NEET-UG Biology Sample Paper-17

Duration: 1 Hour **Maximum Marks: 360**

Instructions

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

Q1. The criteria for declaring a "Biodiversity Hotspot" include not just species richness, but also the degree of endemism and the level of threat. If a region has 1500 species of vascular plants as endemics but has lost 70% of its primary vegetation, it qualifies. Which of the following regions in India was the most recently recognized as a global biodiversity hotspot?

(A) Western Ghats

(B) Indo-Burma

(C) Himalayas

(D) Sundaland

Q2. A researcher is studying the taxonomic hierarchy of the Housefly (*Musca domestica*). Which of the following represents the correct combination of its Order and Family respectively?

(A) Diptera and Muscidae

(B) Sapindales and Anacardiaceae

(C) Hominidae and Primata

(D) Poales and Poaceae

Q3. In the Whittaker five-kingdom classification, certain organisms like viruses, viroids, and lichens are not mentioned. Consider a sub-viral agent that consists

only of a low molecular weight RNA without a protein coat. This agent was discovered by:

(A) D.J. Ivanowsky

(B) M.W. Beijerinck

(C) T.O. Diener

(D) W.M. Stanley

Q4. Which of the following statements regarding the "Key" as a taxonomical aid is incorrect?

(A) Keys are based on the contrasting characters generally in a pair called a couplet.

(B) Each statement in the key is called a lead.

(C) Separate taxonomic keys are required for each taxonomic category.

(D) Keys are generally non-analytical in nature.

Q5. In many algae, the cell wall possesses certain hydrocolloids. Identify the pair where the first substance is found in Brown Algae and the second in Red Algae.

(A) Algin and Carrageen

(B) Carrageen and Algin

(C) Agar and Algin

(D) Cellulose and Chitin

Q6. Select the option that correctly matches the animal with its level of organization and symmetry:

(A) *Spongilla* - Cellular level - Radial symmetry

(B) *Physalia* - Tissue level - Radial symmetry

(C) *Planaria* - Organ level - Asymmetry

(D) *Pheretima* - Organ system level - Radial symmetry

Q7. The specialized cells called "Cyanocytes" or "Cnidoblasts" are the hallmark of Phylum Coelenterata. These cells are mostly found on the:

(A) Hypostome only

(B) Basal disc only

(C) Tentacles and the body

(D) Internal gastric cavity

Q8. In which of the following groups of animals are the heart four-chambered, despite belonging to a class where most members have a three-chambered heart?

(A) *Chelone* and *Testudo*

(B) *Calamar* and *Columba*

(C) *Crocodilus* and *Gavialis*

(D) *Vipera* and *Naja*

Q9. In the anatomy of a dicot root, the "Casparian strips" are essential for regulating the flow of water and minerals. These strips are found in the:

(A) Pericycle

(B) Endodermis

(C) Hypodermis

(D) Pith

Q10. The phellogen (cork cambium) cuts off cells on both sides. The cells cut off toward the outside differentiate into _____ while those on the inner side form _____.

(A) Phellem; Phelloderm

(B) Phelloderm; Phellem

(C) Periderm; Secondary Phloem

(D) Secondary Xylem; Phellem

Q11. Which type of epithelial tissue lines the inner surface of the urinary bladder and has the ability to stretch?

(A) Simple Squamous Epithelium

(B) Transitional Epithelium

(C) Stratified Columnar Epithelium

(D) Ciliated Cuboidal Epithelium

Q12. During muscle contraction, the sarcoplasmic reticulum releases calcium ions. These ions bind to which specific subunit of troponin to initiate the movement of tropomyosin?

(A) Troponin T

(B) Troponin I

(C) Troponin C

(D) Troponin A

Q13. In the mouthparts of a Cockroach (*Periplaneta americana*), which structure acts as a tongue?

(A) Labrum

(B) Labium

(C) Hypopharynx

(D) Maxilla

Q14. The organelle responsible for the synthesis of ribosomal RNA (rRNA) and the assembly of ribosomal subunits is:

(A) Lysosome

(B) Nucleolus

(C) Peroxisome

(D) Centriole

Q15. In the fluid mosaic model, the "quasi-fluid" nature of lipids enables lateral movement of proteins. The ease of this movement is measured as its:

(A) Permeability

(B) Fluidity

(C) Elasticity

(D) Solubility

Q16. Which of the following structures is absent in a prokaryotic cell but present in a eukaryotic cell?

(A) Ribosomes

(B) Plasma membrane

(C) Nuclear envelope

(D) Cytoplasm

Q17. During the S-phase of the cell cycle, if the initial amount of DNA is denoted as 2C, what will be the amount of DNA after replication?

(A) C

(B) 2C

(C) 4C

(D) 8C

Q18. The synaptonemal complex is formed during which specific sub-stage of Prophase I in meiosis?

(A) Leptotene

(B) Zygotene

(C) Pachytene

(D) Diplotene

Q19. Which enzyme is known as the "pacemaker enzyme" of glycolysis because it catalyzes a key rate-limiting step?

(A) Hexokinase

(B) Phosphofructokinase (PFK)

(C) Pyruvate Kinase

(D) Aldolase

Q20. In the C_4 pathway, the initial CO_2 fixation occurs in the mesophyll cells. The four-carbon compound formed is then transported to the bundle sheath cells, where it undergoes:

(A) Carboxylation

(B) Decarboxylation

(C) Hydrogenation

(D) Hydrolysis

Q21. The site of the light reaction (Photochemical phase) in a chloroplast is the _____ while the dark reaction (Biosynthetic phase) occurs in the _____.

(A) Stroma; Grana

(B) Grana; Stroma

(C) Matrix; Thylakoid

(D) Inner membrane; Outer membrane

Q22. Which of the following phytohormones is primarily responsible for "bolting" (internode elongation just prior to flowering) in rosette plants?

(A) Auxin

(B) Cytokinin

(C) Gibberellin

(D) Ethylene

Q23. The deficiency of which element causes "Interveinal Chlorosis" where the veins remain green but the tissue between them turns yellow?

(A) Magnesium

(B) Nitrogen

(C) Potassium

(D) Boron

Q24. In the human digestive system, the "Sphincter of Oddi" guards the opening of the:

(A) Esophagus into the stomach

(B) Stomach into the duodenum

(C) Hepatopancreatic duct into the duodenum

(D) Ileum into the caecum

Q25. A person has a Tidal Volume of 500 mL and a Breathing Rate of 12 times per minute. Their Minute Respiratory Volume (MRV) is:

(A) 6000 mL/min

(B) 1200 mL/min

(C) 5000 mL/min

(D) 4200 mL/min

Q26. Which part of the brain acts as the "Pneumotaxic Center," which can moderate the functions of the respiratory rhythm center?

(A) Medulla oblongata

(B) Pons Varolii

(C) Cerebellum

(D) Hypothalamus

Q27. The state of heart when it is not pumping blood effectively enough to meet the needs of the body is called:

(A) Heart attack

(B) Cardiac arrest

(C) Heart failure

(D) Angina pectoris

Q28. The glomerular filtration rate (GFR) in a healthy individual is approximately:

(A) 125 mL/min

(B) 180 L/min

(C) 125 L/day

(D) 1250 mL/min

Q29. Which of the following joints is a "Pivot joint"?

(A) Between Humerus and Pectoral girdle

(B) Between Atlas and Axis

(C) Between Carpals

(D) Between Carpal and Metacarpal of thumb

Q30. The sensory organ in the internal ear responsible for maintaining body balance and posture is the:

(A) Organ of Corti

(B) Vestibular apparatus

(C) Eustachian tube

(D) Tectorial membrane

Q31. Which hormone is often called the "pregnancy hormone" because it is essential for the maintenance of the endometrium?

(A) Estrogen

(B) Progesterone

(C) LH

(D) FSH

Q32. The hormone Secretin, produced by the duodenal mucosa, primarily acts on the _____ to stimulate the secretion of _____.

(A) Pancreas; Bicarbonate ions

(B) Liver; Bile

(C) Pancreas; Digestive enzymes

(D) Stomach; Gastrin

Q33. In flowering plants, the process of triple fusion results in the formation of:

(A) Zygote

(B) Synergids

(C) Primary Endosperm Nucleus

(D) Antipodal cells

Q34. Which of the following is a "Non-Albuminous" (non-endospermic) seed?

(A) Castor

(B) Maize

(C) Pea

(D) Wheat

Q35. The milk-ejection reflex and the contraction of smooth muscles of the uterus during childbirth are triggered by:

(A) Prolactin

(B) Oxytocin

(C) Relaxin

(D) Progesterone

Q36. A population of organisms is in Hardy-Weinberg equilibrium. If the frequency of the recessive allele 'a' is 0.4, what is the frequency of the homozygous dominant genotype 'AA'?

(A) 0.16

(B) 0.36

(C) 0.48

(D) 0.60

Q37. The theory of Natural Selection was independently proposed by Charles Darwin and:

(A) Alfred Wallace

(B) Lamarck

(C) Hugo de Vries

(D) Thomas Malthus

Q38. Which of the following represents the "Central Dogma" of molecular biology as proposed by Francis Crick?

(A) DNA $\rightarrow$ Protein $\rightarrow$ RNA

(B) DNA → RNA → Protein

(C) RNA → DNA → Protein

(D) Protein → RNA → DNA

Q39. In a DNA molecule, the ratio of Adenine to Thymine and Guanine to Cytosine is always constant and equals one. This is known as:

(A) Mendel's Law

(B) Chargaff's Rule

(C) Griffith's Principle

(D) Hershey-Chase Rule

Q40. Which of the following amino acids is coded by the initiation codon AUG?

(A) Valine

(B) Phenylalanine

(C) Methionine

(D) Leucine

Q41. The process of synthesis of RNA from a DNA template is called:

(A) Replication

(B) Transcription

(C) Translation

(D) Transformation

Q42. In the Lac Operon, the repressor protein binds to the _____ in the absence of an inducer.

(A) Promoter

(B) Operator

(C) Structural gene

(D) Regulatory gene

Q43. The enzyme that "unzips" the DNA double helix during replication by breaking hydrogen bonds is:

(A) DNA Polymerase

(B) DNA Ligase

(C) Helicase

(D) Topoisomerase

Q44. Sickle-cell anemia is caused by a point mutation in the beta-globin chain where Glutamic acid is replaced by Valine at the:

(A) 4th position

(B) 5th position

(C) 6th position

(D) 7th position

Q45. A person with Down syndrome has an extra copy of which chromosome?

