BITSAT Biology Sample Paper-7

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** marks. Unattempted questions carry **0** marks.
- Only one option is correct for each question.
- Use of mobile phones, smartwatches, calculators, or any electronic gadgets is strictly prohibited.

Q1. Which of the following elements is present in negligible or trace amounts in human living tissue but is a major component of the Earth's crust?

(A) Carbon

(B) Hydrogen

(C) Silicon

(D) Nitrogen

Q2. Consider the two statements below regarding human physiology:
Statement 1: The major part of carbon dioxide (CO_2) is transported in human blood as carbamino-haemoglobin within the erythrocytes.
Statement 2: The enzyme carbonic anhydrase is present in high concentration in erythrocytes and in minute quantities in the plasma.

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

(B) Both Statement 1 and Statement 2 are incorrect.

(C) Statement 1 is correct but Statement 2 is incorrect.

(D) Statement 1 is incorrect but Statement 2 is correct.

Q3. Arrange the following taxonomic categories in the correct ascending order of their hierarchy based on the classification of living organisms: 1. Family 2. Genus 3. Order 4. Species 5. Class

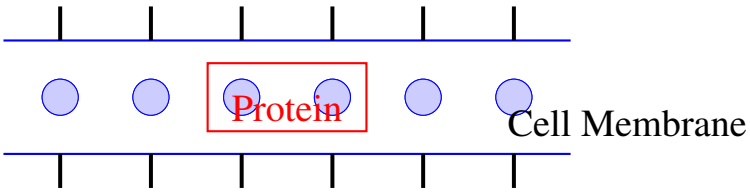
(A) $4 \rightarrow 2 \rightarrow 1 \rightarrow 3 \rightarrow 5$

(B) $4 \rightarrow 1 \rightarrow 2 \rightarrow 3 \rightarrow 5$

(C) $2 \rightarrow 4 \rightarrow 1 \rightarrow 5 \rightarrow 3$

(D) $5 \rightarrow 3 \rightarrow 1 \rightarrow 2 \rightarrow 4$

Q4. The fluid mosaic model describes the structure of:



(A) Cell membrane

(B) Nuclear envelope

(C) Mitochondrial cristae

(D) Chloroplast thylakoid

Q5. Fill in the blanks with the correct combination of words:
During the luteal phase of the human menstrual cycle, the ruptured Graafian follicle transforms into the _____, which secretes large amounts of _____ to maintain the endometrium.

(A) corpus albicans, estrogen

(B) corpus luteum, progesterone

(C) corpus luteum, LH

(D) corpus callosum, FSH

Q6. Under specialized conditions, a plant hormone is known to induce runtime responses such as triple response in seedlings, root hair formation, and breaking seed dormancy. Identify this phytohormone.

(A) Abscisic acid

(B) Indole-3-acetic acid

(C) Gibberellic acid

(D) Ethylene

Q7. Select the correct option that identifies the infectious agent, its target organ, and the primary diagnostic test associated with Typhoid fever in humans.

(A) *Streptococcus pneumoniae* — Alveoli — Widal Test

(B) *Salmonella typhi* — Small intestine — Widal Test

(C) *Salmonella typhi* — Large intestine — Western Blot

(D) *Plasmodium vivax* — Liver — Schick Test

Q8. Which ecosystem possesses the highest productivity per unit area per year, and what type of ecological pyramid can occasionally be inverted in a marine ecosystem?

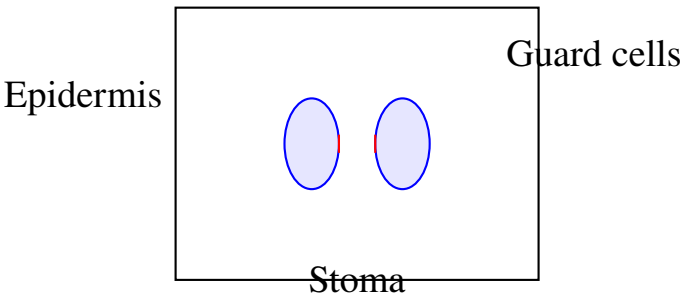
(A) Desert; Pyramid of Energy

(B) Tropical Rainforest; Pyramid of Biomass

(C) Taiga; Pyramid of Numbers

(D) Coral reef; Pyramid of Energy

Q9. Which hormone regulates the opening and closing of stomata?



(A) Gibberellin

(B) Abscisic acid

(C) Auxin

(D) Cytokinin

Q10. During the process of cell division, specific pairs of homologous chromosomes line up at the equatorial plate during Metaphase I. Which specific sub-stage

of Prophase I is characterized by the actual appearance of the recombination nodules and crossing over?

(A) Leptotene

(B) Zygotene

(C) Pachytene

(D) Diplotene

Q11. A mutation that replaces a single purine base with a pyrimidine base in a coding segment of DNA is structurally classified as a:

(A) Transition mutation

(B) Transversion mutation

(C) Frameshift deletion

(D) Chromosomal translocation

Q12. Fill in the blanks with the correct pair of words:
The primary structure of a protein is held together by _____ bonds, whereas the folding of a polypeptide into a stable α-helix or β-pleated sheet is primarily stabilized by _____ bonds.

