BITSAT Biology Sample Paper-19

Duration: 60 Minutes **Maximum Marks: 120**

Instructions

- This paper contains **40** Multiple Choice Questions (Single Correct).
- Each correct answer carries **+3 marks**. Each incorrect answer carries **-1 mark**. Unattempted question carries **0 marks**.
- Only **one** option is correct for each question.
- Use of mobile phones, smartwatches, or any electronic gadgets is strictly prohibited.

Q1. A plant physiologist observed that when guard cells absorbed potassium ions, the stomatal aperture widened significantly. Which immediate cellular event most directly caused the opening of stomata?

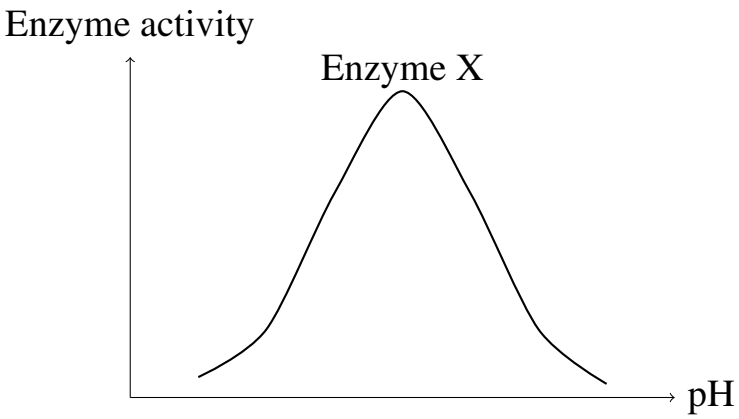
(A) Active loss of water from guard cells

(B) Increase in turgor pressure of guard cells

(C) Complete breakdown of starch into proteins

(D) Shrinkage of subsidiary cells

Q2. The following graph represents the rate of enzyme activity at different pH values.



Based on the graph, enzyme X is most likely to function optimally in:

(A) Strongly acidic conditions

(B) Mildly acidic conditions

(C) Strongly alkaline conditions

(D) Neutral conditions only

Q3. A human cell in metaphase of mitosis contains 46 chromosomes. If the cell successfully completes mitosis followed by cytokinesis, each daughter cell will contain:

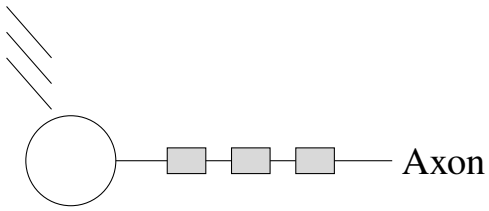
(A) 23 chromosomes

(B) 46 chromosomes

(C) 92 chromosomes

(D) 184 chromatids

Q4. The figure below represents a generalized neuron.



The structures shown around the axon primarily function to:

(A) Synthesize neurotransmitters

(B) Increase speed of nerve impulse conduction

(C) Produce ATP for synaptic transmission

(D) Carry genetic information

Q5. In a monohybrid cross involving complete dominance, two heterozygous individuals were crossed. What proportion of the offspring is expected to show the recessive phenotype?

(A) 1/2

(B) 1/4

(C) 3/4

(D) 1/8

Q6. A scientist discovered a unicellular organism that lacked membrane-bound organelles but possessed circular DNA and ribosomes. The organism most likely belongs to:

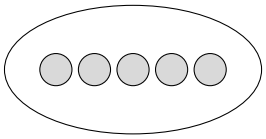
(A) Protista

(B) Fungi

(C) Monera

(D) Plantae

Q7. The following figure represents oxygen transport in blood.



Red blood cells

The protein primarily responsible for oxygen transport in these cells is:

(A) Albumin

(B) Keratin

(C) Haemoglobin

(D) Collagen

Q8. A xerophytic plant species exhibits reduced leaf surface area and thick cuticle. These adaptations primarily help in:

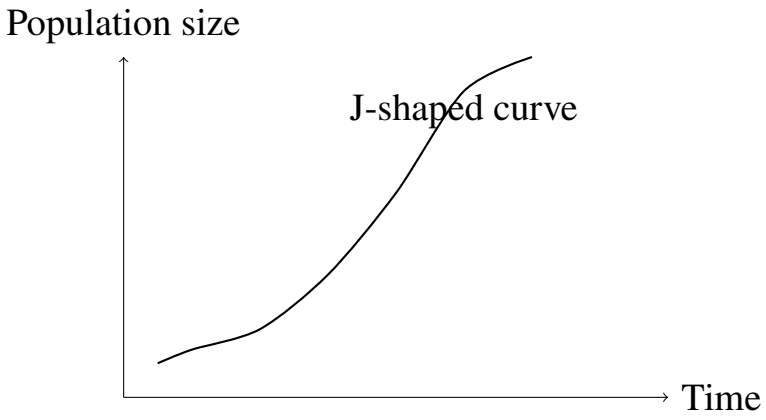
(A) Increasing transpiration rate

(B) Maximizing nutrient loss

(C) Conserving water under dry conditions

(D) Enhancing anaerobic respiration

Q9. The graph below represents population growth under unlimited resources.



The type of growth shown above is termed:

(A) Logistic growth

(B) Exponential growth

(C) Negative growth

(D) Cyclic growth

Q10. A molecular biologist isolated an RNA molecule that carried anticodons complementary to mRNA codons during protein synthesis. The molecule isolated was:

(A) rRNA

(B) tRNA

(C) hnRNA

(D) miRNA

Q11. Which of the following events occurs specifically during prophase I of meiosis and not during mitosis?

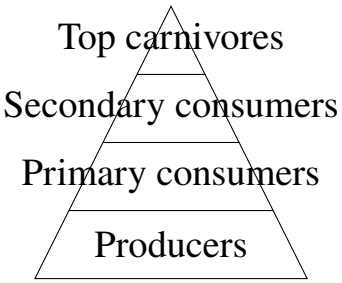
(A) Chromosome condensation

(B) Nuclear membrane disintegration

(C) Synapsis of homologous chromosomes

(D) Formation of spindle fibres

Q12. The following diagram represents a food pyramid.



The decreasing size of trophic levels toward the top primarily reflects:

(A) Increase in available energy

(B) Progressive loss of energy between trophic levels

(C) Equal biomass at all levels

(D) Absence of respiration in producers

Q13. A student observed that a plant kept in darkness for several days showed starch depletion in leaves. This occurred because:

(A) Respiration continued in absence of photosynthesis

(B) Chlorophyll synthesis increased

(C) Water absorption completely stopped

(D) Protein synthesis exceeded respiration

Q14. The hormone secreted by the posterior pituitary gland that stimulates reabsorption of water in kidney tubules is:

(A) Thyroxine

(B) Insulin

(C) ADH

(D) Prolactin

Q15. In biotechnology, PCR is primarily used to:

(A) Sequence proteins

(B) Amplify specific DNA fragments

(C) Translate RNA into DNA

(D) Isolate ribosomes

Q16. A researcher observed that when the oxygen concentration surrounding germinating seeds was drastically reduced, ATP production declined sharply. This reduction occurred because oxygen acts primarily as:

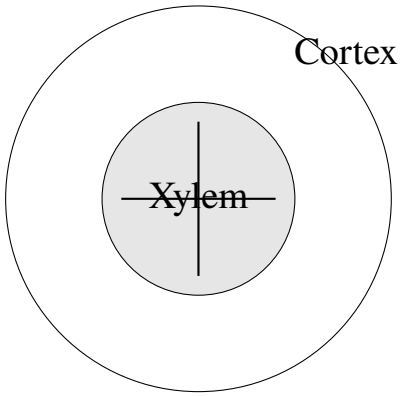
(A) The first electron acceptor in glycolysis

(B) The terminal electron acceptor in aerobic respiration

(C) A substrate for ATP synthase directly

(D) An inhibitor of Krebs cycle enzymes

Q17. The following figure represents a section through a dicot root.



