MHT-CET Biology Sample Paper-5

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

Instructions

- This paper contains a total of **100** Multiple Choice Questions.
- Each correct answer carries **+1 marks**.
- 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. Select the CORRECT sequence of taxonomic hierarchy in the plant kingdom:

(A) Division → Class → Order → Family → Genus

(B) Kingdom → Division → Family → Order → Species

(C) Division → Order → Class → Genus → Family

(D) Class → Division → Order → Family → Species

Q2. In a typical dicot stem, the vascular bundles are arranged in a ring. This condition is known as _____ and the bundles are usually _____.

(A) Eustele; Conjoint and Closed

(B) Atactostele; Conjoint and Open

(C) Eustele; Conjoint and Open

(D) Siphonostele; Radial and Open

Q3. Identify the INCORRECT statement regarding the Fluid Mosaic Model of the plasma membrane:

(A) The quasi-fluid nature of lipids enables lateral movement of proteins.

(B) Peripheral proteins lie on the surface of the membrane.

(C) The membrane is a static structure with fixed protein positions.

(D) Carbohydrates are attached to the outer surface of lipids or proteins.

Q4. Match the following Cell Organelles (Column I) with their Functions (Column II):

Column I	Column II
i. Golgi Apparatus	p. Synthesis of lipids
ii. Smooth ER	q. Photorespiration
iii. Peroxisomes	r. Formation of glycoproteins
iv. Lysosomes	s. Intracellular digestion

(A) i-r, ii-p, iii-q, iv-s

(B) i-p, ii-r, iii-s, iv-q

(C) i-q, ii-s, iii-p, iv-r

(D) i-r, ii-q, iii-p, iv-s

Q5. During the S-phase of the cell cycle, the amount of DNA _____ per cell, but the chromosome number _____.

(A) Doubles; Doubles

(B) Remains same; Doubles

(C) Doubles; Remains same

(D) Half; Doubles

Q6. In Pteridophytes, the dominant phase in the life cycle is _____ which is differentiated into _____.

(A) Gametophyte; Root, stem, and leaves

(B) Sporophyte; True root, stem, and leaves

(C) Gametophyte; Rhizoid, thallus, and seta

(D) Sporophyte; Capsule and Foot

Q7. Bulliform cells are found in _____ and help in _____.

(A) Dicot leaves; Transpiration

(B) Monocot leaves; Rolling of leaves

(C) Dicot stems; Secondary growth

(D) Monocot stems; Protection

(E)

Q8. The term 'Protoplast' refers to a cell without its:

(A) Nucleus

(B) Plasma membrane

(C) Cell wall

(D) Cytoplasm

Q9. Identify the stage of Prophase I where crossing over occurs:

(A) Leptotene

(B) Zygotene

(C) Pachytene

(D) Diplotene

Q10. Which of the following is a non-membranous cell organelle found in both prokaryotes and eukaryotes?

(A) Mitochondria

(B) Ribosome

(C) Vacuole

(D) Chloroplast

Q11. Secondary xylem and secondary phloem in dicot stems are produced by:

(A) Phellogen

(B) Vascular cambium

(C) Apical meristem

(D) Axillary meristem

Q12. In Bryophytes, the sporophyte is:

(A) Free-living and independent

(B) Parasitic on the gametophyte

(C) Dominant and photosynthetic

(D) Formed by the fusion of spores

Q13. Select the CORRECT statement about Mitochondria:

(A) The inner membrane forms infoldings called thylakoids.

(B) They are the sites of anaerobic respiration.

(C) They possess a single circular DNA and 70S ribosomes.

(D) Matrix contains the enzymes for Glycolysis.

Q14. The Casparian strips are present in the _____ and are composed of _____.

(A) Pericycle; Lignin

(B) Endodermis; Suberin

(C) Epidermis; Cutin

(D) Cortex; Pectin

Q15. Which type of vascular bundle is found in Cucurbita stems?

(A) Collateral

(B) Bicollateral

(C) Concentric

(D) Radial

Q16. The physiological process of 'Guttation' in plants is primarily driven by _____-__ and occurs through specialized structures called _____.

(A) Transpiration pull; Stomata

(B) Root pressure; Hydathodes

(C) Imbibition; Lenticels

(D) Active transport; Phloem

Q17. Which of the following is the CORRECT sequence of electron carriers in the mitochondrial Electron Transport System (ETS)?

(A) Cyt b → Cyt c1 → Cyt c → Cyt a → Cyt a3

(B) Cyt a → Cyt a3 → Cyt b → Cyt c → Cyt c1

(C) Cyt c → Cyt b → Cyt a → Cyt c1 → Cyt a3

(D) Cyt b → Cyt a → Cyt a3 → Cyt c1 → Cyt c

Q18. The ratio of 9:3:3:1 in a Mendelian dihybrid cross is modified to _____ in the case of 'Duplicate Genes' interaction.

(A) 9:7

(B) 12:3:1

(C) 15:1

(D) 13:3

Q19. In a mature embryo sac of angiosperms, the 'Filiform Apparatus' is a characteristic feature of:

(A) Egg cell

(B) Antipodal cells

(C) Synergids

(D) Central cell

Q20. Identify the plant hormone that promotes 'Bolting' (internode elongation) in rosette plants like cabbage:

(A) Auxin

(B) Gibberellin

(C) Cytokinin

(D) Abscisic acid

Q21. The first stable product of CO2 fixation in C4 plants is _____ and it is formed in the _____ cells.

(A) 3-PGA; Mesophyll

(B) Oxaloacetic acid; Mesophyll

(C) Oxaloacetic acid; Bundle sheath

(D) Malic acid; Bundle sheath

Q22. Which specific part of the human brain is responsible for the regulation of body temperature and the urge for eating?

(A) Cerebellum

(B) Thalamus

(C) Hypothalamus

(D) Medulla oblongata

Q23. During skeletal muscle contraction, the 'I-band' shortens because:

(A) Actin filaments slide over myosin filaments

(B) Myosin filaments shorten in length

(C) Actin filaments shorten in length

(D) Z-lines move further apart

Q24. Match the following Hormones (Column I) with their Deficiency Diseases (Column II):

Column I	**Column II**
i. Insulin	p. Diabetes insipidus
ii. Thyroxine	q. Diabetes mellitus
iii. ADH	r. Tetany
iv. Parathyroid hormone	s. Simple Goitre

(A) i-q, ii-s, iii-p, iv-r

(B) i-p, ii-q, iii-r, iv-s

(C) i-q, ii-p, iii-s, iv-r

(D) i-r, ii-s, iii-p, iv-q

Q25. In human females, the 'LH surge' typically occurs during which phase of the menstrual cycle?

(A) Just before the end of the follicular phase

(B) Middle of the luteal phase

(C) Beginning of the menstrual phase

(D) End of the secretory phase

Q26. Restriction endonucleases are called 'Molecular Scissors' because they:

(A) Cut DNA at random locations

(B) Cleave phosphodiester bonds at specific recognition sequences

(C) Join two DNA fragments together

(D) Remove nucleotides from the ends of DNA

Q27. The pyramid of energy is ALWAYS upright because:

(A) Energy is lost as heat at each trophic level

(B) Herbivores have more energy than producers

(C) Top carnivores are more efficient

(D) Decomposers return energy to the sun

Q28. Which type of natural selection favors average phenotypes and eliminates extreme variations?

(A) Directional selection

(B) Disruptive selection

(C) Stabilizing selection

(D) Balancing selection

Q29. Identify the correctly matched pair of animal and its respiratory organ:

(A) Earthworm - Tracheal tubes

(B) Prawn - Gills

(C) Scorpion - Ctenidia

(D) Cockroach - Moist cuticle

Q30. The process of 'Translation' in protein synthesis involves the movement of ribosome along mRNA in the _____ direction.

(A) 3' $\rightarrow$ 5'

(B) 5' $\rightarrow$ 3'

(C) C-terminus $\rightarrow$ N-terminus

(D) Variable direction

Q31. A person with blood group 'O' is considered a universal donor because their RBCs lack:

(A) Both A and B antigens

(B) Both A and B antibodies

(C) Rh factor

(D) Hemoglobin

Q32. In biotechnology, 'pBR322' is a widely used:

(A) Bacterium

(B) Plasmid vector

(C) Restriction enzyme

(D) Selectable marker

Q33. The volume of air remaining in the lungs even after a forcible expiration is known as:

(A) Tidal Volume

(B) Expiratory Reserve Volume

(C) Residual Volume

(D) Vital Capacity

Q34. Turner's syndrome in humans is caused by the chromosomal constitution of:

(A) 44 + XXY

(B) 44 + XYY

(C) 44 + XO

(D) 45 + XX

Q35. Double fertilization is a unique feature of angiosperms. It involves:

(A) Syngamy and Triple fusion

(B) Two eggs being fertilized by one sperm

(C) One sperm fertilizing two eggs

(D) Fertilization of the same egg twice

Q36. The 'Juxtaglomerular Apparatus' (JGA) releases _____ in response to a fall in glomerular blood pressure.

(A) Aldosterone

(B) Renin

(C) ADH

(D) Atrial Natriuretic Factor

Q37. The semi-conservative nature of DNA replication was first experimentally proved in _____ by _____.

(A) Escherichia coli; Meselson and Stahl

(B) Vicia faba; Taylor

(C) Drosophila; Morgan

(D) Pneumococcus; Griffith

Q38. Which of the following is an example of 'Ex-situ' conservation?

(A) National Park

(B) Wildlife Sanctuary

(C) Seed Bank

(D) Biosphere Reserve

Q39. In the human heart, the 'SAN' (Sino-atrial node) is located in the:

(A) Upper left corner of the left atrium

(B) Upper right corner of the right atrium

(C) Lower left corner of the right atrium

(D) Inter-ventricular septum

Q40. The primary neurotransmitter released at the neuromuscular junction is:

(A) Dopamine

(B) Serotonin

(C) Acetylcholine

(D) Adrenaline

Q41. Which of the following represents the correct floral formula of the family Solanaceae?

(A) $\oplus \subsetneq K_{(5)}C_{(5)}A_5\underline{G}_{(2)}$

(B) $\oplus \subsetneq K_{(5)}C_5A_{(5)}\underline{G}_2$

(C) $\% \subsetneq K_{(5)}C_{1+2+(2)}A_{(9)+1}\underline{G}_1$

(D) $\oplus \subsetneq K_5C_5A_5\underline{G}_{(2)}$

Q42. The term 'Linkage' was coined by _____ based on his experiments with _____.

(A) Gregor Mendel; Garden Pea

(B) T.H. Morgan; Drosophila melanogaster

(C) Henking; Firefly

(D) Sutton and Boveri; Grasshopper

Q43. In human lungs, the exchange of gases takes place across the _____ membrane, which is made up of _____ layers.

(A) Pleural; Two

(B) Diffusion; Three

(C) Mucosal; One

(D) Pericardial; Two

Q44. Which of the following is an example of an 'Analogous' organ pair?

(A) Flippers of Penguins and Dolphins

(B) Forelimbs of Cheetah and Human

(C) Thorns of Bougainvillea and Tendrils of Cucurbita

(D) Hearts of different vertebrates

Q45. The process of charging tRNA is technically known as _____ and it requires _____.

(A) Aminoacetylation; GTP

(B) Aminoacylation; ATP

(C) Translation; Mg2+

(D) Transcription; ATP

Q46. Which antibody is the most abundant in the human body and can cross the placenta?

(A) IgA

(B) IgM

(C) IgG

(D) IgE

Q47. The 'Lock and Key' hypothesis of enzyme action was proposed by:

(A) Emil Fischer

(B) Koshland

(C) Watson and Crick

(D) Robert Hooke

Q48. The 'Great Barrier Reef' along the coast of Australia is a significant example of which ecosystem?

(A) Estuarine

(B) Freshwater

(C) Marine

(D) Grassland

Q49. In the context of the lac operon, the 'i' gene codes for the _____.

(A) Inducer

(B) Repressor

(C) Beta-galactosidase

(D) Permease

Q50. The hormone 'Erythropoietin', which stimulates RBC production, is produced by:

(A) Bone marrow

(B) Liver

(C) Juxtaglomerular cells of the kidney

(D) Spleen

Q51. Identify the correct match for the type of pollination and its agent:

(A) Anemophily - Insects

(B) Hydrophily - Water

(C) Chiropterophily - Birds

(D) Ornithophily - Bats

Q52. Which phase of the sigmoid growth curve represents the period of maximum growth?

(A) Lag phase

(B) Log phase (Exponential phase)

(C) Stationary phase

(D) Deceleration phase

Q53. The 'Statins' used for lowering blood cholesterol are commercially produced from which microorganism?

(A) Trichoderma polysporum

(B) Monascus purpureus

(C) Saccharomyces cerevisiae

(D) Aspergillus niger

Q54. Select the incorrect statement regarding Down's syndrome:

(A) It is caused by the trisomy of the 21st chromosome.

(B) The affected individual has a furrowed tongue and partially open mouth.

(C) It was first described by Langdon Down.

(D) It is a sex-linked recessive disorder.