(A) ionic, covalent

(B) peptide, hydrogen

(C) disulfide, hydrophobic

(D) glycosidic, peptide

Q13. Consider the two statements below regarding muscle contraction in humans:
Statement 1: The structural and functional unit of myofibril contraction is the sarcomere, which is the segment between two successive H-zones.
Statement 2: During contraction, the length of the A-band remains constant, while the I-band shortens.

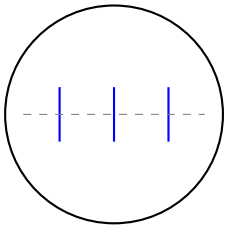
(A) Both Statement 1 and Statement 2 are correct.

(B) Both Statement 1 and Statement 2 are incorrect.

(C) Statement 1 is correct but Statement 2 is incorrect.

(D) Statement 1 is incorrect but Statement 2 is correct.

Q14. During which stage of meiosis do chromosomes align at the metaphase plate?



Metaphase I

(A) Prophase I

(B) Metaphase I

(C) Anaphase II

(D) Telophase II

Q15. An antibody molecule is a complex glycoprotein represented structurally as H_2L_2. Where exactly are the antigen-binding sites located on this molecule?

(A) At the constant regions of both heavy and light chains.

(B) At the variable regions of both heavy and light chains.

(C) Exclusively at the C-terminal end of the heavy chains.

(D) Within the disulfide bridges joining the heavy chains.

Q16. Arrange the structural events of human spermatogenesis in the correct chronological sequence from the initial germ cells to mature gametes: 1. Primary spermatocyte 2. Spermatid 3. Spermatogonium 4. Spermatozoon 5. Secondary spermatocyte

(A) $3 \rightarrow 1 \rightarrow 5 \rightarrow 2 \rightarrow 4$

(B) $3 \rightarrow 5 \rightarrow 1 \rightarrow 2 \rightarrow 4$

(C) $1 \rightarrow 3 \rightarrow 5 \rightarrow 2 \rightarrow 4$

(D) $3 \rightarrow 1 \rightarrow 2 \rightarrow 5 \rightarrow 4$

Q17. In a laboratory experiment, a student observed a certain type of algae belonging to Chlorophyceae that shows anisogamous sexual reproduction with flagellated motile gametes. Identify the organism.

(A) *Spirogyra*

(B) *Volvox*

(C) *Ectocarpus*

(D) *Eudorina*

Q18. The accumulation of which substance in the joints due to metabolic errors leads to inflammation and the painful condition known as gout?

(A) Calcium oxalate crystals

(B) Urea crystals

(C) Uric acid crystals

(D) Cholesterol plaques

Q19. Which of the following molecular techniques relies on the separation of DNA fragments by size via gel electrophoresis, followed by hybridization with a labeled radioactive single-stranded probe to detect specific gene variants?

(A) Western Blotting

(B) Northern Blotting

(C) Southern Blotting

(D) Enzyme-Linked Immunosorbent Assay (ELISA)

Q20. According to the competitive exclusion principle proposed by G.F. Gause, what happens when two closely related species compete for exactly the same limiting resources in an ecosystem?

(A) Both species evolve to share the resource through behavioral shifts.

(B) The competitively inferior species will eventually be eliminated.

(C) Both species experience a mutualistic population boom.

(D) The carrying capacity of the habitat doubles for both species.

Q21. Match the cell organelle with its unique enzymatic or structural marker: Lysosome is to _____ as Peroxisome is to _____.

(A) Hydrolases; Catalase

(B) Oxido-reductases; Cytochrome c oxidase

(C) Lipases; Ribozyme

(D) Amylases; RNA polymerase

Q22. In the human male reproductive system, which accessory gland secretes a fluid rich in fructose, calcium ions, and specific coagulation enzymes to nourish and activate spermatozoa?

(A) Prostate gland

(B) Bulbourethral gland

(C) Seminal vesicle

(D) Bartholin's gland

Q23. The geological time scale records the major milestones of biological evolution. In which specific geological era did the rapid radiation of mammals and angiosperms take place on Earth?

(A) Paleozoic Era

(B) Mesozoic Era

(C) Cenozoic Era

(D) Proterozoic Era

Q24. In the classical model of a vascular plant, water transport from roots to leaves depends on cohesive, adhesive, and surface tension properties of water. This mechanism is best explained by the:

(A) Pressure Flow Hypothesis

(B) Cohesion-Tension-Transpiration Pull Model

(C) Active Potassium-Pump Theory

(D) Root Pressure Hydrostatic Theory

Q25. Which specific type of immunoglobulin is found most abundantly in human colostrum, providing vital passive immunity to a newborn infant during the initial days of lactation?

(A) IgG

(B) IgM

(C) IgE

(D) IgA

Q26. A segment of double-stranded DNA contains a total of 1200 base pairs. If the biochemical analysis reveals that the percentage of Adenine bases is 30%, what is the total number of Cytosine bases present in this DNA molecule?

(A) 360

(B) 480

(C) 240

(D) 720

Q27. In the human kidney, the regulation of water reabsorption in the distal convoluted tubule and collecting duct is directly controlled by the hormone Antidiuretic Hormone (ADH). From which exact anatomical site is ADH synthesized and released?