The star-shaped structure shown at the center of the root primarily functions in:

(A) Food storage

(B) Water and mineral conduction

(C) Photosynthesis

(D) Secretion of hormones

Q18. A person with blood group O can donate blood to individuals of all ABO blood groups because the red blood cells of group O individuals:

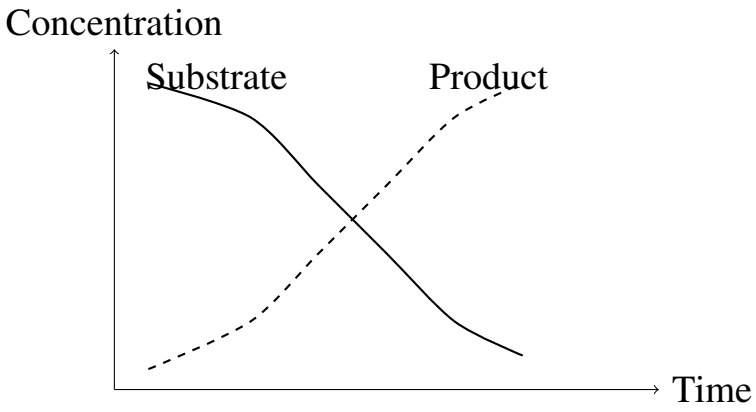
(A) Lack both A and B antigens

(B) Possess both A and B antibodies on their surface

(C) Contain no haemoglobin

(D) Are incapable of oxygen transport

Q19. The graph below represents changes in substrate and product concentration during an enzyme-catalyzed reaction.



The graph indicates that as the reaction proceeds:

(A) Product concentration decreases continuously

(B) Substrate molecules are converted into product molecules

(C) Enzyme concentration becomes zero

(D) ATP is permanently consumed

Q20. A diploid cell undergoing meiosis contains 12 chromosomes initially. At the end of meiosis II, each daughter cell will contain:

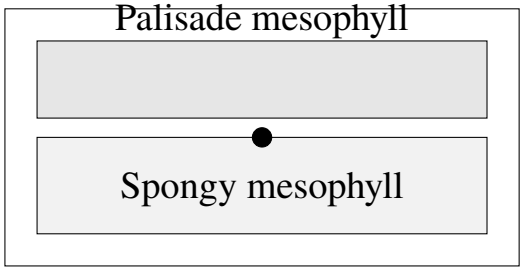
(A) 12 chromosomes

(B) 24 chromosomes

(C) 6 chromosomes

(D) 3 chromosomes

Q21. The following diagram represents a transverse section of a leaf.



Which feature of spongy mesophyll cells primarily facilitates gaseous exchange?

(A) Presence of thick lignified walls

(B) Closely packed arrangement without spaces

(C) Large intercellular air spaces

(D) Absence of chloroplasts

Q22. In a certain species of flowering plant, self-pollination is prevented because anthers and stigma mature at different times. This condition is termed:

(A) Herkogamy

(B) Dichogamy

(C) Polyembryony

(D) Apomixis

Q23. A scientist discovered that a mutation in a structural gene produced a nonfunctional protein even though transcription occurred normally. The defect most likely arose during:

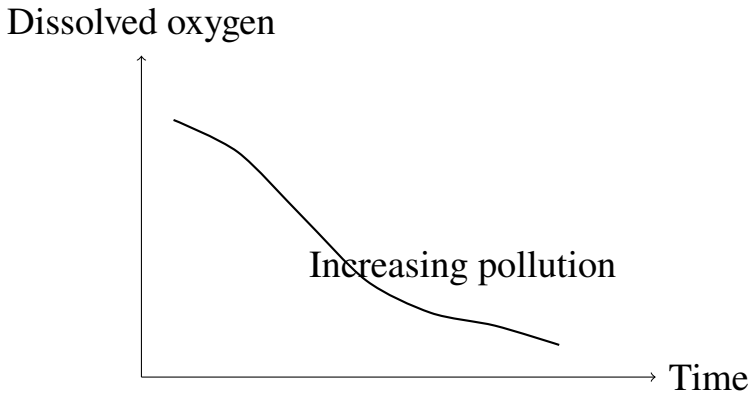
(A) DNA replication only

(B) Translation resulting in altered amino acid sequence

(C) Formation of phospholipid membranes

(D) Glycolysis in cytoplasm

Q24. The following graph represents dissolved oxygen concentration in a pond over time.



The gradual decline in dissolved oxygen most likely indicates:

(A) Enhanced photosynthesis by aquatic plants

(B) Increased decomposition of organic matter

(C) Complete absence of microorganisms

(D) Sudden reduction in temperature

Q25. Which of the following structures develops directly into the embryo during seed formation in angiosperms?

(A) Zygote

(B) Endosperm nucleus

(C) Synergid

(D) Antipodal cell

Q26. The figure below represents the structure of ATP.

The bonds between phosphate groups shown above are important because they:

(A) Store and release usable cellular energy

(B) Permanently stabilize ATP molecules

(C) Prevent hydrolysis reactions

(D) Encode genetic information

Q27. A mutation in the gene coding for haemoglobin results in sickle-cell anaemia. This disease is an example of:

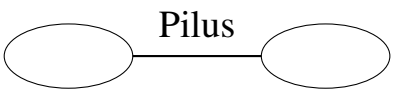
(A) Chromosomal disorder

(B) Mendelian gene disorder

(C) Polygenic inheritance

(D) Cytoplasmic inheritance

Q28. The following diagram represents bacterial conjugation.



The process shown above results primarily in:

(A) Binary fission

(B) Genetic recombination between bacteria

(C) Spore formation

(D) Protein translation

Q29. A population of rabbits introduced into an island without predators multiplied rapidly. Which factor would eventually limit further exponential growth?

(A) Unlimited food availability

(B) Environmental resistance such as resource limitation

(C) Complete absence of competition

(D) Constant mutation rate

Q30. The process by which green plants convert light energy into chemical energy stored in carbohydrates is called:

(A) Respiration

(B) Fermentation

(C) Photosynthesis

(D) Transpiration

Q31. A researcher observed that a particular inhibitor blocked electron transfer from cytochrome complex to oxygen in mitochondria. Which cellular process would be most immediately affected by this inhibition?

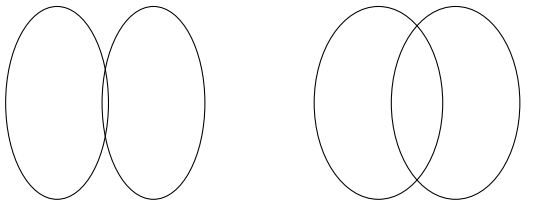
(A) Glycolysis in cytoplasm

(B) Oxidative phosphorylation and ATP synthesis

(C) DNA replication in nucleus

(D) Protein digestion in lysosomes

Q32. The following figure represents stages in the opening and closing of stomata.