(A) Chromosome 13

(B) Chromosome 18

(C) Chromosome 21

(D) X chromosome

Q46. The first human-like hominid was:

(A) *Homo habilis*

(B) *Homo erectus*

(C) *Australopithecus*

(D) *Neanderthal man*

Q47. Which of the following is used as a "biological control" agent against butterfly caterpillars?

(A) *Trichoderma*

(B) *Bacillus thuringiensis*

(C) *Baculoviruses*

(D) *Ladybird*

Q48. The "Large-scale" production of antibiotics is done using:

(A) Petri dishes

(B) Test tubes

(C) Fermenters

(D) Beakers

Q49. Which fungus is used for the commercial production of Cyclosporin A (an immunosuppressive agent)?

(A) *Monascus purpureus*

(B) *Trichoderma polysporum*

(C) *Aspergillus niger*

(D) *Saccharomyces cerevisiae*

Q50. Statins, used for lowering blood cholesterol, are obtained from:

(A) Bacteria

(B) Yeast

(C) Virus

(D) Algae

Q51. In Recombinant DNA technology, the enzyme used to cut DNA at specific palindromic sequences is:

(A) Exonuclease
(B) Restriction Endonuclease
(C) DNA Ligase
(D) RNA Polymerase

Q52. The technique used to amplify a specific segment of DNA in vitro is:

(A) Gel Electrophoresis
(B) PCR (Polymerase Chain Reaction)
(C) Southern Blotting
(D) DNA Fingerprinting

Q53. A "chimeric" DNA molecule is also known as:

(A) Native DNA
(B) Recombinant DNA
(C) Complementary DNA
(D) Satellite DNA

Q54. The first transgenic cow, Rosie, produced milk that was enriched with which human protein?

(A) Alpha-1-antitrypsin
(B) Alpha-lactalbumin
(C) Insulin
(D) Growth hormone

Q55. The use of bio-resources by multinational companies without proper authorization from the countries concerned is called:

(A) Bio-remediation

(B) Bio-prospecting

(C) Bio-piracy

(D) Bio-ethics

Q56. In an ecological pyramid, which level always occupies the base?

(A) Primary consumers

(B) Secondary consumers

(C) Producers

(D) Decomposers

Q57. The relationship between an Orchid growing on a Mango branch is an example of:

(A) Mutualism

(B) Parasitism

(C) Commensalism

(D) Amensalism

Q58. Which of the following is an "ex-situ" conservation method?

(A) National Park

(B) Wildlife Sanctuary

(C) Biosphere Reserve

(D) Zoological Park

Q59. The "Evil Quartet" refers to the four major causes of:

(A) Air pollution

(B) Biodiversity loss

(C) Global warming

(D) Population explosion

Q60. The unit used to measure the thickness of the Ozone layer is:

(A) Decibel

(B) Dobson Unit

(C) Pascal

(D) Nanometer

Q61. Which of the following organelles is NOT part of the endomembrane system?

(A) Golgi complex

(B) Peroxisome

(C) Lysosome

(D) Vacuole

Q62. The resting membrane potential of a neuron is maintained primarily by the:

(A) Sodium-Potassium pump

(B) Voltage-gated Calcium channels

(C) Simple diffusion of neurotransmitters

(D) Leakage of Chloride ions

Q63. Which of the following is a second messenger in hormonal action?

(A) Insulin

(B) cAMP

(C) Epinephrine

(D) Thyroxine

Q64. The structural and functional unit of the liver is the:

(A) Nephron

(B) Hepatic lobule

(C) Alveolus

(D) Osteon

Q65. Identify the correctly matched pair of the disease and its cause:

(A) Tetany - High blood calcium

(B) Gout - Accumulation of uric acid crystals

(C) Myasthenia gravis - Genetic disorder

(D) Osteoporosis - Increased bone mass

Q66. Which of the following is an "Inhibitory" neurotransmitter?

(A) Acetylcholine

(B) Glutamate

(C) GABA

(D) Norepinephrine

Q67. In the human eye, the "Blind Spot" is the region where:

(A) Only cones are present

(B) Only rods are present

(C) Optic nerve leaves the eye and no photoreceptors are present

(D) Visual acuity is the highest

Q68. Which hormone is responsible for the reabsorption of water from the distal parts of the tubule, thereby preventing diuresis?

(A) Aldosterone

(B) ADH (Vasopressin)

(C) ANF

(D) Renin

Q69. The process of formation of a mature female gamete is called:

(A) Spermatogenesis

(B) Oogenesis

(C) Parthenogenesis

(D) Gametogenesis

Q70. In a human female, the blastocyst usually implants in the:

(A) Fallopian tube

(B) Ovary

(C) Endometrium of the uterus

(D) Cervix

Q71. The surgical method of contraception in males is called:

(A) Tubectomy

(B) Vasectomy

(C) IUD

(D) Barrier method

Q72. Mendel selected how many pairs of "true-breeding" pea plant varieties for his experiments?

(A) 7

(B) 14

(C) 21

(D) 4

Q73. A cross where the parents differ in two pairs of contrasting traits is called a:

(A) Monohybrid cross

(B) Dihybrid cross

(C) Test cross

(D) Back cross

(E) Reciprocal cross

Q74. The phenomenon of "Pleiotropy" refers to:

(A) Multiple genes controlling one trait

(B) One gene controlling multiple traits

(C) Two genes being located on the same chromosome

(D) Lack of dominance between alleles

Q75. The semi-conservative nature of DNA replication was experimentally proven by:

(A) Meselson and Stahl

(B) Taylor

(C) Watson and Crick

(D) Hershey and Chase

Q76. The total number of codons that code for amino acids is:

(A) 64

(B) 61

(C) 20

(D) 3

Q77. RNA polymerase II in eukaryotes is responsible for the transcription of:

(A) rRNA
(B) tRNA
(C) hnRNA (precursor of mRNA)
(D) snRNA

Q78. According to the "Oparin-Haldane" theory, the first form of life could have come from:

(A) Pre-existing living cells
(B) Non-living organic molecules
(C) Spontaneous generation
(D) Extraterrestrial space

Q79. Analogous structures are a result of:

(A) Divergent evolution
(B) Convergent evolution
(C) Genetic drift
(D) Shared ancestry

Q80. The most common filler used in modern medicine to treat ADA deficiency is:

(A) Enzyme replacement therapy
(B) Bone marrow transplantation
(C) Gene therapy
(D) Chemotherapy

Q81. Which of the following is a "Restriction fragment length polymorphism" (RFLP) used for?

(A) DNA sequencing

(B) DNA fingerprinting

(C) Protein synthesis

(D) RNA interference

Q82. The term "Totipotency" refers to the capacity to:

(A) Generate a whole plant from any cell/explant

(B) Produce large amounts of biomass

(C) Resist pests and diseases

(D) Grow in harsh environments

Q83. In "Bt cotton", the toxin is coded by a gene named:

(A) *lac*

(B) *cry*

(C) *amp*

(D) *tet*

Q84. The process by which a population becomes better suited to its environment is called:

(A) Adaptation

(B) Succession

(C) Evolution

(D) Mutation

Q85. Which of the following is a "Primary Productivity" limiting factor in an ocean?

(A) Nitrogen

(B) Phosphorus

(C) Iron

(D) Carbon dioxide

Q86. The "Greenhouse effect" is primarily due to the accumulation of:

(A) Oxygen

(B) Nitrogen

(C) Carbon dioxide and Methane

(D) Sulfur dioxide

Q87. The relationship between a Cuckoo bird laying eggs in a Crow's nest is:

(A) Predation

(B) Parasitism (Brood parasitism)

(C) Mutualism

(D) Competition

Q88. Which of the following is the "Hotspot" of biodiversity in India?

(A) Aravalli Hills

(B) Western Ghats

(C) Gangetic Plain

(D) Thar Desert

Q89. The "Red Data Book" is maintained by:

(A) WWF

(B) IUCN

(C) UNESCO

(D) CITES

Q90. The historical convention on Biological Diversity (The Earth Summit) was held in 1992 in:

(A) Johannesburg

(B) Rio de Janeiro

(C) Kyoto

(D) Montreal

Detailed Solutions

Q1.

Solution

Concept:

The concept of "Biodiversity Hotspots" was developed by Norman Myers to identify regions with high species richness and high degrees of endemism that are under significant threat. To qualify, a region must contain at least 1,500 species of vascular plants as endemics and must have lost at least 70% of its original habitat.

Solution:

1. India has four global biodiversity hotspots: The Himalayas, Indo-Burma, the Western Ghats and Sri Lanka, and Sundaland (which includes the Nicobar Islands). 2. The Western Ghats and the Himalayas were among the earliest recognized. 3. The Indo-Burma and Sundaland regions are also highly significant. 4. Among the options provided, Sundaland (incorporating parts of the Nicobar islands) is often highlighted in recent global assessments as a critical zone of high endemism.

Final Answer: Sundaland.

Answer: (D)

Q2.

Solution

Concept:

Taxonomic classification follows a hierarchy: Kingdom, Phylum/Division, Class, Order, Family, Genus, and Species. For the common housefly (*Musca domestica*), it belongs to the Kingdom Animalia, Phylum Arthropoda, Class Insecta.

Solution:

1. The Order for *Musca domestica* is **Diptera** (which includes flies). 2. The Family for *Musca domestica* is **Muscidae**. 3. Other options provided correspond to different organisms (e.g., Sapindales/Anacardiaceae for Mango, Primata/Hominidae for Humans).

Final Answer: Diptera and Muscidae.

Answer: (A)

Q3.

Solution

Concept:

Viruses, viroids, and prions are acellular agents not included in Whittaker's five-kingdom classification. Viroids are smaller than viruses and consist only of a free, low molecular weight RNA strand without a protective protein coat (capsid).

Solution:

1. In 1971, **T.O. Diener** discovered a new infectious agent that was smaller than viruses and caused potato spindle tuber disease. 2. He found that it was a free RNA; it lacked the protein coat found in viruses, hence the name viroid. 3. Ivanowsky and Beijerinck are associated with the discovery and "contagium vivum fluidum" nature of viruses, while Stanley demonstrated that viruses could be crystallized.

Final Answer: T.O. Diener.

Answer: (C)

Q4.

Solution

Concept:

Taxonomical keys are tools used for the identification of plants and animals based on similarities and dissimilarities. They are an essential part of systematic biology.

Solution:

1. Keys are based on contrasting characters in a pair called a **couplet**. 2. Each statement in the key is called a **lead**. 3. Keys are indeed analytical in nature because they require a choice between two options at each step. 4. Therefore, the statement "Keys are generally non-analytical" is incorrect.

