MHT-CET Biology Sample Paper-14

Duration: 90 Minutes **Maximum Marks: 100**

Instructions

- This paper contains a total of **100** Multiple Choice Questions.
- Each correct answer carries **+1 mark**.
- No negative marking for incorrect questions.
- Use of mobile phones, smartwatches, or any electronic gadgets is strictly prohibited.
- No marks will be deducted for questions that are left unattempted.

Q1. A scientist observed that certain membrane proteins moved laterally within the phospholipid bilayer while maintaining membrane integrity. This observation strongly supports the concept proposed in the fluid mosaic model of plasma membrane organization. Which property of the membrane is primarily responsible for such movement?

(A) Presence of cellulose

(B) Fluid nature of lipids

(C) Covalent bonding in proteins

(D) Absence of carbohydrates

Q2. During an experiment on photosynthesis, a plant was exposed to light containing only wavelengths absorbed poorly by chlorophyll *a*. As a result, the rate of photosynthesis declined considerably. Which region of visible spectrum is least effective for photosynthesis?

(A) Blue region

(B) Red region

(C) Green region

(D) Violet region

Q3. A cross between two heterozygous individuals resulted in offspring showing a phenotypic ratio of 1:2:1 instead of the Mendelian 3:1 ratio. This deviation may occur in traits exhibiting:

(A) Codominance

(B) Incomplete dominance

(C) Linkage

(D) Polyploidy

Q4. A patient suffered severe dehydration due to excessive sweating and insufficient water intake. The body responded by increasing secretion of a hormone that enhances water reabsorption in kidney tubules. Identify the hormone involved.

(A) Aldosterone

(B) Thyroxine

(C) Antidiuretic hormone

(D) Adrenaline

Q5. Restriction enzymes used in recombinant DNA technology are often isolated from bacteria because they naturally function as a defense mechanism against invading foreign DNA. These enzymes specifically belong to the class of:

(A) Exonucleases

(B) Ligases

(C) Endonucleases

(D) Polymerases

Q6. In a stable ecosystem, the amount of energy transferred from one trophic level to the next is only a small fraction of the total available energy because most energy is lost during metabolic activities. According to Lindeman's law, approximately what percentage of energy is transferred?

(A) 1%

(B) 10%

(C) 25%

(D) 50%

Q7. The wings of birds and insects perform similar functions but differ significantly in their anatomical structure and evolutionary origin. Such structures are considered:

(A) Homologous organs

(B) Vestigial organs

(C) Analogous organs

(D) Rudimentary organs

Q8. In CAM plants, stomata remain closed during the day and open at night to minimize water loss under arid conditions. The carbon dioxide absorbed during night is initially stored in the form of:

(A) Glucose

(B) Malic acid

(C) Pyruvic acid

(D) Citric acid

Q9. A couple facing infertility problems opted for a procedure in which fertilization occurs outside the body under laboratory conditions followed by transfer of embryo into the uterus. This technique is known as:

(A) GIFT

(B) ZIFT

(C) IVF-ET

(D) ICSI

Q10. During protein synthesis, transfer RNA molecules recognize codons present on messenger RNA with the help of complementary nucleotide triplets present on them. These triplets on tRNA are called:

(A) Exons

(B) Anticodons

(C) Introns

(D) Operons

Q11. An individual consuming food contaminated with *Salmonella typhi* developed prolonged fever, abdominal pain, and weakness. The disease caused by this bacterium is:

(A) Pneumonia

(B) Typhoid

(C) Tuberculosis

(D) Cholera

Q12. The endodermis of roots possesses Casparian strips made of suberin which regulate the movement of water and dissolved substances into vascular tissues. These strips are absent in:

(A) Monocot roots

(B) Dicot roots

(C) Stem endodermis

(D) Root hairs

Q13. A species introduced into a new ecosystem spread rapidly, displaced native organisms, and altered ecological balance significantly. Such species are commonly referred to as:

(A) Keystone species

(B) Endemic species

(C) Exotic invasive species

(D) Indicator species

Q14. In aerobic respiration, most ATP molecules are generated during the final stage involving transfer of electrons through a series of carriers embedded in the inner mitochondrial membrane. This stage is known as:

(A) Glycolysis

(B) Krebs cycle

(C) Electron transport system

(D) Fermentation

Q15. A woman with blood group A and a man with blood group B produced a child with blood group O. Which of the following represents the possible genotypes of the parents?

(A) I^AI^A and I^BI^B

(B) I^Ai and I^Bi

(C) I^AI^A and I^Bi

(D) I^Ai and I^BI^B

Q16. During allergic reactions, mast cells release certain chemical substances responsible for dilation of blood vessels and inflammation. The major chemical mediator released is:

(A) Insulin

(B) Histamine

(C) Serotonin

(D) Melatonin

Q17. A bacterium carrying a recombinant plasmid was selected successfully because only transformed bacteria survived in the presence of a specific antibiotic. This was possible due to the presence of:

(A) Restriction sites

(B) Ori sequence

(C) Selectable marker gene

(D) DNA ligase

Q18. When the apical bud of a plant was removed experimentally, lateral buds began to grow vigorously due to reduced concentration of a hormone responsible for apical dominance. Identify the hormone.

(A) Cytokinin

(B) Ethylene

(C) Auxin

(D) Gibberellin

Q19. The gradual increase in nutrient concentration, particularly nitrates and phosphates, in a water body often results in excessive algal growth followed by oxygen depletion. This process is known as:

(A) Desertification

(B) Biomagnification

(C) Eutrophication

(D) Afforestation

Q20. During nerve impulse transmission, depolarization of neuronal membrane occurs primarily due to rapid influx of specific ions through voltage-gated channels. These ions are:

(A) Potassium ions

(B) Calcium ions

(C) Sodium ions

(D) Chloride ions

Q21. In a forest ecosystem, certain organisms such as fungi and bacteria break down dead organic matter into simpler inorganic substances, thereby recycling nutrients back into the environment. These organisms are collectively known as:

(A) Producers

(B) Consumers

(C) Decomposers

(D) Scavengers

Q22. In flowering plants, pollen grains are transferred from anther to stigma by external agents such as wind, water, or animals. Transfer of pollen grains between flowers of different plants of the same species is termed as:

(A) Autogamy

(B) Geitonogamy

(C) Xenogamy

(D) Cleistogamy

Q23. A patient suffering from hyposecretion of insulin showed elevated blood glucose levels along with excessive thirst and frequent urination. This endocrine disorder is commonly known as:

(A) Diabetes insipidus

(B) Diabetes mellitus

(C) Addison's disease

(D) Acromegaly

Q24. During meiosis, homologous chromosomes separate and move towards opposite poles during a specific stage of meiosis-I. Identify this stage.

(A) Prophase-I

(B) Metaphase-I

(C) Anaphase-I

(D) Telophase-I

Q25. According to Lamarck's theory of evolution, organisms acquire certain traits during their lifetime in response to environmental conditions and transmit them to offspring. This theory is popularly known as:

(A) Natural selection

(B) Mutation theory

(C) Inheritance of acquired characters

(D) Germplasm theory

Q26. A student observed that stomata of leaves closed rapidly when the plant experienced water stress. Which plant hormone is mainly responsible for inducing stomatal closure under such conditions?

(A) Auxin

(B) Gibberellin

(C) Cytokinin

(D) Abscisic acid

Q27. In recombinant DNA technology, DNA fragments generated using the same restriction enzyme possess complementary overhanging ends that can pair with each other. These ends are commonly referred to as:

(A) Blunt ends

(B) Sticky ends

(C) Phosphodiester ends

(D) Replicative ends

Q28. A man with normal vision married a carrier woman for colour blindness. What is the probability that their son will be colour blind?

(A) 0%

(B) 25%

(C) 50%

(D) 100%

Q29. Certain organisms can tolerate a wide range of environmental conditions and are therefore capable of surviving in diverse habitats. Such organisms are described as:

(A) Stenothermal

(B) Eurythermal

(C) Endemic

(D) Extinct

Q30. During pregnancy, a temporary endocrine structure develops inside the uterus and facilitates exchange of nutrients, gases, and wastes between maternal and fetal blood. This structure is known as:

(A) Corpus luteum

(B) Placenta

(C) Endometrium

(D) Amnion

Q31. A eukaryotic cell actively synthesizing proteins for export was found to possess highly developed membrane-bound organelles with flattened sacs studded with ribosomes. Identify the organelle.

(A) Smooth endoplasmic reticulum

(B) Rough endoplasmic reticulum

(C) Golgi apparatus

(D) Peroxisome

Q32. A person developed breathing difficulty due to narrowing of bronchi and excessive mucus secretion triggered by allergic response. The condition described above is characteristic of:

(A) Emphysema

(B) Asthma

(C) Tuberculosis

(D) Pneumonia

Q33. Species that play a disproportionately large role in maintaining the structure and stability of an ecosystem despite relatively low abundance are termed as:

(A) Dominant species

(B) Endangered species

(C) Keystone species

(D) Exotic species

Q34. Thomas Hunt Morgan conducted experiments on *Drosophila melanogaster* and discovered that genes located on the same chromosome tend to be inherited together. This phenomenon is called:

(A) Mutation

(B) Linkage

(C) Codominance

(D) Segregation

Q35. In the human respiratory system, gaseous exchange between alveolar air and blood occurs rapidly because alveoli possess a very thin membrane and extensive:

(A) Keratinization

(B) Blood capillary network

(C) Cartilaginous rings

(D) Muscle fibres

Q36. The vascular bundles of dicot stems are arranged in a ring and possess cambium between xylem and phloem. Such vascular bundles are described as:

(A) Closed

(B) Radial

(C) Open

(D) Amphicribral

Q37. During transcription, one strand of DNA serves as a template for synthesis of RNA. This strand is commonly known as:

(A) Coding strand

(B) Sense strand

(C) Template strand

(D) Leading strand

Q38. The sinoatrial node generates electrical impulses at regular intervals and controls heartbeat rhythm. It is located in the wall of the:

(A) Left ventricle

(B) Right ventricle

(C) Left atrium

(D) Right atrium

Q39. A lichen represents a close association between an alga and a fungus in which both partners derive benefit from each other. Such an interaction is classified as:

(A) Competition

(B) Mutualism

(C) Commensalism

(D) Predation

Q40. Mineral ions are actively transported from soil into root cells against concentration gradient with the expenditure of metabolic energy. This process is known as:

(A) Diffusion

(B) Osmosis

(C) Active transport

(D) Imbibition

Q41. A patient exhibited enlargement of hands, feet, and facial bones due to excessive secretion of growth hormone after puberty. The disorder resulting from such hormonal imbalance is known as:

(A) Dwarfism

(B) Gigantism

(C) Acromegaly

(D) Cretinism

Q42. In some flowering plants, stamens and stigma mature at different times to prevent self-pollination and encourage cross-pollination. This adaptation is referred to as:

(A) Herkogamy

(B) Dichogamy

(C) Cleistogamy

(D) Apomixis

Q43. The age distribution of individuals within a population can provide valuable information regarding its growth trend. A population with a broad base in its age pyramid generally indicates:

(A) Declining population

(B) Stable population

(C) Expanding population

(D) Extinct population

Q44. During DNA replication, synthesis of the lagging strand occurs discontinuously because DNA polymerase can add nucleotides only in a particular direction. DNA synthesis always proceeds in the:

(A) 3' $\rightarrow$ 5' direction

(B) 5' $\rightarrow$ 3' direction

(C) Centromere to telomere direction

(D) Random direction

Q45. An individual infected with *Plasmodium* experienced recurring fever associated with rupture of red blood cells. The infectious stage of the parasite transmitted by female *Anopheles* mosquito is:

(A) Merozoite

(B) Trophozoite

(C) Sporozoite

(D) Gametocyte

Q46. During seed germination, stored food materials present in cotyledons or endosperm are hydrolyzed into simpler forms under the influence of enzymes. Which hormone promotes synthesis of hydrolytic enzymes during germination?

(A) Cytokinin

(B) Gibberellin

(C) Ethylene

(D) Abscisic acid

Q47. A trait controlled by two or more genes, each contributing equally and cumulatively to the phenotype, generally exhibits continuous variation in a population. Such inheritance is termed:

(A) Monogenic inheritance

(B) Polygenic inheritance

(C) Codominance

(D) Linkage

Q48. Certain species survive only within a narrow range of temperature variation and are unable to tolerate extreme changes in environmental temperature. Such organisms are known as:

(A) Eurythermal

(B) Stenothermal

(C) Cosmopolitan

(D) Endemic

Q49. Mitochondria are referred to as semiautonomous organelles because they contain their own genetic material and machinery for protein synthesis. The genetic material present in mitochondria is:

(A) Linear double-stranded DNA

(B) Circular double-stranded DNA

(C) Single-stranded RNA

(D) Histone-free chromatin

Q50. The process of introducing recombinant DNA into a bacterial host cell by exposing the cells to divalent cations followed by heat shock is commonly known as:

(A) Hybridization

(B) Transformation

(C) Translation

(D) Transduction

Q51. In the human digestive system, bile salts assist in digestion not by enzymatic breakdown but by increasing the surface area of fats for enzyme action. This process is known as:

(A) Coagulation

(B) Emulsification

(C) Hydrolysis

(D) Neutralization

Q52. Deforestation, overgrazing, and improper irrigation practices can degrade fertile land and convert it into desert-like conditions over time. This ecological process is called:

(A) Eutrophication

(B) Biomagnification

(C) Desertification

(D) Afforestation

Q53. The tissue responsible for transport of organic food materials from leaves to other parts of the plant consists of sieve tubes, companion cells, phloem parenchyma, and fibres. This tissue is known as:

(A) Xylem

(B) Phloem

(C) Cambium

(D) Epidermis

Q54. Francis Crick proposed the adaptor hypothesis to explain the mechanism by which amino acids are brought to ribosomes during protein synthesis. The adaptor molecules referred to in this hypothesis are:

(A) mRNA

(B) rRNA

(C) tRNA

(D) snRNA

Q55. During menstrual cycle, a sudden increase in secretion of luteinizing hormone triggers ovulation. This hormone is secreted by the:

(A) Thyroid gland

(B) Hypothalamus

(C) Anterior pituitary

(D) Posterior pituitary

Q56. In anaerobic conditions, yeast cells convert pyruvate into ethanol and carbon dioxide through a process that regenerates NAD^+. This process is known as:

(A) Lactic acid fermentation

(B) Alcoholic fermentation

(C) Glycolysis

(D) Oxidative phosphorylation

Q57. The chromosomal theory of inheritance proposed that genes are located on chromosomes and segregate during meiosis. This theory was primarily proposed by:

(A) Darwin and Wallace

(B) Watson and Crick

(C) Sutton and Boveri

(D) Morgan and Mendel

Q58. A species restricted to a particular geographical region and not naturally found elsewhere is described as:

(A) Cosmopolitan

(B) Endemic

(C) Exotic

(D) Keystone

Q59. When a plant cell is placed in a hypertonic solution, the plasma membrane shrinks away from the cell wall due to loss of water. This phenomenon is called:

(A) Deplasmolysis

(B) Plasmolysis

(C) Diffusion

(D) Imbibition

Q60. The oxygen dissociation curve of haemoglobin shifts towards the right under conditions of increased carbon dioxide concentration, increased temperature, and decreased pH. Such a shift facilitates:

(A) Greater oxygen loading in lungs

(B) Greater oxygen release in tissues

(C) Reduced oxygen transport

(D) Formation of carbaminohaemoglobin

Q61. During mitosis, chromosomes align themselves at the equatorial plane of the cell and become attached to spindle fibres through kinetochores. This characteristic arrangement is observed during:

(A) Prophase

(B) Metaphase

(C) Anaphase

(D) Telophase

Q62. The process by which water vapor is added to the atmosphere from aerial parts of plants, mainly through stomata, contributes significantly to the hydrological cycle. This process is called:

(A) Guttation

(B) Translocation

(C) Transpiration

(D) Respiration

Q63. A patient with prolonged deficiency of iodine in diet developed enlargement of thyroid gland accompanied by reduced production of thyroid hormones. This condition is commonly known as:

(A) Myxedema

(B) Exophthalmic goitre

(C) Simple goitre

(D) Addison's disease

Q64. In a dihybrid cross involving two independently assorting gene pairs, the phenotypic ratio obtained in the F_2 generation under complete dominance is:

(A) 3:1

(B) 1:2:1

(C) 9:3:3:1

(D) 15:1

Q65. Water conduction in plants mainly occurs through dead elongated cells with lignified walls arranged end to end. These conducting elements are collectively known as:

(A) Companion cells

(B) Sieve tubes

(C) Tracheary elements

(D) Collenchyma

Q66. A DNA fragment was amplified repeatedly in vitro using sequence-specific primers, thermostable DNA polymerase, and cycles of heating and cooling. The technique described is known as:

(A) Southern blotting

(B) Gel electrophoresis

(C) Polymerase chain reaction

(D) DNA fingerprinting

Q67. The ozone layer present in the stratosphere protects living organisms by absorbing a major portion of harmful ultraviolet radiations from the sun. Excessive depletion of this layer can particularly increase the incidence of:

(A) Malaria

(B) Skin cancer

(C) Tuberculosis

(D) Cholera

Q68. After fertilization in humans, the diploid zygote undergoes repeated mitotic divisions to form a solid ball of blastomeres before blastocyst formation. This early embryonic stage is called:

(A) Gastrula

(B) Morula

(C) Neurula

(D) Trophoblast

Q69. Photolysis of water during the light reaction of photosynthesis takes place in the thylakoid lumen and results in liberation of oxygen, electrons, and protons. The oxygen released during photosynthesis originates from:

(A) Carbon dioxide

(B) Chlorophyll

(C) Water

(D) Glucose

Q70. The genetic material of certain viruses consists of RNA instead of DNA. In retroviruses, synthesis of DNA from RNA template occurs with the help of a specialized enzyme called:

(A) DNA ligase

(B) RNA polymerase

(C) Reverse transcriptase

(D) Primase

Q71. The bicuspid valve present in the human heart prevents backflow of blood from the left ventricle into the left atrium during ventricular contraction. This valve is also known as:

(A) Tricuspid valve

(B) Semilunar valve

(C) Mitral valve

(D) Pulmonary valve

Q72. The upper layer of soil rich in decomposed organic matter, minerals, microorganisms, and humus is particularly important for plant growth and agricultural productivity. This fertile layer is called:

(A) Bedrock

(B) Subsoil

(C) Topsoil

(D) Parent rock

Q73. A mutation causing insertion or deletion of nucleotides in DNA may alter the reading frame of codons during translation and drastically affect protein synthesis. Such mutations are known as:

(A) Silent mutations

(B) Point mutations

(C) Frameshift mutations

(D) Somatic mutations

Q74. In some plants, flowers remain closed and self-pollination occurs within the unopened flower, ensuring seed set even in the absence of pollinators. Such flowers are called:

(A) Chasmogamous flowers

(B) Dichogamous flowers

(C) Cleistogamous flowers

(D) Monoecious flowers

Q75. The use of antibiotics against viral infections is generally ineffective because viruses lack many metabolic pathways and cellular structures targeted by antibiotics. Antibiotics are mainly effective against:

(A) Fungi

(B) Protozoa

(C) Bacteria

(D) Algae

Q76. The interaction between a lion and a deer in a forest ecosystem represents an ecological relationship in which one organism kills and feeds upon another organism. This interaction is termed as:

(A) Mutualism

(B) Commensalism

(C) Predation

(D) Symbiosis

Q77. A plant grown in complete darkness developed long weak stems and pale yellow leaves due to absence of chlorophyll formation. This condition is referred to as:

(A) Vernalization

(B) Etiolation

(C) Stratification

(D) Senescence

Q78. DNA fingerprinting techniques commonly rely on variations in repetitive DNA sequences among individuals. These highly variable repetitive regions are called:

(A) Exons

(B) Introns

(C) VNTRs

(D) Operons

Q79. In the human nephron, filtration of blood plasma occurs under pressure through specialized capillaries present within Bowman's capsule. These capillaries collectively form the:

(A) Loop of Henle

(B) Vasa recta

(C) Glomerulus

(D) Collecting duct

Q80. When two species compete intensely for the same limiting resource, one species may eventually eliminate the other from that habitat. This outcome is described by the principle of:

(A) Adaptive radiation

(B) Competitive exclusion

(C) Resource partitioning

(D) Ecological succession

Q81. A person suffering from severe diarrhoea experienced a rapid fall in blood pressure due to excessive loss of water and electrolytes from the body. Immediate administration of oral rehydration solution is effective because it helps restore:

(A) Hormonal balance

(B) Blood clotting factors

(C) Water and ion balance

(D) Enzyme secretion

Q82. The process of synthesizing messenger RNA from a DNA template involves unwinding of DNA and complementary base pairing of ribonucleotides. This process is known as:

(A) Translation

(B) Replication

(C) Transcription

(D) Transformation

Q83. The gradual and orderly replacement of one biological community by another until a relatively stable climax community is established is known as ecological:

(A) Stratification

(B) Succession

(C) Biomagnification

(D) Migration

Q84. In higher plants, translocation of organic food materials occurs mainly through sieve tube elements with the expenditure of metabolic energy. This transport process through phloem is commonly referred to as:

(A) Ascent of sap

(B) Diffusion

(C) Translocation

(D) Imbibition

Q85. A child inherited a genetic disorder only when both parents were carriers of the defective allele, although neither parent expressed the disease phenotype. Such inheritance pattern is characteristic of:

(A) Autosomal dominant inheritance

(B) X-linked dominant inheritance

(C) Autosomal recessive inheritance

(D) Y-linked inheritance

Q86. The hormone human chorionic gonadotropin (hCG), commonly detected in pregnancy tests, is secreted during early pregnancy by the:

(A) Corpus luteum

(B) Placenta

(C) Anterior pituitary

(D) Endometrium

Q87. The Golgi apparatus plays a major role in packaging and secretion of cellular products. In plant cells, Golgi bodies are commonly referred to as:

(A) Cristae

(B) Grana

(C) Dictyosomes

(D) Mesosomes

Q88. The term biodiversity encompasses variation at genetic, species, and ecosystem levels. Among these, diversity occurring within a species due to variations in genes is called:

(A) Ecological diversity

(B) Species diversity

(C) Genetic diversity

(D) Community diversity

Q89. The liver plays a central role in metabolism and detoxification. One of its important excretory products formed by deamination of amino acids is:

(A) Glucose

(B) Glycogen

(C) Urea

(D) Cholesterol

Q90. Collenchyma tissue provides mechanical support and flexibility to growing parts of plants due to uneven thickening of cell walls at the corners. The thickening material mainly consists of:

(A) Lignin

(B) Suberin

(C) Cellulose and pectin

(D) Chitin

Q91. A man affected with haemophilia married a normal woman who was not a carrier. Which of the following correctly represents the condition of their daughters?