Q55. Which part of the sperm contains the enzymes that help in the penetration of the ovum?

(A) Nucleus

(B) Middle piece

(C) Acrosome

(D) Tail

Q56. In an ecosystem, the rate of production of organic matter during photosynthesis is termed:

(A) Net Primary Productivity

(B) Gross Primary Productivity

(C) Secondary Productivity

(D) Decomposition

Q57. The restriction enzyme 'EcoRI' recognizes which palindromic sequence?

(A) 5' - GAATTC - 3'

(B) 5' - GGATCC - 3'

(C) 5' - AGCT - 3'

(D) 5' - CCCGGG - 3'

Q58. Which of the following cells are known as 'HIV factories' in an infected person?

(A) T-helper cells

(B) Macrophages

(C) B-lymphocytes

(D) Cytotoxic T-cells

Q59. The 'Lichen' is a symbiotic association between _____ and _____.

(A) Algae and Fungus

(B) Fungus and Roots of higher plants

(C) Algae and Bacteria

(D) Bacteria and Fungus

Q60. Identify the hormone that triggers the release of bile from the gallbladder:

(A) Gastrin

(B) Secretin

(C) Cholecystokinin (CCK)

(D) Enterogastrone

Q61. Which of the following is the 'Start Codon' for translation in most organisms?

(A) UAA

(B) UGA

(C) AUG

(D) UAG

Q62. The cranial capacity of 'Homo habilis' was approximately:

(A) 650–800 cc

(B) 900 cc

(C) 1400 cc

(D) 400–500 cc

Q63. In DNA, the two strands are held together by _____ bonds between the nitrogenous bases.

(A) Phosphodiester

(B) Peptide

(C) Hydrogen

(D) Glycosidic

Q64. Which of the following plants is used for the production of 'Bio-diesel'?

(A) Jatropha

(B) Brassica

(C) Helianthus

(D) Gossypium

Q65. The 'Golden Rice' is a transgenic variety rich in:

(A) Vitamin C

(B) Vitamin A

(C) Iron

(D) Essential fatty acids

Q66. Which of the following is a 'Living Fossil' among the Arthropods?

(A) Apis

(B) Limulus

(C) Locusta

(D) Laccifer

Q67. The process of 'Triple Fusion' in angiosperms results in the formation of:

(A) Zygote

(B) Primary Endosperm Nucleus

(C) Synergid

(D) Antipodal cell

Q68. Identify the hormone that inhibits the secretion of gastric juice and decreases gastric motility:

(A) Gastrin

(B) Enterogastrone

(C) Secretin

(D) Cholecystokinin

Q69. The 'Pneumatophores' (breathing roots) are typically found in _____ growing in _____ areas.

(A) Rhizophora; Swampy

(B) Opuntia; Arid

(C) Monstera; Tropical

(D) Banyan; Terrestrial

Q70. Which of the following is an example of an 'In-situ' biodiversity conservation method?

(A) Botanical Garden

(B) Zoological Park

(C) Biosphere Reserve

(D) Cryopreservation

Q71. The term 'Genetics' was coined by:

(A) Gregor Mendel

(B) William Bateson

(C) T.H. Morgan

(D) Hugo de Vries

Q72. The functional unit of the human kidney is the _____, which is composed of a renal corpuscle and a _____.

(A) Neuron; Axon

(B) Nephron; Renal tubule

(C) Alveolus; Bronchiole

(D) Osteon; Canaliculus

Q73. Which specific enzyme is responsible for the 'Unwinding' of the DNA double helix during replication?

(A) DNA Polymerase

(B) Ligase

(C) Helicase

(D) Topoisomerase

Q74. In human blood, the CO_2 is primarily transported in the form of:

(A) Carbamino-hemoglobin

(B) Bicarbonate ions

(C) Dissolved CO2 in plasma

(D) Carbonic acid

Q75. The 'A-band' of a sarcomere contains:

(A) Only Actin filaments

(B) Only Myosin filaments

(C) Both Actin and Myosin filaments

(D) Neither Actin nor Myosin filaments

Q76. Identify the correctly matched pair of the disease and its pathogen:

(A) Typhoid - Salmonella typhi

(B) Malaria - Wuchereria bancrofti

(C) Pneumonia - Plasmodium vivax

(D) Common Cold - Haemophilus influenzae

Q77. The 'Bt-toxin' protein produced by Bacillus thuringiensis exists as inactive pro-toxin. It gets activated in the insect gut due to:

(A) Acidic pH

(B) Alkaline pH

(C) Presence of specific enzymes

(D) High temperature

Q78. In the context of population interactions, 'Commensalism' is defined as an interaction where:

(A) One species is benefitted and the other is harmed

(B) Both species are benefitted

(C) One species is benefitted and the other is neither benefitted nor harmed

(D) Both species are harmed

Q79. The main structural component of the bacterial cell wall is _____.

(A) Cellulose

(B) Chitin

(C) Peptidoglycan

(D) Hemicellulose

Q80. Which part of the brain acts as a relay station for sensory and motor signaling?

(A) Hypothalamus

(B) Thalamus

(C) Cerebrum

(D) Pons

Q81. The 'Montreal Protocol' was signed to control the emission of:

(A) Greenhouse gases

(B) Ozone depleting substances

(C) Toxic industrial waste

(D) Nuclear radiation

Q82. Which type of epithelium is found in the inner lining of the fallopian tubes and bronchioles to move particles?

(A) Squamous epithelium

(B) Cuboidal epithelium

(C) Ciliated epithelium

(D) Columnar epithelium

Q83. The 'Corpus Luteum' secretes a large amount of _____ which is essential for the maintenance of the endometrium.

(A) Estrogen

(B) Progesterone

(C) LH

(D) FSH

Q84. In a food chain, the 'Decomposers' occupy which trophic level?

(A) First Trophic Level

(B) Second Trophic Level

(C) Third Trophic Level

(D) They are not typically assigned a single specific trophic level

Q85. Which of the following is a non-reducing sugar?

(A) Glucose

(B) Fructose

(C) Sucrose

(D) Maltose

Q86. The technique of 'Amniocentesis' is often misused for:

(A) Detecting chromosomal abnormalities

(B) Sex determination of the fetus

(C) Checking metabolic disorders

(D) Treating genetic diseases

Q87. Identify the enzyme used to join DNA fragments in genetic engineering:

(A) Restriction endonuclease

(B) DNA Ligase

(C) Alkaline phosphatase

(D) Exonuclease

Q88. In human digestion, the enzyme 'Enterokinase' helps in the conversion of:

(A) Pepsinogen to Pepsin

(B) Trypsinogen to Trypsin

(C) Casein to Paracasein

(D) Proteins to Dipeptides

Q89. Which hormone is popularly known as the 'Emergency Hormone' or the 'Fight or Flight' hormone?

(A) Insulin

(B) Adrenaline

(C) Thyroxine

(D) Oxytocin

Q90. The semi-dwarf varieties of wheat, 'Sonalika' and 'Kalyan Sona', were developed in India through _____.

(A) Mutation breeding

(B) Genetic engineering

(C) Plant hybridization

(D) Tissue culture

Q91. The movement of water through the cell wall and intercellular spaces is known as _____ pathway.

(A) Symplastic

(B) Apoplastic

(C) Transcellular

(D) Osmotic

Q92. Which of the following is NOT a characteristic of the family Liliaceae?

(A) Perianth present

(B) Epipetalous stamens

(C) Tricarpellary gynoecium

(D) Axile placentation

Q93. The 'Lichen' is a sensitive bio-indicator of _____ pollution.

(A) Water

(B) Noise

(C) Air (specifically SO2)

(D) Radioactive

Q94. The 'Darwin's Finches' of Galapagos Islands are an excellent example of:

(A) Adaptive Radiation

(B) Parallel Evolution

(C) Mutation

(D) Natural Selection only

Q95. Which of the following is a hormone-releasing IUD?

(A) Lippes loop

(B) Multiload 375

(C) LNG-20

(D) Cu7

Q96. In human female, the first menstruation is called _____ and its cessation is called _____.

(A) Menopause; Menarche

(B) Menarche; Menopause

(C) Ovulation; Menarche

(D) Menstrual cycle; Menopause

Q97. The process of synthesis of mRNA from DNA is called _____ and occurs in the _____.

(A) Translation; Cytoplasm

(B) Transcription; Nucleus

(C) Replication; Nucleus

(D) Transcription; Cytoplasm

Q98. Which of the following is the 'Structural and functional unit of liver'?

(A) Hepatic lobule

(B) Hepatocyte

(C) Glisson's capsule

(D) Hepatic duct

Q99. The enzyme 'Catalase' is found in which organelle?

(A) Lysosome

(B) Peroxisome

(C) Ribosome

(D) Mitochondria

Q100. The Indian Parliament recently cleared the second amendment of the _____-Bill to take into account issues like 'Biopiracy'.

(A) Environment Protection

(B) Indian Patents

(C) Biological Diversity

(D) Wildlife Protection

Detailed Solutions

Q1.

Solution

Concept:

Taxonomic hierarchy is the process of arranging various organisms into successive levels of biological classification in either a decreasing or an increasing order from kingdom to species.

Solution:

Step 1: Recall the standard taxonomic categories. In the plant kingdom, the term 'Division' is used instead of 'Phylum' which is used for animals.

Step 2: The hierarchy starts with the broadest category: Kingdom.

Step 3: Following Kingdom, the order descends as: Division, Class, Order, Family, Genus, and finally Species (the most specific unit).

Step 4: Comparing this with the options, Option A provides the correct sequential flow: Division → Class → Order → Family → Genus. Option B is incorrect as it places Family before Order.

Final Answer: $\boxed{A}$

Answer: (A)

Go Back to Question 1

Q2.

Solution

Concept:

The internal structure of the dicot stem is characterized by the arrangement and nature of its vascular bundles.

Solution:

Step 1: In dicotyledonous stems, the vascular bundles are arranged in a ring-like pattern. This specific type of stele is called a Eustele.

Step 2: Each individual vascular bundle in a dicot stem is 'Conjoint', meaning xylem and phloem are on the same radius.

Step 3: Furthermore, they are 'Open', which indicates the presence of intrafascicular cambium between the xylem and phloem. This cambium allows for secondary growth.

Step 4: Atactostele refers to the scattered bundles seen in monocots. radial bundles are found in roots. Therefore, Eustele and Conjoint/Open is the correct description.

Final Answer: $\boxed{C}$

Answer: (C)

Go Back to Question 2

Q3.

Solution

Concept:

The Fluid Mosaic Model, proposed by Singer and Nicolson (1972), describes the structure of the plasma membrane as a dynamic, fluid-like phospholipid bilayer with embedded proteins.

Solution:

Step 1: Analyze the fluid nature. The model emphasizes that the lipid bilayer is quasi-fluid, allowing proteins to move laterally within the membrane. This is crucial for membrane function.

Step 2: Examine the protein types. Integral proteins are buried in the bilayer, while peripheral proteins are loosely attached to the surface.

Step 3: Evaluate the 'static' claim. Statement C claims the membrane is a static structure. This is factually incorrect as the Fluid Mosaic Model is defined by its fluidity and the constant movement of its components.

Step 4: Carbohydrates (oligosaccharides) are indeed found on the exterior, forming the glycocalyx. Therefore, statement C is the only incorrect one.

Final Answer: C

Answer: (C)

Go Back to Question 3

Q4.

Solution

Concept:

Different cell organelles perform specialized physiological tasks within the eukaryotic cell.

Solution:

Step 1: Golgi Apparatus is primarily involved in the modification, sorting, and packaging of proteins and lipids. It is the site for the formation of glycoproteins and glycolipids (i-r).

Step 2: Smooth Endoplasmic Reticulum (SER) is the major site for lipid synthesis, including steroidal hormones (ii-p).

Step 3: Peroxisomes contain enzymes involved in oxidative reactions, including photorespiration in plants (iii-q).

Step 4: Lysosomes contain hydrolytic enzymes and are responsible for intracellular digestion and waste removal (iv-s).

Step 5: Matching these: i-r, ii-p, iii-q, iv-s corresponds to Option A.

Final Answer: A

Answer: (A)

Go Back to Question 4

Q5.

Solution

Concept:

The S-phase (Synthesis phase) is the part of the interphase where DNA replication occurs.

Solution:

Step 1: During S-phase, DNA replication takes place, meaning the amount of DNA per cell doubles. If the initial amount was 2C, it becomes 4C.

Step 2: However, the number of chromosomes remains the same. Even though each chromosome now consists of two sister chromatids, they are still attached at the centromere and counted as one chromosome.

Step 3: If the cell had 2n chromosomes at the beginning, it still has 2n chromosomes after S-phase.

Step 4: Thus, the DNA doubles but the chromosome number remains unchanged. This matches Option C.

Final Answer: $\boxed{C}$

Answer: (C)

Go Back to Question 5

Q6.

Solution

Concept:

Pteridophytes represent the first group of terrestrial plants to possess vascular tissues (xylem and phloem). Their life cycle exhibits a distinct alternation of generations.

Solution:

Step 1: In Pteridophytes, unlike Bryophytes, the dominant, conspicuous, and independent phase is the sporophyte ($2n$).