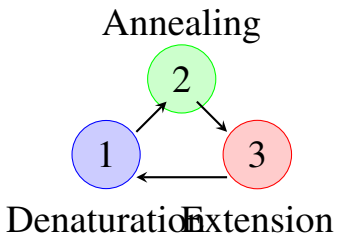
(A) Synthesized in the anterior pituitary, released by the posterior pituitary.

(B) Synthesized in the adrenal cortex, released by the medulla.

(C) Synthesized in the hypothalamus, released by the posterior pituitary.

(D) Synthesized in the kidney juxtaglomerular cells, released by the cortex.

Q28. The technique used to amplify specific DNA sequences is:



(A) Gel electrophoresis

(B) Polymerase chain reaction

(C) Southern blotting

(D) DNA sequencing

Q29. In a double-stranded helical DNA molecule, the pitch of the helix is 3.4 nm and the distance between two consecutive base pairs is approximately 0.34 nm. How many base pairs are present in exactly ten complete turns of a B-DNA helix?

(A) 10

(B) 100

(C) 34

(D) 20

Q30. Which of the following terms correctly defines an enzyme that is active only when it is bound to its non-protein cofactor component?

(A) Apoenzyme

(B) Holoenzyme

(C) Coenzyme

(D) Zymogen

Q31. Which group of living organisms belongs entirely to the Kingdom Monera, characterized by the absence of a well-defined nuclear membrane and possessing peptidoglycan cell walls?

(A) Diatoms and Desmids

(B) Cyanobacteria and Mycoplasma

(C) Slime molds and Protozoans

(D) Ascomycetes and Basidiomycetes

Q32. In human respiratory physiology, the volume of air that remains in the lungs even after a forceful, maximum expiration is known as the:

(A) Expiratory Reserve Volume (ERV)

(B) Vital Capacity (VC)

(C) Residual Volume (RV)

(D) Functional Residual Capacity (FRC)

Q33. What is the main ecological function of heterocysts present in certain filamentous cyanobacteria like *Nostoc* and *Anabaena*?

(A) Carbon dioxide fixation via the Calvin cycle

(B) Oxygenic photosynthesis and water splitting

(C) Nitrogen fixation under anaerobic conditions

(D) Fragmentation and asexual spore production

Q34. The process of double fertilization is a defining evolutionary feature of angiosperms. It involves the fusion of:

(A) One male gamete with the egg cell, and the other male gamete with the synergid cell.

(B) One male gamete with the egg cell, and the other male gamete with the central polar nuclei.

(C) Two male gametes with a single egg cell to form a triploid zygote.

(D) One male gamete with the antipodal cell, and the other with the vegetative cell.

Q35. A cross between a homozygous red-flowered plant and a homozygous white-flowered plant yields offspring with completely pink flowers. This genetic phenomenon represents:

(A) Co-dominance

(B) Complete dominance

(C) Incomplete dominance

(D) Epistasis

Q36. During the dark reactions of photosynthesis (C_3 pathway), the primary CO_2 acceptor molecule is a 5-carbon compound known as:

(A) Phosphoenolpyruvate (PEP)

(B) Ribulose-1,5-bisphosphate (RuBP)

(C) Oxaloacetic acid (OAA)

(D) 3-phosphoglyceric acid (PGA)

Q37. Which of the following methods of contraception works by changing the hormonal feedback mechanism to prevent ovulation and altering the cervical mucus quality to retard sperm entry?

(A) Barrier methods (Diaphragms)

(B) Oral contraceptive pills

(C) Intrauterine Devices (CuT)

(D) Vasectomy

Q38. In the global carbon cycle, which of the following activities acts as a major biological sink that removes carbon dioxide from the atmosphere?

(A) Volcanic eruptions

(B) Microbe-mediated decomposition

(C) Photosynthesis by marine phytoplanktons and terrestrial plants

(D) Combustion of fossil fuels

Q39. Recombinant DNA technology uses vectors to clone genes. Which of the following statements correctly differentiates a plasmid vector from a bacteriophage vector?

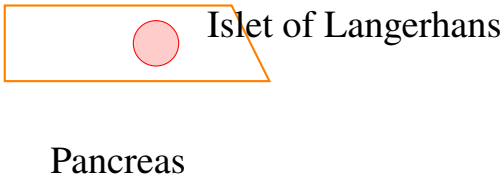
(A) Plasmids can accommodate much larger fragments of foreign DNA than bacteriophages.

(B) Plasmids replicate autonomously within bacterial cells, whereas bacteriophages integrate into the host genome or lyse the cell.

(C) Plaimids are linear single-stranded RNA molecules, whereas bacteriophages are double-stranded circular DNA vectors.

(D) Plasmids lack an origin of replication (ori) site, while bacteriophages have multiple ori sites.

Q40. Which gland produces insulin in humans?



(A) Thyroid gland

(B) Pancreas

(C) Adrenal gland

(D) Pituitary gland

Detailed Solutions

Q1.

Solution

Concept:

Elements essential for life are abundant in living tissues, whereas some elements abundant in Earth's crust occur only in trace quantities in organisms.

Solution:

(a) Carbon, hydrogen, and nitrogen are major constituents of biomolecules such as carbohydrates, proteins, lipids, and nucleic acids.

(b) Silicon is highly abundant in the Earth's crust as silicates and silica.

(c) However, silicon occurs only in negligible or trace amounts in human living tissues.

(d) Therefore, silicon satisfies the given condition.