(A) All daughters affected

(B) All daughters normal but carriers

(C) Half daughters affected

(D) All daughters completely normal and non-carriers

Q92. Coral reefs are among the most productive and diverse marine ecosystems but are highly sensitive to increases in sea temperature. Loss of symbiotic algae from coral tissues due to stress leads to:

(A) Coral extinction

(B) Coral bleaching

(C) Eutrophication

(D) Biomagnification

Q93. The enzyme responsible for joining discontinuous Okazaki fragments during DNA replication by forming phosphodiester bonds is:

(A) Helicase

(B) Primase

(C) DNA ligase

(D) Topoisomerase

Q94. The medulla oblongata contains several vital centers responsible for regulation of involuntary activities such as heartbeat and respiration. It is a part of the:

(A) Forebrain

(B) Midbrain

(C) Hindbrain

(D) Cerebrum

Q95. Certain seeds require exposure to low temperature for successful germination and flowering in subsequent growth stages. This physiological requirement is known as:

(A) Stratification

(B) Vernalization

(C) Scarification

(D) Etiolation

Q96. The process of conversion of atmospheric nitrogen into ammonia by microorganisms such as *Rhizobium* and cyanobacteria is referred to as:

(A) Nitrification

(B) Denitrification

(C) Nitrogen fixation

(D) Ammonification

Q97. An individual with deficiency of vitamin D during childhood developed soft and weak bones along with skeletal deformities. The disease caused by this deficiency is:

(A) Scurvy

(B) Beriberi

(C) Rickets

(D) Pellagra

Q98. In gene cloning experiments, plasmids are preferred as vectors because they possess an origin of replication which enables them to:

(A) Synthesize proteins independently

(B) Integrate permanently into chromosomes

(C) Replicate autonomously inside host cells

(D) Produce ATP for bacterial cells

Q99. The transfer of energy from producers to herbivores and subsequently to carnivores in an ecosystem follows a linear pathway known as:

(A) Food web

(B) Ecological niche

(C) Food chain

(D) Biogeochemical cycle

Q100. Adaptive radiation is best illustrated by Darwin's finches because multiple species evolved from a common ancestral form and occupied different ecological niches. This phenomenon demonstrates:

(A) Convergent evolution

(B) Divergent evolution

(C) Parallel evolution

(D) Artificial selection

Detailed Solutions

Q1.

Solution

Concept: The fluid mosaic model describes the plasma membrane as a dynamic structure where proteins are embedded or attached to the fluid phospholipid bilayer. This fluidity allows for lateral movement of membrane components.

Solution: Step 1: Analyze the observation. Membrane proteins move laterally within the phospholipid bilayer, maintaining membrane integrity. This suggests that the membrane is not rigid.

Step 2: Understand the fluid mosaic model. The model posits that the phospholipid bilayer is fluid, allowing embedded proteins to move freely within it.

Step 3: Evaluate the components of the plasma membrane and their properties:
Presence of cellulose (Option A): Cellulose is a structural polysaccharide found in plant cell walls, providing rigidity. It is absent in animal plasma membranes and does not contribute to protein mobility within the membrane.
Fluid nature of lipids (Option B): The phospholipid bilayer, composed of lipids, is fluid due to the unsaturated fatty acid tails (kinks in the tails prevent tight packing) and the thermal energy. This fluidity allows proteins embedded within or associated with the bilayer to move laterally. This directly explains the observation.
Covalent bonding in proteins (Option C): While proteins are held together by covalent bonds, their lateral movement within the membrane is not due to these bonds but rather their association with the fluid lipid bilayer.
Absence of carbohydrates (Option D): Carbohydrates are typically found on the outer surface of the plasma membrane (glycocalyx) and are involved in cell recognition. Their absence or presence does not primarily dictate the lateral movement of proteins.

Step 4: Conclude the primary reason for lateral protein movement. The fluid nature of the phospholipid bilayer, due to the properties of lipids, allows for the lateral mobility of membrane proteins.

Final Answer: Fluid nature of lipids

Answer: (B)

Go Back to Question 1

Q2.

Solution

Concept: Photosynthesis is driven by light absorption by pigments, primarily chlorophylls. Different wavelengths of light are absorbed with varying efficiency by these pigments.

Solution: Step 1: Understand the role of photosynthetic pigments. Chlorophyll a is the primary pigment in photosynthesis, directly absorbing light energy to drive the process. Other pigments, like chlorophyll b and carotenoids, act as accessory pigments, broadening the spectrum of light that can be absorbed and transferring energy to chlorophyll a.

Step 2: Recall the absorption spectrum of chlorophylls. Chlorophylls (chlorophyll a and b) primarily absorb light in the blue-violet and red regions of the visible spectrum. They reflect light in the green region.

Step 3: Determine the region of the spectrum least effective for photosynthesis. Since chlorophylls poorly absorb green light and reflect most of it, this region of the spectrum is least effective for driving photosynthesis.

Step 4: Evaluate the options:
Blue region (Option A): Chlorophyll absorbs strongly in the blue region.
Red region (Option B): Chlorophyll absorbs strongly in the red region.
Green region (Option C): Chlorophyll reflects most green light, making it the least effective region for photosynthesis.
Violet region (Option D): Chlorophyll absorbs strongly in the violet region.

Step 5: Conclude the least effective region. The green region of the visible spectrum is least effective for photosynthesis because it is poorly absorbed by chlorophyll.

Final Answer: Green region

Answer: (C)

Go Back to Question 2

Q3.

Solution

Concept: Mendelian genetics describes the inheritance of traits. Deviations from expected Mendelian ratios can occur due to various genetic phenomena, such as incomplete dominance, codominance, and linkage.

Solution: Step 1: Recall Mendelian dihybrid cross ratios. A typical Mendelian dihybrid cross between two heterozygotes ($AaBb \times AaBb$) results in a 9:3:3:1 phenotypic ratio in the F2 generation if the genes are on different chromosomes and assort independently.

Step 2: Analyze the observed phenotypic ratio of 1:2:1. This ratio is characteristic of the inheritance of a single trait where the heterozygote exhibits a phenotype intermediate between the two homozygous phenotypes.

Step 3: Define the genetic phenomena mentioned:
Codominance (Option A): In codominance, both alleles in a heterozygote are fully expressed simultaneously in the phenotype (e.g., AB blood type). This typically results in a 1:2:1 genotypic ratio, but the phenotypic ratio can also be 1:2:1 if the heterozygous phenotype is distinct from both homozygous phenotypes and there's no blending (e.g., roan cattle, where both red and white hairs are expressed).
Incomplete dominance (Option B): In incomplete dominance, the heterozygous phenotype is an intermediate blend of the two homozygous phenotypes (e.g., pink flowers from red and white parents). A cross between two heterozygotes ($Aa \times Aa$) in incomplete dominance yields a 1:2:1 genotypic ratio ($AA : Aa : aa$) and a 1:2:1 phenotypic ratio (e.g., Red:Pink:White). This perfectly matches the observed ratio.
Linkage (Option C): Linkage occurs when genes are located on the same chromosome and tend to be inherited together. It can cause deviations from Mendelian ratios, often leading to an excess of parental phenotypes and a deficit of recombinant phenotypes, not a 1:2:1 ratio for a single trait.
Polyploidy (Option D): Polyploidy refers to having more than two sets of chromosomes. While it can affect inheritance patterns, it does not directly cause a 1:2:1 phenotypic ratio from a cross between two heterozygotes for a single gene.

Step 4: Conclude which phenomenon explains the 1:2:1 phenotypic ratio. The 1:2:1 phenotypic ratio from a cross between two heterozygotes is a hallmark of incomplete dominance (and can also occur in codominance where the heterozygote phenotype is unique). Given the options, incomplete dominance is the most direct explanation for a blended intermediate phenotype resulting in this ratio.

Final Answer: Incomplete dominance

Answer: (B)

Go Back to Question 3

Q4.

Solution

Concept: The human body regulates water balance through the action of hormones that affect kidney function. Antidiuretic hormone (ADH) is crucial for conserving water.

Solution: Step 1: Analyze the patient's condition and symptoms. The patient has excessive urination (polyuria) and intense thirst (polydipsia) due to severe dehydration caused by excessive sweating and insufficient water intake.

Step 2: Identify the hormone that enhances water reabsorption in kidney tubules. The kidneys play a vital role in regulating water balance. The hormone that acts on the kidney tubules to increase water reabsorption, thereby reducing urine output and conserving water, is Antidiuretic Hormone (ADH), also known as vasopressin.

Step 3: Evaluate the options:
Aldosterone (Option A): Aldosterone, secreted by the adrenal cortex, regulates sodium and potassium balance, which indirectly affects water reabsorption, but ADH is more directly involved in regulating water reabsorption itself.
Thyroxine (Option B): Thyroxine, secreted by the thyroid gland, regulates metabolism. It does not directly regulate water reabsorption in the kidneys.
Antidiuretic hormone (ADH) (Option C): This hormone's primary function is to increase water reabsorption by the collecting ducts and distal convoluted tubules of the nephron, reducing water loss in urine. This is exactly what the body would do in response to dehydration and excessive sweating.
Adrenaline (Option D): Adrenaline (epinephrine) is a hormone and neurotransmitter involved in the "fight-or-flight" response. It affects heart rate, blood pressure, and metabolism, but not directly water reabsorption in the kidney tubules.

Step 4: Conclude the hormone involved in enhancing water reabsorption. Antidiuretic hormone (ADH) is the hormone responsible for increasing water reabsorption in the kidney tubules to combat dehydration.

Final Answer: Antidiuretic hormone

Answer: (C)

Go Back to Question 4

Q5.

Solution

Concept: Restriction enzymes are crucial tools in recombinant DNA technology. They cut DNA at specific recognition sites, allowing for the isolation and manipulation of DNA fragments.

Solution: Step 1: Understand the role of restriction enzymes in biotechnology. Restriction enzymes are used to cut DNA molecules at specific nucleotide sequences. This ability is fundamental for processes like gene cloning, DNA fingerprinting, and genetic engineering.

Step 2: Classify the types of nucleases. Nucleases are enzymes that degrade nucleic acids. They are broadly classified into two types based on where they cut DNA:
Exonucleases (Option A): These enzymes degrade nucleic acids by removing nucleotides from either the 5' or 3' end of a DNA or RNA strand.
Endonucleases (Option C): These enzymes cut DNA within the internal phosphodiester bonds of a DNA molecule. Restriction endonucleases are a specific type of endonuclease that recognizes and cuts at specific DNA sequences (restriction sites).
Ligases (Option B): Ligases are enzymes that join DNA fragments together by forming phosphodiester bonds.
Polymerases (Option D): Polymerases are enzymes that synthesize nucleic acids (DNA or RNA) by adding nucleotides.

Step 3: Determine the class of restriction enzymes. Restriction enzymes function by cutting DNA internally at specific sites. Therefore, they are classified as endonucleases.

Step 4: Conclude the class to which restriction enzymes belong. Restriction enzymes are a type of endonuclease.

Final Answer: Endonucleases

Answer: (C)

Go Back to Question 5

Q6.

Solution

Concept: Energy flows through ecosystems from producers to consumers. Energy transfer between trophic levels is inefficient, with a significant portion of energy lost at each transfer.

Solution: Step 1: Understand energy transfer in ecosystems. Energy enters most ecosystems as sunlight, which is captured by producers (plants, algae) through photosynthesis. This energy is then passed on to herbivores (primary consumers) when they eat producers, and then to carnivores (secondary and tertiary consumers) when they eat other animals.

Step 2: Recall Lindeman's Law of Trophic-Dynamic Aspects of Ecology. This law, also known as the 10% rule, states that during the transfer of energy from one trophic level to the next, only about 10% of the energy is incorporated into the biomass of the higher trophic level. The remaining 90% is lost primarily as heat during metabolic processes, or it is not consumed or assimilated.

Step 3: Apply the 10% rule to the question. The question asks for the approximate percentage of energy transferred from one trophic level to the next, according to Lindeman's law.

Step 4: Evaluate the options:
1% (Option A): This is generally too low for energy transfer between trophic levels.
10% (Option B): This is the commonly cited approximate efficiency of energy transfer between trophic levels, as described by Lindeman's law.
25% (Option C): This is higher than the typical energy transfer efficiency.
50% (Option D): This is significantly higher than the typical energy transfer efficiency.

Step 5: Conclude the approximate percentage of energy transferred. According to Lindeman's law, approximately 10% of the energy is transferred from one trophic level to the next.

Final Answer: 10%

Answer: (B)

Go Back to Question 6

Q7.

Solution

Concept: Evolutionary evidence can be drawn from comparative anatomy, looking at the structures of different organisms. Homologous and analogous organs provide insights into evolutionary relationships.

Solution: Step 1: Analyze the description of the wings. The wings of birds and insects perform the same function (flight) but differ significantly in their underlying anatomical structure and evolutionary origin. Bird wings are modified forelimbs with bones, feathers, and muscles, reflecting a vertebrate ancestry. Insect wings are chitinous outgrowths of the exoskeleton, with a completely different structure and evolutionary history.

Step 2: Define the terms related to comparative anatomy and evolution:
Homologous organs (Option A): Organs that have the same underlying anatomical structure and evolutionary origin, but may perform different functions (e.g., forelimbs of humans, bats, whales). They indicate common ancestry.
Vestigial organs (Option B): Reduced or non-functional organs that were functional in ancestors (e.g., appendix in humans, hind limb bones in whales).
Analogous organs (Option C): Organs that have similar functions but different underlying anatomical structures and evolutionary origins. They arise from convergent evolution, where different lineages adapt to similar environmental pressures. The wings of birds and insects fit this definition perfectly.
Rudimentary organs (Option D): Similar to vestigial organs, these are underdeveloped or reduced organs.

Step 3: Match the description to the correct term. Since the wings of birds and insects have similar functions (flight) but different structures and evolutionary origins, they are classified as analogous organs.

Final Answer: Analogous organs

Answer: (C)

Go Back to Question 7

Q8.

Solution

Concept: Crassulacean Acid Metabolism (CAM) is a physiological adaptation found in succulent plants and other xerophytes, primarily in arid regions. It allows them to fix carbon dioxide at night when temperatures are lower and humidity is higher, thus minimizing water loss.

Solution: Step 1: Understand the context of CAM plants. CAM plants live in arid environments and have evolved a water-conserving mechanism for photosynthesis. Their stomata are closed during the day to reduce water loss and open at night.

Step 2: Recall the initial carbon fixation step in CAM plants. During the night, when stomata are open, the plant absorbs atmospheric CO_2. This CO_2 is fixed by the enzyme PEP carboxylase and combined with phosphoenolpyruvate (PEP) to form oxaloacetate.

Step 3: Determine the fate of the fixed carbon. Oxaloacetate is then rapidly converted into malic acid, which is stored in the large central vacuole of the mesophyll cells. This storage form of CO_2 allows the plant to continue photosynthesis during the day even with closed stomata.

Step 4: Evaluate the options:
Glucose (Option A): Glucose is a sugar produced during the Calvin cycle, which occurs during the day in CAM plants, not as the initial storage form at night.
Malic acid (Option B): Malic acid is the 4-carbon organic acid produced from the initial fixation of CO_2 at night and stored in the vacuole. This perfectly matches the description.
Pyruvic acid (Option C): Pyruvic acid is a 3-carbon compound, the end product of glycolysis. It is not the initial storage form of CO_2 in CAM plants.
Citric acid (Option D): Citric acid is a 6-carbon compound involved in the Krebs cycle, not the initial storage form of CO_2 in CAM plants.

Step 5: Conclude the initial storage form of CO_2 in CAM plants. The CO_2 absorbed at night by CAM plants is initially fixed and stored in the form of malic acid.

Final Answer: Malic acid

Answer: (B)

Go Back to Question 8

Q9.

Solution

Concept: Assisted reproductive technologies (ART) have been developed to help couples overcome infertility. These technologies involve various procedures for fertilization and embryo development.

Solution: Step 1: Understand the scenario. A couple is infertile and opts for a procedure where fertilization occurs outside the body (in vitro), followed by embryo transfer into the uterus.

Step 2: Define the assisted reproductive technologies:
GIFT (Gamete Intrafallopian Transfer) (Option A): In GIFT, eggs are retrieved from the woman and mixed with sperm in the laboratory, and then the mixture is transferred into the fallopian tube, where fertilization occurs. Fertilization happens *inside* the body.
ZIFT (Zygote Intrafallopian Transfer) (Option B): In ZIFT, eggs are retrieved, fertilized in vitro (outside the body), and the resulting zygote is then transferred into the fallopian tube. Fertilization occurs in vitro, but the transfer is to the fallopian tube.
IVF-ET (In Vitro Fertilization-Embryo Transfer) (Option C): In IVF-ET, eggs are retrieved from the woman, fertilized with sperm in a laboratory dish (in vitro), and the resulting embryo(s) are cultured for a few days before being transferred into the uterus. This procedure perfectly matches the description.
ICSI (Intracytoplasmic Sperm Injection) (Option D): ICSI is a specific method of IVF where a single sperm is injected directly into an egg. While part of IVF, it's a method of fertilization, not the entire process of embryo transfer.

Step 3: Match the described procedure to the correct ART technique. The process of fertilization outside the body followed by embryo transfer into the uterus is precisely what IVF-ET (In Vitro Fertilization-Embryo Transfer) entails.

Final Answer: IVF-ET

Answer: (C)

Go Back to Question 9

Q10.

Solution

Concept: Protein synthesis involves transcription (DNA to mRNA) and translation (mRNA to protein). Transfer RNA (tRNA) plays a crucial role in translation by carrying specific amino acids to the ribosome and recognizing the codons on mRNA.

Solution: Step 1: Understand the process of translation. Translation is the synthesis of a polypeptide chain from an mRNA template. It occurs on ribosomes.

Step 2: Recall the role of tRNA. Each tRNA molecule has two important sites:
An amino acid attachment site at its 3' end, where a specific amino acid binds.
An anticodon loop, which contains a sequence of three nucleotides that is complementary to a specific codon on the mRNA molecule.

Step 3: Define the terms related to mRNA and tRNA interaction:
Exons (Option A): Exons are coding sequences within a gene that are spliced together to form mature mRNA. They are part of the mRNA, not a recognition triplet on tRNA.
Anticodons (Option B): An anticodon is a sequence of three nucleotides on a tRNA molecule that is complementary to a specific codon on an mRNA molecule. This complementarity ensures that the correct amino acid is brought to the ribosome for incorporation into the growing polypeptide chain. This perfectly matches the description.
Introns (Option C): Introns are non-coding sequences within a gene that are removed during RNA processing. They are not present on tRNA.
Operons (Option D): Operons are clusters of genes regulated together in prokaryotes. They are not related to tRNA structure or function.

Step 4: Conclude the name of the complementary triplet on tRNA. The complementary nucleotide triplet on tRNA that recognizes codons on mRNA is called the anticodon.

Final Answer: Anticodons

Answer: (B)

Go Back to Question 10

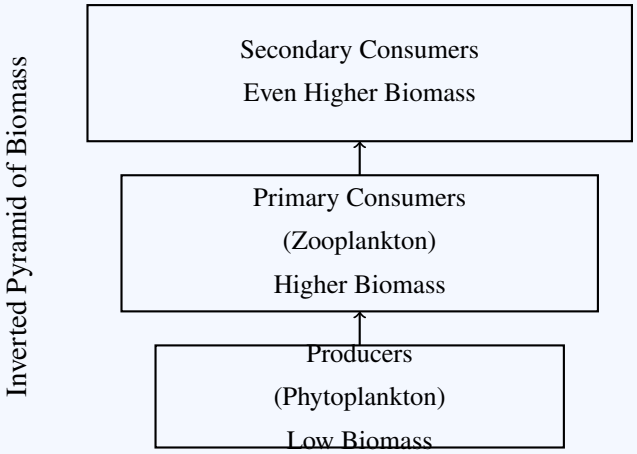
Q11.

Solution

Concept: Infectious diseases are caused by pathogenic microorganisms. Understanding the causative agent and the disease it produces is crucial for diagnosis and treatment.

Solution: Step 1: Analyze the symptoms and the causative agent. The patient exhibits prolonged fever, abdominal pain, and weakness, symptoms consistent with a systemic bacterial infection. The causative agent is given as Salmonella typhi.

Step 2: Identify the disease caused by Salmonella typhi. Salmonella typhi is the bacterium responsible for causing typhoid fever, a serious systemic illness characterized by high fever, abdominal pain, weakness, and sometimes a rash.



Step 3: Evaluate the given options:
Pneumonia (Option A): Pneumonia is an infection of the lungs, typically caused by bacteria like Streptococcus pneumoniae or viruses. It is not caused by Salmonella typhi.
Typhoid (Option B): Typhoid fever is caused by Salmonella typhi and its symptoms match the description.
Tuberculosis (Option C): Tuberculosis is a bacterial disease, usually affecting the lungs, caused by Mycobacterium tuberculosis. It is not caused by Salmonella typhi.
Cholera (Option D): Cholera is an intestinal infection caused by Vibrio cholerae, characterized by severe diarrhea and dehydration. It is not caused by Salmonella typhi.

Step 4: Conclude the disease caused by Salmonella typhi. The disease caused by Salmonella typhi is typhoid fever.

Final Answer: Typhoid

Answer: (B)

Go Back to Question 11

Q12.

Solution

Concept: The endodermis is the innermost layer of the cortex in plant roots. It plays a crucial role in regulating water and solute movement into the vascular cylinder.

Solution: Step 1: Understand the function of the endodermis and Casparian strips. The endodermis is a layer of cells surrounding the vascular cylinder of roots. It contains specialized bands called Casparian strips, which are impregnated with suberin and lignin. These strips are impermeable to water and dissolved substances.

Step 2: Explain the role of Casparian strips. The Casparian strips force water and dissolved minerals to cross the plasma membrane of endodermal cells (apoplastic pathway blocked, forcing movement into the symplastic pathway) before entering the vascular tissues (xylem and phloem). This ensures that the plant controls which substances enter the xylem.

Step 3: Identify where Casparian strips are found. Casparian strips are a characteristic feature of the endodermis in roots. They are essential for the root's function in controlling solute uptake.

Step 4: Consider the presence or absence of Casparian strips in other plant parts. Monocot roots (Option A): Monocot roots have an endodermis with Casparian strips, similar to dicot roots.
Dicot roots (Option B): Dicot roots have an endodermis with well-developed Casparian strips.
Stem endodermis (Option C): While some stems may have an endodermis, the Casparian strips, which are critical for regulating water movement into the vascular tissues in roots, are typically absent or poorly developed in the endodermis of stems. Stems rely on other mechanisms for transport regulation.
Root hairs (Option D): Root hairs are extensions of epidermal cells in the root and are involved in absorption. They are not part of the endodermis and do not have Casparian strips.

Step 5: Conclude where Casparian strips are absent. Casparian strips are typically absent or significantly reduced in the endodermis of stems, even in plants that have an endodermis.

Final Answer: Stem endodermis

Answer: (C)

Go Back to Question 12

Q13.

Solution

Concept: Ecosystems are dynamic and are influenced by the species present. Certain species have a disproportionately large impact on their ecosystem, while others are introduced and can significantly alter the native balance.

Solution: Step 1: Analyze the scenario. A species was introduced into a new ecosystem. It spread rapidly, displaced native organisms, and significantly altered the ecological balance.

