocoelom, which is not fully lined by mesodermal tissue. Example: Phylum Nematoda (roundworms).
- **Eucoelomates:** Have a true coelom, a fluid-filled cavity that is completely lined by tissue derived from the mesoderm. Examples: Phyla Annelida, Arthropoda, Chordata.

Based on this classification, the phylum Nematoda is characterized by the presence of a pseudo-coelom.

Final Answer : "Nematoda"

Answer: (B)



Q50.

Solution

Concept: Body segmentation (metamerism) in animals.

Solution: Metamerism, or segmentation, is the division of the body into a series of similar, repetitive segments arranged along a longitudinal axis.

- **Hydra (Phylum Cnidaria):** Has a simple, radially symmetric body plan with no segmentation.
- **Earthworm (Phylum Annelida):** Is the classic example of metamerism. Its body is clearly divided both externally and internally into a series of repeating segments called metameres.
- **Cockroach (Phylum Arthropoda):** Also shows segmentation, but it is more specialized (heteronomous), with segments grouped into distinct body regions (head, thorax, abdomen). This is a form of metamerism. However, the earthworm is the quintessential example of true, homonomous metamerism.
- **Starfish (Phylum Echinodermata):** Has a pentaradial symmetric body plan with no segmentation.

The earthworm is the best example of an organism with clear metameric segmentation among the given choices.

Final Answer : “Earthworm”

Answer: (B)



Q51.

Solution**Concept:** Functions of cellular organelles.**Solution:**

- **SER (Smooth Endoplasmic Reticulum):** This organelle has diverse functions, including lipid synthesis, steroid hormone production, and, very importantly, detoxification of harmful substances like drugs and poisons. Liver cells, for instance, have abundant SER to carry out this function.
- **RER (Rough Endoplasmic Reticulum):** Its surface is studded with ribosomes, and its primary role is in the synthesis and modification of proteins that will be secreted or embedded in membranes.
- **Golgi apparatus:** Modifies, sorts, and packages proteins and lipids into vesicles for transport to other destinations.
- **Ribosome:** The site of protein synthesis (translation).

Therefore, the smooth ER is the organelle primarily involved in detoxification.

Final Answer : “SER”**Answer:** (A)

Q52.

Solution

Concept: The sequence of stages in mitotic cell division.

Solution: Mitosis is the process of nuclear division in eukaryotic cells, which occurs in four sequential phases:

- (a) **Prophase:** The chromatin condenses into visible chromosomes, and the nuclear envelope begins to break down.
- (b) **Metaphase:** The chromosomes, fully condensed, align along the cell's equator, known as the metaphase plate.
- (c) **Anaphase:** The sister chromatids of each chromosome are pulled apart by the spindle fibers and move to opposite poles of the cell.
- (d) **Telophase:** The chromosomes arrive at the poles, decondense back into chromatin, and new nuclear envelopes form around the two sets of chromosomes.

This is typically followed by cytokinesis, the division of the cytoplasm. The correct order is Prophase → Metaphase → Anaphase → Telophase.

Prophase → Metaphase → Anaphase → Telophase

Final Answer : “Prophase → Metaphase → Anaphase → Telophase”

Answer: (A)



Q53.

Solution

Concept: Events of the eukaryotic cell cycle.

Solution: The cell cycle consists of two main periods: interphase and the M phase (mitosis). Interphase is the period of growth and preparation for division and is subdivided into three phases:

- **G phase (Gap 1):** The cell grows and synthesizes proteins and RNA. It carries out its normal metabolic functions.
- **S phase (Synthesis):** The crucial event of this phase is the replication of the cell's DNA. Each chromosome is duplicated to form two identical sister chromatids.
- **G phase (Gap 2):** The cell continues to grow and produces proteins and organelles needed for cell division.

Therefore, DNA replication is the hallmark process of the S phase.

Final Answer : "DNA replication"

Answer: (B)

Q54.

Solution

Concept: Enzymes involved in DNA replication.

Solution: DNA replication is a complex process involving several key enzymes. DNA polymerases can only add nucleotides to a pre-existing 3' end, so an RNA primer is required to start synthesis.

- **Helicase:** Unwinds the DNA double helix.
- **DNA polymerase III:** The primary enzyme for synthesizing the new DNA strand in E. coli.
- **DNA polymerase I (in prokaryotes):** Has a dual function. It has a 5' → 3' exonuclease activity that allows it to remove the RNA primer from the beginning of each Okazaki fragment on the lagging strand (and from the start of the leading strand). It then uses its 5' → 3' polymerase activity to fill in the resulting gap with DNA nucleotides.
- **Ligase:** Joins the DNA fragments (Okazaki fragments) together by forming phosphodiester bonds.

Thus, DNA polymerase I is responsible for removing the RNA primer.