Step 2: The sporophytic plant body is well-differentiated into true roots, true stems, and true leaves. This is a significant evolutionary advancement over the thalloid structure of lower plants.

Step 3: The gametophyte in Pteridophytes (often called the prothallus) is small, multicellular, and usually photosynthetic, but it is not the dominant phase.

Step 4: Therefore, the correct description of the dominant phase is the sporophyte with true roots, stems, and leaves.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 6

Q7.

Solution

Concept:

Bulliform cells, also known as motor cells, are specialized large, bubble-shaped epidermal cells found in certain plant tissues.

Solution:

Step 1: Bulliform cells are a characteristic feature of the upper epidermis (adaxial surface) of monocot leaves, such as grasses.

Step 2: These cells play a vital role in the water stress response. When the plant has plenty of water, these cells absorb water and become turgid, keeping the leaf surface exposed.

Step 3: Under water stress (drought), these cells lose turgidity due to water loss, causing the leaf to roll inward to minimize the exposed surface area and reduce transpiration.

Step 4: Dicot leaves do not typically possess bulliform cells for this purpose. Thus, they are found in monocot leaves and aid in leaf rolling.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 7

Q8.

Solution

Concept:

In plant cell biology, different terms are used to describe a cell depending on which components are present or removed for experimental or physiological study.

Solution:

Step 1: A typical plant cell consists of a rigid cell wall, a plasma membrane, and the internal cytoplasm containing the nucleus and organelles.

Step 2: When the cell wall is enzymatically digested or mechanically removed, the remaining part of the cell, which is bounded only by the plasma membrane, is called the 'Protoplast'.

Step 3: The 'Protoplasm' refers to the living content of the cell (cytoplasm + nucleus), whereas the 'Cytoplast' refers to the cytoplasm without the nucleus.

Step 4: Since the question specifically asks what is removed to define a protoplast, the answer is the cell wall.

Final Answer: $\boxed{C}$

Answer: (C)

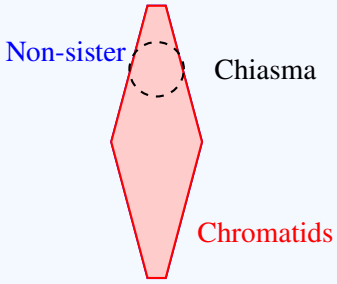
Go Back to Question 8

Q9.

Solution

Concept: Meiosis I involves a prolonged Prophase I, which is divided into five substages: Leptotene, Zygotene, Pachytene, Diplotene, and Diakinesis. Crossing over is the physical exchange of genetic material between non-sister chromatids of homologous chromosomes.

Solution: Step 1: In the Leptotene stage, chromosomes begin to condense and become visible under the light microscope.
Step 2: During Zygotene, homologous chromosomes start pairing up in a process called synapsis, forming a complex known as the synaptonemal complex. The paired chromosomes are called bivalents or tetrads.
Step 3: In the Pachytene stage, the bivalents become clearly visible. This is the stage where crossing over occurs—the exchange of genetic segments between non-sister chromatids mediated by the enzyme recombinase.
Step 4: Diplotene is characterized by the dissolution of the synaptonemal complex and the tendency of the recombined homologous chromosomes to separate, except at the sites of crossing over (chiasmata).
Step 5: Diakinesis is the final stage where chiasmata terminalize, the nucleolus disappears, and the nuclear envelope breaks down.



Pachytene: Crossing Over

Final Answer: (C) Pachytene

Answer: (C)

Go Back to Question 9

Q10.

Solution

Concept:

Organelles can be classified as double-membrane bound, single-membrane bound, or non-membranous based on their structural covering.

Solution:

Step 1: Mitochondria and Chloroplasts are double-membrane bound organelles found only in eukaryotes.

Step 2: Vacuoles are single-membrane bound (the membrane is called the tonoplast) and are primarily found in eukaryotes.

Step 3: Ribosomes are unique because they are not enclosed by any membrane. They consist of RNA and proteins.

Step 4: Ribosomes are present in both prokaryotic cells (70S) and eukaryotic cells (80S in cytoplasm, 70S in organelles). This makes them the universal non-membranous organelle across both cell types.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 10

Q11.

Solution

Concept:

Secondary growth in dicotyledonous stems is responsible for the increase in girth (thickness). This process is driven by lateral meristems, specifically the vascular cambium.

Solution:

Step 1: In a dicot stem, the vascular cambium is formed by the joining of intrafascicular cambium (present within vascular bundles) and interfascicular cambium (formed between bundles).

Step 2: This continuous ring of vascular cambium becomes active and begins to cut off new cells both toward the inner side and the outer side.

Step 3: The cells cut off toward the pith (inner side) mature into secondary xylem, while the cells cut off toward the periphery (outer side) mature into secondary phloem.

Step 4: The cambium is generally more active on the inner side than on the outer side, resulting in a much larger amount of secondary xylem being produced compared to secondary phloem. Phellogen, on the other hand, produces the periderm (bark).

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 11

Q12.

Solution

Concept:

Bryophytes (mosses and liverworts) exhibit an "haplo-diplontic" life cycle where the gametophyte is the dominant phase and the sporophyte has a dependent relationship.

Solution:

Step 1: The main plant body of a bryophyte is the haploid gametophyte, which is photosynthetic and independent. It produces gametes in the antheridia and archegonia.

Step 2: After fertilization, the zygote develops into a multicellular sporophyte ($2n$).

Step 3: In Bryophytes, the sporophyte is not a free-living organism. It remains physically attached to the photosynthetic gametophyte throughout its existence.

Step 4: It derives its nutrition (minerals, water, and often carbohydrates) from the gametophyte. Therefore, it is described as being parasitic or semi-parasitic on the gametophyte. It consists of a foot, seta, and capsule.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 12

Q13.

Solution

Concept:

Mitochondria are known as the "powerhouses of the cell," but they also possess unique structural and genetic characteristics that suggest an endosymbiotic origin.

Solution:

Step 1: Analyze the structure. Mitochondria have two membranes. The outer membrane is smooth, while the inner membrane forms infoldings called cristae (not thylakoids, which are found in chloroplasts).

Step 2: Evaluate the genetic material. Like prokaryotes, mitochondria contain their own genetic machinery. This includes a single, circular DNA molecule and 70S ribosomes.

Step 3: Assess the function. They are the sites of aerobic respiration (specifically the Krebs cycle and Electron Transport System). Glycolysis actually occurs in the cytoplasm, not the mitochondrial matrix.

Step 4: Based on these facts, Option C correctly identifies the presence of circular DNA and 70S ribosomes, which are characteristic of this organelle.

Final Answer: $\boxed{C}$

Answer: (C)

Go Back to Question 13

Q14.

Solution

Concept:

The movement of water through the root layers (cortex to xylem) is regulated by specific structural modifications in the endodermis.

Solution:

Step 1: As water moves through the root via the apoplast pathway (through cell walls), it eventually reaches the innermost layer of the cortex, called the endodermis.

Step 2: The tangential and radial walls of the endodermal cells possess a deposition of a water-impermeable, waxy material called suberin.

Step 3: These depositions are known as Casparian strips. Because suberin is hydrophobic, it blocks the apoplastic movement of water and solutes.

Step 4: This forces the water to move through the plasma membrane into the cytoplasm (symplast pathway), allowing the plant to exert metabolic control over which minerals enter the vascular cylinder. Thus, Casparian strips are in the endodermis and made of suberin.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 14

Q15.

Solution

Concept:

Vascular bundle types are categorized based on the relative arrangement of xylem, phloem, and cambium.

Solution:

Step 1: In most dicot stems, the vascular bundle is 'collateral', meaning phloem is on the outside and xylem is on the inside.

Step 2: However, in certain families like Cucurbitaceae (which includes Cucurbita or pumpkin), a unique arrangement is observed.

Step 3: In these plants, there are two patches of phloem—one on the outer side of the xylem and one on the inner side. This is called a 'Bicollateral' vascular bundle.

Step 4: Specifically, the sequence is: Outer Phloem → Outer Cambium → Xylem → Inner Cambium → Inner Phloem. This structure is a diagnostic feature of the Cucurbita stem.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 15

Q16.

Solution

Concept:

Guttation is the loss of water in the form of liquid droplets from the uninjured margins of leaves, typically occurring at night or early morning.

Solution:

Step 1: Understand the conditions for guttation. It occurs when transpiration is very low (high humidity) and soil moisture is high.

Step 2: Under these conditions, water continues to be absorbed by the roots, creating a positive hydrostatic pressure known as 'Root Pressure'.

Step 3: This pressure pushes the xylem sap upward and out through specialized, non-adjustable pores located at the tips or margins of the leaves.

Step 4: These specialized structures are called 'Hydathodes'. Unlike stomata, they cannot regulate their opening. Transpiration pull, conversely, causes water loss as vapor. Thus, root pressure and hydathodes are the correct mechanisms.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 16

Q17.

Solution

Concept:

The Electron Transport System (ETS) consists of a series of complexes and mobile carriers located in the inner mitochondrial membrane that transport electrons to oxygen.

Solution:

Step 1: Electrons from NADH/FADH2 are passed through complexes. In Complex III (Cytochrome bc1 complex), the sequence involves Cytochrome b and Cytochrome c1.

Step 2: Electrons are then transferred to Cytochrome c, which is a small mobile protein located on the outer surface of the inner membrane.

Step 3: Cytochrome c acts as a shuttle between Complex III and Complex IV (Cytochrome c oxidase).

Step 4: Within Complex IV, electrons flow from Cytochrome a to Cytochrome a3, and finally to oxygen. Therefore, the sequence is: b $\rightarrow$ c1 $\rightarrow$ c $\rightarrow$ a $\rightarrow$ a3.

Final Answer: $\boxed{A}$

Answer: (A)

Go Back to Question 17

Q18.

Solution

Concept:

Duplicate gene interaction occurs when two independent genes (located on different chromosomes) provide the same phenotypic expression. A dominant allele at either of the two loci (or both) will produce the same dominant trait. The recessive phenotype only appears when both genes are in a homozygous recessive state.

Solution:

Step 1: Start with the standard Mendelian dihybrid ratio for two independent genes, which is 9:3:3:1. This represents the genotypes: 9 ($A\_B\_$), 3 (A_bb), 3 ($aaB\_$), and 1 ($aabb$).

Step 2: Identify how "Duplicate Genes" affect these groups. Since a dominant allele at either locus results in the same phenotype, the groups $A\_B\_$, A_bb, and $aaB\_$ will all show the dominant trait.

Step 3: Add the frequencies of these three groups together:

$$9 + 3 + 3 = 15$$

Step 4: The final group, $aabb$, lacks any dominant alleles and will express the alternative (recessive) trait. This results in a frequency of 1.

Step 5: The modified ratio is therefore 15:1. This is often seen in traits like the seed capsule shape in *Capsella bursa-pastoris* (Shepherd's purse).

Final Answer: C

Answer: (C)

Go Back to Question 1

Q19.

Solution

Concept:

The embryo sac (female gametophyte) of angiosperms is typically a 7-celled, 8-nucleate structure with specialized components to facilitate fertilization.

Solution:

Step 1: The egg apparatus is located at the micropylar end and consists of one egg cell and two flanking cells called synergids.

Step 2: The synergids possess special cellular thickenings at their micropylar tip. These finger-like projections are known as the 'Filiform Apparatus'.

Step 3: The function of the filiform apparatus is to guide the pollen tube into the synergid by secreting chemotropic substances.

Step 4: Antipodal cells are at the opposite (chalazal) end and the central cell contains two polar nuclei. Since filiform apparatus is unique to synergids, Option C is correct.

Final Answer: C

Answer: (C)

Go Back to Question 19

Q20.

Solution

Concept:

Plant growth regulators (hormones) control various developmental processes, including elongation and reproductive transitions.

Solution:

Step 1: Certain plants, like cabbage and beet, have a 'rosette' habit where internodes are highly condensed, and leaves are clustered.

Step 2: 'Bolting' is the rapid elongation of these internodes just prior to flowering.

Step 3: Treatment with Gibberellins (specifically GA3) induces this internode elongation even under non-inductive conditions.

Step 4: While Auxins promote cell elongation, they do not specifically trigger bolting in rosette plants. Cytokinins promote cell division, and ABA is a growth inhibitor. Therefore, Gibberellin is the specific hormone responsible for this physiological effect.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 20

Q21.

Solution

Concept:

C4 plants have evolved a specialized mechanism to minimize photorespiration, involving a spatial separation of CO_2 fixation between mesophyll and bundle sheath cells.

Solution:

Step 1: In C4 plants, the primary CO_2 acceptor is Phosphoenolpyruvate (PEP), which is located in the mesophyll cells.

Step 2: The enzyme PEP carboxylase (PEPcase) catalyzes the fixation of CO_2 into a four-carbon compound called Oxaloacetic acid (OAA). This is the first stable product.

Step 3: This OAA is then converted into other four-carbon acids like malic acid or aspartic acid, which are subsequently transported to the bundle sheath cells.

