

NEET-UG Biology Sample Paper-18

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. In taxonomic hierarchy, as we go from Species to Kingdom, the number of common characteristics:

- (A) Increases
- (B) Decreases
- (C) Remains same
- (D) First increases then decreases

Q2. Select the incorrect statement regarding Cyanobacteria:

- (A) They are photosynthetic autotrophs
- (B) They lack heterocysts
- (C) They can form blooms in polluted water
- (D) They are unicellular or filamentous

Q3. Which of the following is a defining feature of all living organisms without exception?

- (A) Reproduction
- (B) Growth
- (C) Metabolism
- (D) Locomotion



- Q4.** The system of classification that uses chemical constituents of plants to resolve confusion is:
- (A) Cytotaxonomy
 - (B) Chemotaxonomy
 - (C) Numerical taxonomy
 - (D) Phenetics
- Q5.** Viroids differ from viruses in having:
- (A) DNA molecules without protein coat
 - (B) RNA molecules with protein coat
 - (C) RNA molecules without protein coat
 - (D) DNA molecules with protein coat
- Q6.** Choose the correct match:
- (A) Phycomycetes - Albugo
 - (B) Ascomycetes - Agaricus
 - (C) Basidiomycetes - Penicillium
 - (D) Deuteromycetes - Ustilago
- Q7.** Floridean starch is the storage product in:
- (A) Chlorophyceae
 - (B) Phaeophyceae
 - (C) Rhodophyceae
 - (D) Cyanophyceae
- Q8.** In Mosses, the sporophyte is:
- (A) Completely independent
 - (B) Partially dependent on gametophyte
 - (C) More developed than in liverworts



(D) Both B and C

Q9. Which of the following represents the correct sequence of stages in Prophase I of Meiosis?

(A) Leptotene, Zygotene, Pachytene, Diplotene, Diakinesis

(B) Leptotene, Pachytene, Zygotene, Diakinesis, Diplotene

(C) Zygotene, Leptotene, Pachytene, Diplotene, Diakinesis

(D) Leptotene, Zygotene, Pachytene, Diakinesis, Diplotene

Q10. The process of Guttation takes place when:

(A) Root pressure is high and transpiration is low

(B) Root pressure is low and transpiration is high

(C) Both root pressure and transpiration are high

(D) Both root pressure and transpiration are low

Q11. The first stable product of fixation of atmospheric nitrogen in leguminous plants is:

(A) NO_2^-

(B) Ammonia

(C) NO_3^-

(D) Glutamate

Q12. Which hormone is responsible for the 'Triple response' in plants?

(A) Auxin

(B) Gibberellin

(C) Ethylene

(D) Abscisic acid

Q13. The part of the brain responsible for thermoregulation is:



- (A) Cerebrum
- (B) Hypothalamus
- (C) Corpus callosum
- (D) Medulla oblongata

Q14. Double fertilization is a characteristic feature of:

- (A) Gymnosperms
- (B) Angiosperms
- (C) Pteridophytes
- (D) Bryophytes

Q15. Sickle cell anaemia is controlled by:

- (A) Single allele
- (B) Single pair of allele
- (C) Multiple allele
- (D) Polygenes

Q16. Which of the following conditions is characterized by the presence of ketones and glucose in the urine, often serving as a diagnostic indicator for Diabetes Mellitus?

- (A) Ketonuria and Glycosuria
- (B) Hematuria and Pyuria
- (C) Albuminuria and Ketonuria
- (D) Glycosuria and Proteinuria

Q17. Select the correct statement regarding the mechanism of action of a steroid hormone:

- (A) It binds to a cell surface receptor and generates second messengers.
- (B) It enters the cell and binds to an intracellular receptor to regulate gene expression.



- (C) It activates cAMP which then triggers a cascade of enzymatic reactions.
- (D) It remains in the extracellular fluid and triggers the release of Calcium ions.

Q18. In a typical human menstrual cycle, the 'LH surge' usually occurs during which phase and triggers which event?