Final Answer : "DNA polymerase I"

Answer: (A)

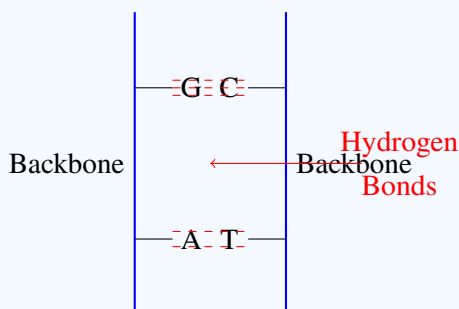


Q55.

Solution**Concept:** Chemical bonds in the structure of DNA.**Solution:** The DNA double helix is a stable structure due to two types of chemical bonds.

- (a) **Covalent Bonds:** Strong phosphodiester bonds link the sugar of one nucleotide to the phosphate group of the next, forming the sugar-phosphate backbone of each strand.
- (b) **Hydrogen Bonds:** Weaker hydrogen bonds form between the complementary nitrogenous bases on the two opposite strands (two H-bonds between Adenine and Thymine, and three H-bonds between Guanine and Cytosine).

While the covalent bonds create the integrity of each strand, it is the collective force of the numerous hydrogen bonds between the strands that holds the entire double helix structure together. These bonds are weak enough to be broken for replication and transcription.

**Final Answer :** “Hydrogen”**Answer:** (B)

Q56.

Solution

Concept: Carbon fixation in C photosynthesis.

Solution: Carbon fixation is the process by which inorganic carbon (like CO) is converted into organic compounds by living organisms. In C plants, this process is the first step of the Calvin cycle.

- **RuBisCO (Ribulose-1,5-bisphosphate carboxylase/oxygenase):** This is the enzyme that catalyzes the initial carbon fixation step in C plants. It combines one molecule of CO with a five-carbon sugar called ribulose-1,5-bisphosphate (RuBP). The resulting six-carbon intermediate immediately splits into two molecules of the three-carbon compound, 3-phosphoglycerate (3-PGA).
- **PEP carboxylase:** This is the primary enzyme for carbon fixation in C and CAM plants, which have adaptations to minimize water loss.

Therefore, RuBisCO is the key enzyme for CO fixation in the C pathway.

Final Answer : “RuBisCO”

Answer: (A)



Q57.

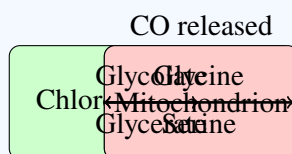
Solution

Concept: The cellular location of the photorespiration pathway.

Solution: Photorespiration is a metabolic pathway that occurs in photosynthetic organisms when the enzyme RuBisCO acts on oxygen rather than carbon dioxide. This process is considered wasteful as it consumes energy (ATP) and releases previously fixed CO, thus reducing the efficiency of photosynthesis. The complex pathway of photorespiration requires the coordinated action of three separate organelles within the plant cell:

- Chloroplast:** The process starts here when RuBisCO binds O. Glycolate is produced and exported.
- Peroxisome:** Glycolate is converted to glycine.
- Mitochondrion:** Two molecules of glycine are converted to one molecule of serine, releasing CO.

The serine then travels back through the peroxisome to the chloroplast to be recycled into the Calvin cycle.



Final Answer : “Chloroplast, mitochondria and peroxisome”

Answer: (C)



Q58.

Solution

Concept: Environmental factors influencing the rate of transpiration in plants.

Solution: Transpiration is the process of water vapor loss from plants, primarily through stomata in the leaves. Several environmental factors affect its rate, but the most critical is the water vapor pressure gradient (or water potential gradient) between the moist interior of the leaf and the surrounding air.

- **Humidity:** The relative humidity of the air is a direct measure of its water vapor content. When humidity is low (dry air), the water potential gradient is steep, causing rapid diffusion of water vapor out of the leaf and a high rate of transpiration. When humidity is high, the gradient is shallow, and transpiration slows down significantly. This makes humidity the most direct and influential factor controlling the rate.
- **Light, Temperature, and Wind:** These factors are also important, but they often act by modifying the humidity gradient. Light opens stomata, temperature increases the kinetic energy of water molecules, and wind removes the layer of humid air (boundary layer) from the leaf surface. However, the ultimate rate is still dictated by the difference in water vapor concentration, i.e., the humidity gradient.

Final Answer : “Humidity”

Answer: (A)



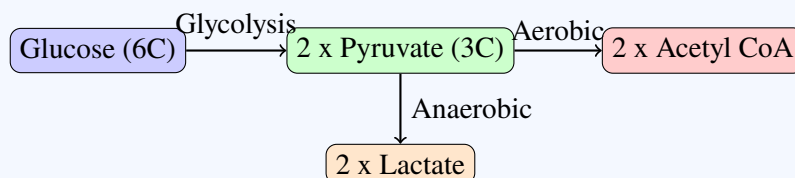
Q59.

Solution

Concept: The initial stage of cellular respiration, glycolysis.