Final Answer: Keys are generally non-analytical in nature.

Answer: (D)

Q5.

Solution

Concept:

Many marine algae produce large amounts of hydrocolloids (water-holding substances) in their cell walls, which have significant commercial value.

Solution:

1. Brown algae (Phaeophyceae) produce a hydrocolloid called **Algin**. 2. Red algae (Rhodophyceae) produce a hydrocolloid called **Carrageen**. 3. Agar is another important product obtained from red algae like *Gelidium* and *Gracilaria*.

Final Answer: Algin and Carrageen.

Answer: (A)

Q6.

Solution

Concept:

Animal classification is based on various fundamental features like levels of organization, body symmetry, and the presence or absence of a body cavity (coelom).

Solution:

1. *Physalia* (Portuguese man-of-war) belongs to the Phylum Cnidaria. 2. Members of Cnidaria exhibit a **tissue level of organization**, where cells performing similar functions are aggregated into tissues. 3. They exhibit **radial symmetry**, meaning any plane passing through the central axis of the body divides the organism into two identical halves. 4. *Spongilla* has a cellular level but is generally asymmetrical. *Planaria* has organ level but is bilaterally symmetrical. *Pheretima* (earthworm) has organ system level and bilateral symmetry.

Final Answer: *Physalia* - Tissue level - Radial symmetry.

Answer: (B)

Q7.

Solution

Concept:

Coelenterates (Cnidarians) derive their name from specialized cells called cnidoblasts or cnidocytes. These cells contain stinging capsules called nematocysts.

Solution:

1. Cnidoblasts are used for anchorage, defense, and for the capture of prey. 2. These specialized cells are not distributed uniformly; they are primarily concentrated on the **tentacles** and the **body wall**. 3. When a prey or predator comes in contact, the nematocyst is triggered to release toxins or entangling threads.

Final Answer: Tentacles and the body.

Answer: (C)

Q8.

Solution

Concept:

Class Reptilia is generally characterized by a three-chambered heart (two atria and one partially divided ventricle). However, there is a significant evolutionary exception in one specific order.

Solution:

1. Most reptiles like snakes (*Naja*, *Vipera*) and turtles (*Chelone*, *Testudo*) have three-chambered hearts. 2. The order Crocodilia, which includes ***Crocodilus*** (crocodile), ***Gavialis*** (gharial), and *Alligator*, possesses a completely **four-chambered heart**, similar to birds and mammals. 3. This is a higher level of structural organization that prevents the mixing of oxygenated and deoxygenated blood.

Final Answer: *Crocodilus* and *Gavialis*.

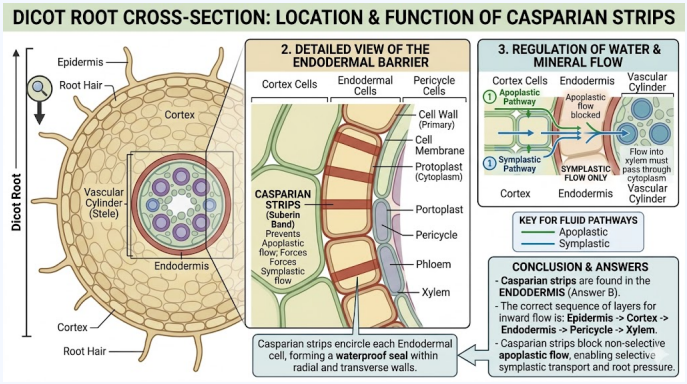
Answer: (C)

Q9.

Solution

Concept:

The movement of water and dissolved minerals from the cortex into the vascular cylinder (stele) in roots is strictly regulated by a specific layer of cells.



Solution:

1. The **endodermis** is the innermost layer of the cortex in a dicot root. 2. The tangential as well as radial walls of the endodermal cells have a deposition of water-impermeable, waxy material called suberin in the form of **Casparian strips**. 3. These strips block the apoplastic pathway (through cell walls), forcing water to move through the symplastic pathway (through the cytoplasm), allowing the plant to filter and control what enters the xylem.

Final Answer: Endodermis.

Answer: (B)

Q10.

Solution

Concept:

Secondary growth in the extra-stelar region is facilitated by the cork cambium or phellogen. It is a meristematic tissue that develops usually in the cortical region.

Solution:

1. The phellogen undergoes periclinal divisions to produce new cells on both its outer and inner faces. 2. The cells produced toward the outside differentiate into cork, technically known as **phellem**. These cells become suberized and dead at maturity. 3. The cells produced toward the inside differentiate into the secondary cortex, technically known as **phelloderm**. These are typically parenchymatous. 4. Together, Phellem, Phellogen, and Phelloderm are referred to as the Periderm.

Final Answer: Phellem; Phelloderm.

Answer: (A)

Q11.

Solution

Concept:

Epithelial tissues are classified based on the number of layers and the shape of the cells. Certain organs that undergo significant volume changes, like the urinary bladder, require a specialized epithelium that can stretch without tearing.

Solution:

1. **Transitional Epithelium** is a type of stratified epithelium. 2. In its relaxed state, the surface cells appear large and rounded (cuboidal or dome-shaped). 3. When the urinary bladder fills with urine, these cells flatten and become thin, appearing more squamous. 4. This flexibility allows the bladder to distend to hold a large volume of urine and then return to its original shape once emptied.

Final Answer: Transitional Epithelium.

Answer: (B)

Q12.

Solution

Concept:

Muscle contraction is regulated by the interaction of calcium ions with regulatory proteins associated with actin filaments. The troponin complex consists of three subunits that play distinct roles in this process.

Solution:

1. The troponin complex consists of: - **Troponin I**: Inhibits actin-myosin binding. - **Troponin T**: Binds to tropomyosin. - **Troponin C**: Binds to calcium ions (Ca^{2+}). 2. When the sarcoplasmic reticulum releases Ca^{2+}, the ions bind specifically to **Troponin C**. 3. This binding induces a conformational change in the troponin-tropomyosin complex, uncovering the myosin-binding sites on the actin filament, allowing contraction to begin.

Final Answer: Troponin C.

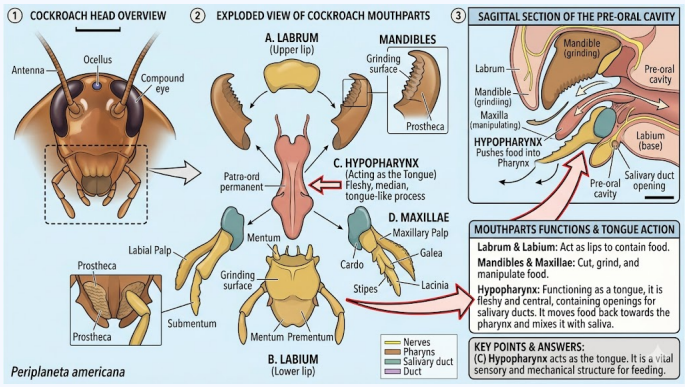
Answer: (C)

Q13.

Solution

Concept:

The mouthparts of a cockroach are of the biting and chewing type, consisting of a labrum (upper lip), a pair of mandibles, a pair of maxillae, and a labium (lower lip).



Solution:

1. Within the cavity enclosed by these mouthparts, there is a median flexible lobe. 2. This structure is the **Hypopharynx**, which acts as a tongue. 3. The ducts of the salivary glands open at the base of the hypopharynx, allowing saliva to mix with food during the chewing process.

Final Answer: Hypopharynx.

Answer: (C)

Q14.

Solution

Concept:

The nucleus contains various sub-structures. One prominent, non-membrane bound structure is the nucleolus, which is the site of intensive metabolic activity related to protein synthesis machinery.

Solution:

1. The **Nucleolus** is a dense region within the nucleoplasm. 2. It is the primary site for the synthesis of **ribosomal RNA (rRNA)**. 3. Cells that are actively engaged in protein synthesis (like pancreatic cells or nerve cells) usually have larger and more numerous nucleoli because they require a high volume of ribosomes.

Final Answer: Nucleolus.

Answer: (B)

Q15.

Solution

Concept:

The Fluid Mosaic Model, proposed by Singer and Nicolson, describes the cell membrane as a tapestry of several types of molecules (phospholipids, cholesterols, and proteins) that are constantly moving.

Solution:

1. The cell membrane is composed of a phospholipid bilayer that has a "quasi-fluid" state. 2. This fluid nature allows the lateral movement of proteins within the overall bilayer. 3. The ability of components to move within the membrane is specifically defined as its **fluidity**. 4. Fluidity is vital for functions like cell growth, formation of intercellular junctions, secretion, endocytosis, and cell division.

Final Answer: Fluidity.

Answer: (B)

Q16.

Solution

Concept:

Prokaryotic and eukaryotic cells represent the two fundamental types of cellular organization. Prokaryotic cells (like bacteria) are simpler, whereas eukaryotic cells (like those in plants and animals) contain membrane-bound compartments that allow for more complex metabolic activities.

Solution:

1. Both prokaryotic and eukaryotic cells possess a **plasma membrane**, **cytoplasm**, and **ribosomes** (though the size differs, being 70S in prokaryotes and 80S in eukaryotes). 2. The defining difference is the presence of a double-membraned **nuclear envelope** in eukaryotic cells, which encloses the genetic material. 3. Prokaryotes lack a nuclear envelope; their DNA is naked and lies directly in the cytoplasm in a region called the nucleoid. 4. Therefore, the nuclear envelope is absent in prokaryotes but present in eukaryotes.

Final Answer: Nuclear envelope.

Answer: (C)

Q17.

Solution

Concept:

The cell cycle consists of Interphase and M-phase. Interphase is further divided into G_1, S, and G_2 phases. The S-phase (Synthetic phase) is characterized by the replication of DNA.

Solution:

1. During the S-phase, DNA replication occurs so that each daughter cell can receive a full set of genetic instructions. 2. If the initial amount of DNA in a diploid cell is **2C**, the amount of DNA will double after the completion of the S-phase because every chromosome produces a sister chromatid. 3. Therefore, the amount of DNA becomes **4C**. 4. Note: While the amount of DNA doubles, the chromosome number (n) remains the same (e.g., if it was 2n, it remains 2n).

Final Answer: 4C.