Step 4: In the bundle sheath cells, these acids are decarboxylated to release CO_2 for the Calvin cycle. Thus, the initial fixation into OAA occurs in the mesophyll.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 21

Q22.

Solution

Concept:

The forebrain contains several structures responsible for higher-order functions, including the diencephalon which houses the hypothalamus.

Solution:

Step 1: The hypothalamus is a small but vital region located at the base of the thalamus.

Step 2: It contains a number of centers which control body temperature (thermoregulation), as well as the urge for eating (hunger) and drinking (thirst).

Step 3: It also secretes various hypothalamic hormones that regulate the pituitary gland, thereby coordinating the endocrine system.

Step 4: The cerebellum is for balance, the thalamus is a relay station for sensory impulses, and the medulla controls involuntary functions like respiration and cardiovascular reflexes.

Final Answer: C

Answer: (C)

Go Back to Question 22

Q23.

Solution

Concept:

According to the Sliding Filament Theory, muscle contraction occurs by the sliding of thin filaments over thick filaments without any change in the actual length of the filaments themselves.

Solution:

Step 1: A sarcomere is the functional unit of a muscle, bounded by two Z-lines. The I-band (Isotropic band) contains only thin actin filaments.

Step 2: During contraction, the myosin heads pull the actin filaments toward the center of the sarcomere (H-zone).

Step 3: As the actin filaments slide inward, the distance between the Z-lines decreases, and the I-band (the region of actin not overlapped by myosin) shortens.

Step 4: It is critical to note that the A-band (myosin length) remains constant. The shortening of the I-band is due to the increased overlap, not a change in the physical length of actin or myosin molecules.

Final Answer: A

Answer: (A)

Go Back to Question 23

Q24.

Solution

Concept:

Hormonal imbalances, specifically hyposecretion, lead to distinct clinical disorders due to the disruption of physiological homeostasis.

Solution:

Step 1: Insulin is produced by the pancreas. Its deficiency leads to high blood sugar levels and impaired glucose uptake, known as Diabetes mellitus (i-q).

Step 2: Thyroxine is produced by the thyroid gland. A lack of iodine or low thyroxine levels leads to the enlargement of the gland, called Simple Goitre (ii-s).

Step 3: Anti-diuretic hormone (ADH) regulates water reabsorption in the kidneys. Its deficiency leads to excessive dilute urination, known as Diabetes insipidus (iii-p).

Step 4: Parathyroid hormone (PTH) regulates calcium. Low PTH leads to low blood calcium, causing muscle spasms or Tetany (iv-r). Matching these yields Option A.

Final Answer: A

Answer: (A)

Go Back to Question 24

Q25.

Solution

Concept:

The menstrual cycle is regulated by a complex interplay of hormones from the hypothalamus, pituitary, and ovaries.

Solution:

Step 1: During the follicular phase, estrogen levels rise as follicles develop. High estrogen exerts positive feedback on the pituitary.

Step 2: This leads to a rapid secretion of Luteinizing Hormone (LH), reaching its maximum level in the middle of the cycle (around day 14).

Step 3: This phenomenon is known as the 'LH surge'. It is the immediate trigger that induces the rupture of the Graafian follicle and the release of the ovum (ovulation).

Step 4: This occurs exactly at the end of the follicular phase and the start of the luteal phase. Therefore, Option A is the most accurate description of its timing.

Final Answer: A

Answer: (A)

Go Back to Question 25

Q26.

Solution

Concept:

Restriction endonucleases are a specific class of enzymes belonging to the larger group called nucleases. They are fundamental tools in recombinant DNA technology.

Solution:

Step 1: In nature, these enzymes are part of the defense mechanism of bacteria against invading viruses (bacteriophages).

Step 2: Unlike exonucleases, which remove nucleotides from the ends of DNA, restriction endonucleases make cuts at specific points within the DNA molecule.

Step 3: Each restriction enzyme inspects the length of a DNA sequence and binds to a specific recognition sequence, usually a palindromic nucleotide sequence.

Step 4: Once bound, the enzyme cuts each of the two strands of the double helix at specific points in their sugar-phosphate backbones (phosphodiester bonds). Because they cut DNA with such precision at internal sites, they are aptly nicknamed 'Molecular Scissors'.

Final Answer: B

Answer: (B)

Go Back to Question 26

Q27.

Solution

Concept:

Ecological pyramids represent the relationship between different trophic levels in terms of number, biomass, or energy.

Solution:

Step 1: The pyramid of energy is a graphical representation of the amount of energy trapped per unit time and area in different trophic levels of food chain.

Step 2: According to the 10

Step 3: The remaining 90

Step 4: Because energy is lost at every successive step and cannot be recycled or reversed, the energy available to a higher trophic level is always less than that of the level below it. This ensures that the pyramid of energy can never be inverted and is always upright.

Final Answer: A

Answer: (A)

Go Back to Question 27

Q28.

Solution

Concept:

Natural selection is the process by which populations adapt to their environment. It can be categorized into three main types based on which phenotypes are favored.

Solution:

Step 1: Directional selection occurs when the environment changes, favoring individuals at one extreme of the phenotypic range.

Step 2: Disruptive selection occurs when environmental conditions favor individuals at both extremes of the phenotypic range over individuals with intermediate phenotypes.

Step 3: Stabilizing selection occurs in a stable environment. It acts against extreme phenotypes and favors the intermediate or "average" individuals.

Step 4: This results in a narrowing of the bell curve, reducing phenotypic variation but maintaining the status quo for a well-adapted population. An example is the birth weight of human infants. Therefore, stabilizing selection is the correct term.

Final Answer: C

Answer: (C)

Go Back to Question 28

Q29.

Solution

Concept:

Animals have evolved diverse respiratory organs to facilitate gas exchange, depending on their habitat and level of organization.

Solution:

Step 1: Earthworms use their moist, highly vascularized skin (cuticle) for gas exchange, not tracheal tubes.

Step 2: Prawns are aquatic crustaceans. They possess specialized structures called gills that allow them to extract dissolved oxygen from water.

Step 3: Scorpions (arachnids) use book lungs for respiration, while Ctenidia are specialized gills found in mollusks.

Step 4: Cockroaches (insects) have a complex system of tracheal tubes that open through spiracles; they do not breathe through their cuticle. Thus, the only correctly matched pair is Prawn with Gills.

Final Answer: B

Answer: (B)

Go Back to Question 29

Q30.

Solution

Concept:

Translation is the process by which the genetic information coded in mRNA is used to synthesize a polypeptide chain.

Solution:

Step 1: The process begins when the small subunit of the ribosome binds to the mRNA at the start codon (usually AUG).

Step 2: Ribosomes move along the mRNA strand, reading the codons one by one and facilitating the addition of corresponding amino acids via tRNA.

Step 3: This movement is directional. The ribosome always travels from the 5' end toward the 3' end of the mRNA molecule.

Step 4: As the ribosome moves, the polypeptide chain grows from the N-terminus to the C-terminus, but the physical "track" (the mRNA) is read in the 5' $\rightarrow$ 3' direction. Any other direction would result in a nonsensical protein sequence.

Final Answer: B

Answer: (B)

Go Back to Question 30

Q31.

Solution

Concept:

The ABO blood grouping system is based on the presence or absence of specific antigens (sugar polymers) on the surface of red blood cells (RBCs) and antibodies in the plasma.

Solution:

Step 1: Blood group 'O' is characterized by the total absence of both Antigen A and Antigen B on the surface of the erythrocytes.

Step 2: Because there are no A or B antigens to be recognized as "foreign" by the recipient's immune system, 'O' type blood does not trigger an immune response (agglutination) when transfused into individuals of other blood groups.

Step 3: However, individuals with blood group 'O' do have both Anti-A and Anti-B antibodies in their plasma, which is why they can only receive blood from other 'O' donors.

Step 4: While the Rh factor also plays a role in compatibility, the primary reason for the "universal donor" status in the ABO context is the lack of A and B antigens. Therefore, Option A is the correct explanation.

Final Answer: A

Answer: (A)

Go Back to Question 31

Q32.

Solution

Concept:

In genetic engineering, a vector is a DNA molecule used as a vehicle to artificially carry foreign genetic material into another cell.

Solution:

Step 1: pBR322 was one of the first versatile cloning vectors to be developed (1977). The 'p' stands for plasmid, and 'BR' stands for the researchers Bolivar and Rodriguez.

Step 2: It is a plasmid vector derived from *Escherichia coli*. It contains essential features such as an Origin of Replication (ori), which allows it to replicate independently within the host.

Step 3: It also features selectable markers, specifically antibiotic resistance genes for ampicillin (amp^R) and tetracycline (tet^R), which help in identifying transformed cells.

Step 4: Furthermore, it contains unique restriction sites for various enzymes (like PstI, BamHI, SalI) within these marker genes, allowing for insertional inactivation. Thus, pBR322 is a plasmid vector.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 32

Q33.

Solution

Concept:

Respiratory volumes represent the quantity of air that the lungs can hold, inhale, or exhale under different conditions, providing a measure of pulmonary function.

Solution:

Step 1: Tidal Volume (TV) is the air inspired or expired during normal breathing. Expiratory Reserve Volume (ERV) is the additional volume of air a person can expire by a forcible expiration.

Step 2: Even after the most forceful expiration, the lungs are never completely empty. Some air always remains in the alveoli and air passages to prevent the lungs from collapsing.

Step 3: This specific volume is known as the Residual Volume (RV). It cannot be measured directly by simple spirometry.

Step 4: Vital Capacity, on the other hand, is the maximum volume of air a person can breathe in after a forced expiration. Therefore, the volume remaining after forced expiration is the Residual Volume.

Final Answer: $\boxed{C}$

Answer: (C)

Go Back to Question 33

Q34.

Solution

Concept:

Chromosomal disorders in humans often arise due to non-disjunction during meiosis, leading to an abnormal number of chromosomes (aneuploidy).

Solution:

Step 1: Turner's syndrome is a genetic condition that specifically affects females. It is caused by the partial or complete absence of one of the X chromosomes.

Step 2: Instead of the normal 46 chromosomes (44 autosomes + XX), an individual with Turner's syndrome has only 45 chromosomes.

Step 3: Their chromosomal constitution is designated as 44 autosomes plus a single X chromosome, written as 44 + XO.

Step 4: This monosomy results in clinical features such as sterile ovaries (rudimentary), short stature, and lack of secondary sexual characteristics. Option A refers to Klinefelter's syndrome (XXY), and Option B is Jacob's syndrome. Thus, 44 + XO is the correct answer.

Final Answer: C

Answer: (C)

Go Back to Question 34

Q35.

Solution

Concept:

Double fertilization is a complex fertilization mechanism unique to flowering plants (angiosperms), involving two separate fusion events within the embryo sac.

Solution:

Step 1: After entering the synergid, the pollen tube releases two male gametes into the cytoplasm of the synergid.

Step 2: One male gamete (n) moves toward the egg cell and fuses with its nucleus. This fusion is called Syngamy, and it results in the formation of a diploid zygote ($2n$).

Step 3: The second male gamete (n) moves toward the central cell and fuses with the two polar nuclei (or the secondary nucleus). Since this involves the fusion of three haploid nuclei, it is termed Triple Fusion.

Step 4: Triple fusion results in the formation of the triploid Primary Endosperm Nucleus (PEN). The combination of Syngamy and Triple Fusion is called Double Fertilization.

Final Answer: A

Answer: (A)

Go Back to Question 35

Q36.

Solution

Concept:

The Juxtaglomerular Apparatus (JGA) is a specialized sensitive region formed by cellular modifications in the distal convoluted tubule and the afferent arteriole at the location of their contact.

Solution:

Step 1: The JGA plays a crucial role in regulating the Glomerular Filtration Rate (GFR). When there is a fall in glomerular blood flow, glomerular blood pressure, or GFR, the specialized Juxtaglomerular (JG) cells are activated.

Step 2: Upon activation, these JG cells release an enzyme called Renin into the bloodstream.

Step 3: Renin initiates the Renin-Angiotensin-Aldosterone System (RAAS) by converting angiotensinogen in the blood to angiotensin I and subsequently to angiotensin II.

Step 4: Angiotensin II, being a powerful vasoconstrictor, increases glomerular blood pressure and GFR. It also stimulates the adrenal cortex to release aldosterone. Therefore, the immediate substance released by JGA is Renin.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 36

Q37.

Solution

Concept:

Semi-conservative replication means that during DNA synthesis, the two strands of the parental DNA separate, and each serves as a template for the synthesis of a new complementary strand.

Solution:

Step 1: Matthew Meselson and Franklin Stahl performed the definitive experiment in 1958 to prove this model.

Step 2: They grew the bacterium *Escherichia coli* in a medium containing a heavy isotope of nitrogen ($^{15}NH_4Cl$) for many generations until the DNA was uniformly labeled with ^{15}N.

Step 3: They then transferred the cells into a medium with normal $^{14}NH_4Cl$ and took samples at definite time intervals (corresponding to cell division cycles).

Step 4: By using cesium chloride (CsCl) density gradient centrifugation, they observed hybrid DNA after one generation and both hybrid and light DNA after two generations. This proved the semi-conservative nature in *E. coli*. Note: Taylor proved it in *Vicia faba* using radioactive thymidine.