Solution: Glycolysis is the first metabolic pathway of cellular respiration, occurring in the cytoplasm of the cell. It is a sequence of ten enzyme-catalyzed reactions that breaks down one molecule of glucose (a 6-carbon sugar) into two molecules of pyruvate (a 3-carbon molecule). This process does not require oxygen and results in a net production of 2 ATP and 2 NADH molecules.

- **Glucose** is the starting substrate.
- **Pyruvate** is the end product of the glycolytic pathway.
- **Acetyl CoA** is formed from pyruvate in the subsequent link reaction before the Krebs cycle.
- **Lactate** is formed from pyruvate during anaerobic fermentation, which occurs when oxygen is not available.



Final Answer : “Pyruvate”

Answer: (B)

Q60.

Solution

Concept: The role of the electron transport chain in aerobic respiration.

Solution: In aerobic respiration, the electron transport chain (ETC) is the final stage where the majority of ATP is produced. High-energy electrons, carried by NADH and FADH, are passed along a series of protein complexes embedded in the inner mitochondrial membrane. As electrons move down the chain, they lose energy, which is used to pump protons (H) across the membrane, creating a proton gradient. At the very end of this process, the de-energized electrons must be removed from the chain. In aerobic organisms, molecular **oxygen (O)** serves as the final electron acceptor. It combines with the electrons and protons to form water (HO). Without oxygen to accept the electrons, the entire chain would back up and stop, halting ATP production.

Final Answer : “Oxygen”

Answer: (B)



Q61.

Solution

Concept: The ABO blood group system and principles of blood transfusion.

Solution: The ABO blood group system is based on the presence or absence of specific antigens (A and B) on the surface of red blood cells (RBCs). A person's plasma contains antibodies against the antigens that are not present on their own RBCs.

- **Type A:** A antigens, anti-B antibodies.
- **Type B:** B antigens, anti-A antibodies.
- **Type AB:** Both A and B antigens, no antibodies. Universal recipient.
- **Type O:** No A or B antigens, both anti-A and anti-B antibodies.

A universal donor is a person whose blood can be safely transfused to a recipient of any ABO blood type. Since the RBCs of a Type O individual lack both A and B antigens, they will not be attacked by the recipient's anti-A or anti-B antibodies. Therefore, Type O blood is considered the universal donor.

Final Answer : "O"

Answer: (D)



Q62.

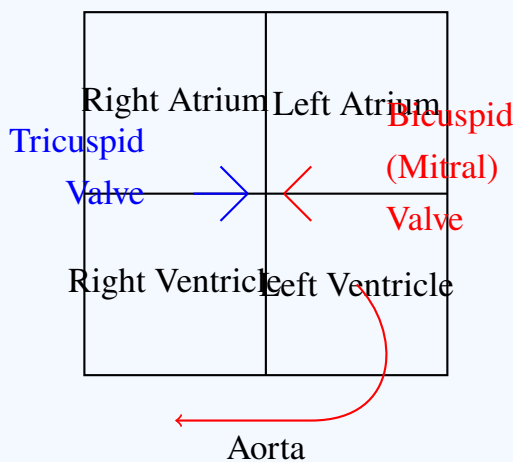
Solution

Concept: Anatomy and function of the valves of the human heart.

Solution: The heart contains four valves that ensure blood flows in only one direction. The atrioventricular (AV) valves are located between the atria and ventricles.

- The valve between the right atrium and right ventricle is the **tricuspid valve**.
- The valve between the left atrium and left ventricle is the **bicuspid valve**, also known as the mitral valve.

When the ventricles contract to pump blood out of the heart, these AV valves close to prevent blood from flowing backward into the atria. Therefore, the bicuspid (mitral) valve specifically prevents the backflow of blood from the left ventricle into the left atrium. The semilunar valves (aortic and pulmonary) prevent backflow from the major arteries into the ventricles.



Simplified
Heart Diagram

Final Answer : “Bicuspid”

Answer: (B)



Q63.

Solution

Concept: The function and permeability of different segments of the renal nephron.

Solution: The nephron is the functional unit of the kidney, responsible for filtering blood and forming urine. The Loop of Henle plays a crucial role in creating a concentration gradient in the kidney medulla, which is essential for concentrating urine. The two limbs of the loop have distinct permeabilities:

- **Descending limb:** This segment is highly permeable to water but relatively impermeable to solutes like NaCl. As filtrate moves down, water moves out via osmosis into the hypertonic interstitial fluid.
- **Ascending limb:** This segment is the opposite. It is **impermeable to water** but actively transports NaCl out of the filtrate into the interstitial fluid. This active removal of salt without water following makes the interstitial fluid salty and the remaining filtrate more dilute.

This countercurrent mechanism is vital for water reabsorption. The PCT and DCT are both permeable to water (the latter under hormonal control by ADH).

Final Answer : “Ascending limb”

Answer: (C)

Q64.

Solution

Concept: Neurotransmission at the neuromuscular junction.