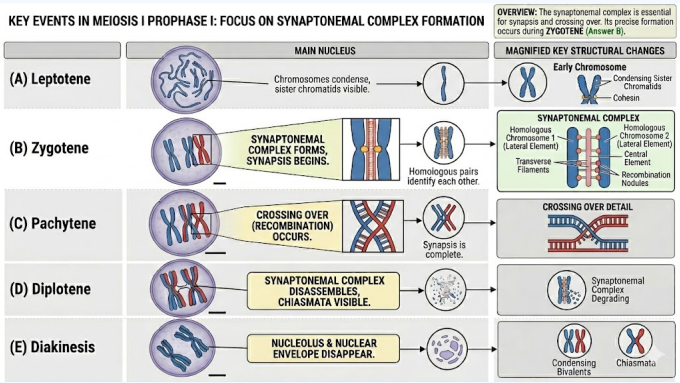
Answer: (C)

Q18.

Solution

Concept:

Meiosis I involves a very long and complex Prophase I, which is divided into five sub-stages: Leptotene, Zygotene, Pachytene, Diplotene, and Diakinesis. These stages involve the pairing and recombination of homologous chromosomes.



Solution:

1. During the **Zygotene** stage, homologous chromosomes start pairing together, a process called synapsis. 2. The formation of synapsis is accompanied by the development of a complex protein structure called the **synaptonemal complex**. 3. This complex facilitates the close pairing of the homologs, which is necessary for the subsequent crossing over that occurs in the Pachytene stage.

Final Answer: Zygotene.

Answer: (B)

Q19.

Solution

Concept:

Glycolysis is a series of ten enzymatic reactions. The overall rate of the pathway is controlled by specific "regulatory" or "pacemaker" enzymes that catalyze irreversible steps.

Solution:

1. **Phosphofructokinase (PFK)** is considered the primary pacemaker enzyme of glycolysis.
2. It catalyzes the conversion of Fructose-6-phosphate to Fructose-1,6-bisphosphate using ATP.
3. This step is the "committed" step; once it occurs, the molecule is destined to complete the glycolytic pathway. PFK is highly regulated by the energy status of the cell (inhibited by high ATP, stimulated by high AMP).

Final Answer: Phosphofructokinase (PFK).

Answer: (B)

Q20.

Solution

Concept:

The C_4 pathway (Hatch-Slack pathway) is an adaptation to minimize photorespiration. It involves a spatial separation of CO_2 fixation between two different types of cells: mesophyll and bundle sheath cells.

Solution:

1. In mesophyll cells, CO_2 is fixed into a 4-carbon acid (Oxaloacetic acid, then Malic or Aspartic acid). 2. This 4-carbon compound is transported to the **bundle sheath cells**. 3. In the bundle sheath cells, the 4-carbon acid is broken down to release CO_2 and a 3-carbon molecule. This release of CO_2 is called **decarboxylation**. 4. The high concentration of CO_2 released here ensures that the enzyme RuBisCO functions as a carboxylase and not an oxygenase, increasing photosynthetic efficiency.

Final Answer: Decarboxylation.

Answer: (B)

Q21.

Solution

Concept:

Photosynthesis is a two-step process. The first phase is the Light Reaction (Photochemical phase), where solar energy is trapped to produce ATP and $NADPH$. The second phase is the Dark Reaction (Biosynthetic phase), where these energy molecules are used to fix CO_2 into sugars.

Solution:

1. The light reaction occurs in the **Grana** (thylakoid membranes) of the chloroplast. This is because the chlorophyll pigments and the electron transport chain components are embedded in these membranes. 2. The dark reaction (Calvin Cycle) occurs in the **Stroma**, which is the fluid-filled matrix of the chloroplast. The stroma contains all the enzymes (like RuBisCO) necessary for the enzymatic conversion of CO_2 into glucose. 3. Although it is called the "dark reaction," it does not necessarily occur in the dark; it is simply independent of direct light but dependent on the products of the light reaction.

Final Answer: Grana; Stroma.

Answer: (B)

Q22.

Solution

Concept:

Gibberellins are a group of plant hormones that regulate various developmental processes, including stem elongation, germination, and flowering.

Solution:

1. "Bolting" refers to the sudden, rapid elongation of internodes in plants with a rosette habit (like cabbage or beet) just before they enter the flowering stage. 2. In nature, this is often triggered by environmental cues like change in day length or temperature. 3. If these plants are treated with **Gibberellins** (specifically GA_3), they undergo bolting even under non-inductive conditions. 4. Auxins are involved in apical dominance, Cytokinins in cell division, and Ethylene in fruit ripening.

Final Answer: Gibberellin.

Answer: (C)

Q23.

Solution

Concept:

Plants require several essential mineral elements for growth. When these elements are not available in sufficient quantities, plants show specific deficiency symptoms.

Solution:

1. Chlorosis is the loss of chlorophyll leading to yellowing of leaves. 2. Interveinal chlorosis specifically refers to the yellowing of the leaf blade while the veins remain green. 3. This is a characteristic symptom of **Magnesium** (Mg^{2+}) deficiency because Magnesium is the central atom of the chlorophyll molecule. 4. Without enough Magnesium, the plant cannot synthesize sufficient chlorophyll, and the deficiency appears first in the older leaves (as Magnesium is mobile).

Final Answer: Magnesium.

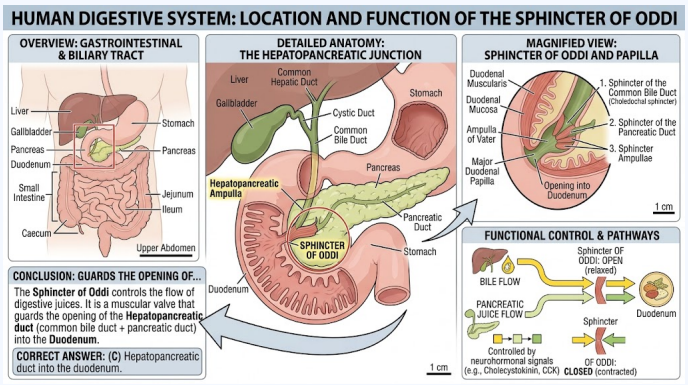
Answer: (A)

Q24.

Solution

Concept:

The human digestive system uses various sphincters (valves) to control the movement of food and digestive juices between different organs and ducts.



Solution:

1. The liver produces bile, and the pancreas produces pancreatic juice. 2. These two secretions travel through the common hepatopancreatic duct. 3. The opening of this hepatopancreatic duct into the **duodenum** (the first part of the small intestine) is guarded by a circular muscle called the **Sphincter of Oddi**. 4. This sphincter regulates the flow of these digestive juices into the intestine only when food is present.

Final Answer: Hepatopancreatic duct into the duodenum.

Answer: (C)

Q25.

Solution

Concept:

Pulmonary ventilation can be measured using specific volumes and rates. The Minute Respiratory Volume (MRV) is the total amount of air moved into or out of the lungs in one minute.

Solution:

1. Tidal Volume (TV) is the volume of air inspired or expired during a normal breath. Given TV = 500 mL. 2. Breathing Rate (BR) is the number of breaths per minute. Given BR = 12 breaths/min.
3. The formula for MRV is:

$$\text{MRV} = \text{TV} \times \text{BR}$$

4. Calculation:

$$\text{MRV} = 500 \text{ mL} \times 12 = 6000 \text{ mL/min}$$

5. This indicates the total ventilation of the lungs per minute.

Final Answer: 6000 mL/min.

Answer: (A)

Q26.

Solution

Concept:

The regulation of respiration is a sophisticated process involving both neural and chemical controls. While the primary respiratory rhythm center is located in the medulla, other regions of the brain can modify its output to adapt to the body's needs.

Solution:

1. The **Pneumotaxic Center** is located in the **Pons Varolii** region of the brainstem. 2. Its primary function is to "switch off" or limit the duration of inspiration. By doing so, it indirectly increases the breathing rate. 3. Neural signals from this center can reduce the duration of inspiration and thereby alter the respiratory rate. 4. The Medulla oblongata contains the respiratory rhythm center, which is primarily responsible for the basic rhythm of breathing, while the pneumotaxic center acts as a fine-tuner.

Final Answer: Pons Varolii.

Answer: (B)

Q27.

Solution

Concept:

Cardiovascular disorders are classified based on the specific nature of the heart's dysfunction. It is important to distinguish between "arrest," "attack," and "failure."

Solution:

1. **Heart Failure** is the state of the heart when it is not pumping blood effectively enough to meet the metabolic needs of the body. It is sometimes called congestive heart failure because lung congestion is one of its main symptoms. 2. **Cardiac Arrest** occurs when the heart stops beating altogether. 3. **Heart Attack** (Myocardial Infarction) occurs when the heart muscle is suddenly damaged by an inadequate blood supply (blockage). 4. **Angina Pectoris** is chest pain resulting from reduced oxygen supply to the heart muscles.

Final Answer: Heart failure.

Answer: (C)

Q28.

Solution

Concept:

The Glomerular Filtration Rate (GFR) is the volume of filtrate formed by the kidneys per minute. It is a key indicator of renal health and function.

Solution:

1. In a healthy adult, the GFR is approximately **125 mL/min**. 2. If we calculate this over a 24-hour period: 125 mL $\times$ 60 minutes $\times$ 24 hours = 180,000 mL or **180 L/day**. 3. It is important to distinguish between the rate per minute (125 mL) and the volume per day (180 L). 4. Despite filtering 180 L per day, only about 1.5 L is excreted as urine, as 99% of the filtrate is reabsorbed.

Final Answer: 125 mL/min.

Answer: (A)

Q29.

Solution

Concept:

Synovial joints are characterized by the presence of a fluid-filled synovial cavity between the articulating surfaces of the two bones. They allow for considerable movement and are categorized into several types.

Solution:

1. A **Pivot joint** allows for rotational movement around a single axis. 2. A classic example in the human body is the joint between the **Atlas (first cervical vertebra) and the Axis (second cervical vertebra)**, which allows the head to turn from side to side. 3. Ball and socket joints are found between the humerus and pectoral girdle. Gliding joints are found between carpals. Saddle joints are found between the carpal and metacarpal of the thumb.

Final Answer: Between Atlas and Axis.

Answer: (B)

Q30.

Solution

Concept:

The internal ear (labyrinth) consists of two main parts: the Cochlea, which is responsible for hearing, and the Vestibular Apparatus, which is responsible for equilibrium.

Solution:

1. The **Vestibular apparatus** is located above the cochlea and is composed of three semi-circular canals and the otolith organ (saccule and utricle). 2. The semi-circular canals detect rotational movement, while the saccule and utricle detect linear acceleration and head tilt. 3. The specific receptors for balance located in these structures are the crista ampullaris and the macula. 4. The Organ of Corti is the sensory organ for hearing located within the cochlea.

Final Answer: Vestibular apparatus.

Answer: (B)

Q31.