Final Answer: $\boxed{A}$

Answer: (A)

Go Back to Question 37

Q38.

Solution

Concept:

Biodiversity conservation strategies are broadly classified into two categories: In-situ (on-site) and Ex-situ (off-site) conservation.

Solution:

Step 1: In-situ conservation involves protecting the entire ecosystem so that the species is protected in its natural habitat. Examples include National Parks, Wildlife Sanctuaries, and Biosphere Reserves.

Step 2: Ex-situ conservation involves taking threatened animals and plants out from their natural habitat and placing them in special settings where they can be protected and given special care.

Step 3: Seed banks, botanical gardens, zoological parks, and cryopreservation are primary examples of Ex-situ conservation.

Step 4: In a seed bank, seeds of different genetic strains of commercially important plants can be stored for long periods in a viable and fertile condition. Since it involves moving the genetic material away from the natural environment, it is Ex-situ.

Final Answer: C

Answer: (C)

Go Back to Question 38

Q39.

Solution

Concept:

The human heart is myogenic, meaning the heartbeat is initiated by specialized nodal muscular tissue distributed in the heart wall.

Solution:

Step 1: The nodal tissue consists of the Sino-atrial node (SAN) and the Atrio-ventricular node (AVN).

Step 2: The SAN is responsible for initiating and maintaining the rhythmic contractile activity of the heart, acting as the "Natural Pacemaker."

Step 3: Anatomically, the SAN is located in the upper right corner of the right atrium, close to the opening of the superior vena cava.

Step 4: The AVN, by contrast, is located in the lower-left corner of the right atrium close to the atrio-ventricular septum. Therefore, the correct location for the SAN is the upper right corner of the right atrium.

Final Answer: B

Answer: (B)

Go Back to Question 39

Q40.

Solution

Concept:

The neuromuscular junction (NMJ) or motor end-plate is the junction between a motor neuron and the sarcolemma of a muscle fiber.

Solution:

Step 1: When a neural signal reaches the NMJ, it triggers the release of a chemical messenger from the synaptic vesicles of the axon terminal.

Step 2: This chemical messenger is a neurotransmitter that diffuses across the synaptic cleft to bind with receptors on the sarcolemma.

Step 3: In the case of skeletal muscle contraction, the specific and primary neurotransmitter used is Acetylcholine (ACh).

Step 4: The binding of Acetylcholine generates an action potential in the sarcolemma, which then spreads through the muscle fiber to release calcium ions from the sarcoplasmic reticulum. Dopamine and Serotonin are primarily central nervous system neurotransmitters.

Final Answer: $\boxed{C}$

Answer: (C)

Go Back to Question 40

Q41.

Solution

Concept:

Floral formulas are shorthand representations of the characteristics of flowers in a specific family, using symbols for symmetry, sexuality, and floral whorls.

Solution:

Step 1: Analyze the symmetry and sexuality of Solanaceae. Most members (like tomato, potato, and brinjal) have actinomorphic ($\oplus$) and bisexual ($\subsetneq$) flowers.

Step 2: Examine the calyx and corolla. There are 5 united sepals ($K_{(5)}$) and 5 united petals ($C_{(5)}$), often showing valvate aestivation.

Step 3: Look at the androecium. There are 5 stamens that are epipetalous (attached to the petals, represented by an arc over C and A).

Step 4: Evaluate the gynoecium. It is bicarpellary and syncarpous with a superior ovary ($\underline{G}_{(2)}$). Option A correctly represents all these features. Option C is the formula for Fabaceae.

Final Answer: $\boxed{A}$

Answer: (A)

Go Back to Question 41

Q42.

Solution

Concept:

Linkage describes the tendency of DNA sequences that are close together on a chromosome to be inherited together during the meiosis phase of sexual reproduction.

Solution:

Step 1: While Mendel worked on independent assortment in Garden Pea, he did not encounter linkage.

Step 2: Thomas Hunt Morgan carried out several dihybrid crosses in the fruit fly, *Drosophila melanogaster*, to study genes that were sex-linked.

Step 3: He observed that two genes did not segregate independently of each other and the F_2 ratio deviated significantly from the expected 9:3:3:1.

Step 4: He coined the term 'Linkage' to describe this physical association of genes on a chromosome and 'Recombination' to describe the generation of non-parental gene combinations. Thus, Morgan and Drosophila is the correct pair.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 42

Q43.

Solution

Concept:

The respiratory membrane is the anatomical site where gas exchange (oxygen and carbon dioxide) occurs between the alveoli and the blood.

Solution:

Step 1: The diffusion membrane is made up of three major layers.

Step 2: The first layer is the thin squamous epithelium of the alveoli.

Step 3: The second layer is the endothelium of the alveolar capillaries.

Step 4: The third layer is the basement substance (composed of a thin basement membrane supporting the squamous epithelium and the basement membrane surrounding the single layer endothelial cells of capillaries) in between them. Despite being three layers, its total thickness is much less than a millimeter, facilitating rapid diffusion.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 43

Q44.

Solution

Concept:

Evolutionary biology distinguishes between organs based on whether they share a common origin (homology) or a common function (analogy).

Solution:

Step 1: Homologous organs have the same anatomical structure and origin but may perform different functions (e.g., forelimbs of vertebrates).

Step 2: Analogous organs are structures that are anatomically different and have different origins but perform similar functions due to convergent evolution.

Step 3: Penguins (birds) and Dolphins (mammals) have flippers. These structures evolved independently in different lineages as adaptations for swimming.

Step 4: Because their internal structure is different but their function is identical, they are analogous. Thorns and tendrils (Option C) are homologous as both are modified axillary buds.

Final Answer: $\boxed{A}$

Answer: (A)

Go Back to Question 44

Q45.

Solution

Concept:

Aminoacylation is the preparatory step for translation where an amino acid is linked to its specific tRNA molecule.

Solution:

Step 1: Translation requires that amino acids are activated before they can be incorporated into a polypeptide chain.

Step 2: This activation involves the attachment of an amino acid to the 3' end of its cognate tRNA. This process is called aminoacylation (or charging of tRNA).

Step 3: The reaction is catalyzed by the enzyme aminoacyl-tRNA synthetase.

Step 4: This step is an energy-consuming process and specifically requires the hydrolysis of ATP to AMP and pyrophosphate. GTP is used later in the elongation and translocation steps of translation, but not for the initial charging.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 45

Q46.

Solution

Concept:

Antibodies, or immunoglobulins (Ig), are Y-shaped proteins produced by B-lymphocytes to identify and neutralize foreign objects like bacteria and viruses. There are five main classes: IgG, IgA, IgM, IgD, and IgE.

Solution:

Step 1: Identify the most prevalent antibody. IgG is the most abundant class of immunoglobulins in the blood, accounting for approximately 75

Step 2: Evaluate placental transfer. Among all the classes, only IgG has the unique ability to cross the placental barrier from the mother to the fetus.

Step 3: Understand the function. This transfer provides essential passive immunity to the newborn during the first few months of life, protecting it until its own immune system matures.

Step 4: Other antibodies have different roles: IgA is found in secretions like colostrum, IgM is the first produced during an infection, and IgE is involved in allergic reactions. Thus, IgG is the correct answer.

Final Answer: C

Answer: (C)

Go Back to Question 46

Q47.

Solution

Concept:

Enzymes are biocatalysts that speed up chemical reactions. To explain how they bind to substrates, various models have been proposed to describe the specificity of the active site.

Solution:

Step 1: The 'Lock and Key' hypothesis was the earliest model proposed to explain enzyme-substrate specificity.

Step 2: It was proposed by the German chemist Emil Fischer in 1894.

Step 3: The hypothesis suggests that the enzyme (the lock) has a rigid, pre-shaped active site that specifically fits a particular substrate (the key). Just as a specific key opens a specific lock, only a specific substrate can fit into the enzyme's active site to trigger a reaction.

Step 4: While this model was later refined by Koshland's 'Induced Fit' theory (which suggests the active site is flexible), Fischer is credited with the original Lock and Key concept.

Final Answer: A

Answer: (A)

Go Back to Question 47

Q48.

Solution

Concept:

Ecosystems are classified based on their environment. Marine ecosystems are the largest of Earth's aquatic ecosystems and are distinguished by waters that have high salt content.

Solution:

Step 1: The Great Barrier Reef is the world's largest coral reef system, located in the Coral Sea, off the coast of Queensland, Australia.

Step 2: Coral reefs are formed by colonies of coral polyps held together by calcium carbonate. These thrive in shallow, clear, tropical salt waters.

Step 3: Because this environment is characterized by high salinity and is part of the ocean, it is classified as a marine ecosystem.

Step 4: Estuarine ecosystems occur where freshwater meets saltwater, and freshwater ecosystems include lakes and rivers. Since the reef is purely oceanic, it is a marine ecosystem.

Final Answer: C

Answer: (C)

Go Back to Question 48

Q49.

Solution

Concept:

The lac operon is a classic model of gene regulation in prokaryotes (*E. coli*). it consists of structural genes and regulatory elements.

Solution:

Step 1: The lac operon contains three structural genes (z, y, and a) and a regulatory gene called the 'i' gene.

Step 2: The 'i' in the 'i' gene stands for 'inhibitor,' not inducer. This gene is expressed constitutively (all the time).

Step 3: The 'i' gene codes for the repressor protein. In the absence of an inducer (like lactose), the repressor binds to the operator region, preventing RNA polymerase from transcribing the structural genes.

Step 4: When lactose is present, it acts as an inducer and binds to the repressor, changing its shape so it can no longer bind to the operator. Therefore, the 'i' gene specifically codes for the repressor.

Final Answer: B

Answer: (B)

Go Back to Question 49

Q50.

Solution

Concept:

Erythropoiesis is the process of red blood cell production. While it occurs in the bone marrow, it is regulated by a hormone produced elsewhere in the body.

Solution:

Step 1: When oxygen levels in the blood decrease (hypoxia), the body needs to produce more RBCs to increase oxygen-carrying capacity.

Step 2: The primary sensor for blood oxygen levels is located in the kidneys.

Step 3: Specifically, the juxtaglomerular cells of the kidney respond to low oxygen by secreting a peptide hormone called Erythropoietin (EPO).

Step 4: EPO travels through the bloodstream to the red bone marrow, where it stimulates the proliferation and maturation of erythrocyte precursors. Thus, the kidney is the primary site of production for this hormone.

Final Answer: $\boxed{C}$

Answer: (C)

Go Back to Question 50

Q51.

Solution

Concept:

Pollination is the transfer of pollen grains from the anther to the stigma. Plants use various biotic (living) and abiotic (non-living) agents to achieve this.

Solution:

Step 1: Different agents have specific scientific names for the pollination they perform. Anemophily refers to pollination by wind, not insects (which is called Entomophily).

Step 2: Hydrophily is the term used for pollination where water acts as the medium for pollen transfer. This is relatively rare and is found in some aquatic plants like *Vallisneria* and *Hydrilla*.

Step 3: Ornithophily is pollination performed by birds, such as sunbirds and hummingbirds.

Step 4: Chiropterophily is the term for pollination by bats. Matching the terms, Option B is the only correctly matched pair where the term 'Hydrophily' correctly corresponds to the agent 'Water'.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 51

Q52.

Solution

Concept:

A sigmoid growth curve (S-curve) represents the typical growth pattern of cells, tissues, or organs in a natural environment over time.

Solution:

Step 1: The curve is divided into three distinct phases. The first is the 'Lag phase', characterized by initial slow growth as the organism adapts to the environment.

Step 2: The second phase is the 'Log phase' or 'Exponential phase'. During this period, the rate of growth increases rapidly, reaching its maximum potential.

Step 3: This rapid increase occurs because the progeny cells maintain the ability to divide, and resources are usually abundant during this window.

Step 4: Eventually, growth slows down due to limited resources (Deceleration phase) and finally reaches the 'Stationary phase' where the growth rate becomes zero. Therefore, maximum growth occurs during the Log phase.

Final Answer: B

Answer: (B)

Go Back to Question 52

Q53.

Solution

Concept:

Microbes are used extensively in the industrial production of bioactive molecules, which are chemicals used in medicine for specific therapeutic purposes.

Solution:

Step 1: Statins are a class of bioactive molecules that act as blood-cholesterol lowering agents.

Step 2: They function by competitively inhibiting the enzyme HMG-CoA reductase, which is responsible for the synthesis of cholesterol in the liver.

Step 3: Statins are produced commercially through the fermentation process of the yeast *Monascus purpureus*.

Step 4: Other microbes mentioned have different roles: *Trichoderma polysporum* produces Cyclosporin A (immunosuppressant), and *Aspergillus niger* is used for citric acid production. Thus, *Monascus purpureus* is the correct source.

Final Answer: B

Answer: (B)

Go Back to Question 53

Q54.

Solution

Concept:

Down's syndrome is an autosomal chromosomal disorder that leads to physical and mental developmental delays.

Solution:

Step 1: The primary cause is an extra copy of chromosome number 21 (trisomy). This usually occurs due to non-disjunction during gamete formation.