Solution: The contraction of skeletal muscle is initiated by a nerve impulse from a motor neuron. The point of communication between the motor neuron and the muscle fiber is a specialized synapse called the neuromuscular junction. When an action potential arrives at the axon terminal of the motor neuron, it triggers the release of the neurotransmitter **acetylcholine (ACh)** into the synaptic cleft. ACh then binds to specific receptors on the sarcolemma (muscle cell membrane), causing it to depolarize. This depolarization, if it reaches threshold, generates an action potential in the muscle fiber, which propagates along the membrane and leads to muscle contraction. Dopamine, serotonin, and GABA are major neurotransmitters but are primarily associated with functions within the central nervous system, not direct muscle activation.

Final Answer : “Acetylcholine”

Answer: (C)



Q65.

Solution

Concept: Hormonal regulation of blood glucose concentration.

Solution: The body maintains blood glucose levels within a narrow range through the action of two antagonistic hormones produced by the Islets of Langerhans in the pancreas:

- **Insulin:** Released by beta cells when blood glucose is high (e.g., after a meal). It promotes the uptake of glucose by body cells and the conversion of glucose to glycogen in the liver and muscles, thereby *lowering* blood glucose levels.
- **Glucagon:** Released by alpha cells when blood glucose is low (e.g., during fasting). It stimulates the liver to break down its stored glycogen (glycogenolysis) and synthesize new glucose (gluconeogenesis), releasing it into the blood and thereby *increasing* blood glucose levels.

Therefore, glucagon is the hormone that raises blood glucose.

Final Answer : “Glucagon”

Answer: (B)



Q66.

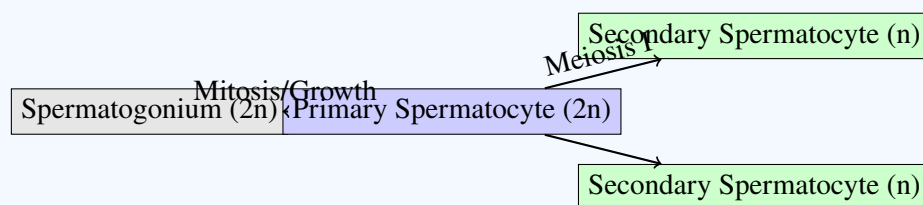
Solution

Concept: The stages and ploidy levels of spermatogenesis.

Solution: Spermatogenesis is the process of sperm cell development. It involves mitotic divisions to increase cell number and meiotic divisions to reduce the chromosome number. The ploidy level changes at a specific point:

- (a) **Spermatogonia:** Diploid ($2n$) stem cells that undergo mitosis.
- (b) **Primary Spermatocyte:** A diploid ($2n$) cell that is committed to meiosis. It grows from a spermatogonium.
- (c) **Meiosis I:** The primary spermatocyte divides into two **Secondary Spermatocytes**. This is a reductional division, so the secondary spermatocytes are **haploid (n)**.
- (d) **Meiosis II:** Each haploid secondary spermatocyte divides to form two haploid spermatids (n).

Therefore, the secondary spermatocyte is the first haploid stage in the spermatogenesis pathway.



Final Answer : “Secondary spermatocyte”

Answer: (C)

Q67.

Solution

Concept: Hormonal control of parturition (childbirth).

Solution: Parturition is a complex process initiated by a cascade of hormonal and physical signals. While hormones like estrogen and progesterone set the stage by increasing uterine sensitivity and removing the block on contractions, the primary hormone that directly stimulates and sustains the powerful contractions of labor is **Oxytocin**. Oxytocin is released from the posterior pituitary gland and acts on the smooth muscle of the uterine wall. The process involves a positive feedback loop: uterine contractions push the baby’s head against the cervix, which stimulates nerve endings to signal the brain to release more oxytocin, which in turn causes even stronger contractions. This loop continues until the baby is born.

Final Answer : “Oxytocin”

Answer: (A)



Q68.

Solution

Concept: Surgical methods of contraception.

Solution: Surgical sterilization is a permanent method of contraception. The procedures differ for males and females:

- **Vasectomy:** This is the surgical sterilization procedure for males. It involves cutting, tying, or sealing the **vas deferens**, which are the tubes that transport sperm from the epididymis to the ejaculatory ducts. By blocking these tubes, sperm are prevented from becoming part of the semen, making the male infertile.
- **Tubectomy (Tubal Ligation):** This is the corresponding procedure for females, where the fallopian tubes are blocked to prevent the egg from meeting sperm.

IUDs and pills are non-surgical, reversible contraceptive methods.

Final Answer : “Vasectomy”

Answer: (B)

Q69.

Solution

Concept: The sequence of early embryonic development in mammals.

Solution: Following fertilization, the zygote undergoes a series of rapid mitotic divisions known as cleavage. This leads to a sequence of developmental stages:

- (a) **Zygote:** The initial single-celled fertilized egg.
- (b) **Morula:** After several rounds of cleavage, a solid ball of about 16-32 cells is formed. This stage is called the morula.
- (c) **Blastocyst:** The morula continues to divide, and a fluid-filled cavity, the blastocoel, forms within the mass of cells. This transformation from a solid ball to a hollow structure results in the formation of the blastocyst. The blastocyst is the stage that implants in the uterine wall.
- (d) **Gastrula:** This stage follows the blastocyst, involving major cell rearrangements to form the three primary germ layers.