Open stoma Closed stoma

Stomata generally close during severe water stress because:

(A) Photosynthesis becomes permanently impossible

(B) Guard cells lose turgidity

(C) Chlorophyll is completely degraded

(D) Xylem vessels collapse irreversibly

Q33. A diploid organism has a chromosome number of $2n = 16$. During metaphase I of meiosis, the number of bivalents expected inside the cell is:

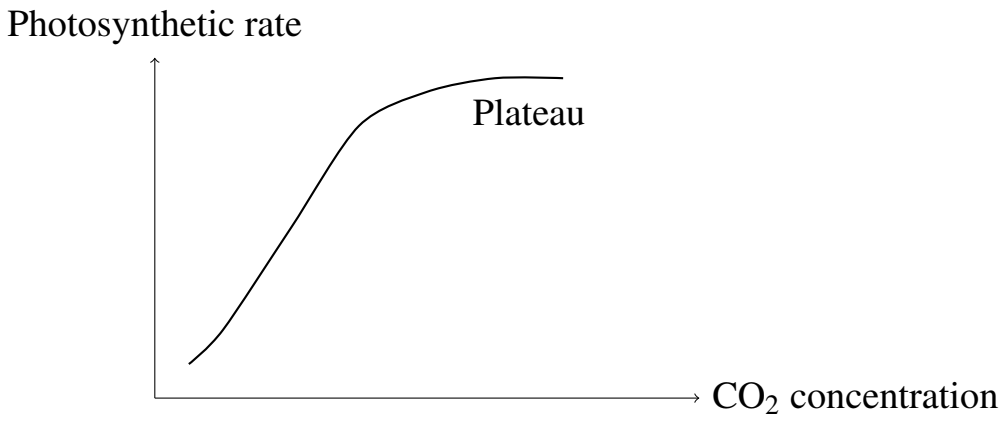
(A) 4

(B) 8

(C) 16

(D) 32

Q34. The graph below represents the effect of increasing carbon dioxide concentration on the rate of photosynthesis at constant light intensity.



The plateau observed at higher CO_2 concentration most likely occurs because:

(A) Carbon dioxide becomes toxic instantly

(B) Another factor becomes limiting

(C) Chlorophyll molecules disappear

(D) Oxygen production completely ceases

Q35. A patient suffering from hypothyroidism commonly exhibits low metabolic rate and lethargy because thyroxine primarily regulates:

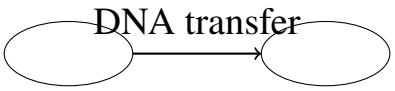
(A) Blood clotting

(B) Basal metabolic activity of cells

(C) Production of antibodies

(D) Osmotic balance in kidneys

Q36. The following diagram represents transfer of genetic material between bacterial cells.



The mechanism illustrated above contributes significantly to bacterial evolution because it:

(A) Prevents all genetic variation

(B) Allows horizontal gene transfer

(C) Stops plasmid replication

(D) Converts bacteria into viruses

Q37. In an ecosystem, secondary consumers obtain energy directly from:

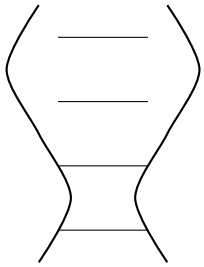
(A) Producers

(B) Decomposers

(C) Primary consumers

(D) Solar radiation

Q38. The following figure represents a DNA double helix.



The nitrogenous base adenine pairs specifically with thymine because:

(A) Both bases possess identical molecular masses

(B) Their structures allow formation of complementary hydrogen bonds

(C) Adenine is positively charged while thymine is negative

(D) They are connected through phosphodiester linkages

Q39. A scientist discovered a flowering plant in which seeds were formed without fertilization. This phenomenon is termed:

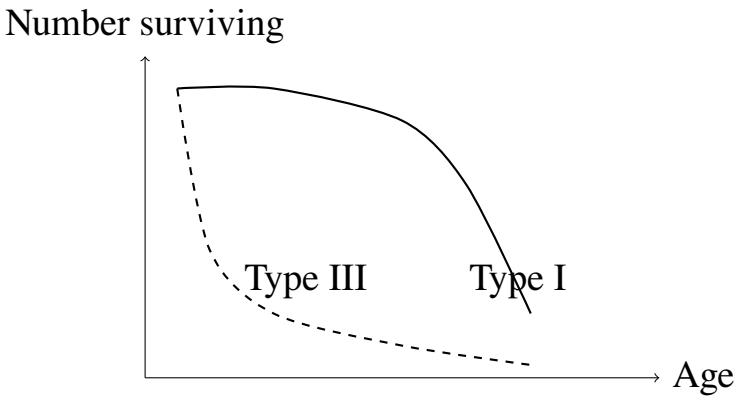
(A) Double fertilization

(B) Apomixis

(C) Polyembryony

(D) Vegetative propagation

Q40. The graph below represents survivorship curves of different populations.



Type III survivorship curves are typically associated with organisms that:

(A) Produce few offspring with extensive parental care

(B) Exhibit high mortality during early life stages

(C) Maintain constant mortality throughout life

(D) Show no reproductive strategy

Detailed Solutions

Q1.

Solution

Concept: The opening and closing of stomata are regulated by changes in the turgidity of the guard cells surrounding the stomatal pore. This process is driven by osmotic shifts governed by active ion transport.

Solution: Step 1: Understand the ion transport event: When a plant is exposed to light or favorable conditions, active transport proteins pump hydrogen ions (H^+) out of the guard cells, creating an electrochemical gradient that drives the influx of potassium ions (K^+) from surrounding subsidiary cells.

Step 2: Relate ion concentration to water movement:

- The accumulation of K^+ (along with anions like malate and Cl^-) inside the guard cells lowers their water potential (makes it more negative).
- Consequently, water molecules move osmotically into the guard cells from adjacent cells.

Step 3: Analyze the physical changes in the guard cells:

- The osmotic entry of water leads to a dramatic **increase in the turgor pressure** of the guard cells.
- The cell wall of guard cells is unevenly thickened (the inner wall adjacent to the pore is thick and inelastic, while the outer wall is thin and highly elastic).
- As turgor pressure rises, the thin outer walls bow outward, pulling the inner inelastic walls along with them, which opens the stomatal aperture.

Step 4: Therefore, the immediate cellular event that directly causes the stomatal opening is the increase in the turgor pressure of the guard cells (Option B).

Final Answer: Increase in turgor pressure of guard cells

Answer: (B)

Go Back to Question 1

Q2.

Solution

Concept: The catalytic activity of an enzyme is highly dependent on environmental pH. Each enzyme has an optimum pH at which its tertiary structure is stabilized in the ideal conformation for substrate binding and catalysis.

Solution: Step 1: Locate the optimum pH value from the graph:

- The peak of the curve represents the maximum rate of enzyme activity.
- Projecting the peak downward to the horizontal axis (pH) yields an optimum pH value of exactly **4**.

Step 2: Classify the optimum pH condition:

- A pH of 7 is considered strictly neutral.
- Values above 7 are alkaline (basic), with values above 10 being strongly alkaline.
- Values below 7 are acidic. Specifically, the range 1–3 is strongly acidic (such as gastric juice), while the range 4–6 is classified as **mildly (or weakly) acidic**.

Step 3: Conclude: Because the peak activity of Enzyme X occurs at pH 4, it is adapted to function optimally in mildly acidic conditions (Option B).

Final Answer: Mildly acidic conditions

Answer: (B)

Go Back to Question 2

Q3.

Solution

Concept: Mitosis is characterized as an equational cell division. It serves to partition duplicated chromosomes equally, resulting in daughter cells that are genetically identical to each other and to the parent cell.

Solution: Step 1: Understand the chromosome state during metaphase: In a human somatic cell during metaphase, there are 46 chromosomes aligned along the spindle equator. Each of these chromosomes consists of two identical sister chromatids joined at a single centromere.

Step 2: Trace the segregation during anaphase: During anaphase, the centromeres split, and the sister chromatids of all 46 chromosomes separate. They are pulled to opposite spindle poles as individual, single-chromatid chromosomes (46 moving to one pole, and 46 moving to the other).

Step 3: Identify the contents of the post-mitotic daughter cells: Following telophase and cytokinesis, the cytoplasm divides, encapsulating the sorted chromosomes into two separate nuclei. Each of the resulting daughter cells receives exactly 46 chromosomes.

Final Answer: 46 chromosomes

Answer: (B)

Go Back to Question 3

Q4.

Solution

Concept: Axons are specialized projections of neurons that conduct electrical impulses (action potentials) away from the cell body toward synaptic terminals. Many axons are surrounded by an insulating layer.