Step 2: Langdon Down first described this condition in 1866. Characteristic symptoms include a small round head, furrowed tongue, and a partially open mouth.

Step 3: It is an autosomal aneuploidy, meaning it affects the non-sex chromosomes.

Step 4: Statement D claims it is a "sex-linked recessive disorder." This is incorrect because sex-linked disorders (like Hemophilia or Color blindness) are caused by genes on the X or Y chromosomes, whereas Down's syndrome is a result of chromosomal number abnormality on an autosome.

Final Answer: D

Answer: (D)

Go Back to Question 54

Q55.

Solution

Concept:

The human sperm is a microscopic structure composed of a head, neck, middle piece, and a tail. Each part is specialized for the journey toward and fertilization of the ovum.

Solution:

Step 1: The head of the sperm contains an elongated haploid nucleus.

Step 2: The anterior portion of the head is covered by a cap-like structure called the 'Acrosome'.

Step 3: The acrosome is filled with enzymes, primarily hyaluronidase and acrosin (collectively called sperm lysins).

Step 4: These enzymes are essential for dissolving the protective layers of the ovum (corona radiata and zona pellucida), allowing the sperm nucleus to enter the egg. The middle piece provides energy (mitochondria), and the tail provides motility. Therefore, the acrosome contains the penetrating enzymes.

Final Answer: C

Answer: (C)

Go Back to Question 55

Q56.

Solution

Concept:

Primary productivity is the rate at which solar energy is captured by the producers (autotrophs) through the process of photosynthesis and converted into chemical energy in the form of organic matter.

Solution:

Step 1: Understand the total production. The total amount of solar energy captured and organic matter produced by plants per unit area over a given time period is called Gross Primary Productivity (GPP).

Step 2: Recognize the plant's own needs. A significant portion of this GPP is utilized by the plants themselves for their metabolic activities, primarily through respiration (R).

Step 3: Define the remainder. The energy that remains after accounting for respiratory losses ($GPP - R$) is called Net Primary Productivity (NPP). This is the biomass available for consumption by heterotrophs.

Step 4: Since the question specifically asks for the "rate of production of organic matter during photosynthesis" without subtracting losses, it refers to the Gross Primary Productivity.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 56

Q57.

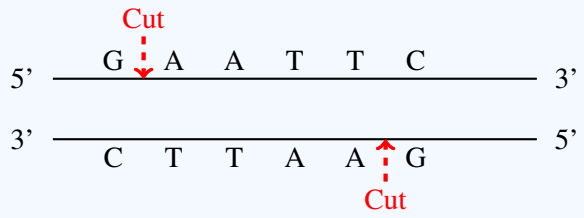
Solution

Concept: Restriction endonucleases are enzymes that cut DNA at specific recognition sequences called palindromic sites. A palindromic sequence in DNA is a sequence of base pairs that reads the same on the two strands when the orientation of reading (5' to 3') is kept the same.

Solution: Step 1: EcoRI is a restriction enzyme isolated from the bacterium *Escherichia coli* RY 13. It was the first restriction enzyme to be isolated from this strain.
Step 2: Each restriction endonuclease functions by 'inspecting' the length of a DNA sequence. Once it finds its specific recognition sequence, it will bind to the DNA and cut each of the two strands of the double helix at specific points in their sugar-phosphate backbones.
Step 3: The specific palindromic sequence recognized by EcoRI is:

5' — GAATTC — 3'
3' — CTTAAG — 5'

Step 4: The enzyme cuts between the G and A bases on both strands, leaving overhanging single-stranded stretches called "sticky ends" (5' - AATT - 3'). These ends are useful in genetic engineering as they can form hydrogen bonds with their complementary cut counterparts.
Step 5: Other options represent different enzymes: (B) 5' - GGATCC - 3' is for BamHI, (C) 5' - AGCT - 3' is for AluI, and (D) 5' - CCCGGG - 3' is for SmaI.



EcoRI Cleavage Site

The enzyme cuts between G and A, producing sticky ends.

Final Answer: (A) 5' - GAATTC - 3'

Answer: (A)

Go Back to Question 57

Q58.

Solution

Concept:

After entering the human body, the Human Immunodeficiency Virus (HIV) targets specific cells of the immune system to replicate and increase its population.

Solution:

Step 1: Upon infection, the HIV virus first enters into the macrophages.

Step 2: Inside the macrophage, the RNA genome of the virus replicates to form viral DNA with the help of the enzyme reverse transcriptase. This viral DNA then incorporates into the host cell's DNA.

Step 3: The infected macrophage begins to produce viral particles. Because the macrophage continues to survive and pump out new viruses like a production line, it is referred to as an 'HIV factory'.

Step 4: Simultaneously, HIV enters into Helper T-lymphocytes (T_H cells) where it replicates and causes their destruction, leading to a progressive decrease in their count and the onset of AIDS. However, the term 'factory' specifically applies to macrophages.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 58

Q59.

Solution

Concept:

Symbiosis or mutualism is an interaction where both species benefit from each other. Lichens are a classic example of such a close, integrated relationship.

Solution:

Step 1: A lichen is not a single organism but a composite entity formed by the association of two different organisms.

Step 2: The first component is an autotrophic partner, typically a green alga or a cyanobacterium, known as the 'Phycobiont'.

Step 3: The second component is a heterotrophic partner, a fungus (usually Ascomycetes or Basidiomycetes), known as the 'Mycobiont'.

Step 4: The alga prepares food through photosynthesis for the fungus, while the fungus provides protection, anchorage, and absorbs water and minerals for the alga. An association between fungi and roots of higher plants is called Mycorrhiza. Therefore, Lichens are Algae and Fungus.

Final Answer: $\boxed{A}$

Answer: (A)

Go Back to Question 59

Q60.

Solution

Concept:

The digestive process is regulated by local hormones produced by the gastrointestinal mucosa in response to the presence of food.

Solution:

Step 1: When food containing fats enters the duodenum (the first part of the small intestine), the intestinal mucosa secretes certain hormones into the blood.

Step 2: One of these hormones is Cholecystokinin (CCK).

Step 3: CCK acts on two main targets: the pancreas (to stimulate the release of pancreatic enzymes) and the gallbladder.

Step 4: It causes the gallbladder to contract, which squeezes the stored bile into the common bile duct and then into the duodenum to aid in the emulsification of fats. Secretin, by contrast, primarily stimulates the secretion of water and bicarbonate ions from the pancreas.

Final Answer: C

Answer: (C)

Go Back to Question 60

Q61.

Solution

Concept:

In the genetic code, specific three-nucleotide sequences called codons determine the start and stop of protein synthesis (translation).

Solution:

Step 1: The process of translation begins with the binding of the small ribosomal subunit to the mRNA. It scans for a specific initiation signal.

Step 2: In almost all organisms and for nearly every mRNA, the 'Start Codon' is AUG.

Step 3: AUG has a dual function: it acts as the initiation codon and it also codes for the amino acid Methionine (formyl-methionine in prokaryotes).

Step 4: Codons like UAA, UAG, and UGA do not code for any amino acids and serve as "Stop Codons" or termination signals to end the polypeptide chain. Therefore, AUG is the universal start codon.

Final Answer: C

Answer: (C)

Go Back to Question 61

Q62.

Solution

Concept:

Human evolution is marked by a progressive increase in brain size (cranial capacity) and complexity, alongside the development of tool-making and social structures.

Solution:

Step 1: *Homo habilis* is considered one of the earliest members of the genus *Homo*, appearing about 2 million years ago.

Step 2: They are often called 'Handy Man' because they were the first to make and use stone tools.

Step 3: Based on fossil evidence (skulls), their brain size was significantly larger than that of Australopithecines but smaller than later hominids.

Step 4: The cranial capacity of *Homo habilis* ranged between 650–800 cc. For comparison, *Homo erectus* had a capacity of about 900 cc, and Neanderthals had about 1400 cc.

Final Answer: $\boxed{A}$

Answer: (A)

Go Back to Question 62

Q63.

Solution

Concept:

DNA is a double-helical structure consisting of two polynucleotide chains. The stability of this helix depends on specific chemical bonds between the two strands.

Solution:

Step 1: The backbone of each DNA strand is formed by sugar-phosphate groups linked by covalent phosphodiester bonds.

Step 2: However, the two strands are held together in the center by the pairing of nitrogenous bases (Purines and Pyrimidines).

Step 3: This pairing is governed by Hydrogen bonds. Adenine (A) pairs with Thymine (T) via two hydrogen bonds ($A = T$), and Guanine (G) pairs with Cytosine (C) via three hydrogen bonds ($G \equiv C$).

Step 4: While individual hydrogen bonds are weak, the cumulative effect of millions of these bonds across the DNA molecule provides the necessary stability to hold the helix together. Glycosidic bonds link the base to the sugar within a nucleotide.

Final Answer: $\boxed{C}$

Answer: (C)

Go Back to Question 63

Q64.

Solution

Concept:

Bio-fuels are renewable energy sources derived from biological materials. Bio-diesel is specifically produced from plants containing high amounts of vegetable oils.

Solution:

Step 1: Certain plants produce "petro-crops" or oils that can be chemically converted into a fuel that can replace or be blended with conventional diesel.

Step 2: The most prominent plant used for this purpose globally, especially in India, is *Jatropha curcas*.

Step 3: The seeds of Jatropha contain high levels of non-edible oil that can be processed into bio-diesel through a process called transesterification.

Step 4: While other plants like Brassica (mustard) or Helianthus (sunflower) also produce oil, Jatropha is the primary species cultivated specifically for large-scale bio-diesel production on marginal lands.

Final Answer: $\boxed{A}$

Answer: (A)

Go Back to Question 64

Q65.

Solution

Concept:

Biofortification is the process of breeding crops with higher levels of vitamins and minerals, or higher protein and healthier fats, to improve public health.

Solution:

Step 1: Golden Rice is a genetically modified (transgenic) variety of rice (*Oryza sativa*).

Step 2: It was developed to address dietary deficiencies in parts of the world where rice is a staple food but lacks essential micronutrients.

Step 3: Scientists inserted genes from maize and a bacterium into the rice genome to allow the plant to produce Beta-carotene in the grain.

Step 4: Beta-carotene is a precursor that the human body converts into Vitamin A. This gives the rice its characteristic golden-yellow color. Therefore, Golden Rice is biofortified with Vitamin A.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 65

Q66.

Solution

Concept:

A 'Living Fossil' is an organism that has remained essentially unchanged from earlier geologic times and whose close relatives are usually extinct.

Solution:

Step 1: Within the Phylum Arthropoda, there is a specific chelicerate arthropod that has existed for over 450 million years.

Step 2: *Limulus*, commonly known as the King Crab or Horseshoe Crab, is the classic example of a living fossil.

Step 3: While other arthropods like *Apis* (Honey bee), *Locusta* (Locust), and *Laccifer* (Lac insect) have undergone significant evolutionary changes and belong to diverse modern lineages, *Limulus* retains primitive features.

Step 4: It provides a unique window into the morphology of ancient arthropods. Thus, Option B is the correct choice.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 66

Q67.

Solution

Concept:

Double fertilization is a hallmark of Angiosperms. It involves two separate fusion events: Syngamy and Triple Fusion.

Solution:

Step 1: During the process of fertilization, two male gametes are released into the embryo sac.

Step 2: One male gamete fuses with the egg cell to form the zygote ($2n$).

Step 3: The second male gamete (n) moves toward the center of the embryo sac and fuses with the two polar nuclei (which often fuse to form a secondary nucleus, $2n$).

Step 4: This fusion of three haploid nuclei is called 'Triple Fusion'. It results in the formation of a triploid ($3n$) nucleus known as the Primary Endosperm Nucleus (PEN). This nucleus eventually develops into the endosperm, which provides nourishment to the growing embryo.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 67

Q68.

Solution

Concept:

The digestive system is regulated by several hormones that either stimulate or inhibit the secretion of digestive juices to ensure efficient nutrient processing.

Solution:

Step 1: Gastrin is a hormone that stimulates the secretion of HCl and gastric motility.

Step 2: When fatty chyme enters the duodenum, the intestinal mucosa releases hormones to slow down the stomach's activity, allowing more time for fat digestion.

Step 3: Enterogastrone (also known as Gastric Inhibitory Peptide or GIP) is the primary hormone responsible for inhibiting gastric secretions and slowing down the churning of the stomach.

Step 4: Secretin primarily affects the pancreas, and CCK affects the gallbladder. Therefore, Enterogastrone is the specific inhibitor for gastric activity.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 68

Q69.

Solution

Concept:

Plants growing in specific challenging environments, such as saline swamps, develop specialized modifications to ensure survival and physiological functioning.

Solution:

Step 1: In swampy or marshy areas (mangroves), the soil is waterlogged and lacks sufficient oxygen for root respiration.

Step 2: To overcome this, plants like *Rhizophora* develop specialized roots that grow vertically upward out of the soil/water.

Step 3: These roots are called 'Pneumatophores' or breathing roots. They possess numerous small pores called lenticels or pneumathodes on their surface.