Therefore, the morula is the stage that develops into the blastocyst.

Final Answer : “Morula”

Answer: (A)



Q70.

Solution

Concept: Genotypic ratios in Mendelian inheritance.

Solution: A **monohybrid cross** is a genetic cross between parents who differ in the alleles they possess for one particular gene, typically involving a cross between two heterozygous individuals (e.g., Tt x Tt). Using a Punnett square to visualize this cross:

	T	t
T	TT	Tt
t	Tt	tt

The resulting genotypes of the offspring are:

- 1 TT (homozygous dominant)
- 2 Tt (heterozygous)
- 1 tt (homozygous recessive)

This gives the characteristic genotypic ratio of **1:2:1**. A dihybrid cross gives a more complex ratio, and a test cross gives a 1:1 or 1:0 ratio depending on the parent.

Final Answer : “**Monohybrid cross**”

Answer: (A)

Q71.

Solution

Concept: Sources of genetic variation in sexually reproducing organisms.

Solution: Genetic variation is the foundation of evolution and is generated through several key processes:

- (a) **Mutation:** A permanent alteration in the DNA sequence. This is the ultimate source of all new genetic information (alleles) in a population.
- (b) **Crossing Over:** The exchange of genetic material between homologous chromosomes during Prophase I of meiosis. This creates new combinations of alleles on the chromosomes.
- (c) **Independent Assortment:** The random orientation of homologous chromosome pairs at the metaphase plate during Metaphase I of meiosis. This leads to a random mix of paternal and maternal chromosomes in the resulting gametes.

All three processes—mutation creating new alleles, and crossing over and independent assortment shuffling those alleles into new combinations—are crucial for producing genetic variation.

Final Answer : “**All**”

Answer: (D)



Q72.

Solution

Concept: Complementary base pairing rules in DNA structure.

Solution: The structure of DNA is a double helix, with two strands held together by hydrogen bonds between specific pairs of nitrogenous bases. According to the base pairing rules established by Erwin Chargaff and integral to the Watson-Crick model:

- **Adenine (A)**, a purine, always pairs with **Thymine (T)**, a pyrimidine, via two hydrogen bonds.
- **Guanine (G)**, a purine, always pairs with **Cytosine (C)**, a pyrimidine, via three hydrogen bonds.

In RNA, Uracil (U) replaces Thymine and pairs with Adenine. Therefore, in a DNA molecule, Adenine's complementary base is Thymine.

Final Answer : "Thymine"

Answer: (C)

Q73.

Solution

Concept: The discovery of the molecular structure of DNA.

Solution: In 1953, James Watson and Francis Crick proposed the now-famous double helix model for the structure of DNA. Their model successfully integrated previous findings, including Erwin Chargaff's rules on base pairing (A pairs with T, C pairs with G) and, crucially, the X-ray diffraction data produced by Rosalind Franklin and Maurice Wilkins, which provided evidence for the helical shape and dimensions of the molecule. This discovery was a cornerstone of modern biology.

- Charles Darwin proposed the theory of evolution.
- Gregor Mendel is known for his work on the principles of heredity.
- Louis Pasteur is famous for his work on pasteurization and vaccination.

Final Answer : "Watson and Crick"

Answer: (C)



Q74.

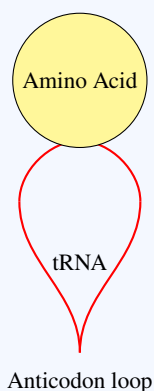
Solution

Concept: The roles of different types of RNA in protein synthesis.

Solution: Protein synthesis (translation) involves several types of RNA molecules with distinct functions:

- **mRNA (messenger RNA):** Carries the genetic code transcribed from DNA in the nucleus to the ribosome in the cytoplasm.
- **tRNA (transfer RNA):** Acts as an adaptor molecule. It has a specific anticodon that recognizes a codon on the mRNA and carries the corresponding amino acid to the ribosome to be added to the growing polypeptide chain.
- **rRNA (ribosomal RNA):** A structural and catalytic component of ribosomes, the machinery of protein synthesis.
- **snRNA (small nuclear RNA):** Involved in splicing and other processes within the nucleus.

Therefore, tRNA is the molecule responsible for carrying amino acids.



Final Answer : “tRNA”

Answer: (B)



Q75.

Solution

Concept: The principle of natural selection in evolution.

Solution: Natural selection is a core mechanism of evolution, as proposed by Charles Darwin. The process is based on the idea that in any given environment, some individuals possess inherited traits that make them better suited to survive and reproduce than others. These advantageous traits are said to increase an individual's "fitness." Because these fit individuals are more likely to survive and pass on their genes, the frequency of these favorable traits increases in the population over successive generations. Natural selection is not a random process; it acts on existing variation and consistently favors individuals with higher fitness, leading to adaptation.