Solution: Step 1: Identify the structures shown wrapping the axon: The rectangular segments wrapping at intervals around the axon represent the **myelin sheath**, which is produced by Schwann cells in the peripheral nervous system and oligodendrocytes in the central nervous system.

Step 2: Explain the biological function of myelin:

- The myelin sheath acts as a high-resistance, low-capacitance electrical insulator.
- It prevents the continuous leakage of ions across the axonal membrane, restricting ion exchange and depolarization solely to the unmyelinated gaps, known as the nodes of Ranvier.

Step 3: Determine the physiological effect: This specialized arrangement forces the action potential to skip from one node to the next (a process called **saltatory conduction**), which dramatically **increases the speed of nerve impulse conduction** compared to unmyelinated fibers (Option B).

Final Answer: Increase speed of nerve impulse conduction

Answer: (B)

Go Back to Question 4

Q5.

Solution

Concept: A monohybrid cross tracks the inheritance of a single gene with two alleles. In cases of complete dominance, the dominant allele fully masks the phenotypic expression of the recessive allele in heterozygous individuals.

Solution: Step 1: Set up the genotypes of the parents: Let A represent the dominant allele and a represent the recessive allele. Two heterozygous individuals have the genotype:

$$Aa \times Aa$$

Step 2: Use a Punnett square to determine the offspring genotypes:

	A	a
A	AA	Aa
a	Aa	aa

The genotypic ratio is:

$$1\ AA \quad : \quad 2\ Aa \quad : \quad 1\ aa$$

Step 3: Identify the phenotypic expression of each genotype:

- AA (homozygous dominant) $\longrightarrow$ Dominant phenotype
- Aa (heterozygous) $\longrightarrow$ Dominant phenotype
- aa (homozygous recessive) $\longrightarrow$ Recessive phenotype

Step 4: Determine the proportion showing the recessive phenotype: Only the aa genotype displays the recessive trait, which represents a fraction of **1/4** (or 25%) of the total offspring.

Final Answer: $\boxed{1/4}$

Answer: (B)

Go Back to Question 5

Q6.

Solution

Concept: Organisms are classified based on fundamental cellular characteristics, particularly whether they exhibit eukaryotic (membrane-bound organelles and nucleus) or prokaryotic (lacking membrane-bound compartments) cellular architecture.

Solution: Step 1: Analyze the characteristics of the discovered organism:

- **Lacks membrane-bound organelles:** Indicates the absence of a nucleus, mitochondria, chloroplasts, endoplasmic reticulum, etc. This is a hallmark of prokaryotes.
- **Possesses circular DNA:** Double-stranded, naked circular DNA is the typical form of the prokaryotic genome (nucleoid), unlike the linear chromosomes of eukaryotes.
- **Possesses ribosomes:** Ribosomes are non-membrane-bound macromolecular complexes required for translation, and are present in both prokaryotic and eukaryotic cells.

Step 2: Match with the biological kingdoms: Under the five-kingdom classification system, all prokaryotic organisms are placed in the kingdom **Monera** (Option C). Eukaryotic kingdoms include Protista, Fungi, Plantae, and Animalia.

Final Answer: Monera

Answer: (C)

Go Back to Question 6

Q7.

Solution

Concept: Red blood cells (erythrocytes) are highly specialized biconcave cells that lack nuclei and mitochondria in their mature mammalian form to optimize their capacity for gas transport.

Solution: Step 1: Identify the specialized protein within erythrocytes: The cytoplasm of red blood cells is densely packed with **haemoglobin** (hemoglobin), which is a tetrameric metalloprotein containing iron-containing heme groups.

Step 2: Understand the function of haemoglobin:

- In the lungs, where oxygen concentration is high, oxygen molecules bind reversibly to the iron atoms in haemoglobin to form oxyhaemoglobin.
- In systemic tissues, where oxygen levels are low, haemoglobin releases the bound oxygen, facilitating its diffusion into metabolizing cells.

Step 3: Evaluate the other options:

- **Albumin** (Option A) is a transport and osmotic protein in blood plasma.
- **Keratin** (Option B) is a structural protein in hair, nails, and skin.
- **Collagen** (Option D) is a major structural protein in connective tissues.

Final Answer: Haemoglobin

Answer: (C)

Go Back to Question 7

Q8.

Solution

Concept: Xerophytes are plants adapted to survive in dry, arid regions, where water is scarce, solar radiation is intense, and transpirational demand is extremely high.

Solution: Step 1: Evaluate the physical adaptations described:

- **Reduced leaf surface area:** Modifying leaves into spines or smaller scales dramatically decreases the total surface area available for evaporation.
- **Thick waxy cuticle:** An extra thick layer of cutin on the epidermal surface forms a highly hydrophobic barrier that restricts water from escaping across the leaf surface.

Step 2: Determine the biological advantage: Both of these features work in synergy to restrict non-stomatal and stomatal evaporation, thus **conserving water under dry conditions** (Option C).

Step 3: Analyze the other options: These modifications decrease (rather than increase) transpiration rates (ruling out Option A) and are unrelated to nutrient loss or anaerobic respiration (ruling out Options B and D).

Final Answer: Conserving water under dry conditions

Answer: (C)

Go Back to Question 8

Q9.

Solution

Concept: In population ecology, population growth curves are classified based on the availability of resource inputs (food, space, nesting sites) and environmental resistance.

Solution: Step 1: Analyze the graph's curve:

- The graph represents a population size that continuously accelerates over time without flattening.
- This continuous, rapid upward trajectory is styled as a J-shaped curve.

Step 2: Identify the type of growth:

- **Exponential growth** (or geometric growth) occurs in an idealized environment with unlimited resources and no competition, predation, or disease. Under these conditions, the growth rate is proportional to the population size, yielding a J-shaped curve.
- **Logistic growth** (Option A) is S-shaped (sigmoid), showing a plateau as resources become limited and the population reaches its carrying capacity.

Step 3: Therefore, the growth pattern shown is exponential growth.

Final Answer: Exponential growth

Answer: (B)

Go Back to Question 9

Q10.

Solution

Concept: Protein synthesis (translation) involves the translation of genetic codons on mRNA into a sequence of amino acids, which is facilitated by specialized adaptor molecules.

Solution: Step 1: Understand codon-anticodon pairing: During translation, the ribosome reads codons (triplets of nucleotides) on the messenger RNA (mRNA) strand. To ensure the correct amino acid is added, an adaptor molecule must base-pair precisely with these codons.

Step 2: Identify the adaptor molecule:

- **tRNA (transfer RNA)** is the molecule that carries a three-nucleotide anticodon on its anticodon loop.
- This anticodon is complementary to a specific codon on the mRNA.
- The other end of the tRNA is covalently bound to the specific amino acid corresponding to that codon, ensuring high fidelity during translation.

Step 3: Evaluate other RNA classes: rRNA (Option A) is a structural component of ribosomes; hnRNA (Option C) is pre-mRNA; miRNA (Option D) regulates gene expression post-transcriptionally.

Final Answer: tRNA

Answer: (B)

Go Back to Question 10

Q11.

Solution

Concept: Meiosis and mitosis share several superficial steps (such as spindle formation and chromosome condensation) but differ in genetic mechanisms during the initial phases of division.

Solution: Step 1: Analyze events that occur in both mitosis and meiosis:

- Chromosome condensation (Option A), nuclear membrane disintegration (Option B), and spindle fiber formation (Option D) occur in both mitotic prophase and meiotic Prophase I.

Step 2: Identify the event unique to Prophase I of meiosis:

- **Synapsis** is the highly specific pairing of homologous maternal and paternal chromosomes along their lengths, mediated by a protein structure called the synaptonemal complex.
- This pairing forms bivalents (or tetrads) and is a absolute prerequisite for homologous recombination (crossing over).
- Synapsis does not occur during mitosis, where chromosomes align independently along the metaphase plate without pairing.