Step 2: Define the terms related to species roles in ecosystems:
Keystone species (Option A): A keystone species is one that has a disproportionately large effect on its natural environment relative to its abundance. Its removal would drastically alter the ecosystem. While the introduced species caused significant change, the description focuses on its invasiveness and displacement of natives, not necessarily its disproportionate impact relative to its own biomass.
Endemic species (Option B): Endemic species are those found only in a specific geographic area and nowhere else. This refers to the distribution of a species, not its ecological role or invasiveness.
Exotic invasive species (Option C): An exotic species is one that has been introduced into a new ecosystem from another region. An invasive species is an exotic species that spreads rapidly and causes ecological or economic harm by displacing native organisms, altering habitats, or disrupting food webs. The description perfectly matches this definition.
Indicator species (Option D): An indicator species is a species whose presence, absence, or abundance reflects a specific environmental condition. They are used to monitor the health of an ecosystem.

Step 3: Match the description to the correct term. The species introduced into a new ecosystem that spreads rapidly, displaces native organisms, and alters ecological balance is best described as an exotic invasive species.

Final Answer: Exotic invasive species

Answer: (C)

Go Back to Question 13

Q14.

Solution

Concept: Aerobic respiration is the process of generating ATP in the presence of oxygen. It involves several stages, with the majority of ATP being produced in the final stage.

Solution: Step 1: Understand the stages of aerobic respiration. Aerobic respiration consists of three main stages:
1. Glycolysis: Occurs in the cytoplasm, breaks down glucose into pyruvate, yielding a net of 2 ATP and 2 NADH.
2. Krebs cycle (Citric acid cycle): Occurs in the mitochondrial matrix, further oxidizes pyruvate derivatives (acetyl CoA), producing ATP (or GTP), NADH, and $FADH_2$.
3. Electron transport system (ETS) / Oxidative phosphorylation: Occurs on the inner mitochondrial membrane, where NADH and $FADH_2$ donate electrons, which pass through a series of protein complexes. This electron flow generates a proton gradient, which drives ATP synthesis via ATP synthase. This is where most ATP is produced.

Step 2: Identify the stage where most ATP is generated. The electron transport system, coupled with chemiosmosis (oxidative phosphorylation), is responsible for the vast majority of ATP production during aerobic respiration.

Step 3: Evaluate the options:
Glycolysis (Option A): Produces only a net of 2 ATP molecules through substrate-level phosphorylation.
Krebs cycle (Option B): Produces a small amount of ATP (or GTP) via substrate-level phosphorylation (2 ATP per glucose molecule) and a large number of reduced electron carriers (NADH and $FADH_2$).
Electron transport system (Option C): This stage, also known as oxidative phosphorylation, generates a significantly larger amount of ATP (around 26-28 ATP per glucose molecule) through chemiosmosis, driven by the electron carriers produced in glycolysis and the Krebs cycle.
Fermentation (Option D): Fermentation is an anaerobic process that occurs in the absence of oxygen and produces very little ATP (only from glycolysis). It is not part of aerobic respiration.

Step 4: Conclude the stage producing the most ATP. The electron transport system (oxidative phosphorylation) is responsible for the majority of ATP generation in aerobic respiration.

Final Answer: Electron transport system

Answer: (C)

Go Back to Question 14

Q15.

Solution

Concept: The ABO blood group system in humans is an example of inheritance involving multiple alleles and a pattern of dominance and codominance.

Solution: Step 1: Understand the ABO blood group genetics. The ABO blood groups are determined by a single gene with three alleles: I^A, I^B, and i.
I^A allele codes for A antigen.
I^B allele codes for B antigen.
i allele codes for no antigen (Type O).

Step 2: Recall the dominance relationships:
I^A and I^B are codominant with each other.
Both I^A and I^B are dominant over i.

Step 3: Determine the genotypes for the given phenotypes:
Blood group A phenotype can have genotypes I^AI^A or I^Ai.
Blood group B phenotype can have genotypes I^BI^B or I^Bi.
Blood group O phenotype has the genotype ii.

Step 4: Analyze the cross to produce blood group O (genotype ii). For a child to have genotype ii, they must inherit one 'i' allele from each parent.

Step 5: Evaluate the parental genotypes based on the requirement for passing 'i' alleles:
Option A: I^AI^A and I^BI^B: Parent 1 (AA) can only pass I^A. Parent 2 (BB) can only pass I^B. Offspring genotypes would be only I^AI^B (Blood group AB). Cannot produce O.
Option B: I^Ai and I^Bi: Parent 1 (Ai) can pass I^A or i. Parent 2 (Bi) can pass I^B or i.
This cross can produce offspring with genotypes I^AI^B (AB), I^Ai (A), I^Bi (B), and ii (O). This is a possible combination.
Option C: I^AI^A and I^Bi: Parent 1 (AA) can only pass I^A. Parent 2 (Bi) can pass I^B or i. Offspring genotypes would be I^AI^B (AB) and I^Ai (A). Cannot produce O.
Option D: I^Ai and I^BI^B: Parent 1 (Ai) can pass I^A or i. Parent 2 (BB) can only pass I^B. Offspring genotypes would be I^AI^B (AB) and I^Bi (B). Cannot produce O.

Step 6: Conclude the possible parental genotypes. The only combination that can produce an offspring with blood group O (genotype ii) is when both parents carry the 'i' allele, i.e., both are heterozygous. Thus, the woman's genotype is I^Ai (Blood group A) and the man's genotype is I^Bi (Blood group B).

Final Answer: I^Ai and I^Bi

Answer: (B)

Go Back to Question 15

Q16.

Solution

Concept: Allergic reactions are hypersensitive immune responses to normally harmless substances (allergens). These reactions involve the release of chemical mediators from immune cells like mast cells and basophils.

Solution: Step 1: Understand the process of allergic reactions. Allergic reactions are triggered by the binding of an allergen to IgE antibodies, which are attached to the surface of mast cells and basophils. This binding causes these cells to degranulate and release various chemical mediators.

Step 2: Identify the role of mast cells. Mast cells are key effector cells in allergic reactions. Upon activation by allergen-IgE binding, they release potent inflammatory mediators.

Step 3: Recall the major chemical mediators released by mast cells. Key mediators released during allergic reactions include histamine, leukotrienes, prostaglandins, and cytokines. Histamine is the most prominent and rapidly released mediator responsible for many of the immediate symptoms of allergy.

Step 4: Evaluate the options:
Insulin (Option A): Insulin is a hormone produced by the pancreas that regulates blood glucose levels. It is not involved in allergic reactions.
Histamine (Option B): Histamine is a powerful vasodilator and bronchoconstrictor. It increases blood vessel permeability (leading to swelling/edema) and causes smooth muscle contraction (leading to bronchoconstriction in airways). These actions contribute to inflammation and allergy symptoms. This matches the description.
Serotonin (Option C): Serotonin is a neurotransmitter and hormone involved in various physiological processes, including mood and vasoconstriction. While it can be released by some immune cells, histamine is the primary mediator responsible for the immediate effects described.
Melatonin (Option D): Melatonin is a hormone produced by the pineal gland that regulates sleep-wake cycles. It is not involved in allergic reactions.

Step 5: Conclude the major chemical mediator responsible for dilation of blood vessels and inflammation in allergic reactions. Histamine is the primary chemical mediator released by mast cells that causes these effects.

Final Answer: Histamine

Answer: (B)

Go Back to Question 16

Q17.

Solution

Concept: In recombinant DNA technology, plasmids are commonly used as vectors to carry foreign DNA into host cells. The selection of successfully transformed cells relies on specific genetic elements present in the plasmid.

Solution: Step 1: Understand the process of bacterial transformation and selection. For a bacterium to successfully incorporate and replicate a recombinant plasmid, the plasmid must contain certain elements. After the transformation process (introducing the plasmid into bacteria), it is essential to identify which bacteria have actually taken up the plasmid.

Step 2: Identify the components of a typical cloning plasmid:
Restriction sites (Option A): These are the sites where restriction enzymes cut the plasmid DNA to insert foreign DNA. While important for creating the recombinant plasmid, they don't directly help in selecting transformed bacteria.
Ori sequence (Origin of replication) (Option B): This sequence allows the plasmid to replicate independently within the bacterial host cell. It is essential for maintaining the plasmid in the host but doesn't directly select for transformed cells.
Selectable marker gene (Option C): This is a gene on the plasmid that confers a trait allowing the selection of transformed cells. The most common selectable markers are antibiotic resistance genes (e.g., resistance to ampicillin, kanamycin, or tetracycline). Bacteria transformed with the plasmid carrying the resistance gene can survive and grow on a medium containing the antibiotic, while non-transformed bacteria are killed. This is how transformed cells are selected.
DNA ligase (Option D): DNA ligase is an enzyme used in the laboratory to join DNA fragments (e.g., to insert foreign DNA into a plasmid). It is not a component of the plasmid itself that aids in selection.

Step 3: Conclude the role of the plasmid component in selection. The presence of a selectable marker gene (like an antibiotic resistance gene) on the plasmid allows for the successful selection of bacteria that have taken up the plasmid.

Final Answer: Selectable marker gene

Answer: (C)

Go Back to Question 17

Q18.

Solution

Concept: Plant growth and development are regulated by plant hormones. Apical dominance is a phenomenon where the main stem grows taller, and the lateral buds are suppressed, which is influenced by hormones.

Solution: Step 1: Understand apical dominance. Apical dominance is the phenomenon where the terminal bud (apical bud) of a plant inhibits the growth of lateral buds. This results in the main stem growing longer and the plant having a more or less conical or columnar shape.

Step 2: Identify the hormone responsible for apical dominance. Apical dominance is primarily mediated by auxins, which are produced in the apical bud. High concentrations of auxin transported down the stem inhibit the growth of lateral buds.

Step 3: Analyze the experimental observation. When the apical bud was removed, the lateral buds began to grow vigorously. This indicates that the removal of the apical bud removed the source of inhibition. The question states this is due to a reduced concentration of the hormone responsible for apical dominance.

Step 4: Evaluate the options:
Cytokinin (Option A): Cytokinins are plant hormones that promote cell division and growth, often acting antagonistically to auxins regarding bud outgrowth. Lowering auxin levels (by removing the apical bud) would allow cytokinins to promote lateral bud growth.
Ethylene (Option B): Ethylene is involved in fruit ripening, senescence, and abscission. It does not primarily cause apical dominance.
Auxin (Option C): Auxin, produced in the apical bud, directly inhibits lateral bud growth. Removing the apical bud reduces auxin levels in the stem, allowing the lateral buds to grow. This perfectly matches the description.
Gibberellin (Option D): Gibberellins promote stem elongation and can sometimes counteract apical dominance, but they are not the primary hormone responsible for causing it.

Step 5: Conclude the hormone responsible for apical dominance. Auxin is the hormone produced in the apical bud that inhibits the growth of lateral buds, thus maintaining apical dominance.

Final Answer: Auxin

Answer: (C)

Go Back to Question 18

Q19.

Solution

Concept: Eutrophication is an environmental issue related to water bodies, characterized by excessive nutrient enrichment and its ecological consequences.

Solution: Step 1: Understand the process described. The question describes a scenario in a water body where nutrient concentration, particularly nitrates and phosphates, increases. This leads to excessive algal growth (algal bloom), which eventually results in oxygen depletion (hypoxia or anoxia) when the algae die and decompose.

Step 2: Define the ecological terms:
Desertification (Option A): This is the process by which fertile land becomes desert, typically as a result of drought, deforestation, or inappropriate agriculture. It relates to land degradation.
Biomagnification (Option B): This is the increasing concentration of toxins in organisms at successively higher trophic levels in a food chain. It relates to the accumulation of pollutants.
Eutrophication (Option C): This is the process where a body of water becomes excessively enriched with nutrients, leading to increased production of organic matter (like algae). This enrichment often leads to oxygen depletion as the organic matter decomposes, harming aquatic life. This perfectly matches the description.
Afforestation (Option D): Afforestation is the establishment of forests on land that was not previously forested. It is a measure to combat deforestation and desertification.

Step 3: Match the description to the correct term. The process of nutrient enrichment of water bodies leading to excessive algal growth and oxygen depletion is known as eutrophication.

Final Answer: Eutrophication

Answer: (C)

Go Back to Question 19

Q20.

Solution

Concept: Nerve impulse transmission, or action potential generation, involves changes in the membrane potential of neurons. These changes are driven by the movement of ions across the neuronal membrane through specific ion channels.

Solution: Step 1: Understand nerve impulse transmission (depolarization). A nerve impulse involves a rapid change in the electrical potential across the neuron's membrane. This change, called depolarization, occurs when the membrane potential becomes less negative (moves towards positive values).

Step 2: Recall the ionic basis of depolarization. Depolarization is primarily caused by the rapid influx of positive ions into the neuron.

Step 3: Identify the primary ion involved in depolarization. In most neurons, the rapid influx of sodium ions (Na^+) into the cell through voltage-gated sodium channels is responsible for the rapid depolarization phase of an action potential. This influx makes the inside of the cell more positive.

Step 4: Evaluate the options:
Potassium ions (Option A): Potassium ions (K^+) are primarily involved in repolarization (returning the membrane potential to negative values) as they flow out of the cell through voltage-gated potassium channels.
Calcium ions (Option B): Calcium ions are important for neurotransmitter release at the synapse, but their influx is not the primary cause of initial membrane depolarization.
Sodium ions (Option C): The rapid influx of sodium ions (Na^+) into the neuron through voltage-gated sodium channels causes the rapid depolarization that constitutes the rising phase of the action potential. This matches the description.
Chloride ions (Option D): Chloride ions are negatively charged and their movement typically leads to hyperpolarization (making the membrane potential more negative), not depolarization.

Step 5: Conclude the ions responsible for depolarization. The rapid influx of sodium ions is primarily responsible for the depolarization of the neuronal membrane during nerve impulse transmission.

Final Answer: Sodium ions

Answer: (C)

Go Back to Question 20

Q21.

Solution

Concept: Ecosystems rely on the cycling of nutrients. Decomposers play a crucial role in breaking down dead organic matter and returning essential nutrients to the ecosystem.

Solution: Step 1: Understand the role of organisms in nutrient recycling. The question describes organisms that break down dead organic matter (like dead plants and animals) into simpler inorganic substances. This process releases nutrients back into the soil or water, making them available for producers.

Step 2: Define the ecological terms:
Producers (Option A): Producers (like plants and algae) are organisms that produce their own food, usually through photosynthesis. They form the base of the food chain.
Consumers (Option B): Consumers (like herbivores and carnivores) obtain energy by feeding on other organisms.
Decomposers (Option C): Decomposers are organisms, primarily bacteria and fungi, that break down dead organic matter and waste products. They are essential for nutrient cycling. This perfectly matches the description.
Scavengers (Option D): Scavengers consume dead organisms that have already died from other causes (e.g., vultures eating carcasses). While they break down organic matter, decomposers are the primary agents responsible for converting complex organic matter into inorganic nutrients.

Step 3: Match the description to the correct term. The organisms that break down dead organic matter into simpler inorganic substances, thereby recycling nutrients, are known as decomposers.

Final Answer: Decomposers

Answer: (C)

Go Back to Question 21

Q22.

Solution

Concept: Pollination is the transfer of pollen from the anther to the stigma. This transfer can occur through various agents and mechanisms, leading to different types of pollination.

Solution: Step 1: Understand the scenario of pollen transfer. Pollen grains are transferred from the anther to the stigma by external agents like wind, water, or animals. The specific situation described is the transfer of pollen between flowers of different plants of the same species.

Step 2: Define the types of pollination: Autogamy (Option A): Autogamy is self-pollination, where pollen is transferred from the anther to the stigma of the same flower.
Geitonogamy (Option B): Geitonogamy is pollination between different flowers on the same plant. Genetically, it is self-pollination because the pollen comes from the same plant, but it involves an external agent for transfer.
Xenogamy (Option C): Xenogamy is cross-pollination, which is the transfer of pollen grains from the anther of one flower to the stigma of a flower on a different plant of the same species. This requires an external agent (wind, water, animals). This perfectly matches the description.
Cleistogamy (Option D): Cleistogamy occurs when flowers remain closed, ensuring self-pollination.

Step 3: Match the description to the correct term. The transfer of pollen between flowers of different plants of the same species is called xenogamy.

Final Answer: Xenogamy

Answer: (C)

Go Back to Question 22

Q23.

Solution

Concept: Hormones regulate many bodily functions, including water balance and glucose metabolism. Imbalances in these hormones can lead to endocrine disorders.

Solution: Step 1: Analyze the patient's symptoms. The patient exhibits elevated blood glucose levels (hyperglycemia), excessive thirst (polydipsia), and frequent urination (polyuria). These are classic symptoms of diabetes.

Step 2: Identify the hormone involved in blood glucose regulation. Insulin, a hormone secreted by the beta cells of the islets of Langerhans in the pancreas, lowers blood glucose levels by promoting glucose uptake and utilization by cells and by promoting storage of glucose as glycogen in the liver and muscles.

Step 3: Determine the condition caused by insulin deficiency. Hyposecretion of insulin leads to hyperglycemia because glucose cannot be effectively removed from the blood. This results in the characteristic symptoms of diabetes.

Step 4: Evaluate the endocrine disorders listed:
Diabetes insipidus (Option A): This disorder is caused by a deficiency of antidiuretic hormone (ADH) or the kidneys' inability to respond to it, leading to excessive water loss and frequent urination, but blood glucose levels are typically normal.
Diabetes mellitus (Option B): This is a metabolic disorder characterized by high blood glucose levels due to insufficient insulin production or insulin resistance. It is commonly known as "sugar diabetes" and matches the described symptoms.
Addison's disease (Option C): This disorder results from adrenal insufficiency (inadequate production of cortisol and aldosterone). It affects electrolyte balance and stress response, not primarily blood glucose levels in this manner.
Acromegaly (Option D): Acromegaly is caused by excessive growth hormone secretion after puberty, leading to enlarged extremities and facial features. It is not directly related to insulin deficiency or blood glucose regulation.

Step 5: Conclude the disorder caused by hyposecretion of insulin. The endocrine disorder characterized by elevated blood glucose, excessive thirst, and frequent urination due to insulin deficiency is diabetes mellitus.

Final Answer: Diabetes mellitus

Answer: (B)

Go Back to Question 23

Q24.

Solution

Concept: Meiosis is a type of cell division that reduces the chromosome number by half, producing gametes. It involves two successive divisions, Meiosis I and Meiosis II, each with its own stages.

Solution: Step 1: Understand the stages of Meiosis I. Meiosis I is a reductional division where homologous chromosomes separate. The stages are Prophase I, Metaphase I, Anaphase I, and Telophase I.

Step 2: Describe chromosome behavior in each stage of Meiosis I:
Prophase I: Homologous chromosomes pair up (synapsis), forming bivalents. Crossing over occurs between non-sister chromatids. Chromosomes condense.
Metaphase I: Homologous chromosome pairs (bivalents) align at the metaphase plate (equator of the cell). Each pair is attached to spindle fibres from opposite poles.
Anaphase I: Homologous chromosomes separate and are pulled towards opposite poles of the cell. Sister chromatids remain attached.
Telophase I: Chromosomes arrive at the poles, and cytokinesis may occur, resulting in two haploid cells (each chromosome still consists of two sister chromatids).

Step 3: Identify the stage where homologous chromosomes separate. The stage in Meiosis I where homologous chromosomes separate and move to opposite poles is anaphase I.

Step 4: Evaluate the options:
Prophase-I (Option A): Chromosomes condense and pair, but they do not separate.
Metaphase-I (Option B): Homologous pairs align at the equator, but they do not separate.
Anaphase-I (Option C): Homologous chromosomes separate and move to opposite poles. This matches the description.
Telophase-I (Option D): Chromosomes have reached the poles; separation has already occurred.

Step 5: Conclude the stage of homologous chromosome separation. The separation of homologous chromosomes occurs during Anaphase I.

Final Answer: Anaphase-I

Answer: (C)

Go Back to Question 24

Q25.

Solution

Concept: Theories of evolution attempt to explain how life on Earth has changed over time. Lamarckism and Darwinism are two prominent historical theories, with Darwin's theory of natural selection being widely accepted.

Solution: Step 1: Understand Lamarck's theory of evolution. Lamarck proposed that organisms evolve through the inheritance of acquired characteristics. He suggested that traits acquired by an organism during its lifetime in response to environmental pressures could be passed on to its offspring. For example, he proposed that giraffes stretched their necks to reach higher leaves, and this acquired longer neck was passed to their offspring.

Step 2: Define the other evolutionary concepts presented:
Natural selection (Option A): Darwin's theory, where organisms with traits better suited to their environment survive and reproduce more, passing those favorable traits to their offspring. This is based on pre-existing variations, not acquired ones.
Mutation theory (Option B): Proposed by de Vries, it suggests that evolution occurs through sudden, large changes in genetic material (mutations).
Inheritance of acquired characters (Option C): This is the core concept of Lamarck's theory. It directly refers to the idea that traits acquired during an organism's life are heritable.
Germplasm theory (Option D): Proposed by Weismann, it distinguished between heritable germ cells and non-heritable somatic cells, arguing against the inheritance of acquired characteristics.

Step 3: Match Lamarck's theory to its popular name. Lamarck's theory is famously known as the "inheritance of acquired characters."

Final Answer: Inheritance of acquired characters

Answer: (C)

Go Back to Question 25

Q26.

Solution

Concept: Plant hormones regulate various aspects of plant growth and development, including responses to environmental stress like water deficit.

Solution: Step 1: Understand the observed phenomenon. Stomata of leaves close rapidly when the plant experiences water stress. Stomata are pores that regulate gas exchange and transpiration (water loss). Their closure is a mechanism to conserve water.

Step 2: Recall the roles of major plant hormones:
Auxin (Option A): Auxins primarily promote cell elongation, root formation, and apical dominance. They do not directly induce stomatal closure under water stress.
Gibberellin (Option B): Gibberellins promote stem elongation, seed germination, and flowering. They generally do not induce stomatal closure.
Cytokinin (Option C): Cytokinins promote cell division and differentiation, delay senescence, and can sometimes influence stomatal opening. They do not typically induce closure under stress.
Abscisic acid (ABA) (Option D): Abscisic acid is a plant hormone that plays a crucial role in stress responses, including drought. Under water stress, ABA levels increase, leading to the closure of stomata by influencing the movement of ions and water in guard cells. This action helps to reduce water loss.

Step 3: Match the function to the hormone. The rapid closure of stomata in response to water stress is primarily induced by abscisic acid (ABA).

Final Answer: Abscisic acid

Answer: (D)

Go Back to Question 26

Q27.

Solution

Concept: Recombinant DNA technology involves cutting DNA with restriction enzymes and joining fragments using DNA ligase. Specific types of ends are generated by restriction enzymes, which are crucial for forming recombinant molecules.

Solution: Step 1: Understand the process of generating DNA fragments with restriction enzymes. Restriction enzymes cut DNA at specific recognition sites. The way they cut can produce either flush ends or staggered ends.