Final Answer : "Fit individuals"

Answer: (B)

Q76.

Solution

Concept: Pathogens responsible for common infectious diseases.

Solution: Infectious diseases are caused by various types of pathogenic organisms. It is important to distinguish between them:

- **Tuberculosis (TB):** A contagious infection that primarily affects the lungs, caused by the bacterium *Mycobacterium tuberculosis*.
- **Malaria:** Caused by a single-celled protozoan parasite of the genus *Plasmodium*, transmitted by mosquitoes.
- **AIDS (Acquired Immunodeficiency Syndrome):** Caused by the Human Immunodeficiency Virus (HIV).
- **Dengue:** A fever caused by the dengue virus, transmitted by mosquitoes.

Therefore, tuberculosis is the bacterial disease among the options.

Final Answer : "Tuberculosis"

Answer: (B)



Q77.

Solution

Concept: Microorganisms used in industrial fermentation.

Solution: Ethanol (ethyl alcohol) is produced through a process called alcoholic fermentation. This is an anaerobic pathway where sugars like glucose are converted into ethanol and carbon dioxide. The microorganism most famously used for this process, especially in baking and the production of alcoholic beverages like beer and wine, is **Yeast**. Yeasts, such as *Saccharomyces cerevisiae*, are single-celled fungi that can carry out this fermentation when oxygen is scarce. *Lactobacillus* is a bacterium used in dairy fermentation to produce lactic acid. Algae are primarily photosynthetic, and viruses are obligate intracellular parasites that cannot perform fermentation.

Final Answer : “Yeast”

Answer: (B)

Q78.

Solution

Concept: Key enzymes used as tools in molecular biology.

Solution: In genetic engineering, specific enzymes are used to manipulate DNA molecules. These are often referred to as 'molecular tools'.

- **Restriction enzyme (or restriction endonuclease):** Acts as 'molecular scissors'. These enzymes recognize specific, short DNA sequences (restriction sites) and cut the DNA at or near these sites. This allows scientists to cut DNA in a predictable and precise way, which is fundamental for cloning and DNA analysis.
- **Ligase:** Acts as 'molecular glue', joining DNA fragments together.
- **Polymerase:** Synthesizes new strands of DNA or RNA.
- **Helicase:** Unwinds the DNA double helix.

Final Answer : “Restriction enzyme”

Answer: (B)



Q79.

Solution

Concept: Applications of genetic engineering in agriculture.

Solution: Transgenic plants are plants that have been genetically modified using recombinant DNA technology to introduce a new trait. One of the most famous examples is **Golden Rice**. It is a variety of rice (*Oryza sativa*) genetically engineered to biosynthesize beta-carotene, a precursor of Vitamin A, in the edible parts of the grain. This was developed as a public health intervention to combat Vitamin A deficiency, which is prevalent in many parts of the world where rice is a staple food. Insulin is produced using transgenic bacteria or yeast, not plants. Antibiotics are naturally produced by microbes, and vaccines are typically produced in microbial cultures or cell lines.

Final Answer : “Golden rice”

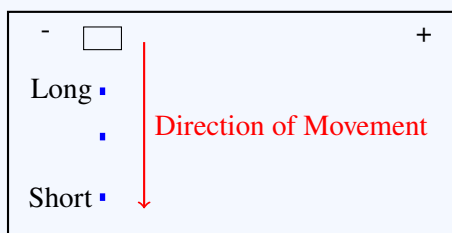
Answer: (B)

Q80.

Solution

Concept: Laboratory techniques for analyzing DNA.

Solution: **Gel electrophoresis** is a standard laboratory technique used to separate molecules like DNA, RNA, or proteins based on their size and electrical charge. For DNA analysis, fragments (often generated by restriction enzymes) are loaded into a gel matrix (e.g., agarose). An electric current is then applied across the gel. Since DNA has a negative charge due to its phosphate backbone, the fragments will move towards the positive electrode. Shorter fragments are able to navigate through the pores of the gel more easily and thus travel farther than longer fragments. This results in the separation of DNA fragments by size, creating a pattern of distinct bands.



Final Answer : “Gel electrophoresis”

Answer: (B)

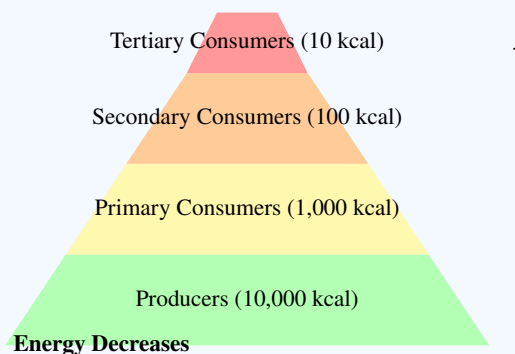


Q81.

Solution

Concept: The 10% rule of energy transfer in an ecosystem's food chain.