Final Answer: Synapsis of homologous chromosomes

Answer: (C)

Go Back to Question 11

Q12.

Solution

Concept: An ecological pyramid of energy or biomass illustrates the distribution of energy or organic matter at successive trophic levels in an ecosystem.

Solution: Step 1: Understand the thermodynamic constraints of food webs: When energy is transferred from one trophic level to the next, a large portion of it is lost to the environment (typically 90%), primarily as metabolic heat from cellular respiration, along with unconsumed or undigested biomass.

Step 2: Relate energy loss to trophic level size:

- Because of this **progressive loss of energy between trophic levels**, less energy is available to support the growth and maintenance of organisms at each successive level.
- Consequently, the total biomass and energy pool decrease progressively as one moves from producers up to primary consumers, secondary consumers, and top carnivores.

Step 3: Conclude: The decreasing width of the pyramid towards the top is a structural reflection of this thermodynamic inefficiency (Option B).

Final Answer: Progressive loss of energy between trophic levels

Answer: (B)

Go Back to Question 12

Q13.

Solution

Concept: Plants store excess glucose synthesized during photosynthesis in the form of starch in their leaves. Starch functions as an energy reserve that can be mobilized when carbon capture is not possible.

Solution: Step 1: Analyze the metabolic state of a plant in the dark: When a plant is placed in complete darkness for several days:

- It cannot perform the light-dependent reactions of photosynthesis, which halts carbon fixation and glucose production.
- However, the plant's cells must still generate ATP to maintain basic life processes, meaning cellular respiration continues constantly.

Step 2: Explain starch depletion:

- To fuel cellular respiration in the absence of new photosynthetic sugars, the plant enzymatically breaks down its stored starch reserves back into glucose.
- Over several days, this continuous mobilization consumes the leaf's stored starch, leading to starch depletion.

Step 3: Conclude: This occurs because respiration continues in the absence of photosynthesis (Option A).

Final Answer: Respiration continued in absence of photosynthesis

Answer: (A)

Go Back to Question 13

Q14.

Solution

Concept: The pituitary gland is divided into the anterior and posterior lobes. The posterior pituitary (neurohypophysis) does not synthesize hormones itself, but stores and releases hormones produced by neurons in the hypothalamus.

Solution: Step 1: Identify the hormone regulating water balance: The hormone responsible for maintaining body water balance is antidiuretic hormone (**ADH**, or vasopressin).

Step 2: Understand its mechanism of action:

- When the body is dehydrated, the posterior pituitary releases ADH into the bloodstream.
- ADH acts on the principal cells of the distal convoluted tubule and collecting ducts in the kidneys, prompting the insertion of aquaporin-2 water channels into the apical membrane.
- This increases the permeability of the tubules, promoting the reabsorption of water back into the blood, concentrating the urine, and conserving water.

Step 3: Evaluate other options:

- Thyroxine (Option A) is secreted by the thyroid gland.
- Insulin (Option B) is secreted by the pancreas.
- Prolactin (Option D) is secreted by the anterior pituitary.

Final Answer: ADH

Answer: (C)

Go Back to Question 14

Q15.

Solution

Concept: Polymerase Chain Reaction (PCR) is a revolutionary molecular biology technique developed by Kary Mullis in 1983.

Solution: Step 1: Define the mechanism of PCR: PCR is an *in vitro* enzymatic technique that mimics natural DNA replication. It utilizes thermal cycling (repeated heating and cooling) along with a thermostable DNA polymerase (like *Taq* polymerase), primers, and deoxynucleotides (dNTPs).

Step 2: Identify the primary objective of PCR: The cycle of denaturation, annealing, and extension is repeated 25–35 times to selectively and exponentially amplify specific target DNA fragments (Option B), producing billions of identical copies from a minute starting sample.

Step 3: Evaluate other options: PCR is not used to sequence proteins (Option A), translate RNA into DNA (Option C - which is the role of reverse transcriptase), or isolate ribosomes (Option D).

Final Answer: Amplify specific DNA fragments

Answer: (B)

Go Back to Question 15

Q16.

Solution

Concept: Aerobic cellular respiration consists of glycolysis, the link reaction, the Krebs cycle, and oxidative phosphorylation (via the electron transport chain).

Solution: Step 1: Understand the pathway of electron transport: During oxidative phosphorylation, high-energy electrons extracted from organic substrates during glycolysis and the Krebs cycle are carried by NADH and $FADH_2$ to the electron transport chain (ETC) in the inner mitochondrial membrane.

Step 2: Identify the role of oxygen in the ETC:

- As electrons move through the complexes of the ETC, their energy is used to pump protons (H^+) into the intermembrane space, building a proton gradient.
- At the very end of the transport chain (Complex IV, cytochrome c oxidase), molecular oxygen (O_2) acts as the **terminal (final) electron acceptor**.
- Oxygen combines with the incoming electrons and free protons to form water:

$$O_2 + 4H^+ + 4e^- \longrightarrow 2H_2O$$

Step 3: Analyze the effect of oxygen deprivation: If the oxygen concentration is drastically reduced, the ETC stalls because there is no terminal acceptor to clear the electrons. This shuts down the proton-pumping mechanism, causing the proton gradient to dissipate and stopping ATP synthesis via oxidative phosphorylation.

Final Answer: The terminal electron acceptor in aerobic respiration

Answer: (B)

Go Back to Question 16

Q17.

Solution

Concept: Roots are specialized plant organs designed for anchoring, nutrient absorption, and transport. The anatomical organization of tissues differs significantly between dicots and monocots.

Solution: Step 1: Identify the tissue at the center of the dicot root: In a transverse section of a primary dicot root, the vascular cylinder (stele) occupies the center. The vascular arrangement is diarch to tetrarch, where the **xylem** occupies the very center and forms a characteristic star-shaped structure (often with 2–4 radiating arms), with phloem patches located between the xylem arms.

Step 2: Understand the function of xylem:

- Xylem is a complex permanent vascular tissue consisting of tracheids, vessel elements, xylem parenchyma, and xylem fibers.
- Its primary physiological role is the unidirectional transport of water and dissolved mineral nutrients absorbed from the soil by root hairs upward to the stem and leaves.

Step 3: Conclude: The star-shaped xylem tissue at the center of the root is primarily specialized for water and mineral conduction.

Final Answer: Water and mineral conduction

Answer: (B)

Go Back to Question 17

Q18.

Solution

Concept: Safe blood transfusions require compatibility between the donor's red blood cell surface antigens and the recipient's plasma antibodies to prevent a life-threatening immune response (agglutination and hemolysis).

Solution: Step 1: Understand the ABO blood group antigens: The ABO blood group is classified based on the presence of specific carbohydrate antigens on the erythrocyte membrane:

- Blood Group A possesses A antigens.
- Blood Group B possesses B antigens.
- Blood Group AB possesses both A and B antigens.
- **Blood Group O possesses neither A nor B antigens** (it contains only the basic H antigen precursor).

Step 2: Analyze the immunological reaction during transfusion: When group O red blood cells are transfused into a recipient of any blood group (A, B, AB, or O), the recipient's immune system does not recognize the transfused cells as foreign because they lack both A and B antigens on their surface. As a result, no anti-A or anti-B antibodies in the recipient's plasma will bind to or agglutinate the donor cells.

Step 3: Conclude: This absence of surface antigens allows group O individuals to act as universal red blood cell donors.

Final Answer: Lack both A and B antigens

Answer: (A)

Go Back to Question 18

Q19.

Solution

Concept: Enzymes are highly specific catalysts that accelerate chemical reactions by facilitating the transition of starting materials (substrates) into final substances (products).