Step 2: Define the types of DNA ends produced by restriction enzymes:
Blunt ends (Option A): Some restriction enzymes cut straight across both DNA strands at the recognition site, leaving no overhangs. These are called blunt ends.
Sticky ends (Option B): Many restriction enzymes cut DNA at staggered positions on the two strands, leaving short, single-stranded overhangs called sticky ends. These ends are complementary and can readily anneal (pair) with other DNA fragments that have been cut with the same enzyme. This complementary pairing is essential for the action of DNA ligase in joining fragments.
Phosphodiester ends (Option C): All DNA fragments have phosphodiester bonds linking the nucleotides. This is a general chemical feature, not a specific type of cut end that facilitates joining.
Replicative ends (Option D): This term is not standard in the context of restriction enzyme cutting. Replication involves the synthesis of new DNA strands, not cutting ends.

Step 3: Match the description to the type of ends. The description states that the fragments possess complementary overhanging ends that can pair, which is the definition of sticky ends.

Final Answer: Sticky ends

Answer: (B)

Go Back to Question 27

Q28.

Solution

Concept: Colour blindness is an X-linked recessive trait. Understanding the inheritance patterns of sex-linked genes is crucial for predicting the probability of offspring inheriting certain traits.

Solution: Step 1: Understand the genetics of colour blindness. Colour blindness is typically an X-linked recessive trait. The gene for colour vision is located on the X chromosome.
A normal male has genotype X^BY.
A colour-blind male has genotype X^bY.
A normal woman has genotype X^BX^B or X^BX^b.
A colour-blind woman has genotype X^bX^b.
A carrier woman (heterozygous) has genotype X^BX^b.

Step 2: Analyze the parental genotypes.
The woman is a carrier for colour blindness, so her genotype is X^BX^b.
The man has normal vision, so his genotype is X^BY.

Step 3: Determine the possible genotypes of their offspring. We can use a Punnett square:

Step 4: Calculate the probability of a son being colour blind.
From the Punnett square, the possible outcomes for male offspring are X^BY (normal vision) and X^bY (colour blind). There are two possibilities for males, and one of them is colour blind.
Probability of a son being colour blind = (Number of colour-blind sons) / (Total number of sons) = 1/2 = 50%.

Step 5: Evaluate the options. The probability that their son will be colour blind is 50%.

Final Answer: 50%

Answer: (C)

Go Back to Question 28

Q29.

Solution

Concept: Organisms adapt to their environments in various ways. Some species have broad tolerance ranges for environmental conditions, allowing them to inhabit a wide variety of habitats, while others are specialized.

Solution: Step 1: Understand the characteristic described. The species can tolerate a wide range of environmental conditions and survive in diverse habitats. This implies flexibility and broad adaptability.

Step 2: Define the ecological terms related to environmental tolerance:
Stenothermal (Option A): Stenothermal organisms have a narrow tolerance range for temperature. They can only survive within a limited range of temperatures.
Eurythermal (Option B): Eurythermal organisms have a wide tolerance range for temperature. They can survive across a broad spectrum of temperatures and are found in diverse habitats with varying thermal conditions. This matches the description of tolerating a wide range of environmental conditions, with temperature being a primary factor.
Endemic (Option C): Endemic species are found only in a specific geographic area and nowhere else. This refers to their distribution, not their tolerance range.
Extinct (Option D): Extinct species are those that no longer exist.

Step 3: Match the description to the correct term. Organisms that can tolerate a wide range of environmental conditions, particularly temperature, are described as eurythermal.

Final Answer: Eurythermal

Answer: (B)

Go Back to Question 29

Q30.

Solution

Concept: Pregnancy involves the development of the embryo within the uterus. Several structures and hormones play vital roles in supporting the developing fetus and maintaining the pregnancy.

Solution: Step 1: Understand the functions during pregnancy. The question asks to identify the temporary endocrine structure that develops inside the uterus, facilitates exchange between maternal and fetal blood, and supports the initial stages of pregnancy.

Step 2: Define the roles of the options:
Corpus luteum (Option A): The corpus luteum is a temporary endocrine structure formed in the ovary after ovulation. It produces progesterone and estrogen, which are crucial for maintaining the uterine lining and thus the early pregnancy. However, it is located in the ovary and its primary role is early support, being gradually replaced by the placenta. It does not directly facilitate exchange between maternal and fetal blood within the uterus.
Placenta (Option B): The placenta is a temporary organ that develops in the uterus during pregnancy. It provides oxygen and nutrients to the growing baby and removes waste products from the baby's blood. It is formed from both maternal and fetal tissues and is richly supplied with blood vessels, facilitating the essential exchange between mother and fetus. It also produces hormones essential for maintaining pregnancy. This perfectly matches the description.
Endometrium (Option C): The endometrium is the inner lining of the uterus. It is where the embryo implants, and it thickens and becomes vascularized to support the pregnancy. While essential for pregnancy, it is the tissue that the embryo implants into, not the structure that facilitates exchange between maternal and fetal blood.
Amnion (Option D): The amnion is a membrane that encloses the fetus within the amniotic sac, filled with amniotic fluid. It protects the fetus and provides a stable environment but does not directly facilitate nutrient/waste exchange between maternal and fetal blood.

Step 3: Conclude the structure described. The temporary endocrine structure within the uterus that facilitates maternal-fetal exchange and maintains pregnancy is the placenta.

Final Answer: Placenta

Answer: (B)

Go Back to Question 30

Q31.

Solution

Concept: Cells have various organelles, each with specialized functions. The endoplasmic reticulum (ER) is a network of membranes involved in protein and lipid synthesis and modification.

Solution: Step 1: Analyze the description of the cell and organelle. The cell is actively synthesizing proteins for export, and the organelle in question is described as:
Membrane-bound.
Having flattened sacs (cisternae).
Studded with ribosomes.

Step 2: Recall the functions and structures of relevant organelles:
Smooth endoplasmic reticulum (SER) (Option A): The SER is a network of interconnected tubules and sacs that lack ribosomes. It is primarily involved in lipid synthesis, detoxification, and calcium storage. It does not synthesize proteins for export.
Rough endoplasmic reticulum (RER) (Option B): The RER is a network of interconnected flattened sacs (cisternae) and tubules studded with ribosomes on its outer surface. Ribosomes attached to the RER synthesize proteins that are destined for secretion, insertion into membranes, or delivery to other organelles (like lysosomes). The proteins enter the RER lumen for folding and modification. The presence of ribosomes and the function of synthesizing proteins for export strongly indicate the RER.
Golgi apparatus (Option C): The Golgi apparatus (or Golgi complex/dictyosome) receives proteins and lipids from the ER, further modifies, sorts, and packages them for transport. It is composed of flattened membrane-bound sacs but does not have ribosomes directly attached for protein synthesis.
Peroxisome (Option D): Peroxisomes are small, membrane-bound organelles involved in various metabolic reactions, including the breakdown of fatty acids and detoxification. They do not synthesize proteins for export and do not have ribosomes.

Step 3: Conclude the identity of the organelle. The organelle with flattened sacs studded with ribosomes, actively involved in synthesizing proteins for export, is the rough endoplasmic reticulum.

Final Answer: Rough endoplasmic reticulum

Answer: (B)

Go Back to Question 31

Q32.

Solution

Concept: Respiratory diseases can affect the airways and lungs, leading to symptoms like difficulty breathing and mucus production. Allergic reactions are a common cause of such conditions.

Solution: Step 1: Analyze the symptoms described. The patient experiences breathing difficulty, narrowing of bronchi, and excessive mucus secretion, all triggered by an allergic response.

Step 2: Define the respiratory conditions mentioned:
Emphysema (Option A): Emphysema is a lung condition that causes shortness of breath. It is characterized by damage to the alveoli, leading to loss of lung elasticity. It is not primarily an allergic response causing bronchoconstriction and mucus.
Asthma (Option B): Asthma is a chronic inflammatory disease of the airways characterized by reversible airway narrowing (bronchoconstriction) and increased mucus production, often triggered by allergens or irritants. This description perfectly matches the symptoms of breathing difficulty, narrowed bronchi, and excessive mucus secretion due to an allergic response.
Tuberculosis (Option C): Tuberculosis is an infectious disease caused by Mycobacterium tuberculosis, primarily affecting the lungs. It is not primarily an allergic response involving bronchoconstriction.
Pneumonia (Option D): Pneumonia is an infection that inflames the air sacs in one or both lungs. The air sacs may fill with fluid or pus. While it causes breathing difficulty, it is an infection, not typically an allergic response leading to bronchoconstriction and mucus.

Step 3: Match the symptoms to the characteristic disease. The combination of breathing difficulty, narrowed bronchi, excessive mucus secretion, and allergic triggers is characteristic of asthma.

Final Answer: Asthma

Answer: (B)

Go Back to Question 32

Q33.

Solution

Concept: Ecological communities are structured by the interactions between different species. Some species have a more significant impact on community structure and function than others, even if they are not the most abundant.

Solution: Step 1: Understand the definition provided. The question describes species that play a disproportionately large role in maintaining the structure and stability of an ecosystem, despite being relatively low in abundance.

Step 2: Define the ecological terms:
Dominant species (Option A): Dominant species are typically the most abundant species in an ecosystem, often playing a major role due to their sheer numbers or biomass (e.g., dominant trees in a forest).
Endangered species (Option B): Endangered species are those at high risk of extinction. This refers to their conservation status, not their ecological impact on ecosystem structure.
Keystone species (Option C): A keystone species is a species that has a disproportionately large effect on its environment relative to its abundance. Its removal would drastically alter the ecosystem's structure, function, and stability. This matches the description perfectly.
Exotic species (Option D): Exotic species are introduced from other regions and can become invasive, but their definition is based on origin, not necessarily their disproportionate ecological role.

Step 3: Match the description to the correct ecological term. The description of species that have a disproportionately large impact on ecosystem structure and stability, despite low abundance, is the definition of a keystone species.

Final Answer: Keystone species

Answer: (C)

Go Back to Question 33

Q34.

Solution

Concept: Genes located on the same chromosome are often inherited together, a phenomenon known as linkage. This deviates from Mendel's law of independent assortment.

Solution: Step 1: Recall Mendel's laws. Mendel's Law of Independent Assortment states that alleles of different genes segregate independently of each other during gamete formation, provided the genes are on different chromosomes or far apart on the same chromosome.

Step 2: Understand the phenomenon described. Thomas Hunt Morgan's experiments with fruit flies (*Drosophila melanogaster*) showed that genes located close together on the same chromosome tend to be inherited as a unit. This tendency to be inherited together is called linkage.

Step 3: Define the genetic terms:
Mutation (Option A): A mutation is a change in the DNA sequence. It is a source of genetic variation but not the phenomenon of genes on the same chromosome being inherited together.
Linkage (Option B): Linkage is the phenomenon where genes located close to each other on the same chromosome are inherited together. This directly matches the discovery described.
Codominance (Option C): Codominance is when both alleles of a gene pair are fully expressed in the heterozygote. It relates to the expression of alleles of a single gene, not the inheritance of multiple genes on the same chromosome.
Segregation (Option D): Mendel's Law of Segregation states that the two alleles for each trait separate during gamete formation, so that each gamete carries only one allele for each trait. This applies to alleles of a single gene.

Step 4: Conclude the phenomenon observed by Morgan. The observation that genes on the same chromosome tend to be inherited together is called linkage.

Final Answer: Linkage

Answer: (B)

Go Back to Question 34

Q35.

Solution

Concept: Gas exchange in the human respiratory system occurs in the alveoli, which are tiny air sacs in the lungs. Their structure is highly adapted for efficient diffusion of oxygen and carbon dioxide.

Solution: Step 1: Understand the process of gaseous exchange in the lungs. Gaseous exchange, the movement of oxygen from the alveoli into the blood and carbon dioxide from the blood into the alveoli, occurs by diffusion.

Step 2: Identify the structural features that facilitate efficient diffusion. Diffusion is most efficient across thin membranes and over large surface areas. The alveoli are designed to maximize these factors:
Thin membrane: The respiratory membrane (formed by the alveolar epithelium, capillary endothelium, and their fused basement membrane) is extremely thin, typically only one cell thick in each layer, facilitating rapid diffusion.
Extensive surface area: The lungs contain millions of alveoli, providing an enormous surface area for gas exchange.

Step 3: Evaluate the options based on their relevance to gas exchange efficiency:
Keratinization (Option A): Keratinization is the process of developing keratin, a tough protein, making tissues like skin waterproof and resistant to abrasion. It is not relevant to alveolar gas exchange and would hinder it.
Blood capillary network (Option B): The alveoli are surrounded by a dense network of pulmonary capillaries. This extensive capillary network provides a large surface area for blood to come into close contact with the alveolar air, facilitating efficient diffusion of gases between the alveoli and the blood. This is a critical factor.
Cartilaginous rings (Option C): Cartilaginous rings are found in the trachea and bronchi, providing structural support to keep these airways open. They are not found in the alveoli.
Muscle fibres (Option D): Muscle fibres (smooth muscle) are present in the walls of bronchi and bronchioles, regulating airway diameter, but they are not the primary factor for efficient diffusion across the alveolar membrane.

Step 4: Conclude the factor that contributes to efficient gaseous exchange. The extensive network of blood capillaries surrounding the alveoli provides a large surface area and a close proximity for efficient diffusion of gases.

Final Answer: Blood capillary network

Answer: (B)

Go Back to Question 35

Q36.

Solution

Concept: Vascular bundles are the primary conducting tissues in plants. Their arrangement and the presence of cambium determine the type of growth a plant stem undergoes.

Solution: Step 1: Understand the features of vascular bundles in dicot stems. The question describes vascular bundles in dicot stems that are arranged in a ring and possess cambium between the xylem and phloem.

Step 2: Define the types of vascular bundles:
Closed (Option A): Closed vascular bundles lack cambium. They are typically found in monocots and do not undergo secondary growth.
Radial (Option B): Radial vascular bundles are found in roots, where xylem and phloem are arranged on different radii, alternating with each other.
Open (Option C): Open vascular bundles contain cambium between the xylem and phloem. The vascular cambium is responsible for producing secondary xylem and secondary phloem, enabling secondary growth (increase in girth). This is characteristic of dicot stems.
Amphicribal (Option D): Amphicribral vascular bundles have phloem surrounding xylem, found in some monocot stems and leaves.

Step 3: Match the description to the correct term. The vascular bundles of dicot stems, which are arranged in a ring and have cambium between xylem and phloem, are described as open vascular bundles because they can undergo secondary growth.

Final Answer: Open

Answer: (C)

Go Back to Question 36

Q37.

Solution

Concept: Transcription is the process by which a segment of DNA is copied into mRNA. This process involves RNA polymerase binding to a specific DNA sequence and moving along one strand of the DNA, synthesizing a complementary RNA molecule.

Solution: Step 1: Understand the process of transcription. Transcription is the synthesis of RNA from a DNA template. This process is carried out by RNA polymerase.

Step 2: Identify the role of the DNA strands during transcription. DNA is a double helix. During transcription, RNA polymerase moves along one of the DNA strands, reading its nucleotide sequence and synthesizing a complementary RNA strand.

Step 3: Define the terms related to DNA strands in transcription:
Coding strand (Option A): The coding strand (also called the sense strand) has a sequence similar to the RNA transcript (with T instead of U). RNA polymerase does not directly read this strand.
Sense strand (Option B): This is another name for the coding strand.
Template strand (Option C): The template strand (also called the antisense strand or non-coding strand) is the DNA strand that RNA polymerase reads during transcription. The RNA molecule produced is complementary to this template strand. This directly matches the description.
Leading strand (Option D): The leading strand is a term used in DNA replication, referring to the strand synthesized continuously. It is not directly related to the strand used as a template in transcription.

Step 4: Conclude the name of the DNA strand used as a template. The DNA strand that RNA polymerase reads during transcription is called the template strand.

Final Answer: Template strand

Answer: (C)

Go Back to Question 37

Q38.

Solution

Concept: The human heart has a specialized conducting system that initiates and regulates rhythmic contractions. The sinoatrial (SA) node acts as the natural pacemaker.

Solution: Step 1: Understand the cardiac conduction system. The heart's rhythmic contractions are initiated by specialized cells that generate electrical impulses. These impulses spread through the heart, causing coordinated contractions.

Step 2: Identify the location of the SA node. The sinoatrial (SA) node is a small mass of specialized cardiac muscle tissue located in the upper wall of the right atrium of the heart.

Step 3: Recall the function of the SA node. The SA node acts as the natural pacemaker of the heart because it has the highest intrinsic rate of spontaneous depolarization. It initiates the electrical impulse that spreads throughout the atria, causing them to contract, and then to the AV node.

Step 4: Evaluate the options for the location of the SA node:
Left ventricle (Option A): The ventricles are the lower chambers of the heart responsible for pumping blood out. The SA node is not located here.
Right ventricle (Option B): The right ventricle pumps blood to the lungs. The SA node is not located here.
Left atrium (Option C): The left atrium receives oxygenated blood from the lungs. While the SA node is in the atrium, it's specifically in the right atrium.
Right atrium (Option D): The SA node is located in the wall of the right atrium. This is the correct location.

Step 5: Conclude the location of the SA node. The SA node, the natural pacemaker, is situated in the wall of the right atrium.

Final Answer: Right atrium

Answer: (D)

Go Back to Question 38

Q39.

Solution

Concept: Ecological relationships describe the interactions between different species within an ecosystem. These interactions can range from mutually beneficial to harmful.

Solution: Step 1: Analyze the described ecological interaction. An orchid grows on the branch of a mango tree. The orchid benefits by gaining support and better exposure to sunlight. Crucially, the mango tree is neither harmed nor benefited by the presence of the orchid.

Step 2: Define the types of ecological interactions:
Competition (Option A): This occurs when two or more organisms require the same limited resource, and the presence of one negatively affects the other. This is not the case here, as the mango tree is not affected.
Mutualism (Option B): Mutualism is an interaction where both species benefit from the relationship (e.g., pollination). This does not fit, as the mango tree is not benefiting.
Commensalism (Option C): Commensalism is an interaction where one species benefits, and the other species is neither harmed nor benefited. This accurately describes the relationship between the orchid and the mango tree.
Predation (Option D): Predation involves one organism (predator) killing and consuming another organism (prey). This is clearly not happening here.

Step 3: Match the interaction to the correct term. The relationship where one species benefits (orchid) and the other is unaffected (mango tree) is classified as commensalism.

Final Answer: Commensalism

Answer: (C)

Go Back to Question 39

Q40.

Solution

Concept: Plants absorb essential mineral ions from the soil to support their growth and development. This absorption process can occur through passive or active mechanisms.

Solution: Step 1: Understand the process of mineral ion uptake by plant roots. Plants absorb mineral nutrients from the soil, which are dissolved in soil water. These ions are essential for various physiological processes.

Step 2: Recall the mechanisms of nutrient transport across cell membranes.
Diffusion (Option A): Diffusion is the movement of substances from an area of high concentration to an area of low concentration, down a concentration gradient. It does not require metabolic energy.
Osmosis (Option B): Osmosis is the movement of water across a semipermeable membrane from a region of higher water potential to a region of lower water potential. It is specific to water movement.
Active transport (Option C): Active transport is the movement of substances across a cell membrane against their concentration gradient (from low to high concentration) or from a region of low electrochemical potential to high potential. This process requires metabolic energy, usually in the form of ATP. Mineral ion uptake, especially when concentrations in the soil are lower than inside the root cells, is often an active process.
Imbibition (Option D): Imbibition is the absorption of water by solid substances like seeds or cell walls, causing them to swell. It is not a mechanism for transporting dissolved ions.

Step 3: Match the description to the transport process. The question states that mineral ions are transported from soil into root cells against a concentration gradient with the expenditure of metabolic energy. This is the definition of active transport.

Final Answer: Active transport

Answer: (C)

Go Back to Question 40

Q41.

Solution

Concept:

Hormones produced by endocrine glands regulate various physiological functions, including growth and metabolism. Imbalances in hormone secretion can lead to specific disorders.

Solution:

Step 1: Analyze the patient's condition. The patient shows symptoms of excessive urination and intense thirst, along with a diagnosis of excessive secretion of growth hormone (GH) after puberty.

Step 2: Understand the function of growth hormone. Growth hormone (GH) promotes growth and cell reproduction. It has widespread effects on metabolism, including promoting protein synthesis and influencing carbohydrate and lipid metabolism.

Step 3: Relate excessive GH secretion after puberty to specific disorders.
Dwarfism (Option A): Dwarfism is caused by a deficiency in GH secretion before puberty, leading to stunted growth.
Gigantism (Option B): Gigantism results from excessive GH secretion before puberty, leading to abnormally tall stature.
Acromegaly (Option C): Acromegaly is caused by excessive GH secretion after puberty. In adults, the long bones have fused, so the person cannot grow taller. Instead, GH causes thickening of bones, particularly in the extremities (hands, feet) and facial bones, leading to characteristic coarsening of facial features. This perfectly matches the described symptoms.
Cretinism (Option D): Cretinism is caused by severe iodine deficiency or hypothyroidism during fetal development or infancy, leading to stunted growth and intellectual disability. It is related to thyroid hormones, not growth hormone.

Step 4: Conclude the disorder caused by excessive GH secretion after puberty. The condition resulting from excessive growth hormone secretion after puberty, characterized by enlarged extremities and facial bones, is acromegaly.

Final Answer: Acromegaly

Answer: (C)

Go Back to Question 41

Q42.

Solution

Concept: Pollination mechanisms in flowering plants are diverse and often involve adaptations to prevent self-pollination and promote cross-pollination, thereby increasing genetic diversity.

Solution: Step 1: Understand the scenario. Some flowering plants have both male (stamens) and female (stigma) reproductive parts within the same flower, but they prevent self-pollination because the stamens and stigma mature at different times.

Step 2: Define the terms related to preventing self-pollination:
Herkogamy (Option A): This refers to a spatial separation between the anthers and stigma within a flower, which physically prevents self-pollination.
Dichogamy (Option B): This is the temporal separation of sexual maturity of the stamens and stigma within a flower. It has two forms:
Protandry: Anthers mature before the stigma.
Protogyny: Stigma matures before the anthers.
This phenomenon directly addresses the condition described in the question.
Cleistogamy (Option C): Cleistogamy occurs when flowers remain closed, ensuring self-pollination. This is the opposite of the described situation.
Apomixis (Option D): Apomixis is asexual reproduction through seeds, bypassing fertilization. It is not related to the timing of maturation of reproductive organs.

Step 3: Match the definition to the described adaptation. The temporal separation of the maturation of stamens and stigma to prevent self-pollination is called dichogamy.

Final Answer: Dichogamy

Answer: (B)

Go Back to Question 42

Q43.

Solution

Concept: The age structure of a population, represented by an age pyramid, provides insights into its growth potential and future trends.

Solution: Step 1: Understand age distribution and age pyramids. An age pyramid graphically represents the distribution of different age groups within a population. It typically shows pre-reproductive, reproductive, and post-reproductive age classes.

Step 2: Describe the shapes of age pyramids and their implications:
Broad base (expanding population): A population with a large proportion of young individuals (pre-reproductive age) and a smaller proportion of older individuals has a broad base. This indicates a high birth rate and a growing population.
Bell-shaped (stable population): A population with roughly equal proportions of individuals in pre-reproductive and reproductive age groups, with a tapering top, indicates a stable population with a birth rate roughly equal to the death rate.
Urn-shaped (declining population): A population with a small proportion of young individuals and a larger proportion of older individuals has a narrow base. This indicates a low birth rate and a declining population.