Solution: Energy flows from one trophic level to the next in a food chain. Producers, like plants, form the first trophic level and have the most energy, which they capture from the sun. When primary consumers (herbivores) eat producers, only about 10% of the energy is transferred to them. The remaining 90% is lost as heat during metabolic processes or is unavailable. Similarly, when secondary consumers eat primary consumers, another 90% of the energy is lost. This continues up the food chain. Therefore, the highest trophic level, the tertiary consumers, receives the least amount of energy from the original source.



Final Answer : “Tertiary consumers”

Answer: (D)

Q82.

Solution

Concept: Energy flow through trophic levels in an ecosystem.

Solution: Energy enters an ecosystem primarily from the sun and is captured by producers (e.g., plants) during photosynthesis. This energy then flows to primary consumers when they eat the producers, and subsequently to secondary and tertiary consumers. At each transfer between trophic levels, a significant amount of energy is lost as heat, in accordance with the second law of thermodynamics. Energy does not cycle back from higher trophic levels to lower ones. This one-way path, from the sun to producers to consumers, is described as unidirectional. In contrast, nutrients like carbon and nitrogen are recycled within the ecosystem, making their flow cyclic.

Final Answer : “Unidirectional”

Answer: (B)



Q83.

Solution

Concept: The chemical reaction of photosynthesis.

Solution: Photosynthesis is the process by which green plants, algae, and some bacteria convert light energy into chemical energy. They use carbon dioxide (CO) from the air and water (HO) from the soil as raw materials. In the presence of sunlight, these reactants are converted into glucose (CHO), which is a sugar used for energy, and oxygen (O). This oxygen is released into the atmosphere as a byproduct. The overall balanced chemical equation is:

$$6\text{CO}_2 + 6\text{H}_2\text{O} + \text{Light Energy} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$$

Final Answer : “O”

Answer: (B)

Q84.

Solution

Concept: Functional roles of organisms in an ecosystem: producers, consumers, and decomposers.

Solution: Ecosystems are composed of different types of organisms with specific roles.

- **Producers** (e.g., Grass) create their own food, usually through photosynthesis.
- **Consumers** obtain energy by feeding on other organisms. This includes primary consumers (herbivores like Deer) and secondary/tertiary consumers (carnivores like a Tiger).
- **Decomposers** (e.g., Bacteria and fungi) break down dead organic matter from all trophic levels. They play a crucial role in recycling nutrients back into the ecosystem, making them available for producers to use again.

Of the given options, bacteria are prime examples of decomposers.

Final Answer : “Bacteria”

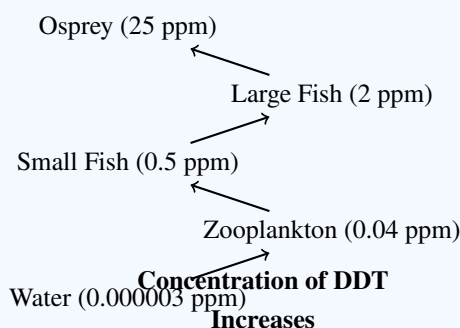
Answer: (C)



Q85.

Solution**Concept:** Biomagnification of persistent toxins in a food chain.

Solution: Biomagnification (or bioamplification) is the process where the concentration of certain persistent, fat-soluble toxins increases in organisms at successively higher levels in a food chain. A pollutant is absorbed by organisms at the bottom of the food chain. When these organisms are eaten, the toxin is transferred to the next trophic level. Because the toxin is not easily broken down or excreted, it accumulates in the tissues of the consumer. This process continues up the food chain, resulting in very high concentrations in top predators. DDT (dichlorodiphenyltrichloroethane), a persistent pesticide, is a classic example of a substance that causes biomagnification, famously leading to the thinning of eggshells in birds of prey. CO, SO, and NO are air pollutants that cause other environmental problems like the greenhouse effect and acid rain, but they do not biomagnify.

**Final Answer :** "DDT"**Answer:** (A)

Q86.

Solution

Concept: Types of ecological succession.

Solution: Ecological succession is the process by which an ecological community undergoes orderly and predictable changes following a disturbance or the initial colonization of a new habitat.

- **Primary Succession:** This occurs on surfaces where no soil or life exists, such as bare rock after a volcanic eruption or a retreating glacier. It is a very slow process as soil must be formed first.
- **Secondary Succession:** This occurs in an area that previously supported life but has undergone a disturbance that did not eliminate all life and nutrients from the environment. Examples include a forest fire, logging, or a flood. Since the soil is already present, along with some seeds and roots, secondary succession is much faster than primary succession.

A forest fire leaves the soil intact, so the regrowth of the forest is an example of secondary succession.

Final Answer : “Secondary”

Answer: (B)



Q87.