Final Answer: Silicon is present in trace amounts in human tissues but abundant in Earth's crust.

Answer: (C)

Go Back to Question 1

Q2.

Solution

Concept:

Carbon dioxide transport in blood occurs mainly as bicarbonate ions, while carbonic anhydrase catalyzes rapid conversion between CO_2 and carbonic acid.

Solution:

(a) Statement 1 is incorrect because most CO_2 is transported as bicarbonate ions $\left(HCO_3^-\right)$ in plasma, not as carbamino-haemoglobin.

(b) Only about 20–25% of CO_2 binds with haemoglobin to form carbamino-haemoglobin.

(c) Statement 2 is correct because erythrocytes contain high concentrations of carbonic anhydrase.

(d) This enzyme accelerates the conversion:

$$CO_2 + H_2O \leftrightarrow H_2CO_3$$

(e) Plasma contains only minute quantities of this enzyme.

Final Answer: Statement 1 is incorrect but Statement 2 is correct.

Answer: (D)

Go Back to Question 2

Q3.

Solution

Concept:

Biological classification follows a hierarchical arrangement from lower to higher taxonomic categories.

Solution:

(a) Species is the basic unit of classification.

(b) Related species form a genus.

(c) Related genera combine to form a family.

(d) Related families form an order.

(e) Related orders form a class.

(f) Therefore, the ascending order is:

$$\text{Species} \rightarrow \text{Genus} \rightarrow \text{Family} \rightarrow \text{Order} \rightarrow \text{Class}$$

(g) Converting into numerical sequence:

$$4 \rightarrow 2 \rightarrow 1 \rightarrow 3 \rightarrow 5$$

Final Answer: Correct ascending hierarchy is $4 \rightarrow 2 \rightarrow 1 \rightarrow 3 \rightarrow 5$.

Answer: (A)

Go Back to Question 3

Q4.

Solution

Concept:

The fluid mosaic model proposed by Singer and Nicolson explains the dynamic arrangement of lipids and proteins in biological membranes.

Solution:

(a) According to the fluid mosaic model, the membrane consists of a phospholipid bilayer.

(b) Proteins are embedded within this bilayer and can move laterally.

(c) The membrane behaves like a fluid structure with proteins forming a mosaic pattern.

(d) This model specifically describes the plasma membrane or cell membrane.

(e) Other structures such as mitochondrial cristae and thylakoids possess membranes, but the model fundamentally refers to the cell membrane.

Final Answer: The fluid mosaic model describes the cell membrane.

Answer: (A)

Go Back to Question 4

Q5.

Solution

Concept:

After ovulation, the Graafian follicle transforms into a temporary endocrine structure that supports pregnancy preparation.

Solution:

(a) During ovulation, the mature Graafian follicle ruptures to release the ovum.

(b) The ruptured follicle transforms into the corpus luteum.

(c) Corpus luteum secretes large amounts of progesterone.

(d) Progesterone maintains the uterine endometrium and prepares it for implantation.

(e) If fertilization does not occur, the corpus luteum degenerates into corpus albicans.

Final Answer: The correct combination is corpus luteum and progesterone.

Answer: (B)

Go Back to Question 5

Q6.

Solution

Concept:
Phytohormones regulate plant growth and stress responses under different environmental conditions.
Solution:

(a) Ethylene is a gaseous plant hormone.

(b) It induces the triple response in seedlings, which includes inhibition of stem elongation, radial swelling, and horizontal growth.

(c) Ethylene also promotes root hair formation.

(d) It helps in breaking seed dormancy and stimulates fruit ripening.

(e) Other hormones such as auxin and gibberellin mainly promote growth, whereas abscisic acid induces dormancy.

Final Answer: The phytohormone is Ethylene.

Answer: (D)
Go Back to Question 6

Q7.

Solution

Concept:
Typhoid fever is a bacterial disease affecting the digestive tract and diagnosed using serological methods.
Solution:

(a) Typhoid fever is caused by the bacterium *Salmonella typhi*.

(b) The pathogen enters through contaminated food and water.

(c) It primarily affects the small intestine after passing through the bloodstream.

(d) The Widal test is commonly used for diagnosis by detecting antibodies against *Salmonella*.

(e) Other options contain mismatched pathogens or diagnostic methods.

Final Answer: *Salmonella typhi* — Small intestine — Widal Test.

Answer: (B)
Go Back to Question 7

Q8.

Solution

Concept:

Ecosystem productivity measures biomass production, while ecological pyramids represent trophic relationships.

Solution:

(a) Tropical rainforests possess the highest productivity per unit area per year because of abundant rainfall, sunlight, and biodiversity.

(b) In marine ecosystems, producers such as phytoplanktons have very low standing biomass.

(c) Despite low biomass, phytoplanktons reproduce rapidly and support larger consumer biomass.

(d) Therefore, the pyramid of biomass may appear inverted in marine ecosystems.

(e) Pyramid of energy is always upright because energy decreases at each trophic level.

Final Answer: Tropical rainforest and Pyramid of Biomass.

Answer: (B)

Go Back to Question 8

Q9.

Solution

Concept:

Plant hormones regulate stomatal movement by affecting guard cell turgidity.

Solution:

(a) Abscisic acid (ABA) is known as a stress hormone in plants.