Solution: Step 1: Interpret the trends in the graph:

- **Substrate curve (solid line):** Starts at a high concentration and decreases steadily over time.
- **Product curve (dashed line):** Starts at zero concentration and increases steadily over time, mirroring the decline of the substrate.

Step 2: Explain the biological process:

- The decrease in substrate concentration coupled with the corresponding increase in product concentration is a direct visual demonstration of the chemical reaction.
- The enzyme molecules repeatedly bind substrate molecules at their active sites, catalyze the reaction, release product molecules, and repeat the cycle.
- This process continuously **converts substrate molecules into product molecules** (Option B).

Step 3: Evaluate other options: Enzymes are catalysts and are not consumed during the reaction (ruling out Option C).

Final Answer: Substrate molecules are converted into product molecules

Answer: (B)

Go Back to Question 19

Q20.

Solution

Concept: Meiosis is a specialized reductional cell division that produces haploid gametes from a diploid progenitor cell. It consists of one round of DNA replication followed by two successive nuclear divisions (meiosis I and meiosis II).

Solution: Step 1: Identify the initial ploidy and chromosome number: The parental cell is diploid ($2n$) and contains 12 chromosomes.

$$2n = 12$$

Step 2: Analyze chromosome numbers during meiotic divisions:

- **Meiosis I (Reductional Division):** Homologous chromosomes pair up and then separate to opposite poles. The resulting two daughter cells are haploid (n), meaning they contain half the number of chromosomes of the parent cell:

$$n = \frac{12}{2} = 6 \text{ chromosomes}$$

  Each chromosome at this point still consists of two sister chromatids.

- **Meiosis II (Equational Division):** The sister chromatids of the 6 chromosomes separate. The chromosome number remains haploid ($n = 6$) in each of the four final daughter cells, though each chromosome now consists of a single chromatid.

Step 3: Therefore, at the end of meiosis II, each haploid daughter cell will contain exactly 6 chromosomes.

Final Answer: 6 chromosomes

Answer: (C)

Go Back to Question 20

Q21.

Solution

Concept: The leaf mesophyll is specialized for photosynthesis and gas exchange. In dicot leaves, it is divided into the upper palisade mesophyll and the lower spongy mesophyll.

Solution: Step 1: Contrast the palisade and spongy mesophyll structures:

- **Palisade mesophyll:** Consists of elongated, column-like cells packed tightly together. They contain a high concentration of chloroplasts, making them the primary site of light absorption and photosynthesis.
- **Spongy mesophyll:** Consists of loosely, irregularly shaped cells located beneath the palisade layer.

Step 2: Identify the feature facilitating gas exchange:

- The defining anatomical feature of the spongy mesophyll is the presence of **large intercellular air spaces** (Option C).
- These air spaces connect directly to the outside environment through the stomatal pores in the epidermis.
- This continuous, air-filled network allows carbon dioxide (CO_2) to diffuse rapidly from the atmosphere to all photosynthesizing cells, and permits oxygen (O_2) and water vapor to exit the leaf.

Final Answer: Large intercellular air spaces

Answer: (C)

Go Back to Question 21

Q22.

Solution

Concept: Outcrossing (cross-pollination) is vital for maintaining genetic diversity. Hermaphroditic (bisexual) flowers have evolved various physical, temporal, and genetic mechanisms to prevent self-pollination.

Solution: Step 1: Define the terminology for outcrossing mechanisms:

- **Herkogamy:** Physical or spatial separation of anthers and stigma to prevent self-contact.
- **Dichogamy:** Temporal separation of the maturation of male and female reproductive organs in the same flower. The anthers and stigma mature at different times, which prevents self-pollination. This is further classified into protandry (pollen shed before stigma is receptive) and protogyny (stigma receptive before pollen is shed).
- **Polyembryony:** The presence of more than one embryo in a single seed.
- **Apomixis:** Asexual reproduction in plants where seeds are formed without fertilization.

Step 2: Match with the described plant condition: The maturation of anthers and stigma at different times is termed **dichogamy** (Option B).

Final Answer: Dichogamy

Answer: (B)

Go Back to Question 22

Q23.

Solution

Concept: Gene expression is a multi-step pathway: DNA is transcribed into mRNA (transcription), and mRNA is subsequently decoded to synthesize a polypeptide chain (translation) which folds into a functional protein.

Solution: Step 1: Analyze the experimental details:

- A mutation exists in a structural gene.
- **Transcription occurred normally:** This means the correct mRNA transcript was successfully synthesized from the mutated DNA template.
- **The final protein is non-functional:** This indicates that despite successful transcription, the protein produced has a defect.

Step 2: Determine where the translational defect arises:

- The mutation in the gene (and thus in the mRNA) is read during the process of **translation**.
- The ribosome decodes the mutated mRNA codon, resulting in the incorporation of an incorrect amino acid (missense mutation) or premature termination of translation (nonsense mutation).
- This altered primary sequence disrupts protein folding, yielding a nonfunctional tertiary structure.

Step 3: Conclude: The structural defect and loss of function most directly manifest during translation, resulting in an altered amino acid sequence (Option B).

Final Answer: Translation resulting in altered amino acid sequence

Answer: (B)

Go Back to Question 23

Q24.

Solution

Concept: The biological health of an aquatic ecosystem is heavily dependent on the concentration of dissolved oxygen (DO).

Solution: Step 1: Understand the effect of organic pollution in aquatic ecosystems: When organic pollution (such as raw sewage, agricultural runoff, or organic waste) enters a pond, it provides an abundant nutrient source for heterotrophic microorganisms (specifically aerobic bacteria).

Step 2: Describe the action of the microorganisms:

- These decomposers proliferate rapidly to break down and oxidize the organic pollutants.
- This high level of metabolic activity requires a massive amount of oxygen, causing the aerobic decomposers to consume dissolved oxygen at a rate far exceeding its replenishment (resulting in high Biochemical Oxygen Demand, or BOD).

Step 3: Explain the graph's trend: The gradual, steep decline in dissolved oxygen is a classic indicator of increased decomposition of organic matter by aerobic bacteria (Option B), which can lead to hypoxia and the death of aquatic animals like fish.

Final Answer: Increased decomposition of organic matter

Answer: (B)

Go Back to Question 24

Q25.

Solution

Concept: Following double fertilization in angiosperms, the components of the embryo sac undergo distinct developmental pathways to form the seed.

Solution: Step 1: Trace the fertilization and development pathways of each cell:

- **Zygote:** Formed by the fusion of the haploid egg cell (n) and one of the haploid male gametes (n). This diploid zygote ($2n$) undergoes repeated mitotic divisions and differentiation to develop directly into the **embryo** of the seed.
- **Primary Endosperm Nucleus:** Formed by the fusion of the second male gamete (n) with the two polar nuclei ($2n$). It develops into the triploid endosperm, which provides nutrition to the developing embryo.
- **Synergids and Antipodal cells:** Helper cells of the female gametophyte that typically degenerate shortly before or after fertilization.

Step 2: Therefore, the zygote is the structure that develops directly into the embryo.

Final Answer: Zygote

Answer: (A)

Go Back to Question 25

Q26.

Solution

Concept: Adenosine triphosphate (ATP) is the primary energy currency of all living cells. Its chemical structure is uniquely designed to couple exergonic and endergonic reactions.

Solution: Step 1: Describe the phosphate composition of ATP: ATP consists of an adenine ring, a ribose sugar, and a chain of three phosphate groups (α, β, and γ phosphates).

Step 2: Explain the nature of the phosphate bonds:

- The covalent bonds linking the adjacent phosphate groups (β–γ and α–β bonds) are high-energy phosphoanhydride bonds.
- These bonds are highly unstable due to the close proximity of many negatively charged oxygen atoms, which repel each other.