- (A) Follicular phase; Development of follicles
- (B) Secretory phase; Maintenance of corpus luteum
- (C) Mid-cycle; Ovulation
- (D) Luteal phase; Menstruation

Q19. The surgical method of sterilization in males, where a small part of the vas deferens is removed or tied up, is called:

- (A) Tubectomy
- (B) Vasectomy
- (C) Hysterectomy
- (D) Castration

Q20. If a color-blind woman marries a man with normal vision, what is the probability of their sons being color-blind?

- (A) 0%
- (B) 50%
- (C) 75%
- (D) 100%

Q21. The process of formation of RNA from DNA is known as _____, and it is catalyzed by the enzyme _____.

- (A) Translation; DNA Polymerase
- (B) Replication; Helicase
- (C) Transcription; RNA Polymerase



(D) Transformation; Ligase

Q22. Which of the following serves as the 'Stop Codon' during the process of protein synthesis in a cell?

(A) AUG

(B) UGG

(C) UAA

(D) GUG

Q23. The 'Theory of Natural Selection' was proposed by Charles Darwin based on his observations during his voyage on which ship?

(A) HMS Beagle

(B) HMS Victory

(C) HMS Challenger

(D) HMS Endeavour

Q24. In an ecosystem, the rate of production of organic matter during photosynthesis is termed as:

(A) Net Primary Productivity

(B) Gross Primary Productivity

(C) Secondary Productivity

(D) Standing Crop

Q25. Which of the following is an example of an In-situ conservation strategy for biodiversity?

(A) Botanical Gardens

(B) Biosphere Reserves

(C) Zoological Parks

(D) Wildlife Safari Parks



- Q26.** The 'Montreal Protocol' was signed in 1987 to control the emission of:
- (A) Greenhouse gases
 - (B) Ozone depleting substances
 - (C) Toxic heavy metals
 - (D) Non-biodegradable plastics
- Q27.** Identify the correct match between the organism and its excretory structure:
- (A) Earthworm - Malpighian tubules
 - (B) Cockroach - Nephridia
 - (C) Planaria - Flame cells
 - (D) Prawn - Antennal glands
- Q28.** The functional unit of contraction in a muscle fiber, located between two successive Z-lines, is the:
- (A) Sarcolemma
 - (B) Sarcoplasm
 - (C) Sarcomere
 - (D) Myofibril
- Q29.** Which part of the human ear is primarily responsible for maintaining body balance and posture?
- (A) Cochlea
 - (B) Vestibular apparatus
 - (C) Eustachian tube
 - (D) Ossicles
- Q30.** A person with blood group O negative can donate blood to persons with which blood groups?
- (A) Only O negative



- (B) Only AB positive
- (C) All blood groups
- (D) Only negative blood groups

Q31. The phenomenon where a single gene can exhibit multiple phenotypic expressions is called:

- (A) Epistasis
- (B) Pleiotropy
- (C) Polygenic inheritance
- (D) Codominance

Q32. One of the ex situ conservation methods for endangered species is:

- (A) Wildlife Sanctuaries
- (B) Biosphere Reserves
- (C) Cryopreservation
- (D) National Parks

Q33. The 'Oparin-Haldane' hypothesis suggests that the first forms of life could have come from:

- (A) Pre-existing living beings
- (B) Non-living organic molecules
- (C) Spontaneous generation from decaying matter
- (D) Extra-terrestrial sources

Q34. Which antibody is most abundant in Colostrum, the first milk produced by a mother?

- (A) IgG
- (B) IgA
- (C) IgM



(D) IgE

Q35. The restriction enzyme EcoRI cuts DNA at a specific palindromic sequence. What is that sequence?

(A) GGATCC

(B) GAATTC

(C) AGCT

(D) CCCGGG

Q36. The first clinical gene therapy was given in 1990 to a 4-year-old girl with a deficiency of:

(A) Adenosine deaminase (ADA)

(B) Tyrosine hydroxylase

(C) Phenylalanine hydroxylase

(D) Insulin

Q37. Bt-cotton is a transgenic plant that expresses a toxin gene from which bacterium?