Solution

Concept:

The menstrual cycle is regulated by a complex interplay of hormones from the hypothalamus, anterior pituitary, and ovaries. After ovulation, the ruptured Graafian follicle transforms into a temporary endocrine structure called the corpus luteum.

Solution:

1. The corpus luteum secretes large amounts of **Progesterone**, which is essential for the maintenance of the endometrium (the lining of the uterus). 2. A thick, vascularized endometrium is necessary for the implantation of the fertilized ovum and the subsequent events of pregnancy. 3. In the absence of fertilization, the corpus luteum degenerates, leading to a drop in progesterone levels and the shedding of the endometrium (menstruation). 4. Because it "supports" and maintains the conditions required for pregnancy, progesterone is often referred to as the **pregnancy hormone**.

Final Answer: Progesterone.

Answer: (B)

Q32.

Solution

Concept:

The gastrointestinal tract produces several hormones that regulate the secretion of digestive juices. Secretin was the first hormone ever to be discovered and plays a vital role in neutralizing stomach acid in the duodenum.

Solution:

1. When acidic chyme enters the duodenum from the stomach, the duodenal mucosa releases the hormone **Secretin**. 2. Secretin travels through the bloodstream and acts primarily on the exocrine **Pancreas**. 3. It stimulates the pancreatic duct cells to secrete a watery juice rich in **Bicarbonate ions**. 4. These bicarbonate ions are alkaline and help neutralize the HCl coming from the stomach, providing the optimal pH for pancreatic enzymes to function.

Final Answer: Pancreas; Bicarbonate ions.

Answer: (A)

Q33.

Solution

Concept:

Angiosperms (flowering plants) undergo a unique process called Double Fertilization. This involves two separate fusion events occurring within the embryo sac.

Solution:

1. The first fusion (Syngamy) involves one male gamete and the egg cell, resulting in a diploid Zygote. 2. The second fusion, called **Triple Fusion**, involves the second male gamete and the two polar nuclei (or the secondary nucleus) located in the central cell. 3. Because three haploid nuclei fuse together ($n + n + n$), the resulting structure is triploid ($3n$). 4. This triploid cell is called the **Primary Endosperm Nucleus (PEN)**, which later develops into the endosperm, the nutritive tissue for the developing embryo.

Final Answer: Primary Endosperm Nucleus.

Answer: (C)

Q34.

Solution

Concept:

Seeds are classified as either albuminous (endospermic) or non-albuminous (non-endospermic) based on whether the endosperm is retained or consumed during embryo development.

Solution:

1. In **Albuminous seeds**, the endosperm is not completely consumed during embryo development and remains to provide nutrition during germination (e.g., Castor, Maize, Wheat, Coconut). 2. In **Non-albuminous seeds**, the endosperm is completely consumed by the developing embryo before the seed matures. The food is instead stored in the cotyledons. 3. The **Pea** plant (along with groundnut and beans) is a classic example of a non-albuminous seed where the endosperm is absent in the mature seed.

Final Answer: Pea.

Answer: (C)

Q35.

Solution

Concept:

Parturition (childbirth) and lactation are governed by neuroendocrine reflexes. These processes require the coordinated contraction of smooth muscles.

Solution:

1. During labor, the "fetal ejection reflex" triggers the release of **Oxytocin** from the maternal posterior pituitary gland. 2. Oxytocin acts on the uterine muscles, causing strong contractions that push the baby out. 3. Post-delivery, when the infant suckles, a reflex is triggered that again releases Oxytocin. 4. In the mammary glands, Oxytocin causes the contraction of myoepithelial cells surrounding the alveoli, resulting in the **milk-ejection reflex** (let-down reflex). 5. Note: Prolactin is responsible for the synthesis of milk, while Oxytocin is responsible for its release.

Final Answer: Oxytocin.

Answer: (B)

Q36.

Solution

Concept:

The Hardy-Weinberg principle states that allele and genotype frequencies in a population will remain constant from generation to generation in the absence of other evolutionary influences. The equation is represented as:

$$p^2 + 2pq + q^2 = 1$$

where p is the frequency of the dominant allele ('A') and q is the frequency of the recessive allele ('a').

Solution:

1. Given the frequency of the recessive allele $q = 0.4$. 2. Since $p + q = 1$, the frequency of the dominant allele p is:

$$p = 1 - 0.4 = 0.6$$

3. The frequency of the homozygous dominant genotype ('AA') is represented by p^2. 4. Calculation:

$$p^2 = (0.6)^2 = 0.36$$

5. Thus, 36% of the population carries the 'AA' genotype.

Final Answer: 0.36.

Answer: (B)

Q37.

Solution

Concept:

The theory of evolution by natural selection was a monumental shift in biological understanding. It posits that individuals with favorable traits are more likely to survive and reproduce.

Solution:

1. While Charles Darwin is the primary figure associated with this theory, another naturalist was working on similar ideas at the same time. 2. **Alfred Wallace**, a British naturalist working in the Malay Archipelago, reached similar conclusions regarding natural selection. 3. He sent a short essay to Darwin in 1858, which prompted Darwin to finally publish his work. 4. Their papers were presented jointly to the Linnean Society of London in 1858, a year before Darwin published "On the Origin of Species."

Final Answer: Alfred Wallace.

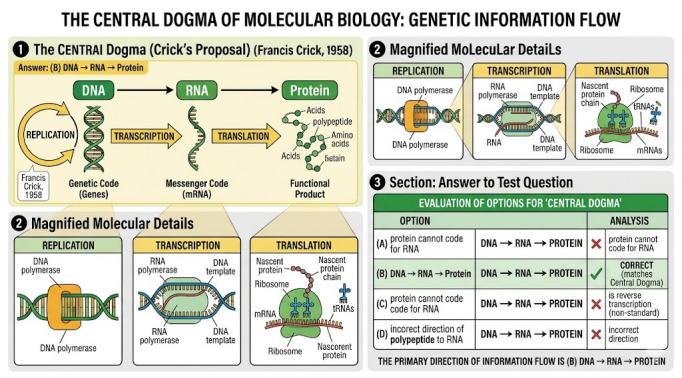
Answer: (A)

Q38.

Solution

Concept:

The "Central Dogma" describes the two-step process, transcription and translation, by which the information in genes flows into proteins: DNA → RNA → Protein.



Solution:

1. DNA serves as the master blueprint (storage of genetic information). 2. Through the process of **transcription**, the information is copied into Messenger RNA (mRNA). 3. Through the process of **translation**, the sequence of the mRNA is used to assemble amino acids into a **protein**. 4. This unidirectional flow of information was proposed by Francis Crick in 1957.

Final Answer: DNA → RNA → Protein.

Answer: (B)

Q39.

Solution

Concept:

Erwin Chargaff's work in the late 1940s was crucial for Watson and Crick's later discovery of the double helix structure of DNA. He analyzed the base composition of DNA from various organisms.

Solution:

1. **Chargaff's Rules** state that in any double-stranded DNA molecule: - The amount of Adenine (A) is equal to Thymine (T). - The amount of Guanine (G) is equal to Cytosine (C). 2. This implies that the ratio of $[A]/[T] = 1$ and $[G]/[C] = 1$. 3. Furthermore, the sum of purines (A+G) equals the sum of pyrimidines (T+C). 4. These rules provided the physical evidence for the base-pairing mechanism.

Final Answer: Chargaff's Rule.

Answer: (B)

Q40.

Solution

Concept:

The genetic code is a set of rules used by living cells to translate information encoded within genetic material into proteins. It consists of 64 codons.

Solution:

1. The codon **AUG** has a dual function in the cell. 2. It acts as the "Initiation Codon" (Start Codon), signaling the start of the translation process. 3. It also codes specifically for the amino acid **Methionine**. 4. In prokaryotes, it codes for N-formylmethionine, but in eukaryotes, it codes for unmodified methionine.

Final Answer: Methionine.

Answer: (C)

Q41.

Solution

Concept:

Transcription is the process by which the genetic information stored in DNA is copied into a complementary strand of RNA. This process is mediated by the enzyme RNA polymerase.

Solution:

1. In the process of **Transcription**, the DNA double helix is unwound, and one strand (the template strand) is used to synthesize a single-stranded RNA molecule. 2. This ensures that the genetic code can be transported from the nucleus (where DNA is located) to the ribosomes in the cytoplasm for protein synthesis. 3. Replication refers to DNA synthesis, Translation to protein synthesis, and Transformation to the uptake of foreign DNA by a cell.

Final Answer: Transcription.

Answer: (B)

Q42.

Solution

Concept:

The Lac Operon is a classic model for understanding gene regulation in prokaryotes (*E. coli*). It consists of regulatory genes and structural genes ($lacZ, lacY, lacA$) that coordinate the metabolism of lactose.

Solution:

1. The regulatory gene (*i* gene) produces a **repressor protein** constitutively. 2. In the **absence of an inducer** (lactose/allolactose), the repressor protein has a high affinity for a specific DNA sequence called the **Operator**. 3. Binding of the repressor to the operator physically blocks the RNA polymerase from moving toward the structural genes, thereby "turning off" the operon. 4. When the inducer is present, it binds to the repressor, changing its shape so it can no longer bind to the operator, allowing transcription to proceed.

Final Answer: Operator.

Answer: (B)

Q43.

Solution

Concept:

DNA replication is a complex process requiring multiple enzymes. For the replication machinery to access the nitrogenous bases, the tightly coiled double helix must be separated into two single strands.

Solution:

1. The enzyme **Helicase** is responsible for the unwinding of the DNA double helix. 2. It acts by breaking the **hydrogen bonds** between the complementary base pairs (A=T and G≡C). 3. This creates a "replication fork" where DNA polymerase can begin adding new nucleotides. 4. DNA Ligase joins fragments, Topoisomerase relieves torsional strain, and DNA Polymerase synthesizes the new strand.

Final Answer: Helicase.

Answer: (C)

Q44.

Solution

Concept:

Sickle-cell anemia is a classic example of a point mutation resulting in a qualitative change in a protein. It follows an autosomal recessive inheritance pattern.

Solution:

1. The mutation occurs in the gene coding for the **beta-globin chain** of hemoglobin. 2. A single base substitution (GAG to GUG) leads to the replacement of the amino acid **Glutamic acid** with **Valine**. 3. This substitution occurs specifically at the **6th position** of the beta-globin chain. 4. This change causes the hemoglobin to polymerize under low oxygen tension, changing the shape of the RBC from biconcave to a sickle shape.

Final Answer: 6th position.

Answer: (C)

Q45.

Solution

Concept:

Chromosomal disorders occur due to the absence or excess of one or more chromosomes. Down syndrome is a type of aneuploidy called trisomy.