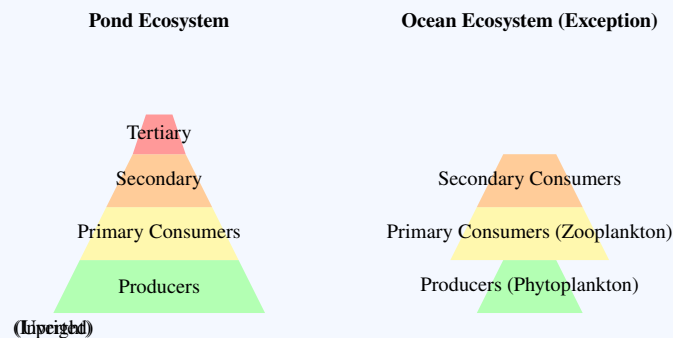
Solution

Concept: Pyramid of biomass in ecosystems.

Solution: A pyramid of biomass illustrates the total mass of living organisms (biomass) at each trophic level.

- **Upright Pyramid:** In most ecosystems, like forests and grasslands, the total biomass of producers is the largest, and it decreases at each successive trophic level. This is the most common pattern. Many aquatic ecosystems, such as ponds and coral reefs, also have an upright pyramid.
- **Inverted Pyramid:** A notable exception occurs in some aquatic ecosystems like the open ocean. Here, the producers are microscopic phytoplankton. They have a very short lifespan and reproduce rapidly, so their standing crop (the biomass at any given moment) can be smaller than that of the primary consumers (zooplankton) that feed on them.

However, the question asks about aquatic ecosystems in general. Since the upright pyramid is a more common and stable representation of biomass across various types of aquatic systems (ponds, marshes, shallow lakes), the producers are considered to have the maximum biomass in the general case.



Final Answer : “Producers”

Answer: (A)



Q88.

Solution

Concept: Types of symbiotic relationships and species interactions.

Solution: Interactions between species can be categorized based on their effect (+ for benefit, - for harm, 0 for no effect) on the participants.

- **Parasitism (+/-):** One species (parasite) benefits, while the other (host) is harmed.
- **Commensalism (+/0):** One species benefits, while the other is unaffected.
- **Mutualism (+/+):** Both species benefit from the interaction. A classic example is the relationship between bees and flowers; bees get nectar for food, and flowers get pollinated.
- **Predation (+/-):** One species (predator) hunts and kills the other (prey).

The interaction where both species benefit is mutualism.

Final Answer : “Mutualism”

Answer: (C)



Q89.

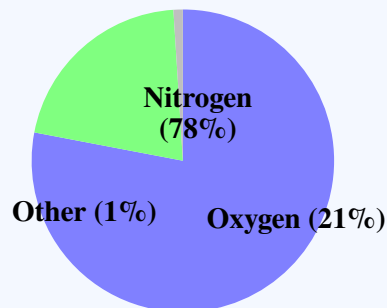
Solution

Concept: The composition of Earth's atmosphere.

Solution: The Earth's atmosphere is a mixture of several gases. By volume, the approximate composition of dry air is:

- **Nitrogen (N):** 78.08%
- **Oxygen (O):** 20.95%
- Argon (Ar): 0.93%
- Carbon dioxide (CO): 0.04%
- Trace amounts of other gases like neon, helium, and hydrogen.

Therefore, nitrogen is by far the most abundant gas in the atmosphere.



Composition of Earth's Atmosphere

Final Answer : "Nitrogen"

Answer: (B)



Q90.

Solution

Concept: Net Primary Productivity (NPP) in different biomes.

Solution: Primary productivity refers to the rate at which producers (mainly plants) create biomass. It is highest in regions where the key factors for photosynthesis—sunlight, water, and warm temperatures—are abundant.

- **Desert:** Productivity is very low due to the extreme lack of water.
- **Tundra:** Productivity is very low due to low temperatures and a short growing season.
- **Grassland:** Productivity is moderate, often limited by rainfall.
- **Tropical rainforest:** Productivity is the highest among all terrestrial biomes. The combination of intense year-round sunlight, high temperatures, and abundant rainfall creates ideal conditions for rapid and dense plant growth.

While some aquatic ecosystems like estuaries can have very high productivity, among the given options, the tropical rainforest is the most productive.

Final Answer : “Tropical rainforest”

Answer: (C)



Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	B	3	C	4	B	5	B
6	B	7	C	8	B	9	C	10	A
11	A	12	A	13	B	14	B	15	A
16	B	17	B	18	A	19	C	20	A
21	B	22	B	23	B	24	B	25	B
26	B	27	B	28	A	29	B	30	A
31	A	32	B	33	B	34	A	35	C
36	B	37	B	38	A	39	B	40	A
41	B	42	B	43	B	44	B	45	C
46	C	47	B	48	C	49	B	50	B
51	A	52	A	53	B	54	A	55	B
56	A	57	C	58	A	59	B	60	B
61	D	62	B	63	C	64	C	65	B
66	C	67	A	68	B	69	A	70	A
71	D	72	C	73	C	74	B	75	B
76	B	77	B	78	B	79	B	80	B
81	D	82	B	83	B	84	C	85	A
86	B	87	A	88	C	89	B	90	C