Step 3: Explain their physiological role:

- Hydrolysis of the terminal phosphate bond to form ADP and inorganic phosphate (P_i) is highly exergonic, releasing approximately 30.5 kJ/mol (7.3 kcal/mol) of free energy.
- This reaction is coupled by enzymes to drive cellular processes, meaning these bonds function primarily to **store and release usable cellular energy** (Option A).

Final Answer: Store and release usable cellular energy

Answer: (A)

Go Back to Question 26

Q27.

Solution

Concept: Genetic disorders can be classified into Mendelian (single-gene) disorders and chromosomal disorders (which involve large-scale structural or numerical changes in chromosomes).

Solution: Step 1: Analyze the cause of sickle-cell anaemia: Sickle-cell anaemia is caused by a point mutation in the single *HBB* gene on chromosome 11, which codes for the β-globin chain of hemoglobin. This mutation replaces a single nucleotide (adenine with thymine, GAG $\rightarrow$ GTG), leading to the substitution of glutamic acid by valine at the sixth position of the polypeptide chain.

Step 2: Classify the inheritance pattern:

- Since the disease is caused by a mutation in a single gene and is transmitted to offspring according to Mendelian principles of inheritance (specifically as an autosomal recessive trait), it is classified as a **Mendelian gene disorder** (Option B).
- It does not involve whole-chromosome alterations (ruling out Option A) and is not polygenic or cytoplasmic (ruling out Options C and D).

Final Answer: Mendelian gene disorder

Answer: (B)

Go Back to Question 27

Q28.

Solution

Concept: Bacteria reproduce asexually via binary fission, which produces clone offspring. However, they can exchange genetic material through horizontal gene transfer mechanisms: transformation, transduction, and conjugation.

Solution: Step 1: Analyze the diagram: The diagram shows two bacterial cells physically connected by a bridge labeled "Pilus."

Step 2: Understand the process of bacterial conjugation:

- Conjugation is a mechanism of horizontal gene transfer in which a donor bacterium (F^+ cell) containing a conjugative plasmid forms a specialized protein structure called a sex pilus to bind to a recipient (F^- cell).
- The pilus retracts, bringing the cells into direct contact, and a copy of the plasmid DNA is transferred from the donor to the recipient.

Step 3: Determine the genetic outcome: By introducing new plasmid genes into the recipient bacterium, conjugation results in genetic recombination (Option B), which can spread traits like antibiotic resistance through a bacterial population.

Final Answer: Genetic recombination between bacteria

Answer: (B)

Go Back to Question 28

Q29.

Solution

Concept: Under idealized conditions with unlimited resources and no predators, a population will exhibit exponential (geometric) growth, characterized by a J-shaped curve. However, natural populations exist in finite environments.

Solution: Step 1: Explain the transition from exponential to logistic growth: Initially, because resources (food, space) are abundant and predators are absent, the rabbit population grows exponentially.

Step 2: Identify the limiting factors: As the population density increases:

- Resources such as food and nesting space become increasingly scarce.
- Intraspecific competition for these resources intensifies.
- Waste products accumulate, and disease can spread more easily.

Step 3: Define environmental resistance: The sum of these density-dependent limiting factors is known as **environmental resistance**. This resistance increases as the population grows, eventually slowing the growth rate and causing the population to plateau at the environment's carrying capacity (K).

Final Answer: Environmental resistance such as resource limitation

Answer: (B)

Go Back to Question 29

Q30.

Solution

Concept: Organisms are classified based on how they obtain energy. Photoautotrophs, such as green plants, can capture electromagnetic radiation and convert it into chemical energy.

Solution: Step 1: Define the physiological process: **Photosynthesis** is the anabolic process by which green plants, algae, and certain bacteria capture solar energy and use it to drive the synthesis of organic compounds (carbohydrates, primarily glucose) from simple inorganic molecules (CO_2 and H_2O):

$$6CO_2 + 6H_2O + \text{light energy} \longrightarrow C_6H_{12}O_6 + 6O_2$$

Step 2: Evaluate other options:

- **Respiration** (Option A) and **Fermentation** (Option B) are catabolic processes that break down carbohydrates to release stored chemical energy.
- **Transpiration** (Option D) is the physical loss of water vapor from plant leaves.

Step 3: Thus, the conversion of light energy into stored chemical energy is called photosynthesis.

Final Answer: Photosynthesis

Answer: (C)

Go Back to Question 30

Q31.

Solution

Concept: The electron transport chain (ETC) in the inner mitochondrial membrane is a series of multi-protein complexes that transfer electrons from electron donors (NADH and $FADH_2$) to a terminal electron acceptor (oxygen).

Solution: Step 1: Understand the pathway of mitochondrial electron transport:

- Electrons are passed sequentially through Complexes I, III, and IV, and finally to molecular oxygen (O_2).
- The cytochrome complex (specifically Complex IV, cytochrome c oxidase) is responsible for taking electrons from cytochrome c and transferring them directly to oxygen, reducing it to water.

Step 2: Determine the effect of blocking this transfer:

- If an inhibitor blocks the transfer of electrons from the cytochrome complex to oxygen, the entire electron transport chain halts.
- Without electron flow, the proton pumps of the ETC stop working, and the proton gradient across the inner mitochondrial membrane collapses.
- Since ATP synthase depends entirely on this proton-motive force to generate ATP, oxidative phosphorylation stops immediately, halting aerobic ATP synthesis.

Step 3: Analyze other options: While glycolysis (Option A) occurs in the cytoplasm and can continue anaerobically, it only produces a small net yield of 2 ATP and is not directly driven by the ETC. Processes like DNA replication (Option C) and protein digestion (Option D) are downstream processes that consume ATP but are not the immediate biochemical targets of the ETC inhibitor.

Final Answer: Oxidative phosphorylation and ATP synthesis

Answer: (B)

Go Back to Question 31

Q32.

Solution

Concept: The opening and closing of stomata are controlled by the turgor pressure of the guard cells. This turgor is regulated by water movement driven by osmotic and hormonal signals under environmental stress.

Solution: Step 1: Analyze the cellular effects of water stress:

- During severe water stress, the soil water potential decreases, making it harder for the plant to absorb water, leading to a general drop in leaf water potential.
- To prevent catastrophic dehydration, plants synthesize the stress hormone **abscisic acid (ABA)** in their leaves.

Step 2: Describe the action of ABA and ion movement:

- ABA binds to receptors on guard cell membranes, triggering the rapid efflux of anions (such as malate) and potassium ions (K^+) out of the guard cells into the surrounding apoplast.
- This loss of solutes raises the water potential inside the guard cells, causing water to diffuse out of the guard cells into surrounding cells via osmosis.

Step 3: Relate to stomatal closure: As water leaves, the **guard cells lose their turgidity** (become flaccid). This loss of pressure causes the elastic inner walls of the guard cells to collapse toward each other, physically sealing the stomatal pore.

Final Answer: Guard cells lose turgidity

Answer: (B)

Go Back to Question 32

Q33.

Solution

Concept: During Prophase I of meiosis, homologous maternal and paternal chromosomes align and pair up tightly in a process called synapsis.

Solution: Step 1: Understand the definition of a bivalent: A **bivalent** (or tetrad) consists of a pair of homologous chromosomes joined together. Each bivalent represents two homologous chromosomes (and therefore four sister chromatids).

Step 2: Calculate the number of bivalents based on chromosome number:

- The diploid chromosome number of the organism is:

$$2n = 16$$

  This means there are 16 individual chromosomes inside the somatic cell.

- Since bivalents are formed by the pairing of homologous chromosomes, the number of bivalents is equal to the haploid chromosome number (n):

$$\text{Number of bivalents} = \frac{2n}{2} = \frac{16}{2} = 8$$

Step 3: Conclude: During metaphase I, these 8 bivalents align along the metaphase plate before separating, making Option B the correct answer.

Final Answer: $\boxed{8}$

Answer: (B)

Go Back to Question 33

Q34.