Step 3: Evaluate the implications of a broad base in the age pyramid. A broad base signifies a large number of young individuals who will enter the reproductive age group in the future. This leads to a high birth rate and a growing population.

Step 4: Match the pyramid shape to the population trend:
Declining population (Option A): Characterized by a narrow base.
Stable population (Option B): Characterized by a bell shape or more even distribution across younger age groups.
Expanding population (Option C): Characterized by a broad base, indicating a high proportion of young individuals and rapid growth. This matches the description.
Extinct population (Option D): An extinct population has no individuals left.

Step 5: Conclude the population trend indicated by a broad base. A broad base in an age pyramid signifies an expanding population.

Final Answer: Expanding population

Answer: (C)

Go Back to Question 43

Q44.

Solution

Concept: DNA replication is a semi-conservative process where the DNA double helix unwinds, and each strand serves as a template for the synthesis of a new complementary strand. DNA polymerase synthesizes DNA only in one direction.

Solution: Step 1: Understand DNA replication. DNA replication involves unwinding the DNA double helix and synthesizing new DNA strands. The synthesis is carried out by DNA polymerase.

Step 2: Recall the directionality of DNA synthesis. DNA polymerase can only add nucleotides to the 3' end of a growing DNA strand. Therefore, DNA synthesis always proceeds in the 5' to 3' direction.

Step 3: Consider the two template strands. DNA strands are antiparallel (run in opposite directions). One template strand runs 3' to 5' relative to the replication fork, and the other runs 5' to 3'.

Step 4: Explain the synthesis of both strands.
The leading strand template runs 3' to 5'. DNA polymerase can synthesize the new strand continuously in the 5' to 3' direction, following the replication fork.
The lagging strand template runs 5' to 3'. Since DNA polymerase can only synthesize in the 5' to 3' direction, it must synthesize this strand discontinuously in short fragments (Okazaki fragments) that are later joined together.

Step 5: Evaluate the options regarding the direction of DNA synthesis:
3' $\rightarrow$ 5' direction (Option A): DNA polymerase does not synthesize DNA in this direction.
5' $\rightarrow$ 3' direction (Option B): This is the direction in which DNA polymerase adds nucleotides. Both leading and lagging strands are synthesized in this direction, although the lagging strand is synthesized discontinuously.
Centromere to telomere direction (Option C): This refers to the direction along a chromosome but not the direction of synthesis.
Random direction (Option D): DNA synthesis is highly specific and proceeds in a defined direction.

Step 6: Conclude the direction of DNA synthesis. DNA synthesis, by DNA polymerase, always proceeds in the 5' to 3' direction.

Final Answer: 5' $\rightarrow$ 3' direction

Answer: (B)

Go Back to Question 44

Q45.

Solution

Concept: Malaria is caused by *Plasmodium* and spreads through the bite of infected female *Anopheles* mosquitoes.

Solution: Step 1: Understand the infectious stage. During a mosquito bite, the parasite enters the human body in the form of sporozoites.

Step 2: Trace their role. Sporozoites travel to the liver, multiply, and later infect red blood cells, causing malaria symptoms.

Step 3: Evaluate the options:
Merozoite (Option A): Infects red blood cells.
Trophozoite (Option B): Growing stage inside RBCs.
Sporozoite (Option C): Infective stage transmitted by mosquito. This is correct.
Gametocyte (Option D): Sexual stage taken up by mosquitoes.

Step 4: Conclude the answer. The infective stage transmitted to humans is the sporozoite.

Final Answer: Sporozoite

Answer: (C)

Go Back to Question 45

Q46.

Solution

Concept: Seed germination involves the activation of metabolic processes within the seed, leading to the emergence of the seedling. Plant hormones play a crucial role in regulating these processes.

Solution: Step 1: Understand seed germination. Seed germination is the process by which a seed embryo develops into a seedling. This process requires the activation of stored food reserves within the seed, which is achieved through the action of hydrolytic enzymes.

Step 2: Recall the role of plant hormones in germination.
Cytokinin (Option A): Cytokinins primarily promote cell division and differentiation, and delay senescence. They are not the primary hormones that stimulate the synthesis of hydrolytic enzymes for breaking down stored food during germination.
Gibberellin (Option B): Gibberellins are well-known for their role in promoting seed germination. They stimulate the synthesis of hydrolytic enzymes (like amylases, proteases, and lipases) in the aleurone layer or cotyledons, which break down stored starch, proteins, and lipids into usable sugars, amino acids, and fatty acids for the growing embryo. This precisely matches the description.
Ethylene (Option C): Ethylene is primarily associated with fruit ripening, senescence, and abscission. While it can influence germination in some species, it is not the primary hormone for inducing hydrolytic enzyme synthesis.
Abscisic acid (ABA) (Option D): Abscisic acid is generally considered an inhibitory hormone, promoting dormancy in seeds and buds. It counteracts the effects of gibberellins on germination.

Step 3: Conclude the hormone that promotes the synthesis of hydrolytic enzymes during germination. Gibberellins are responsible for stimulating the synthesis of hydrolytic enzymes that break down stored food in seeds, facilitating germination.

Final Answer: Gibberellin

Answer: (B)

Go Back to Question 46

Q47.

Solution

Concept: The inheritance of traits can be influenced by multiple genes. Polygenic inheritance describes traits controlled by the additive effects of several genes.

Solution: Step 1: Understand the scenario. A trait is controlled by two or more genes, and each gene contributes equally and cumulatively to the phenotype. The population exhibits continuous variation for this trait.

Step 2: Define the terms related to inheritance patterns:
Monogenic inheritance (Option A): This describes traits controlled by a single gene (e.g., Mendelian traits like pea height).
Polygenic inheritance (Option B): This occurs when a single phenotypic trait is controlled by the additive effects of multiple genes. Traits exhibiting polygenic inheritance often show continuous variation in the population (e.g., height, skin color, weight). This matches the description.
Codominance (Option C): Codominance is when both alleles of a gene pair are fully expressed in the heterozygote. It relates to the expression of alleles of a single gene.
Linkage (Option D): Linkage is the tendency for genes located close together on the same chromosome to be inherited as a unit. It affects the inheritance patterns of specific genes but not the additive effect of multiple genes on a continuous trait.

Step 3: Match the description to the correct inheritance pattern. The situation where a trait is controlled by multiple genes, each contributing additively to the phenotype and resulting in continuous variation, is known as polygenic inheritance.

Final Answer: Polygenic inheritance

Answer: (B)

Go Back to Question 47

Q48.

Solution

Concept: Organisms have varying degrees of tolerance to environmental factors like temperature. These tolerances influence their distribution and the habitats they can occupy.

Solution: Step 1: Understand the characteristic described. The species survives only within a narrow range of temperature variations and cannot tolerate extreme changes. This implies a specialized requirement for a specific temperature range.

Step 2: Define the ecological terms related to temperature tolerance:
Eurythermal (Option A): Eurythermal organisms have a wide tolerance range for temperature. They can survive across a broad spectrum of temperatures. This is the opposite of the description.
Stenothermal (Option B): Stenothermal organisms have a narrow tolerance range for temperature. They can only survive within a limited range of temperatures and are sensitive to temperature fluctuations. This matches the description of surviving within a narrow range and being unable to tolerate extreme changes.
Cosmopolitan (Option C): Cosmopolitan species are found throughout the world in diverse habitats. This refers to their wide geographic distribution, not their temperature tolerance.
Endemic (Option D): Endemic species are found only in a specific geographic area. This refers to their distribution, not their temperature tolerance.

Step 3: Match the description to the correct term. Organisms that can only survive within a narrow range of temperatures are described as stenothermal.

Final Answer: Stenothermal

Answer: (B)

Go Back to Question 48

Q49.

Solution

Concept: Mitochondria and chloroplasts are unique eukaryotic organelles because they possess their own genetic material and protein synthesis machinery, suggesting an evolutionary origin from endosymbiotic prokaryotes.

Solution: Step 1: Understand the term "semiautonomous organelles." Semiautonomous organelles are those that contain their own DNA and ribosomes, allowing them to synthesize some of their own proteins and replicate somewhat independently of the cell nucleus, although they still rely on nuclear genes for many of their components. Mitochondria and chloroplasts are the primary examples.

Step 2: Recall the genetic material found in mitochondria. Mitochondria possess their own genetic material in the form of DNA. This mitochondrial DNA (mtDNA) is distinct from the nuclear DNA.

Step 3: Describe the structure of mitochondrial DNA. Mitochondrial DNA is typically a small, circular molecule of double-stranded DNA. It is not organized with histones into chromatin in the same way as nuclear DNA.

Step 4: Evaluate the options:
Linear double-stranded DNA (Option A): Nuclear DNA in eukaryotes is linear and double-stranded, organized with histones. Mitochondrial DNA is circular.
Circular double-stranded DNA (Option B): This correctly describes the typical structure of mitochondrial DNA, similar to the DNA found in bacteria.
Single-stranded RNA (Option C): RNA is typically single-stranded, but the genetic material in mitochondria is DNA.
Histone-free chromatin (Option D): While mitochondrial DNA is largely histone-free compared to nuclear DNA, the primary characteristic of the genetic material itself is its structure as circular double-stranded DNA. Nuclear DNA is also double-stranded but is organized into chromatin with histones. The key differentiator here is the circular nature and the presence of independent genetic material.

Step 5: Conclude the nature of mitochondrial genetic material. Mitochondrial DNA is typically a circular, double-stranded DNA molecule.

Final Answer: Circular double-stranded DNA

Answer: (B)

Go Back to Question 49

Q50.

Solution

Concept: Introducing foreign DNA into bacterial cells is a fundamental step in recombinant DNA technology. Various methods are used to facilitate this process.

Solution: Step 1: Understand the goal of introducing recombinant DNA into bacteria. The aim is to get the plasmid carrying the foreign gene (recombinant DNA) inside the bacterial host cell so that it can be replicated and the gene can be expressed.

Step 2: Define the methods for introducing foreign DNA into bacteria:
Hybridization (Option A): Hybridization typically refers to the annealing of complementary nucleic acid strands or the crossing of different species/varieties. It is not a method for introducing DNA into cells.
Transformation (Option B): Transformation is the process by which a bacterial cell takes up foreign DNA from its environment. A common laboratory method involves treating bacterial cells with divalent cations (like Ca^{2+}) to make the cell membrane more permeable, followed by a brief heat shock (e.g., 42°C). This treatment facilitates the entry of plasmid DNA into the cells. This precisely matches the description.
Translation (Option C): Translation is the process of synthesizing proteins from mRNA, occurring within the cell. It does not involve introducing DNA into the cell.
Transduction (Option D): Transduction is the process of transferring bacterial DNA from one bacterium to another by a bacteriophage (a virus that infects bacteria). This method involves a viral vector, not direct uptake of naked DNA facilitated by cations and heat.

Step 3: Match the described procedure to the correct term. The process involving divalent cations and heat shock to introduce recombinant DNA into bacteria is known as transformation.

Final Answer: Transformation

Answer: (B)

Go Back to Question 50

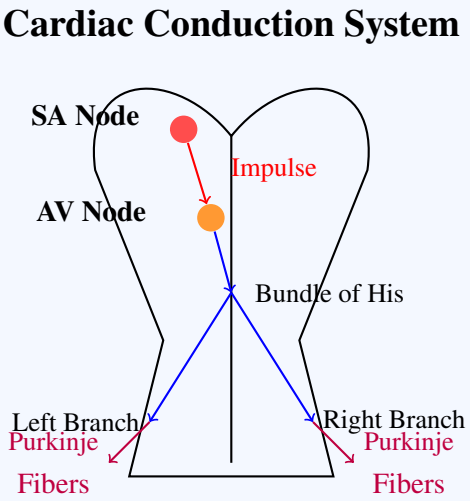
Q51.

Solution

Concept: Digestion involves breaking down food into absorbable molecules. Lipids (fats) are digested by lipases, but their digestion is significantly aided by bile salts.

Solution: Step 1: Understand the role of bile salts in fat digestion. Fats are large, hydrophobic molecules that do not readily mix with the watery environment of the digestive tract. Bile salts, produced by the liver and stored in the gallbladder, are amphipathic molecules.

Step 2: Define the process of emulsification. Emulsification is the process by which large fat globules are broken down into smaller droplets. Bile salts surround these smaller droplets, preventing them from reaggregating. This increases the surface area of the fat, making it more accessible to digestive enzymes like pancreatic lipase.



Step 3: Evaluate the options:
Coagulation (Option A): Blood clotting process.
Emulsification (Option B): Breakdown of fats into smaller droplets by bile salts. This matches the description.
Hydrolysis (Option C): Chemical breakdown of fats by enzymes.
Neutralization (Option D): Adjustment of pH.

Step 4: Conclude the process. Bile salts aid fat digestion through emulsification.

Final Answer: Emulsification

Answer: (B)

Go Back to Question 51

Q52.

Solution

Concept: Environmental degradation can lead to the loss of fertile land and the expansion of desert-like conditions. This process has significant ecological and economic consequences.

Solution: Step 1: Understand the ecological process described. The question describes the degradation of fertile land into desert-like conditions over time, caused by factors like deforestation, overgrazing, and improper irrigation.

Step 2: Define the ecological terms:
Eutrophication (Option A): This is the enrichment of water bodies with nutrients, leading to algal blooms and oxygen depletion. It relates to aquatic ecosystems.
Biomagnification (Option B): This is the increasing concentration of toxins in organisms at successively higher trophic levels. It relates to pollution accumulation.
Desertification (Option C): This is the process by which fertile land becomes desert, typically as a result of drought, deforestation, inappropriate agriculture, or climate change. It leads to loss of biological productivity and degradation of soil. This perfectly matches the description.
Afforestation (Option D): Afforestation is the process of planting trees on land that was not previously forested, aiming to combat desertification and deforestation. It is the opposite of the process described.

Step 3: Match the description to the correct ecological term. The process of fertile land turning into desert-like conditions is called desertification.

Final Answer: Desertification

Answer: (C)

Go Back to Question 52

Q53.

Solution

Concept: Plant vascular tissues are responsible for transporting water, minerals, and nutrients throughout the plant. The arrangement and composition of these tissues are characteristic of different plant groups.

Solution: Step 1: Understand the structure of the described tissue. The tissue transports organic food materials from leaves to other parts of the plant. It consists of sieve tubes, companion cells, phloem parenchyma, and fibres.

Step 2: Identify the vascular tissue responsible for food transport. In plants, there are two main types of vascular tissues:
Xylem (Option A): Xylem is primarily responsible for transporting water and minerals from the roots to the rest of the plant and also provides structural support.
Phloem (Option B): Phloem is the vascular tissue responsible for transporting organic food materials (sugars, amino acids, etc.) produced during photosynthesis from the leaves (source) to other parts of the plant where they are needed for growth or storage (sinks). The components listed (sieve tubes, companion cells, phloem parenchyma, fibres) are characteristic of phloem.
Cambium (Option C): Cambium is a lateral meristematic tissue responsible for secondary growth (increase in girth). It is not the primary food transport tissue.
Epidermis (Option D): Epidermis is the outermost protective layer of cells in plants. It is not involved in long-distance transport of food.

Step 3: Conclude the name of the tissue responsible for food transport. The tissue responsible for transporting organic food materials throughout the plant is the phloem.

Final Answer: Phloem

Answer: (B)

Go Back to Question 53

Q54.

Solution

Concept: Protein synthesis, or translation, is the process by which the genetic information encoded in mRNA is used to build a specific sequence of amino acids. This process involves adapter molecules that bridge the gap between mRNA codons and amino acids.

Solution: Step 1: Understand the process of protein synthesis (translation). Translation occurs on ribosomes, where mRNA codons are read, and corresponding amino acids are brought into position to form a polypeptide chain.

Step 2: Recall the role of adaptor molecules. The genetic code is written in terms of mRNA codons (three-nucleotide sequences). However, amino acids do not directly recognize these codons. An adaptor molecule is needed to link a specific amino acid to its corresponding mRNA codon.

Step 3: Identify the adaptor molecule. The adaptor molecule responsible for carrying specific amino acids to the ribosome and recognizing the mRNA codons is the transfer RNA (tRNA). Each tRNA molecule has an anticodon loop with three nucleotides complementary to a specific mRNA codon and an amino acid attachment site for the corresponding amino acid.

Step 4: Evaluate the options:
mRNA (Option A): Messenger RNA carries the genetic code from DNA to the ribosome. It is read, not used as an adaptor.
rRNA (Option B): Ribosomal RNA (rRNA) is a structural and catalytic component of ribosomes. It does not carry amino acids or recognize codons.
tRNA (Option C): Transfer RNA molecules act as adaptors, bringing specific amino acids to the ribosome based on their anticodon sequence complementary to mRNA codons. This perfectly matches the description of the adaptor molecule referred to in the hypothesis.
snRNA (Option D): Small nuclear RNA (snRNA) is involved in RNA splicing in eukaryotes. It is not directly involved in translation.

Step 5: Conclude the adaptor molecule. The adaptor molecules referred to in the adaptor hypothesis are tRNA molecules.

Final Answer: tRNA

Answer: (C)

Go Back to Question 54

Q55.

Solution

Concept: Hormonal regulation is essential for the menstrual cycle and pregnancy. The pituitary gland plays a central role in regulating the endocrine functions of the ovaries.

Solution: Step 1: Understand the event of ovulation. Ovulation is the release of a mature egg from the ovary. This event is triggered by a surge in a specific hormone.

Step 2: Recall the hormonal control of the menstrual cycle. The menstrual cycle is regulated by hormones from the hypothalamus, pituitary gland, and ovaries.
The hypothalamus releases Gonadotropin-releasing hormone (GnRH).
GnRH acts on the anterior pituitary gland, stimulating it to release Follicle-Stimulating Hormone (FSH) and Luteinizing Hormone (LH).
FSH stimulates the development of ovarian follicles.
As follicles mature, they produce increasing amounts of estrogen.
A surge in estrogen levels near the middle of the cycle triggers a surge in LH secretion from the anterior pituitary.
This LH surge is the immediate cause of ovulation.

Step 3: Identify the gland that secretes LH. LH is secreted by the anterior pituitary gland.

Step 4: Evaluate the options:
Thyroid gland (Option A): Secretes thyroid hormones (T3, T4) regulating metabolism.
Hypothalamus (Option B): Secretes GnRH, which controls the pituitary, but not LH directly.
Anterior pituitary (Option C): This gland secretes FSH and LH in response to GnRH. The LH surge, which triggers ovulation, originates from the anterior pituitary. This matches the description.
Posterior pituitary (Option D): This gland releases ADH and oxytocin, which are synthesized in the hypothalamus. It does not secrete LH.

Step 5: Conclude the gland that secretes LH. Luteinizing hormone (LH), which triggers ovulation, is secreted by the anterior pituitary gland.

Final Answer: Anterior pituitary

Answer: (C)

Go Back to Question 55

Q56.

Solution

Concept: Anaerobic respiration is a metabolic process that occurs in the absence of oxygen, where cells convert pyruvate into different end products depending on the organism.

Solution: Step 1: Understand anaerobic respiration in yeast cells. When oxygen is limited, yeast cells, like many other organisms, can switch to anaerobic pathways to generate ATP.

Step 2: Recall the products of anaerobic respiration in yeast. In yeast, pyruvate is first converted into acetaldehyde and carbon dioxide through a process called decarboxylation. This reaction is catalyzed by pyruvate decarboxylase. Following this, acetaldehyde is reduced to ethanol by NADH, regenerating NAD^+. The overall reaction is:
Glucose $\rightarrow$ 2 Pyruvate $\rightarrow$ 2 Acetaldehyde + 2 CO_2 $\rightarrow$ 2 Ethanol + 2 NAD^+

Step 3: Identify the process. This specific pathway, converting pyruvate to ethanol and CO_2 while regenerating NAD^+ for glycolysis to continue, is known as alcoholic fermentation.

Step 4: Evaluate the options:
Lactic acid fermentation (Option A): This process occurs in animal muscle cells and some bacteria, where pyruvate is converted to lactic acid. It does not produce ethanol or CO_2.
Alcoholic fermentation (Option B): This process, carried out by yeast and some plants, converts pyruvate to ethanol and carbon dioxide and regenerates NAD^+ for glycolysis. This matches the description.
Glycolysis (Option C): Glycolysis is the initial breakdown of glucose to pyruvate, occurring in both aerobic and anaerobic respiration. It precedes fermentation.
Oxidative phosphorylation (Option D): This is the main ATP-producing stage of aerobic respiration, requiring oxygen and occurring in mitochondria. It is not anaerobic.

Step 5: Conclude the name of the process. The conversion of pyruvate to ethanol and carbon dioxide in yeast under anaerobic conditions is called alcoholic fermentation.

Final Answer: Alcoholic fermentation

Answer: (B)

Go Back to Question 56

Q57.

Solution

Concept: The chromosomal theory of inheritance, formulated by Sutton and Boveri, established that genes are located on chromosomes and that the behavior of chromosomes during meiosis explains Mendelian inheritance patterns.

Solution: Step 1: Understand the chromosomal theory of inheritance. This theory linked the observations of Gregor Mendel on the inheritance of traits to the behavior of chromosomes during cell division. It proposed that discrete factors (genes) reside on chromosomes.

Step 2: Identify the scientists who formulated this theory. Walter Sutton and Theodor Boveri independently proposed this theory around the same time (early 1900s). They observed that the segregation of chromosomes during meiosis mirrored the segregation of Mendel's factors.

Step 3: Evaluate the contributions of the scientists listed in the options:
Darwin and Wallace (Option A): Charles Darwin and Alfred Russel Wallace independently developed the theory of evolution by natural selection.
Watson and Crick (Option B): James Watson and Francis Crick are famous for discovering the double-helix structure of DNA and proposing the central dogma of molecular biology.
Sutton and Boveri (Option C): Walter Sutton and Theodor Boveri independently proposed the chromosomal theory of inheritance, linking genes to chromosomes and explaining Mendelian inheritance based on chromosome behavior during meiosis. This perfectly matches the question.
Morgan and Mendel (Option D): Gregor Mendel laid the foundation of genetics with his laws of inheritance. Thomas Hunt Morgan further developed genetics by using Drosophila and establishing gene linkage and sex-linked inheritance, building upon Mendelian principles.

Step 4: Conclude who proposed the chromosomal theory of inheritance. The chromosomal theory of inheritance was primarily proposed by Sutton and Boveri.

Final Answer: Sutton and Boveri

Answer: (C)

Go Back to Question 57

Q58.

Solution

Concept: Species distribution patterns are influenced by their adaptations to environmental conditions and their evolutionary history. Some species are widespread, while others are restricted to specific areas.

Solution: Step 1: Understand the definition of species distribution. The question describes a species that is restricted to a particular geographical region and is not naturally found elsewhere.