(b) Under water stress, ABA accumulates in guard cells.

(c) It causes loss of potassium ions and water from guard cells.

(d) As guard cells become flaccid, stomata close to reduce transpiration.

(e) ABA therefore regulates opening and closing of stomata.

Final Answer: The hormone is Abscisic acid.

Answer: (B)

Go Back to Question 9

Q10.

Solution

Concept:

Prophase I of meiosis consists of several sub-stages associated with chromosome pairing and recombination.

Solution:

(a) During leptotene, chromosomes first become visible.

(b) In zygotene, homologous chromosomes pair through synapsis.

(c) During pachytene, recombination nodules appear and crossing over occurs between homologous chromosomes.

(d) Diplotene is characterized by separation of homologous chromosomes except at chiasmata.

(e) Therefore, crossing over specifically occurs during pachytene.

Final Answer: The correct sub-stage is Pachytene.

Answer: (C)

Go Back to Question 10

Q11.

Solution

Concept:

Base substitution mutations are classified according to the type of nitrogenous bases exchanged.

Solution:

(a) Purines include adenine and guanine, whereas pyrimidines include cytosine and thymine.

(b) A transition mutation involves replacement of one purine by another purine or one pyrimidine by another pyrimidine.

(c) A transversion mutation occurs when a purine is replaced by a pyrimidine or vice versa.

(d) The question describes replacement of a purine with a pyrimidine.

(e) Hence, the mutation is classified as a transversion mutation.

Final Answer: The mutation is a Transversion mutation.

Answer: (B)

Go Back to Question 11

Q12.

Solution

Concept:

Protein structure is stabilized by different chemical bonds at different organizational levels.

Solution:

(a) The primary structure of proteins represents the linear sequence of amino acids.

(b) Adjacent amino acids are joined by peptide bonds formed through condensation reactions.

(c) Secondary structures such as α-helix and β-pleated sheets arise due to regular folding.

(d) These structures are stabilized mainly by hydrogen bonds between peptide groups.

(e) Therefore, peptide bonds maintain primary structure, whereas hydrogen bonds stabilize secondary structure.

Final Answer: The correct pair is peptide bonds and hydrogen bonds.

Answer: (B)

Go Back to Question 12

Q13.

Solution

Concept:

Muscle contraction depends on sliding filament theory and structural organization of myofibrils.

Solution:

(a) The sarcomere is the structural and functional unit of contraction.

(b) It extends between two successive Z-lines, not H-zones.

(c) Therefore, Statement 1 is incorrect.

(d) During contraction, thin filaments slide over thick filaments.

(e) The A-band corresponds to the length of thick filaments and remains constant.

(f) The I-band shortens because overlap between actin and myosin increases.

(g) Therefore, Statement 2 is correct.

Final Answer: Statement 1 is incorrect but Statement 2 is correct.

Answer: (D)

Go Back to Question 13

Q14.

Solution

Concept:
During meiosis, chromosomes align at the equatorial plate during specific metaphase stages.
Solution:

(a) Meiosis I is the reductional division where homologous chromosomes separate.

(b) During Metaphase I, homologous chromosome pairs called bivalents align at the metaphase plate.

(c) Spindle fibers attach to centromeres from opposite poles.

(d) This arrangement ensures equal segregation during Anaphase I.

(e) Therefore, chromosome alignment at the equatorial plate occurs during Metaphase I.

Final Answer: The correct stage is Metaphase I.

Answer: (B)
Go Back to Question 14

Q15.

Solution

Concept:
Antibodies possess specific regions responsible for recognizing and binding antigens.
Solution:

(a) An antibody molecule consists of two heavy chains and two light chains represented as H_2L_2.

(b) Each chain contains variable and constant regions.

(c) Antigen-binding sites are formed by the variable regions of both heavy and light chains.

(d) These variable regions possess unique amino acid sequences that provide specificity.

(e) Constant regions mainly determine antibody class and effector functions.

Final Answer: Antigen-binding sites occur at the variable regions of both heavy and light chains.

Answer: (B)
Go Back to Question 15

Q16.

Solution

Concept:

Spermatogenesis is the process of formation of mature male gametes from germ cells.

Solution:

(a) Spermatogonia are diploid germ cells present in seminiferous tubules.

(b) They divide mitotically to form primary spermatocytes.

(c) Primary spermatocytes undergo Meiosis I to produce secondary spermatocytes.

(d) Secondary spermatocytes undergo Meiosis II to form spermatids.

(e) Spermatids differentiate through spermiogenesis into mature spermatozoa.

(f) Therefore, the correct sequence is:

$$3 \rightarrow 1 \rightarrow 5 \rightarrow 2 \rightarrow 4$$

Final Answer: Correct sequence is $3 \rightarrow 1 \rightarrow 5 \rightarrow 2 \rightarrow 4$.

Answer: (A)

Go Back to Question 16

Q17.

Solution

Concept:

Different algae exhibit distinct modes of sexual reproduction involving motile or non-motile gametes.

Solution:

(a) *Spirogyra* shows conjugation with non-motile gametes.

(b) *Ectocarpus* belongs to brown algae, not Chlorophyceae.

(c) *Volvox* mainly exhibits oogamy.

(d) *Eudorina*, a green alga of Chlorophyceae, shows anisogamous sexual reproduction.