Solution:

1. **Down Syndrome** is caused by the presence of an additional copy of **chromosome number 21**. 2. Instead of the usual pair (2 chromosomes), the individual has three copies of chromosome 21 (Trisomy 21). 3. This results from non-disjunction during gamete formation. 4. Characteristics include short stature, small round head, furrowed tongue, and partially open mouth, along with mental retardation.

Final Answer: Chromosome 21.

Answer: (C)

Q46.

Solution

Concept:

Human evolution is traced through various fossils that show a gradual increase in cranial capacity and changes in skeletal structure. The transition from ape-like ancestors to modern humans involves several intermediate stages.

Solution:

1. *Homo habilis* lived about 2 million years ago and is widely considered the first "human-like" hominid (hominin). 2. They had a cranial capacity of about 650–800 cc. 3. They were likely the first to use tools (hence the name "handy man"). 4. *Homo erectus* came later with a larger brain (900 cc), followed by Neanderthals and eventually *Homo sapiens*. *Australopithecus* is considered an immediate ancestor but not yet belonging to the genus *Homo*.

Final Answer: *Homo habilis*.

Answer: (A)

Q47.

Solution

Concept:

Biological control refers to the method of controlling pests such as insects, mites, weeds, and plant diseases using other organisms. It relies on natural predation, parasitism, or herbivory.

Solution:

1. ***Bacillus thuringiensis*** (Bt) is a bacterium used to control butterfly caterpillars. 2. It is available in sachets as dried spores which are mixed with water and sprayed onto vulnerable plants. 3. When the larvae eat the leaves, the toxin is released in their gut, killing them. 4. *Trichoderma* is used against plant pathogens in the soil, and *Baculoviruses* are used for narrow-spectrum insecticidal applications.

Final Answer: *Bacillus thuringiensis*.

Answer: (B)

Q48.

Solution

Concept:

Microbes are used for the commercial and industrial production of certain organic acids, alcohols, and enzymes. To produce these at a large scale, massive vessels are required.

Solution:

1. In industrial microbiology, specialized large-scale vessels used for growing microbes are called **Fermenters** or Bioreactors. 2. These vessels provide optimal conditions such as temperature, pH, substrate, salts, vitamins, and oxygen to achieve maximum yield. 3. Petri dishes and test tubes are used for small-scale laboratory experiments, not for commercial antibiotic production.

Final Answer: Fermenters.

Answer: (C)

Q49.

Solution

Concept:

Microbes are a rich source of bioactive molecules. These are chemicals produced by microbes that have therapeutic uses in humans.

Solution:

1. **Cyclosporin A** is a powerful immunosuppressive agent used in organ-transplant patients to prevent graft rejection. 2. It is produced by the fungus ***Trichoderma polysporum***. 3. *Monascus purpureus* produces statins (blood cholesterol lowering agents), and *Aspergillus niger* produces citric acid.

Final Answer: *Trichoderma polysporum*.

Answer: (B)

Q50.

Solution

Concept:

Statins are bioactive molecules that act by competitively inhibiting the enzyme responsible for the synthesis of cholesterol in the liver.

Solution:

1. Statins are produced by the **yeast** (a type of fungus) named ***Monascus purpureus***. 2. They are used clinically to lower blood cholesterol levels. 3. This is a classic example of using a microbial product to treat a metabolic condition in humans.

Final Answer: Yeast.

Answer: (B)

Q51.

Solution

Concept:

Recombinant DNA technology involves the use of "molecular scissors" to cut DNA molecules at specific locations. These enzymes are naturally found in bacteria, where they serve as a defense mechanism against viral infections.

Solution:

1. **Restriction Endonucleases** are enzymes that recognize a specific base sequence in a DNA molecule (a recognition sequence) and cut the phosphodiester backbone. 2. Most of these enzymes recognize **palindromic sequences**, where the sequence of base pairs reads the same on the two strands when the orientation of reading is kept the same (e.g., 5' to 3'). 3. Exonucleases remove nucleotides from the ends of the DNA, whereas endonucleases make cuts at specific positions within the DNA. 4. DNA Ligase is used to join DNA fragments, and RNA Polymerase is used for transcription.

Final Answer: Restriction Endonuclease.

Answer: (B)

Q52.

Solution

Concept:

Biotechnology provides tools to produce multiple copies of a specific DNA segment. This is essential when the starting material is limited, such as in forensic investigations or early disease diagnosis.

Solution:

1. **PCR (Polymerase Chain Reaction)** is a technique used to amplify a single copy or a few copies of a segment of DNA across several orders of magnitude, generating thousands to millions of copies. 2. The process involves three main steps repeated in cycles: **Denaturation** (separation of strands), **Annealing** (binding of primers), and **Extension** (synthesis of new strands by Taq polymerase). 3. Gel electrophoresis is used for separation, Southern Blotting for detection, and DNA fingerprinting for identification, but PCR is the specific tool for amplification.

Final Answer: PCR (Polymerase Chain Reaction).

Answer: (B)

Q53.

Solution

Concept:

In genetic engineering, DNA from two different sources (e.g., a human gene and a bacterial plasmid) are combined to create a new genetic combination.

Solution:

1. When a foreign DNA fragment is integrated into a vector (like a plasmid), the resulting DNA molecule contains sequences from two different organisms. 2. This "hybrid" DNA is technically termed **Recombinant DNA**. 3. It is also sometimes colloquially referred to as **chimeric DNA**, named after the Chimera from Greek mythology, which was a creature composed of parts from different animals.

Final Answer: Recombinant DNA.

Answer: (B)

Q54.

Solution

Concept:

Transgenic animals are produced to benefit humans by providing improved food sources, serving as disease models, or producing biological products like specific proteins.

Solution:

1. The first transgenic cow, **Rosie**, was produced in 1997. 2. Her milk contained the human protein **alpha-lactalbumin**. 3. This made the milk nutritionally more balanced for human babies than natural cow milk, as it contained 2.4 grams of the human protein per liter. 4. Alpha-1-antitrypsin is used to treat emphysema, and insulin is used for diabetes, but alpha-lactalbumin was the specific enrichment in Rosie's milk.

Final Answer: Alpha-lactalbumin.

Answer: (B)

Q55.

Solution

Concept:

Bioethics involves the ethical issues emerging from advances in biology and medicine. One major concern is the exploitation of biological resources and traditional knowledge of developing nations.

Solution:

1. **Bio-piracy** is the term used to refer to the use of bio-resources by multinational companies and other organizations without proper authorization from the countries and people concerned without compensatory payment. 2. Most of the industrialized nations are rich financially but poor in biodiversity and traditional knowledge. In contrast, the developing world is rich in biodiversity and traditional knowledge related to bio-resources. 3. Laws are now being implemented (like the Indian Patents Bill) to prevent such unauthorized exploitation.

Final Answer: Bio-piracy.

Answer: (C)

Q56.

Solution

Concept:

An ecosystem follows the laws of thermodynamics, where energy flows from one trophic level to the next. Ecological pyramids are graphical representations designed to show the relationship between different organisms in an ecosystem.

Solution:

1. In almost all ecosystems, the **Producers** (photoautotrophs like plants and algae) form the base of the ecological pyramid. 2. Producers are the only organisms capable of trapping solar energy and converting it into chemical energy (biomass) through photosynthesis. 3. Subsequent levels consist of primary consumers (herbivores), secondary consumers (carnivores), and so on. 4. While pyramids of biomass or numbers can sometimes be inverted (e.g., in a marine ecosystem or a single tree ecosystem), the **Pyramid of Energy** is always upright, with producers at the base, as energy is lost as heat at each functional level.

Final Answer: Producers.

Answer: (C)

Q57.

Solution

Concept:

Population interaction refers to the way different species in a community interact with each other. These interactions can be beneficial (+), harmful (-), or neutral (0) for the species involved.

Solution:

1. **Commensalism** is an interaction where one species benefits while the other is neither harmed nor benefited (+, 0). 2. An **Orchid growing as an epiphyte on a Mango branch** is a classic example of commensalism. 3. The orchid gets a physical perch (habitat) higher up in the canopy for better light and air, thus benefiting (+). 4. The mango tree is neither harmed nor derived any benefit from the presence of the orchid (0). 5. If both benefited, it would be Mutualism; if the tree was harmed, it would be Parasitism.

Final Answer: Commensalism.

Answer: (C)

Q58.

Solution

Concept:

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

Solution:

1. **In-situ conservation** involves protecting the entire ecosystem and its biodiversity in their natural habitat (e.g., National Parks, Sanctuaries, Biosphere Reserves, and Sacred Grooves). 2. **Ex-situ conservation** involves taking threatened animals and plants out of their natural habitat and placing them in special settings where they can be protected and given special care. 3. A **Zoological Park** (Zoo) is an ex-situ method where wild animals are kept in enclosures for public exhibition and often for breeding programs for endangered species. 4. Other ex-situ examples include Botanical Gardens, Wildlife Safari Parks, and Seed/Gene Banks.

Final Answer: Zoological Park.

Answer: (D)

Q59.

Solution

Concept:

The "Evil Quartet" is a term used by ecologists to describe the four major drivers of the current high rates of extinction observed globally.

Solution:

1. The "Evil Quartet" includes: - **Habitat loss and fragmentation** (the most important cause). - **Over-exploitation** (due to human greed). - **Alien species invasions** (e.g., Nile perch in Lake Victoria). - **Co-extinctions** (when a host becomes extinct, its unique parasites also vanish). 2. These four factors are the primary reasons for the accelerated rate of **Biodiversity loss** in the contemporary world.

Final Answer: Biodiversity loss.

Answer: (B)

Q60.

Solution

Concept:

The ozone layer in the stratosphere acts as a shield absorbing ultraviolet (UV) radiation from the sun. The concentration of ozone is not uniform and varies with seasons and geography.

Solution:

1. The thickness of the ozone in a column of air from the ground to the top of the atmosphere is measured in terms of **Dobson Units (DU)**. 2. One DU is defined as the number of molecules of ozone that would be required to create a layer of pure ozone 0.01 millimeters thick at a temperature of 0 degrees Celsius and a pressure of 1 atmosphere. 3. A decrease in these units over a particular area (like Antarctica) indicates "ozone depletion" or the formation of an ozone hole.

Final Answer: Dobson Unit.

Answer: (B)

Q61.

Solution

Concept:

The endomembrane system includes those organelles whose functions are coordinated and whose membranes are physically or functionally linked. It represents a functional unit for the processing, packaging, and transport of cellular materials.