Step 2: Define the ecological terms for species distribution:
Cosmopolitan (Option A): Cosmopolitan species are found throughout the world in diverse habitats. They have a wide geographic distribution. This is the opposite of the described species.
Endemic (Option B): Endemic species are those that are found only in a specific geographical location and nowhere else in the world. This perfectly matches the description of a species restricted to a particular region.
Exotic (Option C): Exotic species are those that have been introduced by humans into a new region outside their native range.
Keystone (Option D): A keystone species is defined by its disproportionately large impact on its ecosystem relative to its abundance, not its geographic distribution.

Step 3: Match the description to the correct term. A species restricted to a particular geographical region is called endemic.

Final Answer: Endemic

Answer: (B)

Go Back to Question 58

Q59.

Solution

Concept: The movement of water across plant cell membranes is a fundamental process governed by osmosis. The response of a plant cell to different concentrations of external solutions is a key concept in understanding water potential.

Solution: Step 1: Understand the scenario. A plant cell is placed in a hypertonic solution. A hypertonic solution has a higher solute concentration (and thus lower water potential) than the cell's cytoplasm.

Step 2: Recall the process of osmosis. Osmosis is the net movement of water molecules across a selectively permeable membrane from a region of higher water potential (lower solute concentration) to a region of lower water potential (higher solute concentration).

Step 3: Describe what happens when a plant cell is placed in a hypertonic solution. Due to the higher external solute concentration, water will move out of the plant cell, across the plasma membrane, into the surrounding solution. As the cell loses water, the plasma membrane and cytoplasm shrink away from the rigid cell wall. This phenomenon is called plasmolysis.

Step 4: Evaluate the options:
Deplasmolysis (Option A): Deplasmolysis is the reverse process, where a plasmolyzed cell is placed in a hypotonic solution, and water re-enters the cell, causing the plasma membrane to press against the cell wall again.
Plasmolysis (Option B): This is the shrinkage of the plasma membrane and cytoplasm away from the cell wall due to water loss when the cell is placed in a hypertonic solution. This matches the description.
Diffusion (Option C): Diffusion is the general movement of substances from high to low concentration. Osmosis is a specific type of diffusion involving water across a semipermeable membrane.
Imbibition (Option D): Imbibition is the absorption of water by hydrophilic substances, causing them to swell. It's not directly related to the shrinking of the plasma membrane in a hypertonic solution.

Step 5: Conclude the phenomenon observed. The shrinkage of the plasma membrane away from the cell wall due to water loss in a hypertonic solution is called plasmolysis.

Final Answer: Plasmolysis

Answer: (B)

Go Back to Question 59

Q60.

Solution

Concept: The oxygen-carrying capacity of haemoglobin is influenced by various factors, which alter its affinity for oxygen. These influences are represented by shifts in the oxygen-haemoglobin dissociation curve.

Solution: Step 1: Understand the oxygen-haemoglobin dissociation curve. This curve shows the relationship between the partial pressure of oxygen and the percentage of haemoglobin saturated with oxygen.

Step 2: Analyze the conditions causing a rightward shift. A rightward shift of the oxygen-haemoglobin dissociation curve means that haemoglobin has a lower affinity for oxygen. This occurs under conditions of:
Increased partial pressure of carbon dioxide (PCO_2).
Decreased pH (increased acidity).
Increased temperature.
Increased levels of 2,3-bisphosphoglycerate (2,3-BPG).

Step 3: Determine the physiological consequence of a rightward shift. A rightward shift indicates that haemoglobin releases oxygen more readily to the tissues. This is beneficial because tissues with higher metabolic activity (like exercising muscles) have higher CO_2 levels, lower pH, and higher temperatures, requiring more oxygen.

Step 4: Evaluate the options:
Greater oxygen loading in lungs (Option A): A rightward shift actually *reduces* oxygen affinity, meaning it would hinder oxygen loading in the lungs (where PO_2 is high but PCO_2 is low and pH is higher). Loading is favored by a leftward shift.
Greater oxygen release in tissues (Option B): A rightward shift means haemoglobin has a lower affinity for oxygen, causing it to release oxygen more easily to the tissues. This is a beneficial adaptation for metabolically active tissues.
Reduced oxygen transport (Option C): While the affinity is reduced, the overall goal is efficient delivery, not necessarily reduced transport. The total amount of oxygen transported depends on factors like haemoglobin concentration and blood flow. However, the primary effect is on release.
Formation of carbaminohaemoglobin (Option D): Carbaminohaemoglobin is formed when carbon dioxide binds to the amino groups of haemoglobin, a process related to CO_2 transport, but it doesn't directly explain the shift in the oxygen dissociation curve due to CO_2 or pH.

Step 5: Conclude the effect of the rightward shift. A rightward shift of the oxygen-haemoglobin dissociation curve facilitates greater oxygen release in the tissues.

Final Answer: Greater oxygen release in tissues

Answer: (B)

Go Back to Question 60

Q61.

Solution

Concept: Mitosis is a type of cell division that results in two daughter cells each having the same number and kind of chromosomes as the parent nucleus. It proceeds through several distinct stages: prophase, metaphase, anaphase, and telophase.

Solution: Step 1: Understand the stages of mitosis and chromosome behavior. Mitosis involves the segregation of duplicated chromosomes to ensure that each daughter cell receives a complete set of chromosomes.

Step 2: Describe chromosome behavior in each stage:
Prophase: Chromosomes condense and become visible. The nuclear envelope breaks down, and the spindle apparatus begins to form.
Metaphase: Chromosomes align at the cell's equator (metaphase plate). Each chromosome is attached to spindle fibres from opposite poles via its kinetochore. This alignment is precise and crucial for proper separation.
Anaphase: Sister chromatids separate and move towards opposite poles of the cell.
Telophase: Chromosomes reach the poles, decondense, and new nuclear envelopes form around them.

Step 3: Identify the stage characterized by alignment at the equatorial plane. The stage where chromosomes align at the equatorial plane (metaphase plate) and attach to spindle fibres via kinetochores is metaphase.

Step 4: Evaluate the options. The description of chromosomes aligning at the equatorial plane and attaching to spindle fibres via kinetochores is characteristic of metaphase.

Step 5: Conclude the stage. This alignment occurs during metaphase.

Final Answer: Metaphase

Answer: (B)

Go Back to Question 61

Q62.

Solution

Concept: Plants release water vapor into the atmosphere from their aerial parts, a process that is essential for water cycling and influences plant physiology.

Solution: Step 1: Understand the process described. Water vapor is released from the aerial parts of plants, mainly through stomata, contributing to the atmosphere and the hydrological cycle.

Step 2: Define the terms related to water movement in plants:
Guttation (Option A): Guttation is the loss of water in liquid form from hydathodes at the edges of leaves, typically occurring when transpiration is low (e.g., at night). It is not the release of water vapor through stomata.
Translocation (Option B): Translocation is the movement of sugars (produced during photosynthesis) from the leaves to other parts of the plant through the phloem. It is not related to water vapor release.
Transpiration (Option C): Transpiration is the process of water movement through a plant and its evaporation from aerial parts, such as leaves, stems, and flowers, primarily through stomata. This process significantly contributes to the water cycle. This matches the description.
Respiration (Option D): Respiration is the process by which organisms release energy from organic molecules, involving the uptake of oxygen and release of carbon dioxide and water. While water is produced metabolically, the described process refers to the loss of water vapor from aerial parts.

Step 3: Match the description to the correct term. The release of water vapor from aerial parts of plants, mainly through stomata, is called transpiration.

Final Answer: Transpiration

Answer: (C)

Go Back to Question 62

Q63.

Solution

Concept: The thyroid gland produces hormones that regulate metabolism. Iodine is an essential component for the synthesis of these hormones. Deficiency of iodine can lead to thyroid disorders.

Solution: Step 1: Analyze the patient's condition. The patient has a prolonged iodine deficiency, resulting in an enlarged thyroid gland and reduced production of thyroid hormones.

Step 2: Recall the role of iodine in thyroid function. Iodine is a crucial element required for the synthesis of thyroid hormones, thyroxine (T4) and triiodothyronine (T3), by the thyroid gland.

Step 3: Understand the consequences of iodine deficiency. When iodine is deficient, the thyroid gland cannot produce sufficient amounts of thyroid hormones. In response to low thyroid hormone levels, the pituitary gland increases the secretion of Thyroid-Stimulating Hormone (TSH). TSH stimulates the thyroid gland to grow in an attempt to increase hormone production. This prolonged stimulation leads to the enlargement of the thyroid gland, a condition known as goiter.

Step 4: Evaluate the given conditions:
Myxedema (Option A): Myxedema is a condition caused by severe hypothyroidism (underactive thyroid), characterized by swelling, dry skin, and metabolic slowing. It is a consequence of iodine deficiency but refers to the metabolic state, not the enlarged gland itself.
Exophthalmic goitre (Option B): Also known as Graves' disease, this is an autoimmune disorder causing hyperthyroidism (overactive thyroid) and bulging eyes (exophthalmos). It is not related to iodine deficiency.
Simple goitre (Option C): Simple goitre (or endemic goitre) is characterized by the enlargement of the thyroid gland due to iodine deficiency or other factors that impair thyroid hormone synthesis. This directly matches the description.
Addison's disease (Option D): Addison's disease is a disorder of the adrenal glands, not the thyroid.

Step 5: Conclude the condition associated with iodine deficiency and thyroid enlargement. The condition characterized by thyroid enlargement due to iodine deficiency and reduced thyroid hormone production is called simple goitre.

Final Answer: Simple goitre

Answer: (C)

Go Back to Question 63

Q64.

Solution

Concept: Mendel's laws of inheritance describe how traits are passed from parents to offspring. Dihybrid crosses, involving two traits, have characteristic phenotypic ratios under complete dominance.

Solution: Step 1: Understand a dihybrid cross with independent assortment. A dihybrid cross involves tracking the inheritance of two different traits controlled by genes located on separate chromosomes. When these genes assort independently, and complete dominance is present for both traits, a specific phenotypic ratio is observed in the F2 generation.

Step 2: Recall the classic Mendelian dihybrid cross result. If we cross two heterozygous individuals for two traits (e.g., $AaBb \times AaBb$), and the genes assort independently, the F2 generation will exhibit four phenotypes in the following ratio:
9/16: Dominant phenotype for both traits (e.g., AABB, AABb, AaBB, AaBb)
3/16: Dominant phenotype for the first trait, recessive for the second (e.g., AAbb, Aabb)
3/16: Recessive phenotype for the first trait, dominant for the second (e.g., aaBB, aaBb)
1/16: Recessive phenotype for both traits (e.g., aabb)
This results in a phenotypic ratio of 9:3:3:1.

Step 3: Evaluate the options:
3:1 (Option A): This is the typical phenotypic ratio for a monohybrid cross with complete dominance in the F2 generation.
1:2:1 (Option B): This ratio is observed in the F2 generation for a monohybrid cross exhibiting incomplete dominance or codominance.
9:3:3:1 (Option C): This is the classic phenotypic ratio for a dihybrid cross with independent assortment and complete dominance for both genes.
15:1 (Option D): This ratio is observed in a dihybrid cross where epistasis occurs, or in some cases of duplicate dominant genes.

Step 4: Conclude the phenotypic ratio for a dihybrid cross with independent assortment and complete dominance. The expected phenotypic ratio in the F2 generation is 9:3:3:1.

Final Answer: 9:3:3:1

Answer: (C)

Go Back to Question 64

Q65.

Solution

Concept: Plant vascular tissues are responsible for transport. Xylem transports water and minerals, while phloem transports food.

Solution: Step 1: Understand the function described. The tissue is responsible for the conduction of water and dissolved minerals from the roots to other parts of the plant. It also provides structural support.

Step 2: Recall the types of plant vascular tissues and their components:
Companion cells (Option A): Companion cells are associated with sieve elements in the phloem and are involved in loading and unloading sugars. They are not the primary water-conducting cells.
Sieve tubes (Option B): Sieve tubes are the main conducting elements of the phloem, responsible for transporting sugars. They are living cells.
Tracheary elements (Option C): Tracheary elements are the principal water-conducting cells in plants. They consist of tracheids and vessel elements. These cells are elongated, dead at maturity, and have lignified secondary walls that provide support. They are arranged end to end, forming continuous tubes for water transport. This matches the description.
Collenchyma (Option D): Collenchyma is a supporting tissue composed of living cells with unevenly thickened primary cell walls. It provides mechanical support, especially in growing stems and leaves, but it is not primarily involved in water conduction.

Step 3: Match the description to the correct term. The dead, elongated, lignified cells responsible for water conduction and arranged end to end are collectively known as tracheary elements.

Final Answer: Tracheary elements

Answer: (C)

Go Back to Question 65

Q66.

Solution

Concept: Polymerase Chain Reaction (PCR) is a powerful technique used to amplify specific DNA sequences. It involves cycles of denaturation, annealing, and extension, requiring specific enzymes and reagents.

Solution: Step 1: Understand the process described. The technique involves repeated cycles of heating (denaturation), cooling (annealing), and synthesis (extension) to amplify DNA in vitro. It uses sequence-specific primers and a thermostable DNA polymerase.

Step 2: Identify the technique. This description perfectly matches the Polymerase Chain Reaction (PCR).

Step 3: Evaluate the given options:
Southern blotting (Option A): Southern blotting is a technique used to detect specific DNA sequences in a DNA sample, involving gel electrophoresis and hybridization. It is not a method for amplifying DNA.
Gel electrophoresis (Option B): Gel electrophoresis separates DNA fragments based on size and charge but does not amplify the DNA itself.
Polymerase chain reaction (Option C): PCR is a technique for in vitro amplification of DNA sequences using repeated cycles of denaturation, annealing, and extension by a thermostable DNA polymerase. This precisely matches the description.
DNA fingerprinting (Option D): DNA fingerprinting is an application of various molecular techniques (like PCR and gel electrophoresis) to identify individuals based on their unique DNA profiles. It is an application, not the amplification technique itself.

Step 4: Conclude the name of the technique. The process described is Polymerase Chain Reaction (PCR).

Final Answer: Polymerase chain reaction

Answer: (C)

Go Back to Question 66

Q67.

Solution

Concept: The Earth's atmosphere contains layers, including the stratosphere, which houses the ozone layer. This layer plays a vital role in protecting life on Earth from harmful solar radiation.

Solution: Step 1: Understand the role of the ozone layer. The ozone layer, located in the stratosphere, absorbs most of the Sun's harmful ultraviolet (UV) radiation, particularly UV-B and UV-C.

Step 2: Consider the consequences of ozone layer depletion. If the ozone layer is depleted, more harmful UV radiation reaches the Earth's surface.

Step 3: Evaluate the effects of increased UV radiation on living organisms:
Malaria (Option A): Malaria is a parasitic disease transmitted by mosquitoes. UV radiation does not directly cause malaria.
Skin cancer (Option B): Excessive exposure to UV radiation, especially UV-B, is a major cause of DNA damage in skin cells, leading to mutations that can result in skin cancer (melanoma and non-melanoma skin cancers). This is a well-established consequence of ozone layer depletion.
Tuberculosis (Option C): Tuberculosis is a bacterial infection, primarily affecting the lungs. UV radiation does not directly cause tuberculosis.
Cholera (Option D): Cholera is an intestinal infection caused by bacteria. UV radiation does not directly cause cholera.

Step 4: Conclude the most significant health risk associated with ozone layer depletion. The excessive depletion of the ozone layer leads to increased incidence of skin cancer due to higher exposure to harmful UV radiation.

Final Answer: Skin cancer

Answer: (B)

Go Back to Question 67

Q68.

Solution

Concept: Early human embryonic development involves a series of cell divisions and structural changes after fertilization.

Solution: Step 1: Understand the events following fertilization. After fertilization in the fallopian tube, the diploid zygote undergoes rapid mitotic cell divisions known as cleavage.

Step 2: Trace the stages of early embryonic development. Cleavage produces a series of progressively smaller cells called blastomeres. As cleavage continues, the zygote develops into a solid ball of blastomeres.
Morula: A solid ball of 16-32 blastomeres, resembling a mulberry.
Blastocyst: Following the morula stage, a fluid-filled cavity forms within the ball of cells, creating the blastocyst. The blastocyst consists of an inner cell mass (which forms the embryo) and an outer layer called the trophoblast.

Step 3: Identify the early embryonic stage described. The description of repeated mitotic divisions of the zygote forming a solid ball of blastomeres before blastocyst formation refers to the morula stage.

Step 4: Evaluate the options:
Gastula (Option A): Gastrulation is the process that follows blastocyst formation, where the inner cell mass reorganizes into germ layers.
Morula (Option B): The morula is the solid ball of blastomeres formed by cleavage before the blastocyst stage. This matches the description.
Neurula (Option C): Neurulation is the process of forming the neural tube, which occurs later in development.
Trophoblast (Option D): The trophoblast is the outer layer of the blastocyst, important for implantation, not the solid ball of cells before it.

Step 5: Conclude the name of the early embryonic stage. The solid ball of blastomeres formed during early cleavage is called the morula.

Final Answer: Morula

Answer: (B)

Go Back to Question 68

Q69.

Solution

Concept: Photosynthesis is the process by which plants convert light energy into chemical energy. The light-dependent reactions involve the splitting of water molecules, releasing oxygen.

Solution: Step 1: Understand the light-dependent reactions of photosynthesis. These reactions occur in the thylakoid membranes of chloroplasts and convert light energy into ATP and NADPH. A key event is the splitting of water molecules.

Step 2: Recall the process of photolysis. Photolysis is the splitting of water molecules using light energy. This process occurs within the thylakoid lumen during the light-dependent reactions. The equation for photolysis is:

$$2H_2O \xrightarrow{\text{Light energy}} 4H^+ + 4e^- + O_2$$

Step 3: Identify the origin of the oxygen released. As seen in the equation, the oxygen gas released during photosynthesis originates from the splitting of water molecules. The carbon dioxide is fixed and reduced to form sugars. Chlorophyll is the pigment that absorbs light. Glucose is the final product of the Calvin cycle.

Step 4: Evaluate the options:
Carbon dioxide (Option A): Carbon dioxide provides the carbon atoms for building sugars but does not contribute oxygen gas to the atmosphere during photosynthesis.
Chlorophyll (Option B): Chlorophyll is the pigment that absorbs light energy; it is not broken down to release oxygen.
Water (Option C): Water molecules are split during photolysis in the light-dependent reactions, releasing oxygen gas. This is the source of atmospheric oxygen produced by photosynthesis.
Glucose (Option D): Glucose is a sugar produced during the Calvin cycle, using CO_2 and the energy from light reactions. It does not directly release oxygen.

Step 5: Conclude the origin of oxygen released during photosynthesis. The oxygen released during photosynthesis originates from the photolysis of water.

Final Answer: Water

Answer: (C)

Go Back to Question 69

Q70.

Solution

Concept: The central dogma of molecular biology describes the flow of genetic information. Retroviruses are a special class of viruses that reverse the typical flow of information, synthesizing DNA from an RNA template.

Solution: Step 1: Understand the genetic material of retroviruses. Retroviruses, such as HIV, have RNA as their genetic material. When they infect a host cell, they need to convert this RNA into DNA to integrate it into the host's genome.

Step 2: Identify the enzyme responsible for synthesizing DNA from an RNA template. This process of synthesizing DNA from an RNA template is called reverse transcription. The enzyme that carries out this process is reverse transcriptase.

Step 3: Evaluate the options:
DNA ligase (Option A): DNA ligase joins DNA fragments together.
RNA polymerase (Option B): RNA polymerase synthesizes RNA from a DNA template (transcription). Reverse transcriptase (Option C): This enzyme synthesizes DNA from an RNA template. This is the enzyme found in retroviruses and is responsible for the reverse flow of genetic information described. This matches the description.
Primase (Option D): Primase synthesizes short RNA primers necessary for DNA polymerase to initiate DNA replication.

Step 4: Conclude the enzyme involved in synthesizing DNA from an RNA template. The enzyme that performs this function is reverse transcriptase.

Final Answer: Reverse transcriptase

Answer: (C)

Go Back to Question 70

Q71.

Solution

Concept: The human heart has a unique structure with valves that ensure unidirectional blood flow, preventing backflow and maintaining efficient circulation.

Solution: Step 1: Understand the function of heart valves. Heart valves are flaps of tissue that open and close to allow blood to flow in only one direction through the heart chambers and into the major arteries.

Step 2: Identify the location and function of the bicuspid valve. The bicuspid valve, also known as the mitral valve, is located between the left atrium and the left ventricle. It opens to allow oxygenated blood to flow from the left atrium into the left ventricle and closes when the left ventricle contracts to prevent backflow of blood into the left atrium.

Step 3: Evaluate the names of the heart valves:
Tricuspid valve (Option A): The tricuspid valve is located between the right atrium and the right ventricle. It has three cusps (flaps).
Semilunar valve (Option B): Semilunar valves (aortic and pulmonary valves) are located at the exit of the ventricles, between the ventricles and the major arteries (aorta and pulmonary artery). They prevent backflow into the ventricles. They have a crescent shape.
Mitral valve (Option C): The mitral valve is the alternative name for the bicuspid valve, located between the left atrium and left ventricle. It has two cusps (hence "bicuspid"). This matches the description.
Pulmonary valve (Option D): The pulmonary valve is one of the semilunar valves, located between the right ventricle and the pulmonary artery.

Step 4: Conclude the alternative name for the bicuspid valve. The bicuspid valve is also known as the mitral valve.

Final Answer: Mitral valve

Answer: (C)

Go Back to Question 71

Q72.

Solution

Concept: Soil is a vital component of terrestrial ecosystems, supporting plant life and agricultural productivity. Its composition and structure are crucial for its fertility.

Solution: Step 1: Understand the importance of soil layers. Soil is composed of several layers, or horizons, formed over time through various physical, chemical, and biological processes.

Step 2: Define the different soil layers:
Bedrock (Option A): Bedrock is the solid rock layer beneath the soil. It is the parent material from which soil forms but is not the fertile top layer itself.
Subsoil (Option B): Subsoil (usually horizon B) is the layer beneath the topsoil. It contains less organic matter and fewer microorganisms than the topsoil.
Topsoil (Option C): Topsoil (horizon O and A) is the uppermost layer of soil. It is characterized by its richness in decomposed organic matter (humus), microorganisms, minerals, and the highest level of biological activity. This layer is crucial for plant growth and agriculture due to its fertility. This matches the description.
Parent rock (Option D): Parent rock is the underlying rock material from which soil develops through weathering. It is not the fertile layer itself.

Step 3: Match the description to the correct soil layer. The fertile upper layer of soil, rich in organic matter, minerals, and microorganisms, which is vital for plant growth, is called topsoil.

Final Answer: Topsoil

Answer: (C)

Go Back to Question 72

Q73.

Solution

Concept: Mutations are changes in DNA. Different types of mutations have varying effects on the protein sequence and function. Frameshift mutations significantly alter the protein product.

Solution: Step 1: Understand the described mutation. A mutation involves the insertion or deletion of nucleotides in DNA. This alteration changes the reading frame of the codons during translation, affecting all amino acids downstream of the mutation site.