(e) In anisogamy, both gametes are motile but differ in size.

(f) Therefore, the described organism is *Eudorina*.

Final Answer: The organism is *Eudorina*.

Answer: (D)

Go Back to Question 17

Q18.

Solution

Concept:

Metabolic imbalance can lead to deposition of crystalline substances in body tissues.

Solution:

(a) Gout is a painful inflammatory disorder affecting joints.

(b) It occurs due to excessive accumulation of uric acid in blood.

(c) Uric acid crystallizes as monosodium urate crystals within joints.

(d) These crystals trigger inflammation, swelling, and severe pain.

(e) Therefore, gout results from deposition of uric acid crystals.

Final Answer: The substance is uric acid crystals.

Answer: (C)

Go Back to Question 18

Q19.

Solution

Concept:

Blotting techniques identify specific biomolecules using probes or antibodies after electrophoretic separation.

Solution:

(a) Southern blotting detects specific DNA sequences.

(b) DNA fragments are first separated according to size using gel electrophoresis.

(c) The separated fragments are transferred onto a membrane.

(d) A labeled radioactive single-stranded DNA probe is then hybridized with complementary DNA fragments.

(e) This technique helps identify specific genes or mutations.

(f) Western blotting identifies proteins, whereas Northern blotting identifies RNA.

Final Answer: The technique is Southern Blotting.

Answer: (C)

Go Back to Question 19

Q20.

Solution

Concept:

The competitive exclusion principle explains the ecological outcome of intense competition for identical resources.

Solution:

(a) G.F. Gause proposed the competitive exclusion principle.

(b) According to this principle, two closely related species cannot coexist indefinitely if they compete for exactly the same limiting resources.

(c) One species becomes more efficient in resource utilization.

(d) The inferior competitor gradually declines in population size.

(e) Eventually, the weaker species is eliminated from that habitat or forced to shift ecological niche.

(f) Thus, stable coexistence is impossible under identical ecological requirements.

Final Answer: The competitively inferior species will eventually be eliminated.

Answer: (B)

Go Back to Question 20

Q21.

Solution

Concept:

Different cell organelles possess characteristic enzymes that help identify their specialized functions.

Solution:

(a) Lysosomes are membrane-bound organelles containing hydrolytic enzymes.

(b) These enzymes digest macromolecules, worn-out organelles, and foreign particles.

(c) Therefore, lysosomes are characterized by acid hydrolases.

(d) Peroxisomes contain oxidative enzymes involved in detoxification reactions.

(e) Catalase is the characteristic enzyme of peroxisomes.

(f) Catalase decomposes hydrogen peroxide into water and oxygen.

(g) Hence, the correct matching is hydrolases for lysosomes and catalase for peroxisomes.

Final Answer: Hydrolases; Catalase.

Answer: (A)

Go Back to Question 21

Q22.

Solution

Concept:

Accessory glands of the male reproductive system contribute secretions that nourish and activate sperm cells.

Solution:

(a) Seminal vesicles are paired glands associated with the vas deferens.

(b) They secrete an alkaline fluid rich in fructose, calcium ions, and coagulating enzymes.

(c) Fructose provides energy for sperm motility.

(d) Calcium ions and enzymes aid activation and stabilization of spermatozoa.

(e) The secretion forms a major portion of semen.

(f) The prostate gland mainly secretes thin milky fluid, whereas bulbourethral glands secrete mucus.

Final Answer: The gland is the Seminal vesicle.

Answer: (C)

Go Back to Question 22

Q23.

Solution

Concept:
The geological time scale records major evolutionary events in Earth's biological history.
Solution:

(a) The Paleozoic Era witnessed diversification of fishes, amphibians, and early reptiles.

(b) The Mesozoic Era is called the age of reptiles and dinosaurs.

(c) The Cenozoic Era is known as the age of mammals.

(d) During this era, mammals underwent rapid adaptive radiation.

(e) Angiosperms also became highly diversified and dominant.

(f) Therefore, the rapid radiation of mammals and angiosperms occurred during the Cenozoic Era.

Final Answer: The correct era is the Cenozoic Era.

Answer: (C)
Go Back to Question 23

Q24.

Solution

Concept:
Water transport in vascular plants depends on physical properties of water and transpiration pull.
Solution:

(a) Water evaporates from leaf surfaces during transpiration.

(b) This creates negative pressure or tension within xylem vessels.

(c) Cohesion between water molecules maintains a continuous water column.

(d) Adhesion between water and xylem walls prevents collapse of the column.

(e) Surface tension also contributes to upward pull.

(f) Together these processes form the Cohesion-Tension-Transpiration Pull Model.

(g) This mechanism explains ascent of sap from roots to leaves.

Final Answer: The mechanism is the Cohesion-Tension-Transpiration Pull Model.

Answer: (B)
Go Back to Question 24

Q25.

Solution

Concept:

Maternal antibodies transferred through colostrum provide passive immunity to newborn infants.

Solution:

(a) Colostrum is the first milk produced immediately after childbirth.

(b) It contains high concentrations of immunoglobulins.

(c) Immunoglobulin A (IgA) is the most abundant antibody present in colostrum.

(d) IgA protects mucosal surfaces of the infant against pathogens.

(e) It provides passive immunity during the early days of life.

(f) Other immunoglobulins are present in smaller quantities.