Solution:

1. The endomembrane system consists of the **Endoplasmic Reticulum (ER)**, **Golgi complex**, **Lysosomes**, and **Vacuoles**. 2. **Peroxisomes** are small membrane-bound vesicles involved in oxidative reactions (like photorespiration in plants and lipid metabolism in animals). 3. However, the functions of peroxisomes are not coordinated with the organelles mentioned above. 4. Therefore, peroxisomes (along with mitochondria and chloroplasts) are not considered part of the endomembrane system.

Final Answer: Peroxisome.

Answer: (B)

Q62.

Solution

Concept:

The resting membrane potential (approximately -70 mV) is the electrical potential difference across the plasma membrane of a non-conducting neuron. It is maintained by the unequal distribution of ions.

Solution:

1. The axonal membrane is more permeable to K^+ and nearly impermeable to Na^+ at rest. 2. The **Sodium-Potassium pump** plays a crucial role by actively transporting 3 Na^+ ions outwards for every 2 K^+ ions brought into the cell. 3. This electrogenic pump, fueled by ATP, maintains the concentration gradients that result in the interior of the neuron being negatively charged relative to the outside. 4. This state of polarization is essential for the subsequent generation of an action potential.

Final Answer: Sodium-Potassium pump.

Answer: (A)

Q63.

Solution

Concept:

Hormones are classified based on their chemical nature. Water-soluble hormones (like catecholamines and peptide hormones) cannot cross the lipid bilayer of the target cell membrane and must use intracellular intermediaries.

Solution:

1. Hormones like Epinephrine (Adrenaline) and Glucagon bind to extracellular receptors on the cell surface. 2. This binding activates an enzyme (adenylate cyclase) that converts ATP into **cAMP (cyclic Adenosine Monophosphate)**. 3. cAMP acts as a **second messenger**, relaying the hormonal signal inside the cell to trigger a biochemical cascade (e.g., glycogen breakdown). 4. Other second messengers include IP_3 and Ca^{2+}. Thyroxine and Steroid hormones cross the membrane and bind to intracellular receptors directly.

Final Answer: cAMP.

Answer: (B)

Q64.

Solution

Concept:

Each organ in the human body has a basic structural unit that performs its primary physiological functions.

Solution:

1. The liver is the largest gland in the body and is made up of numerous **Hepatic lobules**. 2. Each lobule is considered the **structural and functional unit of the liver**. 3. Inside these lobules, hepatic cells (hepatocytes) are arranged in the form of cords. 4. The lobules are covered by a thin connective tissue sheath called Glisson's capsule. 5. In comparison, the Nephron is the unit of the kidney, and the Alveolus is the unit of the lung.

Final Answer: Hepatic lobule.

Answer: (B)

Q65.

Solution

Concept:

Musculoskeletal disorders can arise from hormonal imbalances, autoimmune responses, or metabolic errors.

Solution:

1. **Gout** is a type of arthritis caused by a metabolic disorder involving purine metabolism. 2. It is characterized by the inflammation of joints due to the **accumulation of uric acid crystals**. 3. Tetany is caused by *low* blood calcium (hypocalcemia). 4. Myasthenia gravis is an *autoimmune* disorder affecting the neuromuscular junction. 5. Osteoporosis is characterized by *decreased* bone mass, often due to low estrogen levels in elderly women.

Final Answer: Gout - Accumulation of uric acid crystals.

Answer: (B)

Q66.

Solution

Concept:

Neurotransmitters are chemical messengers that transmit signals across a chemical synapse. They are broadly classified into "Excitatory" (which increase the likelihood of the postsynaptic neuron firing) and "Inhibitory" (which decrease that likelihood by hyperpolarizing the membrane).

Solution:

1. **GABA (Gamma-Aminobutyric Acid)** is the primary inhibitory neurotransmitter in the adult mammalian central nervous system. 2. It acts by binding to specific receptors that open chloride channels, allowing negatively charged chloride ions to enter the neuron, making the membrane potential more negative (hyperpolarization) and thus harder to reach the threshold for an action potential. 3. Acetylcholine and Glutamate are primarily excitatory in the CNS, and Norepinephrine usually acts as an excitatory neurotransmitter involved in the "fight or flight" response.

Final Answer: GABA.

Answer: (C)

Q67.

Solution

Concept:

The retina of the human eye contains light-sensitive cells called photoreceptors (rods and cones). However, there is a specific anatomical point where the optic nerve exits the eyeball to travel to the brain.

Solution:

1. The **Blind Spot** (Optic Disc) is the location on the retina where the optic nerve fibers exit the eye and the central retinal artery and vein enter. 2. Because this area is occupied by the nerve and blood vessels, there is no space for photoreceptor cells (**rods or cones**). 3. Consequently, any light falling on this specific region cannot be detected, resulting in a "blind spot" in the visual field. 4. The fovea centralis (macula), by contrast, is the region of highest visual acuity where only cones are densely packed.

Final Answer: Optic nerve leaves the eye and no photoreceptors are present.

Answer: (C)

Q68.

Solution

Concept:

The concentration of urine and the conservation of water are regulated by the hypothalamus through a feedback mechanism involving the posterior pituitary.

Solution:

1. When osmoreceptors in the body detect an increase in blood osmolarity (indicating dehydration), the hypothalamus triggers the release of **ADH (Antidiuretic Hormone)**, also known as **Vasopressin**, from the posterior pituitary. 2. ADH acts primarily on the **Distal Convoluted Tubule (DCT) and the Collecting Duct** of the nephron. 3. It increases the permeability of these tubules to water, allowing for significant water reabsorption back into the blood. 4. This results in the production of concentrated urine and prevents excessive water loss (**diuresis**).

Final Answer: ADH (Vasopressin).

Answer: (B)

Q69.

Solution

Concept:

Gametogenesis is the biological process by which diploid or haploid precursor cells undergo cell division and differentiation to form mature haploid gametes.

Solution:

1. The specific process of formation of a mature female gamete (ovum) is called **Oogenesis**. 2. Unlike spermatogenesis, which begins at puberty, oogenesis is initiated during the embryonic development stage when a couple of million gamete mother cells (oogonia) are formed within each fetal ovary. 3. These cells enter prophase-I of meiotic division and get temporarily arrested at that stage, called primary oocytes, until puberty. 4. Spermatogenesis refers to male gamete formation, and Parthenogenesis refers to the development of an embryo from an unfertilized egg.

Final Answer: Oogenesis.

Answer: (B)

Q70.

Solution

Concept:

After fertilization in the fallopian tube, the zygote undergoes cleavage as it moves toward the uterus, eventually forming a hollow ball of cells called a blastocyst.

Solution:

1. The blastocyst reaches the uterine cavity about 4–5 days after fertilization. 2. The outer layer of the blastocyst, called the trophoblast, then attaches to the **Endometrium** (the innermost glandular lining of the uterus). 3. The uterine cells then divide rapidly and cover the blastocyst. As a result, the blastocyst becomes embedded in the endometrium. This process is called **implantation** and leads to pregnancy.

Final Answer: Endometrium of the uterus.

Answer: (C)

Q71.

Solution

Concept:

Contraceptive methods are used to prevent unwanted pregnancies. They are broadly categorized into natural, barrier, IUDs, oral, injectable, and surgical methods. Surgical methods, also called sterilization, are generally considered terminal or permanent methods.

Solution:

1. **Vasectomy** is the surgical method of contraception in males. 2. In this procedure, a small part of the **vas deferens** is removed or tied up through a small incision on the scrotum. 3. This prevents the transport of sperm from the testes to the urethra, although the male still produces semen (which will lack sperm). 4. Tubectomy is the corresponding surgical method in females (where fallopian tubes are tied/cut). IUDs and barrier methods are temporary and reversible.

Final Answer: Vasectomy.

Answer: (B)

Q72.

Solution

Concept:

Gregor Mendel, the father of genetics, conducted hybridization experiments on garden peas (*Pisum sativum*) for seven years (1856–1863). He specifically chose traits that had two clear, opposing forms.

Solution:

1. Mendel selected **7 pairs** of contrasting characters, such as stem height (tall/dwarf), seed shape (round/wrinkled), and seed color (yellow/green). 2. Since he worked with pairs of traits, the total number of "true-breeding" pea plant varieties he used was **14**. 3. For example, for the "stem height" character, he had one true-breeding tall variety and one true-breeding dwarf variety. 4. The question asks for the number of pairs of true-breeding varieties.

Final Answer: 14.

Answer: (B)

Q73.

Solution

Concept:

Genetic crosses are named based on the number of traits or characteristics being studied simultaneously in the offspring.

Solution:

1. A **Dihybrid cross** is a cross between two individuals that differ in **two pairs** of contrasting traits (e.g., crossing a plant with round-yellow seeds and a plant with wrinkled-green seeds). 2. A Monohybrid cross involves one pair of traits. 3. A Test cross is used to determine the genotype of a dominant phenotype individual by crossing it with a recessive parent. 4. A Back cross is a cross of an F_1 individual with either of the parents.

Final Answer: Dihybrid cross.

Answer: (B)

Q74.

Solution

Concept:

Usually, one gene influences one phenotypic trait. However, there are instances where a single gene can have a much broader impact on an organism's phenotype.

Solution:

1. **Pleiotropy** occurs when **one gene influences multiple, seemingly unrelated phenotypic traits**. 2. A classic example in humans is Phenylketonuria (PKU), where a single gene mutation results in mental retardation, reduced hair, and skin pigmentation. 3. Another example is the gene for starch synthesis in pea seeds, which affects both starch grain size and seed shape. 4. Polygenic inheritance is the opposite (multiple genes controlling one trait).

Final Answer: One gene controlling multiple traits.

Answer: (B)

Q75.

Solution

Concept:

After Watson and Crick proposed the double helix structure, they suggested that DNA replication might be semi-conservative—meaning each new DNA molecule would consist of one old (parental) strand and one newly synthesized strand.

Solution:

1. In 1958, **Matthew Meselson and Franklin Stahl** performed an experiment using heavy isotope of nitrogen (^{15}N) in *E. coli*. 2. They grew bacteria in a ^{15}N medium, then transferred them to a ^{14}N medium. 3. By analyzing the density of the DNA using cesium chloride ($CsCl$) density gradient centrifugation after successive generations, they proved that the DNA replicates semi-conservatively. 4. Taylor and colleagues performed similar experiments on *Vicia faba* using radioactive thymidine.

Final Answer: Meselson and Stahl.

Answer: (A)

Q76.

Solution

Concept:

The genetic code is degenerate, meaning some amino acids are coded by more than one codon. There are 64 possible triplet codons based on the four nitrogenous bases (A, U, G, C).