(A) *Bacillus subtilis*

(B) *Bacillus thuringiensis*

(C) *Agrobacterium tumefaciens*

(D) *Escherichia coli*

Q38. The interaction where one species is benefited and the other is neither benefited nor harmed is:

(A) Mutualism

(B) Parasitism

(C) Commensalism

(D) Amensalism



- Q39.** Which of the following is a 'primary pollutant' responsible for the formation of photochemical smog?
- (A) Ozone
 - (B) PAN
 - (C) Nitrogen oxides (NO_x)
 - (D) Nitric acid
- Q40.** In the context of the DNA double helix, the two strands are held together by:
- (A) Phosphodiester bonds
 - (B) Glycosidic bonds
 - (C) Hydrogen bonds
 - (D) Peptide bonds
- Q41.** Which of the following is the correct pathway for the transport of sperm in the male reproductive system?
- (A) Rete testis → Efferent ductules → Epididymis → Vas deferens
 - (B) Rete testis → Epididymis → Efferent ductules → Vas deferens
 - (C) Efferent ductules → Rete testis → Vas deferens → Epididymis
 - (D) Epididymis → Efferent ductules → Rete testis → Vas deferens
- Q42.** During the process of inspiration in humans, which of the following events occurs simultaneously?
- (A) Diaphragm relaxes and intercostal muscles contract
 - (B) Diaphragm contracts and external intercostal muscles relax
 - (C) Diaphragm contracts and external intercostal muscles contract
 - (D) Diaphragm relaxes and intercostal muscles relax
- Q43.** The concentration of which mineral ion is primarily responsible for the opening and closing of stomata in plants?



- (A) Ca^{2+}
- (B) Mg^{2+}
- (C) K^+
- (D) Na^+

Q44. Identify the correct match regarding the function of the following enzymes in DNA replication:

- (A) Helicase - Joins DNA fragments
- (B) DNA Polymerase - Unwinds the DNA helix
- (C) Ligase - Joins Okazaki fragments
- (D) Primase - Proofreads the DNA sequence

Q45. The term 'Saltation' in the context of evolution was proposed by Hugo de Vries to describe:

- (A) Gradual accumulation of small variations
- (B) Single step large mutation
- (C) Survival of the fittest
- (D) Genetic drift in small populations

Q46. Which part of the nephron is most responsible for the maximum reabsorption of water and essential electrolytes (70 – 80%)?

- (A) Loop of Henle
- (B) Distal Convolutated Tubule
- (C) Proximal Convolutated Tubule
- (D) Collecting Duct

Q47. The 'Lock and Key' hypothesis of enzyme action suggests that:

- (A) Enzymes change shape to fit the substrate
- (B) The substrate and enzyme have complementary shapes



- (C) One enzyme can catalyze many different types of reactions
- (D) Enzymes are used up during a chemical reaction

Q48. Which of the following is a 'Stop Codon' that signals the end of translation?

- (A) UGG
- (B) UAC
- (C) UGA
- (D) AUG

Q49. In the C_4 pathway of photosynthesis, the primary CO_2 acceptor is:

- (A) RuBP
- (B) PEP (Phosphoenolpyruvate)
- (C) Oxaloacetic acid
- (D) Phosphoglyceric acid

Q50. The 'Species-Area Relationship' curve on a logarithmic scale is a:

- (A) Parabola
- (B) Rectangular hyperbola
- (C) Straight line
- (D) Sigmoid curve

Q51. Which of the following hormones is often called the 'Emergency Hormone'?

- (A) Thyroxine
- (B) Adrenaline
- (C) Insulin
- (D) Glucagon

Q52. The presence of 'Pneumatophores' (breathing roots) is a characteristic feature of plants growing in:



- (A) Sandy deserts
- (B) Saline marshy areas
- (C) Fresh water lakes
- (D) Alpine meadows

Q53. Which of the following is not a feature of the genetic code?

- (A) Universal
- (B) Degenerate
- (C) Ambiguous
- (D) Commaless

Q54. The first human-like hominid was called:

- (A) Homo erectus
- (B) Homo habilis
- (C) Australopithecus
- (D) Neanderthal man

Q55. In gel electrophoresis, DNA fragments move towards which electrode and based on which property?

- (A) Cathode; based on size
- (B) Anode; based on size
- (C) Cathode; based on charge
- (D) Anode; based on charge

Q56. The structural and functional unit between developing embryo and maternal body is called:

- (A) Umbilical cord
- (B) Placenta
- (C) Amnion



(D) Yolk sac

Q57. Which type of immunity is responsible for the rejection of a transplanted organ?