Final Answer: The immunoglobulin is IgA.

Answer: (D)

Go Back to Question 25

Q26.

Solution

Concept:

Chargaff's rule states that adenine pairs with thymine and cytosine pairs with guanine in double-stranded DNA.

Solution:

(a) Total number of base pairs in DNA is 1200.

(b) Therefore, total nitrogenous bases:

$$1200 \times 2 = 2400$$

(c) Adenine constitutes 30% of total bases.

$$A = 0.30 \times 2400 = 720$$

(d) Since adenine equals thymine:

$$T = 720$$

(e) Remaining percentage belongs to cytosine and guanine:

$$100 - 60 = 40\%$$

(f) Cytosine equals guanine, so cytosine percentage:

$$20\%$$

(g) Number of cytosine bases:

$$0.20 \times 2400 = 480$$

Final Answer: Total cytosine bases present are 480.

Answer: (B)

Go Back to Question 26

Q27.

Solution

Concept:

Antidiuretic Hormone regulates water balance and is associated with the hypothalamus and pituitary gland.

Solution:

(a) ADH is synthesized by neurosecretory cells in the hypothalamus.

(b) Specifically, it is produced in the supraoptic and paraventricular nuclei.

(c) The hormone is transported through axons to the posterior pituitary.

(d) Posterior pituitary stores and releases ADH into blood.

(e) ADH increases water reabsorption in distal convoluted tubules and collecting ducts.

(f) This reduces urine volume and maintains osmotic balance.

Final Answer: ADH is synthesized in the hypothalamus and released by the posterior pituitary.

Answer: (C)

Go Back to Question 27

Q28.

Solution

Concept:

Amplification of specific DNA sequences is an essential technique in molecular biology.

Solution:

(a) Polymerase Chain Reaction (PCR) amplifies selected DNA segments.

(b) The process involves repeated cycles of denaturation, annealing, and extension.

(c) During denaturation, DNA strands separate at high temperature.

(d) Primers bind to complementary sequences during annealing.

(e) DNA polymerase synthesizes new strands during extension.

(f) Each cycle doubles the target DNA amount exponentially.

(g) PCR is widely used in diagnostics, forensics, and genetic engineering.

Final Answer: The technique is Polymerase Chain Reaction.

Answer: (B)

Go Back to Question 28

Q29.

Solution

Concept:

The helical structure of B-DNA possesses fixed dimensions and a definite number of base pairs per turn.

Solution:

(a) In B-DNA, one complete turn measures approximately:

$$3.4 \text{ nm}$$

(b) Distance between consecutive base pairs is:

$$0.34 \text{ nm}$$

(c) Therefore, number of base pairs in one turn:

$$\frac{3.4}{0.34} = 10$$

(d) For ten complete turns:

$$10 \times 10 = 100$$

(e) Thus, ten turns of B-DNA contain 100 base pairs.

Final Answer: Ten turns contain 100 base pairs.

Answer: (B)

Go Back to Question 29

Q30.

Solution

Concept:

Enzymes may require non-protein cofactors for catalytic activity.

Solution:

(a) The protein portion of an inactive enzyme is called an apoenzyme.

(b) Many enzymes require cofactors such as metal ions or coenzymes.

(c) When the apoenzyme combines with its cofactor, the complete active enzyme is formed.

(d) This active enzyme complex is known as a holoenzyme.

(e) Therefore, a holoenzyme consists of apoenzyme plus cofactor.

(f) Zymogens are inactive enzyme precursors, whereas coenzymes are organic cofactors only.

Final Answer: The correct term is Holoenzyme.

Answer: (B)

Go Back to Question 30

Q31.

Solution

Concept:

Kingdom Monera includes prokaryotic organisms lacking a true nucleus and membrane-bound organelles.

Solution:

(a) Organisms of Kingdom Monera possess prokaryotic cell organization.

(b) They lack a well-defined nuclear membrane and membrane-bound organelles.

(c) Most members possess peptidoglycan cell walls.

(d) Cyanobacteria are photosynthetic prokaryotes belonging to Monera.

(e) Mycoplasma are also placed in Monera although they lack cell walls.

(f) Diatoms, desmids, slime molds, protozoans, ascomycetes, and basidiomycetes belong to Protista or Fungi.

Final Answer: Cyanobacteria and Mycoplasma belong to Kingdom Monera.

Answer: (B)

Go Back to Question 31

Q32.

Solution

Concept:

Different respiratory volumes describe the amount of air moving in and out of lungs during breathing.

Solution:

(a) Residual Volume (RV) is the air remaining in lungs after forceful expiration.

(b) This volume prevents lung collapse and maintains continuous gas exchange.

(c) Expiratory Reserve Volume is the additional air exhaled after normal expiration.

(d) Vital Capacity is the maximum air exhaled after maximum inspiration.

(e) Functional Residual Capacity includes residual volume plus expiratory reserve volume.

(f) Therefore, the air remaining after maximum expiration is residual volume.

Final Answer: The volume is Residual Volume.

Answer: (C)

Go Back to Question 32

Q33.

Solution

Concept:

Specialized cells called heterocysts perform nitrogen fixation in certain cyanobacteria.

Solution:

(a) Filamentous cyanobacteria such as *Nostoc* and *Anabaena* possess heterocysts.