Solution

Concept: Photosynthesis is a complex metabolic process influenced by several environmental variables, including light intensity, temperature, water availability, and carbon dioxide (CO_2) concentration.

Solution: Step 1: Apply Blackman's Law of Limiting Factors: This biological law states that when a physiological process is governed by multiple independent variables, its rate is limited by the factor that is nearest to its minimum value (most sub-optimal).

Step 2: Analyze the graph's phases:

- **Initial phase (linear rise):** At lower concentrations, carbon dioxide is the primary limiting factor. As CO_2 concentration increases, the photosynthetic rate rises because more substrate is available for the enzyme RuBisCO.
- **Plateau phase:** At high CO_2 concentrations, the rate of photosynthesis levels off and reaches a maximum.

Step 3: Explain the plateau: Once CO_2 is abundant, it is no longer the factor limiting the process. Instead, **another factor becomes limiting** (Option B). This limiting factor is typically light intensity (which limits ATP and NADPH production) or the maximum speed of the enzymes involved in carbon fixation (enzyme saturation).

Final Answer: Another factor becomes limiting

Answer: (B)

Go Back to Question 34

Q35.

Solution

Concept: The thyroid gland secretes the hormones thyroxine (T_4) and triiodothyronine (T_3), which play a key role in systemic endocrine regulation.

Solution: Step 1: Understand the role of thyroxine: Thyroxine acts on almost all tissues in the body to stimulate gene transcription for metabolic proteins. It primarily regulates the **basal metabolic rate (BMR)** of cells, controlling how quickly the body consumes oxygen and utilizes carbohydrates, lipids, and proteins to produce energy.

Step 2: Analyze the symptoms of hypothyroidism: In a patient suffering from hypothyroidism (underactive thyroid), there is an underproduction of thyroxine.

- This leads to a severe drop in the basal metabolic activity of cells.
- Because cells generate less energy (ATP) and heat, the patient experiences symptoms such as a low heart rate, cold intolerance, weight gain, fatigue, and lethargy.

Step 3: Evaluate options: Thyroxine does not primarily regulate blood clotting (Option A), antibody production (Option C), or kidney osmotic balance (Option D - which is regulated by ADH). It is the master regulator of basal metabolic activity (Option B).

Final Answer: Basal metabolic activity of cells

Answer: (B)

Go Back to Question 35

Q36.

Solution

Concept: Bacterial populations evolve and adapt rapidly to environmental changes (such as the presence of antibiotics) not only through vertical transmission (binary fission) but also through horizontal gene transfer.

Solution: Step 1: Identify the process illustrated: The diagram depicts the direct transfer of genetic material (DNA, often a plasmid) from a donor bacterial cell to a recipient cell through physical contact. This is the mechanism of **bacterial conjugation**.

Step 2: Understand the evolutionary significance:

- Unlike eukaryotes, which rely on sexual reproduction for genetic recombination, bacteria use horizontal gene transfer (HGT) to share genetic traits across existing, non-descendant cells.
- Conjugation is a form of **horizontal gene transfer** (Option B) that allows genetic material to cross species boundaries, facilitating the rapid spread of beneficial genes, such as those encoding antibiotic resistance or virulence factors, across bacterial communities.

Final Answer: Allows horizontal gene transfer

Answer: (B)

Go Back to Question 36

Q37.

Solution

Concept: An ecosystem is organized into linear feeding pathways called food chains, which track the transfer of chemical energy through different trophic levels.

Solution: Step 1: Identify the sequence of trophic levels:

(a) **Producers (1st Trophic Level):** Autotrophs (such as green plants) that capture solar radiation to synthesize organic compounds.

(b) **Primary Consumers (2nd Trophic Level):** Herbivores that feed directly on primary producers to obtain energy.

(c) **Secondary Consumers (3rd Trophic Level):** Carnivores that feed directly on primary consumers.

(d) **Tertiary Consumers (4th Trophic Level):** Top carnivores that feed on secondary consumers.

Step 2: Determine where secondary consumers get their energy: By definition, a secondary consumer (carnivore) gets its energy directly by consuming and digesting a **primary consumer** (herbivore, Option C).

Final Answer: Primary consumers

Answer: (C)

Go Back to Question 37

Q38.

Solution

Concept: The double-helix model of DNA (proposed by Watson and Crick) is stabilized by two main forces: vertical base-stacking interactions and horizontal complementary base pairing across the helical axis.

Solution: Step 1: Analyze the structure of DNA nitrogenous bases:

- Adenine (A) and Guanine (G) are double-ringed purines.
- Thymine (T) and Cytosine (C) are single-ringed pyrimidines.

Step 2: Understand the hydrogen bonding rules:

- Complementary base pairing is governed by the specific spatial arrangement of hydrogen bond donors (like amino and imino groups) and hydrogen bond acceptors (like carbonyl oxygens and ring nitrogens).
- The molecular structures of adenine and thymine position their functional groups perfectly to form **two complementary hydrogen bonds** across the double helix.
- Guanine and cytosine are structurally arranged to form three complementary hydrogen bonds.

Step 3: Conclude: Specific pairing occurs because their structures allow the formation of complementary hydrogen bonds (Option B).

Final Answer: Their structures allow formation of complementary hydrogen bonds

Answer: (B)

Go Back to Question 38

Q39.

Solution

Concept: While sexual reproduction is the dominant mode of reproduction in flowering plants, several alternative developmental pathways exist to produce seeds or progeny.

Solution: Step 1: Define the terms listed in the options:

- **Double fertilization** (Option A): The standard sexual reproduction process in angiosperms where one sperm fertilizes the egg and another fuses with polar nuclei.
- **Apomixis** (Option B): A form of asexual reproduction where seeds are formed from maternal tissues of the ovule (such as the diploid megaspore or nucellar cells) without meiosis or fertilization. The resulting seeds are genetic clones of the mother plant.
- **Polyembryony** (Option C): The development of multiple embryos within a single seed.
- **Vegetative propagation** (Option D): Asexual reproduction where new plants grow from non-reproductive structures like stems, roots, or leaves, without forming seeds.

Step 2: Match with the described plant: The formation of seeds without fertilization is termed apomixis.

Final Answer: Apomixis

Answer: (B)

Go Back to Question 39

Q40.

Solution

Concept: Survivorship curves graphically represent the proportion of individuals in a cohort that survive to different ages. Ecologists classify these curves into three general types: Type I, Type II, and Type III.

Solution: Step 1: Define the characteristics of each survivorship curve:

- **Type I curve (solid line):** High survivorship during early and middle life, followed by a steep drop in survival in late life. Typical of large mammals (including humans) that produce few offspring and provide extensive parental care.
- **Type II curve:** Constant mortality rate throughout the lifespan of the organism (represented by a straight diagonal line, typical of some birds and rodents).
- **Type III curve (dashed line):** Extremely low survivorship (high mortality) during the early stages of life. However, for the few individuals that manage to survive this bottleneck, mortality drops significantly, allowing them to live for a relatively long time.

Step 2: Relate Type III curves to reproductive strategies: This curve is characteristic of organisms that produce very large numbers of offspring but provide little to no parental care (e.g., marine invertebrates, many fishes, frogs, and trees). Most offspring are consumed by predators or die from environmental stress early on.

Step 3: Conclude: Type III survivorship curves are typically associated with organisms that exhibit high mortality during early life stages (Option B).

Final Answer: Exhibit high mortality during early life stages

Answer: (B)

Go Back to Question 40

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	B	3	B	4	B	5	B
6	C	7	C	8	C	9	B	10	B
11	C	12	B	13	A	14	C	15	B
16	B	17	B	18	A	19	B	20	C
21	C	22	B	23	B	24	B	25	A
26	A	27	B	28	B	29	B	30	C
31	B	32	B	33	B	34	B	35	B
36	B	37	C	38	B	39	B	40	B