Step 2: Define the types of mutations:
Silent mutations (Option A): These are point mutations where a change in the DNA sequence results in a codon that codes for the same amino acid. They do not alter the protein sequence.
Point mutations (Option B): These involve changes in a single nucleotide pair, such as substitution, insertion, or deletion of a single base. While insertions/deletions are point mutations, the specific effect described (altering the reading frame of codons) is key.
Frameshift mutations (Option C): Frameshift mutations occur due to insertions or deletions of nucleotides in a number that is not a multiple of three. This shifts the reading frame of the codons, leading to a completely different amino acid sequence downstream of the mutation and often resulting in a non-functional protein. This precisely matches the description.
Somatic mutations (Option D): Somatic mutations occur in non-reproductive cells and are not passed on to offspring. This refers to the cell type affected, not the nature of the DNA change itself.

Step 3: Match the description to the type of mutation. The insertion or deletion of nucleotides that alters the reading frame of codons is classified as a frameshift mutation.

Final Answer: Frameshift mutations

Answer: (C)

Go Back to Question 73

Q74.

Solution

Concept: Pollination is the transfer of pollen, and it can occur within a flower or between flowers. Various mechanisms promote cross-pollination and prevent self-pollination.

Solution: Step 1: Understand the scenario. In some plants, flowers have both male (stamens) and female (stigma) parts, but self-pollination is prevented because the stamens and stigma mature at different times.

Step 2: Define the mechanisms that prevent self-pollination:
Chasmogamous flowers (Option A): Chasmogamous flowers are those that open normally, exposing their anthers and stigmas, allowing for cross-pollination.
Dichogamous flowers (Option B): Dichogamy refers to the temporal separation of the maturation of anthers and stigma within a flower. This prevents self-pollination by ensuring that pollen is released either before the stigma is receptive (protandry) or after the stigma has already been pollinated by pollen from another flower (protogyny). This matches the description.
Cleistogamous flowers (Option C): Cleistogamous flowers are those that remain closed, ensuring self-pollination.
Monoecious flowers (Option D): Monoecious plants have separate male and female flowers on the same plant (e.g., maize). This arrangement facilitates self-pollination if anthers and stigmas mature at the same time, or it can be a mechanism to promote cross-pollination if timing differs. However, the question focuses on the timing of maturation within a flower that possesses both parts.

Step 3: Match the description to the correct term. The temporal maturation of stamens and stigma to prevent self-pollination is known as dichogamy.

Final Answer: Dichogamous flowers

Answer: (B)

Go Back to Question 74

Q75.

Solution

Concept: Antibiotics are a class of antimicrobial drugs used to treat bacterial infections. They target specific cellular structures or metabolic pathways that are unique to bacteria.

Solution: Step 1: Understand the mechanism of antibiotic action. Antibiotics work by interfering with essential processes or structures in bacterial cells that are absent or significantly different in eukaryotic cells (like human cells) or viruses.

Step 2: Evaluate the effectiveness of antibiotics against different microbes:
Fungi (Option A): Fungi are eukaryotic organisms. While some antifungal drugs exist, they work differently from antibiotics, targeting fungal-specific structures or pathways. Antibiotics are generally not effective against fungi.
Protozoa (Option B): Protozoa are eukaryotic microorganisms. Similar to fungi, they have different cellular structures and metabolic pathways than bacteria, making them generally resistant to common antibiotics. Some protozoal infections are treated with specific antiprotozoal drugs.
Bacteria (Option C): Bacteria are prokaryotic organisms. Antibiotics are specifically designed to target bacterial structures like cell walls (e.g., penicillin), ribosomes (e.g., tetracycline), or metabolic pathways (e.g., sulfa drugs), making them highly effective against bacterial infections.
Algae (Option D): Algae are eukaryotic organisms, and antibiotics are not designed to target them.

Step 3: Conclude against which type of microbe antibiotics are mainly effective. Antibiotics are primarily effective against bacterial infections.

Final Answer: Bacteria

Answer: (C)

Go Back to Question 75

Q76.

Solution

Concept: Ecological interactions describe the relationships between different species within an ecosystem. These relationships determine the flow of energy and nutrients and influence the structure of the community.

Solution: Step 1: Analyze the described interaction. The interaction involves a lion (predator) and a deer (prey) in a forest ecosystem. The lion kills and feeds upon the deer.

Step 2: Define the types of ecological interactions:
Mutualism (Option A): A relationship where both species benefit (e.g., bees pollinating flowers).
Commensalism (Option B): A relationship where one species benefits, and the other is neither harmed nor benefited (e.g., an orchid on a tree).
Predation (Option C): Predation is an interaction where one organism (the predator) hunts and kills another organism (the prey) for food. This perfectly matches the description of a lion hunting and eating a deer.
Symbiosis (Option D): Symbiosis is a general term for close and long-term interactions between different biological species. It can include mutualism, commensalism, and parasitism, but predation is not typically classified under symbiosis, as it is usually a short-term interaction focused on consumption.

Step 3: Match the interaction to the correct term. The interaction where one organism kills and feeds on another is called predation.

Final Answer: Predation

Answer: (C)

Go Back to Question 76

Q77.

Solution

Concept: Plant growth and development are regulated by hormones and environmental cues. Etiolation is a plant's response to a lack of light.

Solution: Step 1: Analyze the observed condition. The plant was grown in complete darkness and showed specific characteristics:
Long, weak stems.
Pale yellow leaves.
Absence of chlorophyll formation.

Step 2: Define the terms related to plant growth and development:
Vernalization (Option A): Vernalization is the process by which a plant acquires the ability to flower in response to prolonged exposure to cold treatment. It is related to flowering, not growth in darkness.
Etiolation (Option B): Etiolation is a set of morphological adaptations that occur in plants grown in the absence of light or under very low light conditions. These adaptations include elongated, weak stems (to reach for light), reduced leaf surface area, unopened leaves, and lack of chlorophyll (etioplasts instead of chloroplasts), resulting in a pale yellow or white appearance. This perfectly matches the description.
Stratification (Option C): Stratification is a process of treating seeds to simulate natural conditions that cause or hasten germination, typically involving alternating periods of cold and moisture. It is related to breaking seed dormancy.
Senescence (Option D): Senescence is the process of aging in plants, leading to the breakdown of tissues and organs, such as leaf yellowing and drop. While lack of light can contribute to aging, etiolation specifically describes the response to darkness.

Step 3: Match the observed condition to the correct term. The development of long, weak stems and pale yellow leaves due to the absence of chlorophyll formation in darkness is known as etiolation.

Final Answer: Etiolation

Answer: (B)

Go Back to Question 77

Q78.

Solution

Concept: DNA fingerprinting relies on the analysis of highly variable regions within the genome that differ between individuals. These regions are often used for identification and forensic purposes.

Solution: Step 1: Understand the basis of DNA fingerprinting. DNA fingerprinting techniques exploit variations in DNA sequences among individuals to create a unique profile. These variations are often found in non-coding regions of the genome.

Step 2: Identify the types of variable DNA regions used in DNA fingerprinting:
Exons (Option A): Exons are coding regions of genes, and while variations exist, they are generally conserved for protein function. They are not the primary basis for DNA fingerprinting.
Introns (Option B): Introns are non-coding regions within genes that are removed during RNA processing. Some variations in introns can be used, but other regions are more variable.
VNTRs (Variable Number Tandem Repeats) (Option C): VNTRs are regions of DNA where a short nucleotide sequence is repeated multiple times in a tandem array. The number of repeats varies significantly among individuals, making them highly polymorphic. VNTR analysis was a foundational technique for DNA fingerprinting. More modern techniques like STR (Short Tandem Repeats) analysis also rely on similar principles of variable repetitive sequences. This option fits the description.
Operons (Option D): Operons are functional units of genes in prokaryotes, usually involved in metabolic pathways. They are not typically used for DNA fingerprinting.

Step 3: Conclude the name for highly variable repetitive regions used in DNA fingerprinting. These regions are known as VNTRs (Variable Number Tandem Repeats).

Final Answer: VNTRs

Answer: (C)

Go Back to Question 78

Q79.

Solution

Concept: The nephron is the functional unit of the kidney. It filters blood plasma to produce urine. Filtration occurs in a specialized structure within Bowman's capsule.

Solution: Step 1: Understand the process of filtration in the nephron. Filtration is the first step in urine formation, where blood plasma is filtered from the blood into the nephron. This occurs under pressure.

Step 2: Identify the location of filtration. Filtration occurs in the renal corpuscle (also known as the Malpighian body or renal corpuscle), which consists of Bowman's capsule and the glomerulus.

Step 3: Define the components mentioned in the options:
Loop of Henle (Option A): The Loop of Henle is a long, hairpin-shaped portion of the renal tubule that extends from the proximal convoluted tubule to the distal convoluted tubule. It is involved in establishing a concentration gradient for urine concentration.
Vasa recta (Option B): Vasa recta are peritubular capillaries that surround the Loop of Henle in the medulla, particularly in juxtamedullary nephrons. They are involved in maintaining the medullary concentration gradient but are not the site of initial filtration.
Glomerulus (Option C): The glomerulus is a cluster of specialized capillaries within Bowman's capsule. The high pressure within these capillaries forces plasma fluid and small solutes into Bowman's capsule, initiating filtration. This is the site of filtration.
Collecting duct (Option D): The collecting duct receives the filtered fluid from several nephrons and plays a role in final urine concentration under the influence of ADH. It is downstream of filtration.

Step 4: Conclude the structure responsible for blood filtration in Bowman's capsule. The specialized capillaries within Bowman's capsule that perform blood filtration are collectively known as the glomerulus.

Final Answer: Glomerulus

Answer: (C)

Go Back to Question 79

Q80.

Solution

Concept: Species interact within ecosystems in various ways. Competition is a key interaction that can significantly shape community structure.

Solution: Step 1: Analyze the scenario. Two species are competing intensely for the same limited resource. As a result, one species eventually eliminates the other from the habitat.

Step 2: Define the ecological principles related to competition:
Adaptive radiation (Option A): Adaptive radiation is the diversification of a single ancestral lineage into multiple species that occupy different ecological niches. It explains the evolution of diversity but not the outcome of competition between two species.
Competitive exclusion (Option B): Also known as Gause's principle, this states that two species competing for the same limiting resource cannot coexist indefinitely. The species that is more efficient at utilizing the resource will eventually outcompete and eliminate the other. This precisely matches the described outcome.
Resource partitioning (Option C): Resource partitioning occurs when competing species evolve to use different resources or the same resource at different times or in different ways, thereby reducing direct competition and allowing coexistence. This is an alternative outcome to competitive exclusion.
Ecological succession (Option D): This is the process of change in species structure in an ecological community over time. It does not directly describe the outcome of competition between two species.

Step 3: Match the outcome to the principle. The elimination of one species due to intense competition for the same limiting resource is explained by the principle of competitive exclusion.

Final Answer: Competitive exclusion

Answer: (B)

Go Back to Question 80

Q81.

Solution

Concept: Diarrhea causes excessive loss of water and electrolytes, leading to dehydration and potentially hypovolemic shock (low blood volume and pressure). Rehydration therapy aims to restore fluid and electrolyte balance.

Solution: Step 1: Understand the condition of severe diarrhea and its consequences. Severe diarrhea leads to a significant loss of water and electrolytes (like sodium, potassium, and chloride) from the body. This can result in dehydration, decreased blood volume, and a drop in blood pressure.

Step 2: Identify the purpose of an oral rehydration solution (ORS). An ORS is a solution containing water, electrolytes, and a source of glucose. It is designed to effectively rehydrate the body by promoting the absorption of water and electrolytes from the intestines.

Step 3: Analyze how ORS works. The presence of glucose and sodium in the ORS facilitates the co-transport of water and other electrolytes across the intestinal lining, even when normal absorption mechanisms are compromised by diarrhea. This helps to restore the body's fluid and electrolyte balance.

Step 4: Evaluate the options in relation to the effects of ORS:
Hormonal balance (Option A): While dehydration can affect hormone levels, ORS primarily addresses the immediate issue of fluid and electrolyte loss, not long-term hormonal regulation.
Blood clotting factors (Option B): Blood clotting factors are proteins involved in hemostasis. Their levels are not directly affected by diarrhea or restored by ORS.
Water and ion balance (Option C): This accurately describes the primary benefit of ORS. It replenishes lost water and essential ions (electrolytes), restoring the body's hydration and ionic equilibrium.
Enzyme secretion (Option D): ORS does not directly restore or stimulate enzyme secretion in the digestive system.

Step 5: Conclude the primary benefit of administering ORS. Oral rehydration solution is effective because it helps restore the body's water and ion balance, which is severely disrupted by excessive fluid and electrolyte loss during diarrhea.

Final Answer: Water and ion balance

Answer: (C)

Go Back to Question 81

Q82.

Solution

Concept: Gene expression involves two main steps: transcription (DNA to RNA) and translation (RNA to protein). Transcription is the process of synthesizing RNA from a DNA template.

Solution: Step 1: Understand the process of synthesizing messenger RNA (mRNA). mRNA synthesis involves copying genetic information from DNA into an RNA molecule. This process requires RNA polymerase and occurs using one strand of the DNA as a template.

Step 2: Define the steps of gene expression:
Translation (Option A): Translation is the synthesis of protein from an mRNA template. It occurs after transcription.
Replication (Option B): Replication is the process of duplicating DNA, producing two identical DNA molecules. It does not involve RNA synthesis.
Transcription (Option C): Transcription is the synthesis of RNA from a DNA template. It involves unwinding of DNA and complementary base pairing of ribonucleotides, catalyzed by RNA polymerase. This precisely matches the description.
Transformation (Option D): Transformation is the process by which a cell takes up foreign DNA from its environment. It is a method for genetic manipulation, not a step in gene expression.

Step 3: Match the description to the correct process. The synthesis of mRNA from a DNA template is known as transcription.

Final Answer: Transcription

Answer: (C)

Go Back to Question 82

Q83.

Solution

Concept: Ecological succession is the process by which communities change over time. It involves the gradual replacement of one species or group of species by another.

Solution: Step 1: Understand the definition provided. The process described is the gradual and orderly replacement of one biological community by another until a relatively stable climax community is established.

Step 2: Define the ecological terms:
Stratification (Option A): Stratification refers to the layering of vegetation or habitat structure within an ecosystem (e.g., forest canopy layers). It describes the structure, not the process of change over time.
Succession (Option B): Ecological succession is the process of directional change in species composition and community structure over time. It starts from bare or disturbed land and progresses towards a climax community. This perfectly matches the description.
Biomagnification (Option C): Biomagnification is the increasing concentration of toxins at successive trophic levels. It relates to pollution, not community change over time.
Migration (Option D): Migration is the movement of organisms from one area to another, often seasonally. While it can influence community composition, it is not the overall process of community replacement and development.

Step 3: Match the definition to the correct term. The gradual and orderly replacement of communities until a stable climax is reached is called ecological succession.

Final Answer: Succession

Answer: (B)

Go Back to Question 83

Q84.

Solution

Concept: Plants transport water and dissolved minerals from roots to the rest of the plant primarily through the xylem. This process is driven by physical forces.

Solution: Step 1: Understand the process described. Water is transported upwards in plants, from roots to leaves, through dead, elongated cells with lignified walls. These cells form continuous tubes.

Step 2: Identify the conducting tissue responsible for water transport.
Ascent of sap (Option A): Ascent of sap is the *process* of water movement up the plant, driven by transpiration pull, root pressure, and capillarity. It is not the tissue itself.
Diffusion (Option B): Diffusion is a passive movement of substances down a concentration gradient. While it plays a role in water movement across membranes, it's not the bulk transport mechanism through the xylem.
Translocation (Option C): Translocation is the transport of organic solutes (sugars) through the phloem. It is not involved in water conduction.
Imbibition (Option D): Imbibition is the absorption of water by solid materials, causing swelling. It's important in initial water uptake by seeds or cell walls but not for bulk transport.

Step 3: Recall the conducting elements for water transport. The primary conducting elements for water in plants are tracheids and vessel elements. These are collectively referred to as tracheary elements. They are dead at maturity, have lignified walls for strength and preventing collapse, and are arranged end-to-end to form continuous xylem vessels.

Step 4: Match the description to the correct term. The dead, elongated, lignified cells responsible for water conduction are known as tracheary elements.

Final Answer: Tracheary elements

Answer: (C)

Go Back to Question 84

Q85.

Solution

Concept: Genetic disorders can be inherited in different patterns. Autosomal recessive inheritance is characterized by the disease appearing only when an individual inherits two copies of the defective allele, one from each parent.

Solution: Step 1: Analyze the inheritance pattern described. A child inherits a genetic disorder only when both parents are carriers of the defective allele. Neither parent expresses the disease phenotype.

Step 2: Define the inheritance patterns:
Autosomal dominant inheritance (Option A): In this pattern, only one copy of the defective allele is needed to express the disease. Affected individuals usually have at least one affected parent. This does not fit, as parents are unaffected.
X-linked dominant inheritance (Option B): This pattern involves a gene on the X chromosome, where one defective allele causes the disease. Affected fathers pass it to all daughters, and affected mothers pass it to half their sons and daughters. This also doesn't fit the unaffected carrier parents.
Autosomal recessive inheritance (Option C): In this pattern, a person must inherit two copies of the recessive allele (one from each parent) to be affected by the disorder. Individuals with only one copy of the recessive allele are carriers and are typically unaffected phenotypically. This pattern perfectly matches the description: unaffected carrier parents (heterozygotes) producing an affected child (homozygous recessive).
Y-linked inheritance (Option D): This pattern involves genes on the Y chromosome. Only males are affected, and affected fathers pass the trait to all their sons. This does not fit the scenario where both parents are carriers and produce an affected child.

Step 3: Conclude the inheritance pattern. The scenario where unaffected carrier parents produce an affected child is characteristic of autosomal recessive inheritance.

Final Answer: Autosomal recessive inheritance

Answer: (C)

Go Back to Question 85

Q86.

Solution

Concept: Pregnancy is maintained by hormones that support the uterine lining and prevent its breakdown. Human chorionic gonadotropin (hCG) is an early marker of pregnancy.

Solution: Step 1: Understand the role of hormones in early pregnancy. After fertilization and implantation, the developing embryo needs hormonal support to maintain the uterine lining and prevent menstruation.

Step 2: Identify the source and function of human chorionic gonadotropin (hCG). hCG is a hormone produced by the cells that will eventually form the placenta (trophoblast cells) shortly after implantation. Its primary function is to signal the corpus luteum in the ovary to continue producing progesterone and estrogen, which are essential for maintaining the endometrium and supporting the pregnancy in the early weeks. The presence of hCG in the mother's blood or urine is the basis for most pregnancy tests.

Step 3: Evaluate the options:
Corpus luteum (Option A): The corpus luteum produces progesterone and estrogen, which maintain the endometrium, but it is stimulated by hCG, not the primary source of hCG itself.
Placenta (Option B): The placenta develops from the trophoblast cells of the embryo after implantation. It becomes the main producer of hCG in early pregnancy, and later produces progesterone and estrogen. This aligns with the description of a structure secreted during early pregnancy.
Anterior pituitary (Option C): The anterior pituitary secretes LH and FSH, which regulate the ovarian cycle, but it does not secrete hCG.
Endometrium (Option D): The endometrium is the uterine lining where the embryo implants. It responds to hormones but does not secrete hCG.

Step 4: Conclude the source of hCG during early pregnancy. Human chorionic gonadotropin (hCG) is secreted by the developing placenta (initially from the trophoblast).

Final Answer: Placenta

Answer: (B)

Go Back to Question 86

Q87.

Solution

Concept: The Golgi apparatus is a key organelle in eukaryotic cells involved in modifying, sorting, and packaging proteins and lipids. In plant cells, its components have a specific name.

Solution: Step 1: Understand the structure and function of the Golgi apparatus. The Golgi apparatus (or Golgi complex) is composed of a stack of flattened, membrane-bound sacs called cisternae. It receives proteins and lipids from the endoplasmic reticulum, modifies them, and packages them into vesicles for transport to various destinations within or outside the cell.

Step 2: Consider the terminology used for Golgi bodies in plant cells. While the term "Golgi apparatus" or "Golgi complex" is universally used, the individual stacks of cisternae within the Golgi apparatus are referred to by a different term in plant cells.

Step 3: Define the options:
Cristae (Option A): Cristae are the folds of the inner mitochondrial membrane, increasing surface area for ATP synthesis.
Grana (Option B): Grana are stacks of thylakoids within chloroplasts, where light-dependent reactions of photosynthesis occur.
Dictyosomes (Option C): Dictyosomes are the stacks of flattened membrane-bound sacs (cisternae) that constitute the Golgi apparatus. The term "dictyosome" is often used interchangeably with Golgi apparatus, but it specifically refers to the individual stacks, particularly in plant cells and lower invertebrates. This matches the description.
Mesosomes (Option D): Mesosomes are infoldings of the plasma membrane found in some bacteria, involved in respiration and DNA replication. They are not found in eukaryotic cells.

Step 4: Conclude the term used for Golgi bodies in plant cells. The individual stacks of the Golgi apparatus in plant cells are commonly referred to as dictyosomes.

Final Answer: Dictyosomes

Answer: (C)

Go Back to Question 87

Q88.

Solution

Concept: Biodiversity refers to the variety of life at all its levels, from genes to ecosystems. Understanding different levels of diversity is crucial for conservation and ecological studies.

Solution: Step 1: Understand the levels of biodiversity. Biodiversity is generally considered at three main levels:
1. Genetic diversity: The variation in genes within a species. This includes differences in alleles and genotypes among individuals.
2. Species diversity: The variety of different species within a given ecosystem or region. This includes species richness (number of species) and evenness (relative abundance of species).
3. Ecological diversity: The variety of different ecosystems or habitats within a given area. This includes variations in habitats, communities, and ecological processes.

Step 2: Match the definition to the correct level of biodiversity. The question specifically asks for the diversity occurring *within a species* due to variations in genes. This is the definition of genetic diversity.

Step 3: Evaluate the options:
Ecological diversity (Option A): This refers to the variety of ecosystems and habitats.
Species diversity (Option B): This refers to the variety of species in an area.
Genetic diversity (Option C): This refers to the variation in genes within a species. This perfectly matches the description.
Community diversity (Option D): This is closely related to species diversity, referring to the variety of species and their interactions within a community.

Step 4: Conclude the correct term. The variation in genes within a species is called genetic diversity.

Final Answer: Genetic diversity

Answer: (C)

Go Back to Question 88

Q89.

Solution

Concept: The liver is a vital organ involved in numerous metabolic processes, including the processing of amino acids and the detoxification of nitrogenous wastes.

Solution: Step 1: Understand the role of the liver in metabolism and excretion. The liver is a major metabolic hub. It processes nutrients absorbed from the digestive system and detoxifies harmful substances. It also plays a role in the excretion of nitrogenous wastes.

Step 2: Recall the process of amino acid metabolism. When amino acids are broken down (deamination), the amino group ($-NH_2$) is removed. This amino group is converted into ammonia (NH_3), which is highly toxic.

Step 3: Identify how the liver handles ammonia. The liver converts ammonia into a much less toxic compound called urea through a series of reactions known as the urea cycle. Urea is then released into the bloodstream and transported to the kidneys for excretion in urine.