(b) Heterocysts are thick-walled specialized cells.

(c) They provide anaerobic conditions necessary for nitrogenase activity.

(d) Nitrogenase converts atmospheric nitrogen into ammonia.

(e) Oxygen inhibits nitrogenase, therefore heterocysts reduce oxygen concentration internally.

(f) Hence, their primary ecological function is nitrogen fixation.

Final Answer: Heterocysts perform nitrogen fixation under anaerobic conditions.

Answer: (C)

Go Back to Question 33

Q34.

Solution

Concept:
Double fertilization is a unique reproductive feature of flowering plants.
Solution:

(a) A pollen tube releases two male gametes into the embryo sac.

(b) One male gamete fuses with the egg cell to form the diploid zygote.

(c) This process is called syngamy.

(d) The second male gamete fuses with the two polar nuclei in the central cell.

(e) This forms the triploid primary endosperm nucleus.

(f) The second fusion process is called triple fusion.

(g) Together, syngamy and triple fusion constitute double fertilization.

Final Answer: One male gamete fuses with egg cell and the other with polar nuclei.

Answer: (B)
Go Back to Question 34

Q35.

Solution

Concept:
Incomplete dominance occurs when neither allele completely masks the effect of the other.
Solution:

(a) A homozygous red-flowered plant crossed with a homozygous white-flowered plant produces pink offspring.

(b) The heterozygous condition shows an intermediate phenotype.

(c) Neither red nor white allele is completely dominant.

(d) This blending appearance is characteristic of incomplete dominance.

(e) A classic example occurs in snapdragon flowers.

(f) Co-dominance differs because both traits are expressed simultaneously without blending.

Final Answer: The phenomenon is Incomplete Dominance.

Answer: (C)
Go Back to Question 35

Q36.

Solution

Concept:

The Calvin cycle of photosynthesis begins with fixation of carbon dioxide by a specific acceptor molecule.

Solution:

(a) In the C_3 pathway, carbon dioxide fixation occurs in chloroplast stroma.

(b) The primary carbon dioxide acceptor is Ribulose-1,5-bisphosphate (RuBP).

(c) RuBP is a five-carbon compound.

(d) The enzyme RuBisCO catalyzes reaction between carbon dioxide and RuBP.

(e) The unstable intermediate immediately breaks into two molecules of 3-phosphoglyceric acid.

(f) Therefore, RuBP acts as the primary acceptor.

Final Answer: The primary acceptor is Ribulose-1,5-bisphosphate.

Answer: (B)

Go Back to Question 36

Q37.

Solution

Concept:

Hormonal contraceptives prevent pregnancy by inhibiting ovulation and altering reproductive tract conditions.

Solution:

(a) Oral contraceptive pills contain synthetic estrogen and progesterone.

(b) These hormones inhibit secretion of FSH and LH through negative feedback.

(c) Reduced LH prevents ovulation.

(d) The pills also thicken cervical mucus, making sperm entry difficult.

(e) Endometrial changes further reduce chances of implantation.

(f) Barrier methods only block sperm physically, whereas vasectomy prevents sperm transport surgically.

Final Answer: The method is Oral contraceptive pills.

Answer: (B)

Go Back to Question 37

Q38.

Solution

Concept:

The carbon cycle involves processes that either release or remove carbon dioxide from atmosphere.

Solution:

(a) Photosynthetic organisms absorb atmospheric carbon dioxide.

(b) Marine phytoplanktons and terrestrial plants convert carbon dioxide into organic compounds.

(c) This process acts as a major biological carbon sink.

(d) Volcanic eruptions and fossil fuel combustion release carbon dioxide into atmosphere.

(e) Decomposition by microbes also returns carbon dioxide back to environment.

(f) Therefore, photosynthesis is the major process removing atmospheric carbon dioxide.

Final Answer: Photosynthesis by marine phytoplanktons and terrestrial plants acts as the major carbon sink.

Answer: (C)

Go Back to Question 38

Q39.

Solution

Concept:

Vectors used in recombinant DNA technology differ in replication and infection mechanisms.

Solution:

(a) Plasmids are small circular double-stranded DNA molecules present in bacteria.

(b) They replicate autonomously because they possess an origin of replication.

(c) Bacteriophages are viruses that infect bacterial cells.

(d) Some bacteriophages integrate into host genome, whereas others lyse bacterial cells.

(e) Plasmids generally carry smaller DNA inserts compared to many bacteriophage vectors.

(f) Therefore, autonomous replication distinguishes plasmids from bacteriophages.

Final Answer: Plasmids replicate autonomously, whereas bacteriophages integrate or lyse host cells.

Answer: (B)

Go Back to Question 39

Q40.

Solution

Concept:

Insulin is an endocrine hormone involved in regulation of blood glucose concentration.

Solution:

(a) The pancreas is a mixed gland having exocrine and endocrine portions.

(b) Endocrine regions called Islets of Langerhans contain beta cells.

(c) Beta cells synthesize and secrete insulin.

(d) Insulin lowers blood glucose by promoting uptake and storage of glucose.

(e) Deficiency of insulin results in diabetes mellitus.

(f) Thyroid, adrenal, and pituitary glands produce different hormones but not insulin.

Final Answer: Insulin is produced by the Pancreas.

Answer: (B)

Go Back to Question 40

Answer Key

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