Solution:

1. Out of the 64 total codons, three are "Stop Codons" (UAA, UAG, and UGA). These do not code for any amino acid and signal the termination of translation. 2. The remaining **61 codons** code for the **20 standard amino acids** used in protein synthesis. 3. This discrepancy (61 codons for 20 amino acids) is the basis for the "degeneracy" or "redundancy" of the genetic code. 4. One codon, AUG, serves as the start codon and codes for methionine, while the others are specialized for the remaining 19 amino acids.

Final Answer: 61.

Answer: (B)

Q77.

Solution

Concept:

In eukaryotic cells, the process of transcription is more complex than in prokaryotes, involving three different RNA polymerase enzymes that specialize in synthesizing different types of RNA.

Solution:

1. **RNA polymerase I** transcribes rRNAs (28S, 18S, and 5.8S). 2. **RNA polymerase II** transcribes the precursor of messenger RNA (mRNA), which is called **heterogeneous nuclear RNA (hnRNA)**. 3. **RNA polymerase III** is responsible for transcribing tRNA, 5S rRNA, and snRNAs (small nuclear RNAs). 4. hnRNA undergoes processing (splicing, capping, and tailing) to become functional mRNA before it leaves the nucleus.

Final Answer: hnRNA (precursor of mRNA).

Answer: (C)

Q78.

Solution

Concept:

The Oparin-Haldane hypothesis, proposed in the 1920s, suggests that life arose gradually from inorganic molecules, with "building blocks" like amino acids forming first and then combining into complex polymers.

Solution:

1. The theory states that the first form of life could have come from **pre-existing non-living organic molecules** (such as RNA, proteins, etc.). 2. This "chemical evolution" was preceded by the formation of diverse organic molecules from inorganic constituents in a reducing atmosphere. 3. This was later supported by the Miller-Urey experiment, which demonstrated the synthesis of amino acids from a mixture of methane, ammonia, hydrogen, and water vapor under electric discharge.

Final Answer: Non-living organic molecules.

Answer: (B)

Q79.

Solution

Concept:

Evolutionary biology distinguishes between structures that look similar due to shared ancestry and those that look similar due to similar environmental pressures.

Solution:

1. **Analogous structures** are those that perform similar functions but have different anatomical origins and structures (e.g., the wings of a butterfly and the wings of a bird). 2. These structures are the result of **convergent evolution**, where different species evolve similar adaptations independently because they live in similar environments or have similar ecological niches. 3. Homologous structures, on the other hand, result from divergent evolution and share a common ancestral origin.

Final Answer: Convergent evolution.

Answer: (B)

Q80.

Solution

Concept:

Adenosine Deaminase (ADA) deficiency is a genetic disorder that causes severe combined immunodeficiency (SCID). It was the first disease to be treated with gene therapy in humans (1990).

Solution:

1. While bone marrow transplantation and enzyme replacement therapy are possible treatments, they are not completely curative. 2. In **Gene Therapy**, lymphocytes from the patient's blood are grown in a culture outside the body. A functional ADA cDNA (using a retroviral vector) is then introduced into these lymphocytes, which are subsequently returned to the patient. 3. This is currently considered the most advanced and focused filler/treatment for the condition, especially if performed at early embryonic stages for a permanent cure.

Final Answer: Gene therapy.

Answer: (C)

Q81.

Solution

Concept:

DNA Fingerprinting is a technique used to identify individuals based on their unique DNA profiles. It relies on the presence of repetitive DNA sequences called Variable Number Tandem Repeats (VNTRs) or microsatellites.

Solution:

1. In the process of DNA fingerprinting, DNA is extracted and then digested using restriction enzymes. 2. The resulting DNA fragments of varying lengths are called **Restriction Fragment Length Polymorphisms (RFLPs)**. 3. These fragments are separated by size using gel electrophoresis and then transferred to a synthetic membrane (Southern blotting). 4. By using radioactive or fluorescent probes that bind to specific VNTR sequences, a unique pattern of bands is produced for each individual. 5. This technique is widely used in forensic science, paternity testing, and studying genetic diversity.

Final Answer: DNA fingerprinting.

Answer: (B)

Q82.

Solution

Concept:

Plant tissue culture is a collection of techniques used to maintain or grow plant cells, tissues, or organs under sterile conditions on a nutrient culture medium of known composition.

Solution:

1. **Totipotency** is the inherent ability of a single plant cell or an explant (any part of a plant taken out and grown in a test tube) to regenerate into a **whole new plant**. 2. This is possible because, unlike many animal cells, plant cells retain their full genetic potential even after differentiation. 3. This property is exploited in micropropagation to produce thousands of plants in a short period (somaclones). 4. Capacity to produce biomass is related to productivity; resistance refers to immunity.

Final Answer: Generate a whole plant from any cell/explant.

Answer: (A)

Q83.

Solution

Concept:

Bacillus thuringiensis (Bt) produces a protein crystal that contains a toxic insecticidal protein. This protein exists as an inactive protoxin but becomes active in the alkaline pH of the insect's gut.

Solution:

1. The gene responsible for coding the Bt toxin is named the ***cry*** gene** (short for crystal). 2. There are several types of *cry* genes, each effective against specific groups of insects. 3. For example, *cryIAc* and *cryIIAb* control cotton bollworms, while *cryIAb* controls corn borer. 4. *lac* is an operon for lactose metabolism, and *amp* or *tet* are antibiotic resistance genes used as selectable markers in vectors.

Final Answer: *cry*.

Answer: (B)

Q84.

Solution

Concept:

Living organisms are not static; they change over time to increase their chances of survival and reproduction in a specific environment.

Solution:

1. **Adaptation** is any attribute of the organism (morphological, physiological, behavioral) that enables the organism to survive and reproduce in its habitat. 2. For example, the thick cuticle and sunken stomata in desert plants are adaptations to reduce water loss. 3. Over long periods, these adaptations contribute to the process of **Evolution**. 4. Succession refers to the structural change in a community over time, and mutation is a sudden change in the genetic material.

Final Answer: Adaptation.

Answer: (A)

Q85.

Solution

Concept:

Primary productivity is the rate at which solar energy is captured by producers to synthesize organic compounds. This rate is limited by various environmental factors like light, temperature, and nutrient availability.

Solution:

1. In terrestrial ecosystems, Nitrogen or Phosphorus are often the limiting nutrients. 2. In marine ecosystems (oceans), while nitrogen is important, extensive research has shown that **Iron** is a key limiting micronutrient in many "High-Nitrogen, Low-Chlorophyll" (HNLC) zones. 3. Adding iron to these regions can trigger massive phytoplankton blooms, significantly increasing primary productivity. 4. Carbon dioxide is rarely a limiting factor in the ocean due to the large amount of dissolved bicarbonate.

Final Answer: Iron.

Answer: (C)

Q86.

Solution

Concept:

Global warming is caused by the "Greenhouse Effect," where certain gases in the atmosphere trap heat radiating from the Earth's surface, preventing it from escaping into space. This process maintains the Earth's temperature but becomes harmful when the concentration of these gases increases due to human activity.

Solution:

1. The most significant greenhouse gas is **Carbon dioxide (CO_2)**, contributing about 60% to the total global warming effect. It is primarily released through the burning of fossil fuels and deforestation. 2. The second most important gas is **Methane (CH_4)**, contributing about 20%. Sources include paddy fields, livestock (enteric fermentation), and landfills. 3. Other contributors include Chlorofluorocarbons (CFCs) at 14% and Nitrous oxide (N_2O) at 6%. 4. Oxygen and Nitrogen are the most abundant gases in the atmosphere but do not contribute to the greenhouse effect as they do not absorb infrared radiation.

Final Answer: Carbon dioxide and Methane.

Answer: (C)

Q87.

Solution

Concept:

Parasitism is an interaction where one species (parasite) benefits at the expense of another species (host). A unique and fascinating form of this is observed in certain bird species.

Solution:

1. **Brood Parasitism** is a type of parasitism in which the parasitic bird lays its eggs in the nest of its host and lets the host incubate them. 2. A classic example is the **Cuckoo (Koel)** laying its eggs in the nest of a **Crow**. 3. Over evolution, the eggs of the parasitic bird have evolved to resemble the host's eggs in size and color to reduce the chances of the host bird detecting the foreign eggs and ejecting them from the nest. 4. This is a highly specialized survival strategy where the parasite avoids the energy cost of nest-building and chick-rearing.

Final Answer: Parasitism (Brood parasitism).

Answer: (B)

Q88.

Solution

Concept:

Biodiversity is not uniformly distributed across the globe. Certain regions possess exceptionally high levels of species richness and endemism (species found nowhere else) but are also under constant threat of habitat destruction.

Solution:

1. India is one of the 17 "mega-diversity" countries in the world. 2. To protect these high-diversity areas, "Biodiversity Hotspots" have been identified. 3. The **Western Ghats** (along with Sri Lanka) is one of the most prominent hotspots in India. It is home to a vast number of endemic species of amphibians, reptiles, and plants. 4. Other hotspots covering parts of India include the Himalayas, Indo-Burma, and Sundaland. The Gangetic Plain and Thar Desert, while ecologically important, do not meet the specific criteria for a global "hotspot."

Final Answer: Western Ghats.

Answer: (B)

Q89.

Solution

Concept:

Effective conservation requires tracking the status of species globally. It is essential to know which species are extinct, endangered, or vulnerable to prioritize conservation efforts.

Solution:

1. The **Red Data Book** is the world's most comprehensive inventory of the global conservation status of biological species. 2. It is maintained by the **IUCN (International Union for Conservation of Nature and Natural Resources)**, which is now officially known as the World Conservation Union. 3. The book categorizes species into groups like Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, and Least Concern based on their population trends and habitat loss. 4. WWF (World Wildlife Fund) focuses on field conservation, and UNESCO is involved in designating Biosphere Reserves.

Final Answer: IUCN.

Answer: (B)

Q90.

Solution

Concept:

International cooperation is vital for environmental protection. Several global summits and conventions have been organized to address issues like biodiversity loss and climate change.

Solution:

1. The **"Earth Summit"** (The United Nations Conference on Environment and Development) was held in **1992**. 2. The venue for this historic meeting was **Rio de Janeiro**, Brazil. 3. It resulted in the Convention on Biological Diversity (CBD), which called upon all nations to take appropriate measures for the conservation of biodiversity and the sustainable utilization of its benefits. 4. In a follow-up, the World Summit on Sustainable Development was held in 2002 in Johannesburg, South Africa.

Final Answer: Rio de Janeiro.

Answer: (B)

Answer Key

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