Step 4: Evaluate the options:
Glucose (Option A): Glucose is a simple sugar, the primary energy source for cells. The liver produces and stores glucose (as glycogen) but does not form it from deaminated amino acids as an excretory product.
Glycogen (Option B): Glycogen is the storage form of glucose in the liver and muscles. It is not an excretory product of amino acid breakdown.
Urea (Option C): Urea is the primary nitrogenous waste product formed in the liver from the deamination of amino acids. It is excreted by the kidneys. This matches the description.
Cholesterol (Option D): Cholesterol is a lipid synthesized in the liver and is essential for cell membranes and hormone production. It is not an excretory product of amino acid breakdown.

Step 5: Conclude the excretory product formed by deamination of amino acids in the liver. Urea is the main excretory product formed in the liver from the deamination of amino acids.

Final Answer: Urea

Answer: (C)

Go Back to Question 89

Q90.

Solution

Concept: Plant tissues provide structural support and facilitate transport. Collenchyma is a supporting tissue with specific cell wall modifications.

Solution: Step 1: Understand the function and location of collenchyma tissue. Collenchyma is a supporting tissue found in growing stems and petioles, providing mechanical support and flexibility. Its cells are living and have unevenly thickened primary cell walls.

Step 2: Identify the composition of the cell wall thickening in collenchyma. The characteristic feature of collenchyma cells is the uneven thickening of their primary cell walls, particularly at the corners. These thickenings are mainly composed of cellulose and pectin. These substances provide tensile strength and plasticity, allowing the growing organs to bend without breaking.

Step 3: Evaluate the options for the thickening material:
Lignin (Option A): Lignin is a complex polymer that makes cell walls rigid and waterproof, primarily found in sclerenchyma and secondary xylem, providing structural support to mature plant parts. It is not the main component of collenchyma thickenings.
Suberin (Option B): Suberin is a waxy substance found in the cell walls of cork cells and in the Casparian strips of the root endodermis, providing waterproofing. It is not the main component of collenchyma thickenings.
Cellulose and pectin (Option C): Cellulose provides structural integrity, while pectin contributes to the flexibility and hydration of the cell walls. These are the primary components responsible for the characteristic uneven thickenings in collenchyma. This matches the description.
Chitin (Option D): Chitin is a structural polysaccharide found in the cell walls of fungi and the exoskeletons of arthropods. It is not found in plant cell walls.

Step 4: Conclude the main components of collenchyma wall thickenings. The uneven thickening of collenchyma cell walls mainly consists of cellulose and pectin.

Final Answer: Cellulose and pectin

Answer: (C)

Go Back to Question 90

Q91.

Solution

Concept: Haemophilia is an X-linked recessive disorder. Understanding the inheritance pattern of X-linked traits is crucial for predicting the genotypes and phenotypes of offspring.

Solution: Step 1: Understand the genetics of haemophilia. Haemophilia is an X-linked recessive disorder.
Normal male: X^HY
Affected male: X^hY
Normal female: X^HX^H or X^HX^h
Affected female: X^hX^h

Step 2: Determine the parental genotypes.
Affected man: X^hY
Normal non-carrier woman: X^HX^H

Step 3: Use a Punnett square to determine the offspring genotypes.

Father

Mother		X^h	Y
	X^H	X^HX^h	X^HY
	X^H	X^HX^h	X^HY

Haemophilia Inheritance

Step 4: Analyze the daughters' genotype. All daughters inherit X^h from the father and X^H from the mother, giving the genotype X^HX^h.

Step 5: Determine the phenotype. Since haemophilia is recessive, X^HX^h daughters are normal but carriers.

Step 6: Evaluate the options:
Option A: Incorrect.
Option B: Correct — all daughters are normal carriers.
Option C: Incorrect.
Option D: Incorrect, because daughters are carriers.

Final Answer: All daughters normal but carriers

Answer: (B)

Go Back to Question 91

Q92.

Solution

Concept: Coral reefs are highly diverse marine ecosystems built by coral polyps, which live in symbiosis with algae called zooxanthellae. These symbiotic algae provide corals with food and color. However, this symbiosis is sensitive to environmental changes.

Solution: Step 1: Understand the symbiotic relationship in coral reefs. Corals host symbiotic algae (zooxanthellae) within their tissues. These algae perform photosynthesis, providing corals with energy and nutrients, and contributing to their vibrant colors.

Step 2: Analyze the effect of increased sea temperature. Elevated sea temperatures act as a stressor on corals. Under such conditions, the symbiotic relationship breaks down.

Step 3: Describe the consequence of losing symbiotic algae. When corals are stressed by high temperatures, they expel their symbiotic zooxanthellae. This causes the coral to lose its color and its primary source of nutrition, leaving behind the white calcium carbonate skeleton. This phenomenon is known as coral bleaching.

Step 4: Evaluate the options:
Coral extinction (Option A): Coral bleaching is a severe stress that can lead to coral death if conditions do not improve, but it is not the same as the complete extinction of the species.
Coral bleaching (Option B): This is the process where corals lose their symbiotic algae due to stress, resulting in a loss of color and potential death. This matches the description.
Eutrophication (Option C): Eutrophication is the excessive enrichment of water bodies with nutrients, leading to algal blooms and oxygen depletion. It is not directly caused by increased sea temperature impacting corals.
Biomagnification (Option D): Biomagnification is the increasing concentration of toxins at successive trophic levels. It is unrelated to coral bleaching.

Step 5: Conclude the phenomenon resulting from the loss of symbiotic algae due to stress. The loss of symbiotic algae from coral tissues due to stress, such as increased sea temperature, leads to coral bleaching.

Final Answer: Coral bleaching

Answer: (B)

Go Back to Question 92

Q93.

Solution

Concept:

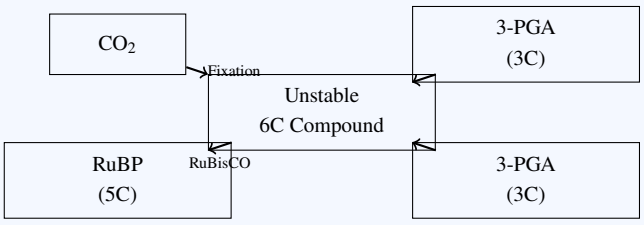
DNA replication is the process of copying DNA. It involves the unwinding of the double helix and the synthesis of new strands by DNA polymerase. The lagging strand is synthesized discontinuously in fragments.

Solution:

Step 1: Understand DNA replication and the lagging strand. DNA replication proceeds bidirectionally from an origin. One strand, the leading strand, is synthesized continuously. The other strand, the lagging strand, is synthesized discontinuously in short segments called Okazaki fragments.

Step 2: Identify the enzyme responsible for joining these fragments. After the Okazaki fragments are synthesized by DNA polymerase, they need to be joined together to form a continuous DNA strand. This joining process involves removing RNA primers and filling in the gaps with DNA, followed by sealing the nicks in the sugar-phosphate backbone.

Carbon Fixation in Calvin Cycle



Step 3: Define the enzymes involved in DNA replication:

Helicase (Option A): Helicase unwinds the DNA double helix at the replication fork.

Primase (Option B): Primase synthesizes short RNA primers, which provide a starting point for DNA polymerase to begin synthesis.

DNA ligase (Option C): DNA ligase is an enzyme that joins DNA fragments by forming phosphodiester bonds. It plays a crucial role in sealing the nicks between Okazaki fragments on the lagging strand, creating a continuous DNA molecule. This matches the description.

Topoisomerase (Option D): Topoisomerase relieves the torsional strain that builds up ahead of the replication fork as the DNA unwinds.

Step 4: Conclude the enzyme that joins Okazaki fragments. DNA ligase is the enzyme responsible for joining the discontinuous Okazaki fragments during DNA replication.

Final Answer: DNA ligase

Answer: (C)

Go Back to Question 93

Q94.

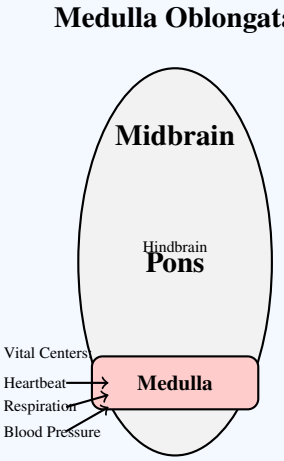
Solution

Concept: The brain is divided into major regions, each responsible for different functions. The brainstem, located at the base of the brain, controls essential involuntary activities.

Solution: Step 1: Understand the role of the medulla oblongata. The medulla oblongata is a part of the brainstem that controls vital involuntary functions.

Step 2: Functions controlled by the medulla oblongata:
Heartbeat regulation
Breathing control
Blood pressure regulation
Reflexes like coughing, sneezing, and vomiting.

Step 3: Identify its location in the brain. The medulla oblongata is a part of the hindbrain.



Step 4: Evaluate the options:
Forebrain (Option A): Controls higher functions like thinking and emotion.
Midbrain (Option B): Involved in visual and auditory reflexes.
Hindbrain (Option C): Includes the cerebellum, pons, and medulla oblongata. This is correct.
Cerebrum (Option D): Responsible for higher cognitive activities.

Step 5: Conclude the part of the brain that includes the medulla oblongata. The medulla oblongata is a part of the hindbrain.

Final Answer: Hindbrain

Answer: (C)

Go Back to Question 94

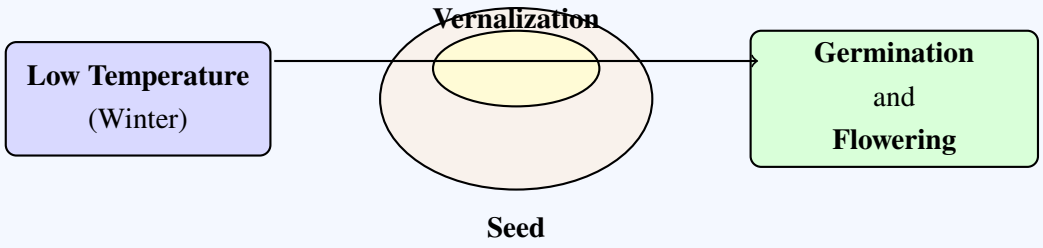
Q95.

Solution

Concept: Plant growth and development are influenced by various hormones. Some processes, like flowering, require specific environmental cues, such as exposure to cold.

Solution: Step 1: Understand the requirement described. Certain seeds need exposure to low temperatures for a period to successfully germinate and for the plant to flower later.

Step 2: Define the plant physiological processes:
Stratification (Option A): Stratification is a process used to break seed dormancy and promote germination. It typically involves exposing seeds to a period of cold and moist conditions, simulating winter. This process is essential for the germination of many seeds that would otherwise remain dormant.
Vernalization (Option B): Vernalization is the process by which a plant acquires the ability to flower in response to prolonged exposure to cold treatment. It is typically required for some temperate plants that need winter to initiate flowering in the spring. This matches the description that the requirement is for successful germination and flowering.
Scarification (Option C): Scarification is a treatment that breaks or softens the seed coat to allow water and gases to enter, thus promoting germination. It often involves physical damage or chemical treatment to overcome dormancy caused by a hard seed coat.
Etiolation (Option D): Etiolation is the phenomenon of abnormal plant growth in the absence of light, characterized by elongated stems and pale leaves.



Step 3: Match the requirement to the correct term. The requirement of low temperature exposure for successful germination and subsequent flowering is known as vernalization. While stratification also involves cold exposure for germination, vernalization specifically relates to the cold requirement for flowering. Given the mention of both germination and flowering, vernalization is the most encompassing term.

Final Answer: Vernalization

Answer: (B)

Go Back to Question 95

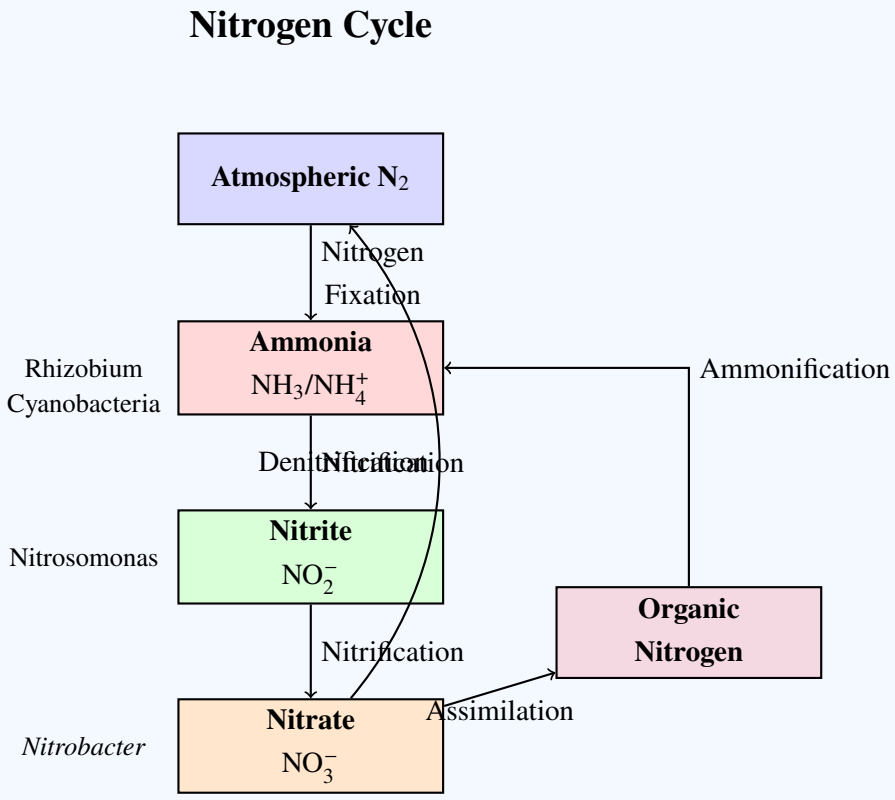
Q96.

Solution

Concept: Nitrogen is an essential nutrient for plant growth. The nitrogen cycle involves various microbial processes that convert atmospheric nitrogen into usable forms for plants.

Solution: Step 1: Understand the process. The question describes the conversion of atmospheric nitrogen (N_2) into ammonia (NH_3) by microorganisms like Rhizobium and cyanobacteria.

Step 2: Define the stages of the nitrogen cycle:
Nitrification (Option A): Conversion of ammonia into nitrites and nitrates.
Denitrification (Option B): Conversion of nitrates into atmospheric nitrogen gas.
Nitrogen fixation (Option C): Conversion of atmospheric nitrogen into ammonia by microorganisms. This matches the description.
Ammonification (Option D): Conversion of organic nitrogen into ammonia by decomposers.



Step 3: Match the description to the correct process. The conversion of atmospheric nitrogen into ammonia by microorganisms is called nitrogen fixation.

Final Answer: Nitrogen fixation

Answer: (C)

Go Back to Question 96

Q97.

Solution

Concept: Vitamins are essential organic compounds required in small quantities for normal metabolism. Deficiencies in specific vitamins can lead to various diseases.

Solution: Step 1: Analyze the symptoms and the deficiency. The patient has soft and weak bones and skeletal deformities due to a prolonged deficiency of vitamin D during childhood.

Step 2: Recall the functions of vitamins and the diseases caused by their deficiencies: Scurvy (Option A): Scurvy is caused by a deficiency of Vitamin C, leading to symptoms like bleeding gums, fatigue, and poor wound healing.
Beriberi (Option B): Beriberi is caused by a deficiency of Vitamin B1 (Thiamine), affecting the nervous system and cardiovascular system.
Rickets (Option C): Rickets is a childhood disease caused by a deficiency of Vitamin D, calcium, or phosphate. Vitamin D is crucial for calcium absorption and bone mineralization. Its deficiency leads to soft, weak, and deformed bones. This perfectly matches the description.
Pellagra (Option D): Pellagra is caused by a deficiency of Vitamin B3 (Niacin), leading to dermatitis, diarrhea, and dementia.

Step 3: Conclude the disease caused by vitamin D deficiency in childhood. The disease characterized by soft, weak bones and skeletal deformities due to vitamin D deficiency in childhood is rickets.

Final Answer: Rickets

Answer: (C)

Go Back to Question 97

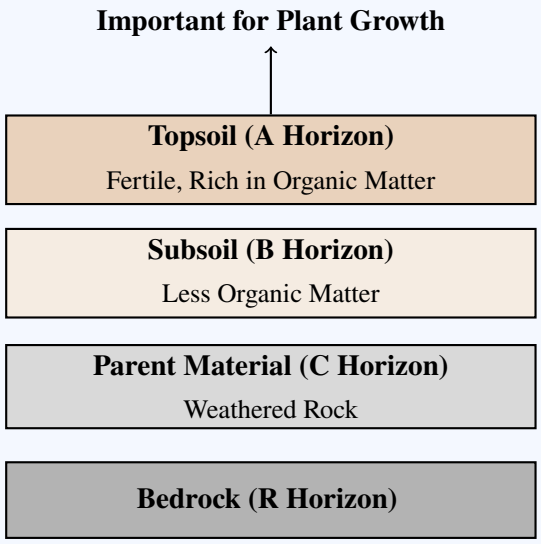
Q98.

Solution

Concept: Plasmids are small, circular DNA molecules found in bacteria that are commonly used as vectors in gene cloning. Their suitability as vectors depends on several properties.

Solution: Step 1: Understand the role of plasmids in gene cloning. Plasmids act as vectors that carry foreign DNA into host cells. They are useful because they are small, easy to manipulate, and can replicate inside bacteria.

Step 2: Identify the essential properties of a plasmid vector:
Origin of replication (ori): Allows the plasmid to replicate inside the host cell.
Selectable marker: Usually an antibiotic resistance gene used to identify transformed cells.
Unique restriction sites: Help in the insertion of foreign DNA.



Step 3: Evaluate the options:
Option A: Plasmids do not synthesize proteins independently.
Option B: Plasmids usually do not integrate into chromosomes.
Option C: The origin of replication allows autonomous replication inside the host cell. This is correct.
Option D: Plasmids do not produce ATP.

Step 4: Conclude the property conferred by the origin of replication. The origin of replication enables the plasmid to replicate autonomously inside the host cell.

Final Answer: Replicate autonomously inside host cells

Answer: (C)

Go Back to Question 98

Q99.

Solution

Concept: Forests play a critical role in regulating atmospheric carbon dioxide levels. They act as reservoirs for carbon, absorbing it from the atmosphere through photosynthesis.

Solution: Step 1: Understand the role of forests in the carbon cycle. Forests absorb carbon dioxide (CO_2) from the atmosphere during photosynthesis. This CO_2 is converted into organic compounds, effectively removing it from the atmosphere and storing it in the biomass of trees (wood, leaves, roots) and in the soil.

Step 2: Define the ecological terms related to carbon reservoirs:
Carbon sources (Option A): Carbon sources are reservoirs that release carbon into the atmosphere (e.g., combustion of fossil fuels, respiration). Forests are primarily carbon removers, not sources.
Carbon sinks (Option B): Carbon sinks are reservoirs that absorb more carbon from the atmosphere than they release. Forests are significant terrestrial carbon sinks. Deforestation leads to the release of stored carbon and the loss of this absorptive capacity.
Nitrogen reservoirs (Option C): Nitrogen reservoirs store nitrogen in various forms. While forests are important in the nitrogen cycle, their primary impact on atmospheric CO_2 relates to carbon storage.
Ozone producers (Option D): Ozone (O_3) is formed in the stratosphere by UV radiation acting on oxygen, and in the troposphere by pollution. Forests do not primarily produce ozone.

Step 3: Explain the impact of deforestation on atmospheric CO_2. When forests are cleared, the carbon stored in the trees and soil is released into the atmosphere through burning or decomposition. Furthermore, the removal of forests eliminates their capacity to absorb CO_2, leading to an increase in atmospheric CO_2 levels and contributing to global warming.

Step 4: Conclude the role of forests concerning atmospheric carbon dioxide. Forests act as carbon sinks because they absorb CO_2 from the atmosphere.

Final Answer: Carbon sinks

Answer: (B)

Go Back to Question 99

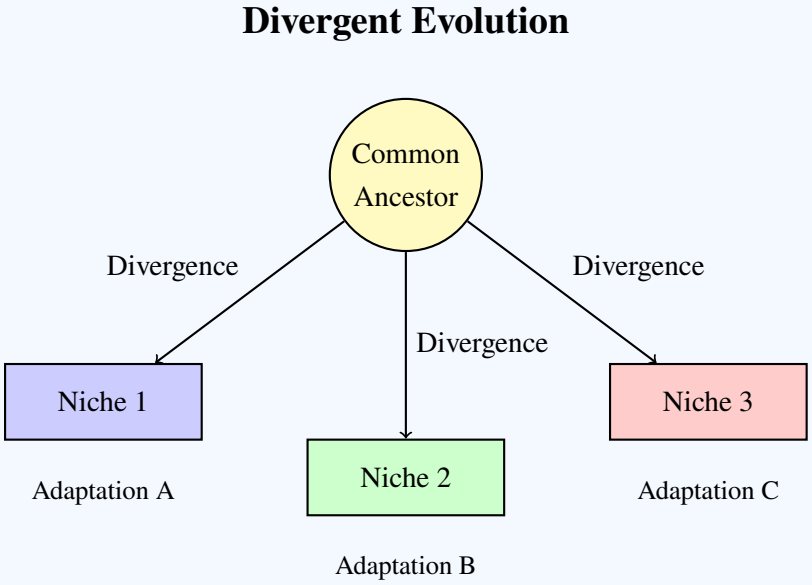
Q100.

Solution

Concept: Evolutionary processes explain the diversity of life. Adaptive radiation is a key mechanism by which new species arise from a common ancestor, adapting to different environments.

Solution: Step 1: Understand the scenario. Different species evolved from a common ancestor and developed different adaptations to occupy different ecological niches.

Step 2: Define the evolutionary patterns:
Convergent evolution (Option A): Unrelated organisms evolve similar traits due to similar environmental pressures, producing analogous structures.
Divergent evolution (Option B): A common ancestor gives rise to multiple species with different adaptations for different niches, producing homologous structures. Darwin's finches are a classic example. This matches the description.
Parallel evolution (Option C): Related organisms independently evolve similar traits under similar environmental conditions.
Artificial selection (Option D): Humans selectively breed organisms for desired traits.



Step 3: Match the phenomenon to the correct evolutionary term. The evolution of multiple species from a common ancestor, each adapting to different ecological niches, is the definition of adaptive radiation, which is a form of divergent evolution. Therefore, divergent evolution best describes this process.

Final Answer: Divergent evolution

Answer: (B)

Go Back to Question 100

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	C	3	B	4	C	5	C
6	B	7	C	8	B	9	C	10	B
11	B	12	C	13	C	14	C	15	B
16	B	17	C	18	C	19	C	20	C
21	C	22	C	23	B	24	C	25	C
26	D	27	B	28	C	29	B	30	B
31	B	32	B	33	C	34	B	35	B
36	C	37	C	38	D	39	C	40	C
41	C	42	B	43	C	44	B	45	C
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76	C	77	B	78	C	79	C	80	B
81	C	82	C	83	B	84	C	85	C
86	B	87	C	88	C	89	C	90	C
91	B	92	B	93	C	94	C	95	B
96	C	97	C	98	C	99	B	100	B