Step 4: These pores allow for the exchange of gases, enabling the underground root system to receive oxygen from the atmosphere. *Opuntia* is a xerophyte with phylloclades. Thus, *Rhizophora* and swampy areas is the correct match.

Final Answer: $\boxed{A}$

Answer: (A)

Go Back to Question 69

Q70.

Solution

Concept:

Biodiversity conservation is categorized based on whether the protection happens inside or outside the natural habitat of the species.

Solution:

Step 1: In-situ conservation (on-site) aims to protect species by maintaining them in their natural ecosystems.

Step 2: Biosphere Reserves, National Parks, Wildlife Sanctuaries, and Sacred Groves are all examples of In-situ conservation.

Step 3: Ex-situ conservation (off-site) involves removing the species from its natural habitat and placing it in a controlled environment.

Step 4: Botanical Gardens, Zoological Parks, and Cryopreservation (storing at very low temperatures) are Ex-situ methods. Among the options, Biosphere Reserve is the only In-situ method.

Final Answer: C

Answer: (C)

Go Back to Question 70

Q71.

Solution

Concept:

Genetics is the branch of biology concerned with the study of genes, genetic variation, and heredity in organisms.

Solution:

Step 1: Gregor Mendel is known as the "Father of Genetics" for his work on pea plants, but he used the term "factors" instead of genes or genetics.

Step 2: The term 'Genetics' was actually coined by the British biologist William Bateson in 1905.

Step 3: Bateson was a staunch defender of Mendelian inheritance and played a key role in bringing Mendel's work to the English-speaking scientific community.

Step 4: Other scientists like Morgan focused on linkage, and Hugo de Vries proposed the mutation theory. Therefore, the credit for the nomenclature 'Genetics' goes to William Bateson.

Final Answer: B

Answer: (B)

Go Back to Question 71

Q72.

Solution

Concept:

The kidney's primary function is to filter blood and form urine. This is achieved through millions of microscopic functional units.

Solution:

Step 1: The nephron is the structural and functional unit of the kidney. Each human kidney contains approximately one million nephrons.

Step 2: A nephron consists of two main parts: the renal corpuscle and the renal tubule.

Step 3: The renal corpuscle includes the Glomerulus and Bowman's capsule, where filtration occurs. The renal tubule includes the Proximal Convoluted Tubule (PCT), Henle's loop, and Distal Convoluted Tubule (DCT).

Step 4: Neurons are units of the nervous system, and alveoli are units of the respiratory system. Thus, the nephron and its tubule system are the correct components.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 72

Q73.

Solution

Concept:

DNA replication is a semi-conservative process requiring several enzymes to work in a coordinated manner to copy the genetic blueprint.

Solution:

Step 1: The first step in replication is the separation of the two strands of the DNA double helix.

Step 2: The enzyme Helicase acts as the "unzipper." It moves along the DNA molecule and uses energy from ATP to break the hydrogen bonds between the nitrogenous bases.

Step 3: This unwinding creates the replication fork.

Step 4: While Topoisomerase prevents supercoiling ahead of the fork, and DNA Polymerase synthesizes the new strand, the physical act of unwinding the helix is the specific job of Helicase.

Final Answer: $\boxed{C}$

Answer: (C)

Go Back to Question 73

Q74.

Solution

Concept:

Carbon dioxide is a metabolic waste product that must be transported from the tissues to the lungs for elimination.

Solution:

Step 1: CO_2 is transported in the blood in three main ways: dissolved in plasma (about 7

Step 2: The vast majority (approximately 70

Step 3: Inside the RBCs, CO_2 reacts with water to form carbonic acid, facilitated by the enzyme carbonic anhydrase. This acid then dissociates into bicarbonate and hydrogen ions.

Step 4: The bicarbonate ions then diffuse into the plasma. This is the most efficient and primary method of CO_2 transport in humans.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 74

Q75.

Solution

Concept:

A sarcomere is the segment of a myofibril between two successive Z-lines. It has a specific arrangement of thick and thin filaments.

Solution:

Step 1: The A-band (Anisotropic band) is the dark band in the center of the sarcomere.

Step 2: Its length is determined by the total length of the thick filaments (Myosin).

Step 3: However, in a resting muscle, the ends of the thin filaments (Actin) overlap with the thick filaments within the A-band.

Step 4: Therefore, the A-band contains the entire length of the thick filaments and the overlapping portions of the thin filaments. This means it contains both actin and myosin. Only the central H-zone within the A-band contains only myosin.

Final Answer: $\boxed{C}$

Answer: (C)

Go Back to Question 75

Q76.

Solution

Concept:

Human health and diseases involve understanding the relationship between a specific pathogen (virus, bacteria, fungi, or protozoa) and the clinical condition it causes.

Solution:

Step 1: Analyze each pair. Typhoid is a bacterial disease caused by the ingestion of contaminated food or water containing *Salmonella typhi*. This is a correct match.

Step 2: Malaria is caused by a protozoan, *Plasmodium* (e.g., *P. vivax*), not by *Wuchereria bancrofti*, which causes Filariasis (Elephantiasis).

Step 3: Pneumonia is primarily caused by bacteria like *Streptococcus pneumoniae* or *Haemophilus influenzae*, not by *Plasmodium*.

Step 4: The Common Cold is caused by Rhinoviruses, while *Haemophilus influenzae* is a bacterium that causes pneumonia or meningitis. Therefore, Option A is the only correctly matched pair.

Final Answer: $\boxed{A}$

Answer: (A)

Go Back to Question 76

Q77.

Solution

Concept:

Biotechnology allows for the production of biological insecticides. The soil bacterium *Bacillus thuringiensis* (Bt) produces a crystalline (Cry) protein that is toxic to certain insect larvae.

Solution:

Step 1: The Bt-toxin protein is synthesized as an inactive "pro-toxin" within the bacterium. This is why the bacterium itself is not killed by the toxin.

Step 2: When an insect (like a bollworm) ingests the transgenic plant tissue, the pro-toxin enters the insect's midgut.

Step 3: The midgut of the insect has a specific pH environment. Unlike the human stomach which is acidic, the insect's gut is highly alkaline.

Step 4: This alkaline pH facilitates the solubilization of the protein crystals and converts the inactive pro-toxin into an active toxin. The active toxin then binds to the midgut epithelial cells, creating pores that cause cell swelling and eventual death.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 77

Q78.

Solution

Concept:

Population interactions describe the impact that two different species living together have on each other. These can be positive, negative, or neutral.

Solution:

Step 1: Mutualism is where both benefit $(+/+)$. Parasitism and Predation are where one benefits and the other is harmed $(+/-)$.

Step 2: Commensalism is a unique interaction where one species (the commensal) derives a benefit, while the other species (the host) is neither helped nor harmed $(+/0)$.

Step 3: Classic examples include an orchid growing as an epiphyte on a mango branch, or barnacles growing on the back of a whale. The orchid and barnacles get a place to live/transport, while the mango tree and whale remain unaffected.

Step 4: Therefore, the definition of commensalism is that one species is benefited and the other is neutral.

Final Answer: $\boxed{C}$

Answer: (C)

Go Back to Question 78

Q79.

Solution

Concept:

The cell wall is a rigid outer layer that provides structural support and protection. Its chemical composition varies significantly across different kingdoms of life.

Solution:

Step 1: In the Kingdom Plantae, the primary component of the cell wall is Cellulose.

Step 2: In the Kingdom Fungi, the cell wall is composed of Chitin (a polymer of N-acetylglucosamine).

Step 3: In the Kingdom Monera (Bacteria), the cell wall is composed of a unique complex called Peptidoglycan (also known as murein).

Step 4: Peptidoglycan consists of sugar chains (NAG and NAM) cross-linked by short peptide fragments. This structure is the target of many antibiotics like penicillin. Therefore, Peptidoglycan is the correct component for bacteria.

Final Answer: $\boxed{C}$

Answer: (C)

Go Back to Question 79

Q80.

Solution

Concept:

The human brain is divided into functional regions. The diencephalon, located between the cerebrum and the midbrain, contains two major structures: the thalamus and hypothalamus.

Solution:

Step 1: The thalamus is a large mass of grey matter situated in the forebrain.

Step 2: It serves as the primary "relay station" for the brain. Almost all sensory information (except smell) that goes to the cerebral cortex first stops at the thalamus.

Step 3: It filters and coordinates these sensory impulses, as well as motor signals, before directing them to the appropriate area of the cerebrum.

Step 4: The hypothalamus is mainly for homeostatic control, and the cerebrum is for higher cognitive functions. Thus, the thalamus is the correct relay center.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 80

Q81.

Solution

Concept:

International environmental protocols are agreements between nations to address specific global ecological threats. The Montreal Protocol is one of the most successful examples of such cooperation.

Solution:

Step 1: In the 1970s and 80s, scientists discovered that the Earth's protective ozone layer in the stratosphere was thinning due to human-made chemicals.

Step 2: The primary culprits were chlorofluorocarbons (CFCs) and other halocarbons, collectively known as Ozone Depleting Substances (ODS).

Step 3: The Montreal Protocol was signed in 1987 (and became effective in 1989) to phase out the production and consumption of these substances.

Step 4: Greenhouse gases like CO_2 and methane are addressed by the Kyoto Protocol and the Paris Agreement. Therefore, the Montreal Protocol specifically targets ozone-depleting substances.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 81

Q82.

Solution

Concept:

Epithelial tissues are categorized by cell shape and specialized modifications. Certain tissues require the physical movement of mucus or particles across their surface.

Solution:

Step 1: Ciliated epithelium consists of columnar or cuboidal cells that possess fine, hair-like protoplasmic outgrowths called cilia on their free surface.

Step 2: The function of cilia is to move particles or mucus in a specific direction over the epithelium.

Step 3: In the human body, this tissue is strategically located in the inner lining of hollow organs. In the fallopian tubes, it helps move the ovum toward the uterus.

Step 4: In the respiratory tract (bronchioles and trachea), it helps move mucus and trapped dust particles toward the pharynx. Squamous epithelium is for filtration and diffusion. Thus, Ciliated epithelium is the correct answer.

Final Answer: C

Answer: (C)

Go Back to Question 82

Q83.

Solution

Concept:

The menstrual cycle involves the transformation of the ovarian follicle after ovulation into a temporary endocrine structure.

Solution:

Step 1: After ovulation (release of the secondary oocyte), the ruptured Graafian follicle is transformed into a yellow glandular body called the Corpus Luteum.

Step 2: The primary function of the Corpus Luteum is to secrete the hormone Progesterone.

Step 3: Progesterone is essential for the maintenance of the endometrium (the inner lining of the uterus). A thick, well-vascularized endometrium is necessary for the implantation of the fertilized ovum and for pregnancy.

Step 4: If fertilization does not occur, the Corpus Luteum degenerates, leading to a drop in progesterone levels and the subsequent shedding of the endometrium (menstruation).

Final Answer: B

Answer: (B)

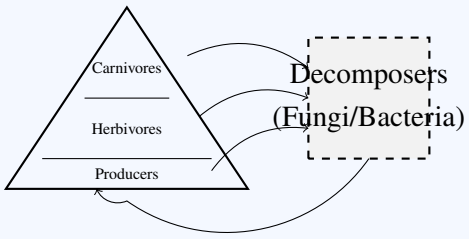
Go Back to Question 83

Q84.

Solution

Concept: A trophic level represents the specific place an organism occupies in a food chain based on its source of nutrition or food. While producers, herbivores, and carnivores follow a linear hierarchy, decomposers play a unique role in recycling nutrients.

Solution: Step 1: The first trophic level is always occupied by producers (autotrophs) like plants. The second level consists of primary consumers (herbivores), and the third level consists of secondary consumers (carnivores).
Step 2: Decomposers (saprotrophs), such as fungi and bacteria, break down the complex organic matter of dead producers and consumers into simple inorganic substances.
Step 3: Because decomposers derive energy from dead organisms at all trophic levels—including plants, herbivores, and top predators—they do not fit into a single linear step of the food chain.
Step 4: In many ecological models, decomposers are placed in a separate category that connects back to the soil/producers, rather than being labeled as the "fourth" or "fifth" level in a simple grazing food chain.
Step 5: Therefore, they are not typically assigned a single specific trophic level in the standard 1, 2, 3 hierarchy.



Decomposers recycle nutrients from all levels back to the environment.

Final Answer: (D) They are not typically assigned a single specific trophic level

Answer: (D)

Go Back to Question 84

Q85.

Solution

Concept:

Sugars are classified as 'reducing' or 'non-reducing' based on their ability to reduce alkaline solutions of copper (like Fehling's or Benedict's solution).

Solution:

Step 1: A sugar is reducing if it has a free aldehyde or ketone group (anomeric carbon) that is not involved in a glycosidic bond.

Step 2: Monosaccharides like Glucose and Fructose are all reducing sugars.

Step 3: Disaccharides like Maltose and Lactose are also reducing because they have one free anomeric carbon.

Step 4: Sucrose (table sugar) is a disaccharide composed of glucose and fructose. In sucrose, the reducing groups of both glucose and fructose are involved in the glycosidic bond. Since there is no free reducing group, sucrose is a non-reducing sugar.

Final Answer: C

Answer: (C)

Go Back to Question 85

Q86.

Solution

Concept:

Amniocentesis is a fetal condition diagnostic test performed during pregnancy. It involves withdrawing a small amount of amniotic fluid, which contains fetal cells, to analyze the genetic health of the developing embryo.

Solution:

Step 1: The primary and legitimate purpose of amniocentesis is to detect chromosomal abnormalities (like Down's syndrome), metabolic disorders, or neural tube defects in the fetus.

Step 2: However, because the fetal cells contain the sex chromosomes (XX or XY), the test can also easily determine the sex of the unborn child.

Step 3: In several regions, this led to a high rate of female feticide. Consequently, individuals began misusing the technology for prenatal sex determination rather than for its intended medical purpose.

Step 4: To curb this, the Indian government has strictly regulated the test under the PNDT Act. While it is designed for detecting abnormalities (Option A), its "misuse" refers specifically to sex determination.

Final Answer: B

Answer: (B)

Go Back to Question 86

Q87.

Solution

Concept:

Genetic engineering requires a specialized molecular toolkit. To create recombinant DNA, fragments of DNA from different sources must be physically connected to one another.

Solution:

Step 1: Restriction endonucleases act as "scissors" to cut DNA at specific sequences.

Step 2: Once the DNA of interest and the vector DNA have been cut (often producing sticky ends), they need to be sealed together.

Step 3: The enzyme DNA Ligase acts as the "molecular glue." It facilitates the formation of a phosphodiester bond between the 3'-hydroxyl group of one nucleotide and the 5'-phosphate group of another.

Step 4: This covalently closes the sugar-phosphate backbone, resulting in a single, continuous DNA molecule. Alkaline phosphatase is used to prevent self-ligation of vectors. Thus, DNA Ligase is the joining enzyme.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 87

Q88.

Solution

Concept:

Protein digestion in the small intestine is a multi-step process involving enzymes from the pancreas that are secreted in an inactive (proenzyme) form to prevent self-digestion of the organ.

Solution:

Step 1: The pancreas secretes pancreatic juice into the duodenum, which contains inactive trypsinogen, chymotrypsinogen, and procarboxypeptidases.

Step 2: Trypsinogen must be activated to trypsin to begin the protein breakdown process.

Step 3: The intestinal mucosa (brush border) secretes an enzyme called Enterokinase (also known as enteropeptidase).

Step 4: Enterokinase specifically targets trypsinogen and converts it into active trypsin. Once formed, trypsin then autocatalytically activates the remaining trypsinogen and other pancreatic enzymes. Pepsinogen activation occurs in the stomach via HCl.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 88

Q89.

Solution

Concept:

The adrenal medulla secretes catecholamines (adrenaline and noradrenaline) in response to stress or emergency situations.

Solution:

Step 1: Adrenaline (Epinephrine) is rapidly secreted during conditions of physical or emotional stress, such as fear, anger, or pain.

Step 2: This hormone prepares the body for an immediate physical response. It increases alertness, pupillary dilation, heart rate, the strength of heart contraction, and the rate of respiration.

Step 3: It also stimulates the breakdown of glycogen into glucose to provide a quick energy boost. These combined effects are known as the "fight or flight" response.

Step 4: Because of its critical role in helping the body cope with sudden threats, it is nicknamed the 'Emergency Hormone'. Insulin regulates blood sugar, and Oxytocin is for birth/milk ejection.

Final Answer: B

Answer: (B)

Go Back to Question 89

Q90.

Solution

Concept:

The Green Revolution in India was characterized by the introduction of high-yielding, disease-resistant, semi-dwarf varieties of cereal crops.

Solution:

Step 1: During the 1960s, Norman Borlaug developed semi-dwarf wheat at CIMMYT in Mexico.

Step 2: These varieties were introduced to India, but they needed to be adapted to local conditions and consumer preferences (such as grain color).

Step 3: Indian scientists used conventional plant breeding techniques, specifically hybridization and selection, to develop Indian varieties.

Step 4: 'Sonalika' and 'Kalyan Sona' were the result of these breeding programs. They were high-yielding and resistant to rust diseases, leading to a dramatic increase in wheat production. Mutation breeding was used for 'Prabhan' (mung bean). Thus, plant hybridization is the correct method.

Final Answer: C

Answer: (C)

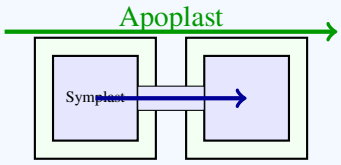
Go Back to Question 90

Q91.

Solution

Concept: Water absorption in plants occurs through two distinct pathways: the apoplast and the symplast. The apoplast consists of the non-living network of cell walls and intercellular spaces, while the symplast involves the living system of interconnected protoplasts.

Solution: Step 1: The apoplastic pathway is the system of adjacent cell walls that is continuous throughout the plant, except at the Casparian strips of the endodermis in the roots.
Step 2: In this pathway, water movement occurs exclusively through the intercellular spaces and the walls of the cells. This movement does not involve crossing the cell membrane.
Step 3: Movement through the apoplast is dependent on a gradient and is facilitated by mass flow. It provides the least resistance to water movement.
Step 4: The symplastic pathway, in contrast, involves water moving from cell to cell through the cytoplasm, connected by bridge-like structures called plasmodesmata. This movement is relatively slower as it requires crossing the plasma membrane.
Step 5: Therefore, the movement through cell walls and intercellular spaces is specifically defined as the apoplastic pathway.



Apoplast: Through cell walls (Green arrow)
Symplast: Through cytoplasm (Blue arrow)

Final Answer: (B) Apoplastic

Answer: (B)

Go Back to Question 91

Q92.

Solution

Concept:

The family Liliaceae, commonly called the "Lily family," is a characteristic representative of monocotyledonous plants with specific floral and vegetative traits.

Solution:

Step 1: Analyze the floral traits of Liliaceae. They typically have a perianth (where sepals and petals are not distinct) consisting of six tepals (3 + 3).

Step 2: The androecium consists of six stamens, which are often epiphyllous (attached to the perianth) rather than epipetalous (attached to petals, as seen in Solanaceae).

Step 3: The gynoecium is tricarpellary and syncarpous with a superior, trilocular ovary.

Step 4: The placentation is axile with many ovules. Evaluating the statements, 'epipetalous stamens' is incorrect for this family because they possess tepals, making the stamens 'epiphyllous'.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 92

Q93.

Solution

Concept:

Lichens are highly sensitive to environmental changes because they lack a waxy cuticle and obtain most of their nutrients directly from the atmosphere.

Solution:

Step 1: Lichens are symbiotic associations between algae and fungi. They are known as "pioneer species" but are extremely vulnerable to industrial pollution.

Step 2: They are particularly sensitive to high levels of sulfur dioxide (SO_2) in the air. SO_2 interferes with the photosynthetic pigment of the algal partner (phycobiont).

Step 3: Because they cannot excrete the pollutants they absorb, they die off in areas with poor air quality.

Step 4: Consequently, the absence of lichens in an area that should naturally support them is a reliable biological indicator of significant air pollution. Therefore, they are indicators of air (SO_2) pollution.

Final Answer: $\boxed{C}$

Answer: (C)

Go Back to Question 93

Q94.

Solution

Concept:

Adaptive radiation is an evolutionary process in which organisms diversify rapidly from an ancestral species into a multitude of new forms, particularly when a change in the environment makes new resources available.

Solution:

Step 1: Charles Darwin observed a variety of small black birds on the Galapagos Islands, later known as Darwin's Finches.

Step 2: He realized that all these varieties evolved on the islands themselves from an original seed-eating ancestral species that migrated from the mainland.

Step 3: Due to competition and the availability of different food sources (insects, cactus, seeds), the beaks of these birds became modified over generations to suit their specific feeding habits.

Step 4: This process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography (habitats) is called adaptive radiation.

Final Answer: A

Answer: (A)

Go Back to Question 94

Q95.

Solution

Concept:

Intrauterine Devices (IUDs) are effective contraceptive methods inserted into the uterus. They are classified into non-medicated, copper-releasing, and hormone-releasing types.

Solution:

Step 1: Non-medicated IUDs like Lippes loop increase phagocytosis of sperm.

Step 2: Copper-releasing IUDs (CuT, Cu7, Multiload 375) release copper ions that suppress sperm motility and fertilizing capacity.

Step 3: Hormone-releasing IUDs, such as Progestasert and LNG-20, release small amounts of progestogens.

Step 4: These hormones make the uterus unsuitable for implantation and the cervix hostile to the sperm. LNG-20 is a specific example of a hormone-releasing IUD. Therefore, Option C is correct.

Final Answer: C

Answer: (C)

Go Back to Question 95

Q96.

Solution

Concept:

The reproductive phase in human females is marked by specific physiological milestones related to the beginning and end of the menstrual cycle.

Solution:

Step 1: The first menstruation that begins at puberty (typically between ages 11–15) is termed 'Menarche'. It signals the start of the reproductive life.

Step 2: Menstruation occurs repeatedly at an interval of about 28/29 days.

Step 3: Around the age of 50, the menstrual cycles cease, and the ovaries stop releasing eggs. This permanent cessation of menstruation is called 'Menopause'.

Step 4: Therefore, the correct sequence for the first and the final cessation is Menarche and Menopause, respectively. This corresponds to Option B.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 96

Q97.

Solution

Concept:

The 'Central Dogma' of molecular biology explains the flow of genetic information from DNA to RNA to Protein.

Solution:

Step 1: The process of copying genetic information from one strand of the DNA into RNA is termed 'Transcription'.

Step 2: In eukaryotic cells, this process takes place inside the nucleus, where the DNA is located.

Step 3: The newly formed mRNA then undergoes processing and is transported out of the nucleus into the cytoplasm.

Step 4: In the cytoplasm, the information on mRNA is used to synthesize proteins through the process of 'Translation'. Therefore, transcription occurs in the nucleus.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 97

Q98.

Solution

Concept:

The liver is the largest gland in the human body. Its internal anatomy reveals a highly organized structure of lobes and smaller units.

Solution:

Step 1: The liver is divided into left and right lobes. Each lobe is made up of many tiny functional units.

Step 2: These units are called 'Hepatic Lobules'. Each lobule is a hexagonal structure consisting of cords of liver cells (hepatocytes) radiating from a central vein.

Step 3: Each hepatic lobule is covered by a thin connective tissue sheath called 'Glisson's capsule'.

Step 4: While hepatocytes are the cells that perform the work, the 'Hepatic Lobule' is considered the structural and functional unit of the liver.

Final Answer: $\boxed{A}$

Answer: (A)

Go Back to Question 98

Q99.

Solution

Concept:

Eukaryotic cells contain specialized membrane-bound organelles that house specific enzymes to prevent them from damaging other parts of the cell.

Solution:

Step 1: Peroxisomes are small, spherical organelles involved in various metabolic pathways, especially the oxidation of long-chain fatty acids.

Step 2: A byproduct of these oxidative reactions is hydrogen peroxide (H_2O_2), which is highly toxic to the cell.

Step 3: Peroxisomes contain a high concentration of the enzyme 'Catalase'.

Step 4: Catalase rapidly breaks down hydrogen peroxide into harmless water and oxygen ($2H_2O_2 \rightarrow 2H_2O + O_2$). Lysosomes contain hydrolytic enzymes, and ribosomes are for protein synthesis. Therefore, catalase is found in the peroxisome.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 99

Q100.

Solution

Concept:

Biopiracy is the use of bio-resources by multi-national companies and other organizations without proper authorization from the countries and people concerned without compensatory payment.

Solution:

Step 1: Many industrialized nations are rich financially but poor in biodiversity, while developing nations are rich in biodiversity and traditional knowledge.

Step 2: To protect these national assets, many countries have developed legislation to monitor and prevent biopiracy.

Step 3: The Indian Parliament recently cleared the second amendment of the 'Indian Patents Bill'.

Step 4: This amendment takes into account issues like patent terms, emergency provisions, and research and development initiatives, specifically designed to protect against the unauthorized patenting of traditional biological knowledge.

Final Answer: $\boxed{B}$

Answer: (B)

Go Back to Question 100

Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	A	2	C	3	C	4	A	5	C
6	B	7	B	8	C	Q9	C	10	B
11	B	12	B	13	C	14	B	15	B
16	B	17	A	18	C	19	C	20	B
21	B	22	C	23	A	24	A	25	A
26	B	27	A	28	C	29	B	30	B
31	A	32	B	33	C	34	C	35	A
36	B	37	A	38	C	39	B	40	C
41	A	42	B	43	B	44	A	45	B
46	C	47	A	48	C	49	B	50	C
51	B	52	B	53	B	54	D	55	C
56	B	57	A	58	B	59	A	60	C
61	C	62	A	63	C	64	A	65	B
66	B	67	B	68	B	69	A	70	C
71	B	72	B	73	C	74	B	75	C
76	A	77	B	78	C	79	C	80	B
81	B	82	C	83	B	Q84	D	85	C
86	B	87	B	88	B	89	B	90	C
91	B	92	B	93	C	94	A	95	C
96	B	97	B	98	A	99	B	100	B