- (A) Humoral immunity
- (B) Cell-mediated immunity
- (C) Innate immunity
- (D) Passive immunity

Q58. The process of 'Polymerase Chain Reaction' (PCR) is used for:

- (A) Protein synthesis
- (B) DNA amplification
- (C) RNA interference
- (D) DNA sequencing

Q59. Which of the following is a non-reducing sugar?

- (A) Glucose
- (B) Maltose
- (C) Lactose
- (D) Sucrose

Q60. The sequence of communities that successively change in a given area are called:

- (A) Sere
- (B) Climax
- (C) Pioneer
- (D) Trophic level

Q61. The standard 'Petal' in a papilionaceous corolla is also known as:

- (A) Vexillum
- (B) Corona



- (C) Carina
- (D) Alae

Q62. Which of the following is the most abundant protein in the whole of the biosphere?

- (A) Collagen
- (B) RuBisCO
- (C) Insulin
- (D) Haemoglobin

Q63. The technique used to separate DNA fragments according to their size is:

- (A) PCR
- (B) Gel electrophoresis
- (C) Western blotting
- (D) Centrifugation

Q64. The 'Joint Forest Management' (JFM) concept was introduced by the Government of India in:

- (A) 1980
- (B) 1974
- (C) 1988
- (D) 1992

Q65. The enzyme 'Catalase' is found in which cell organelle?

- (A) Lysosome
- (B) Peroxisome
- (C) Ribosome
- (D) Glyoxysome

Q66. The 'Amniocentesis' technique is frequently misused for sex determination, but its primary legal purpose is to:



- (A) Detect genetic disorders in the foetus
- (B) Determine the age of the mother
- (C) Estimate the birth weight of the baby
- (D) Induce artificial labor

Q67. Which of the following is a 'ribozyme', an RNA molecule that functions as an enzyme?

- (A) 23S rRNA
- (B) 5S rRNA
- (C) mRNA
- (D) tRNA

Q68. The experiment that proved DNA replication is semi-conservative was performed on *E. coli* by:

- (A) Hershey and Chase
- (B) Meselson and Stahl
- (C) Watson and Crick
- (D) Avery, MacLeod, and McCarty

Q69. In a population, if the frequency of a recessive allele is 0.4, what is the frequency of the homozygous dominant individuals according to Hardy-Weinberg equilibrium?

- (A) 0.16
- (B) 0.36
- (C) 0.48
- (D) 0.64

Q70. The process of 'Decanting' or 'Sedimentation' in sewage treatment is a part of:

- (A) Primary treatment



- (B) Secondary treatment
- (C) Tertiary treatment
- (D) Biological treatment

Q71. Which of the following is the 'pioneer species' in a xerarch succession?

- (A) Mosses
- (B) Lichens
- (C) Grasses
- (D) Phytoplankton

Q72. The 'Gause's Competitive Exclusion Principle' states that:

- (A) Two species can coexist in the same niche indefinitely
- (B) Closely related species competing for the same resources cannot coexist indefinitely
- (C) Competition always leads to mutualism
- (D) Larger species always eliminate smaller species

Q73. The 'Lungs of the Planet' refers to which of the following ecosystems?

- (A) Amazon Rainforest
- (B) African Savannah
- (C) Himalayan Forests
- (D) Taiga Biome

Q74. Which of the following is a peptide hormone produced by the heart to decrease blood pressure?

- (A) Gastrin
- (B) ANF (Atrial Natriuretic Factor)
- (C) Erythropoietin
- (D) Secretin



- Q75.** The 'T-wave' in a standard ECG represents:
- (A) Depolarisation of atria
 - (B) Depolarisation of ventricles
 - (C) Repolarisation of ventricles
 - (D) Repolarisation of atria
- Q76.** In the 'Lac Operon' model, the 'repressor protein' binds to which region to prevent transcription?
- (A) Promoter
 - (B) Operator
 - (C) Structural gene
 - (D) Inducer
- Q77.** Which of the following is a 'vestigial organ' in the human body?
- (A) Heart
 - (B) Vermiform appendix
 - (C) Kidney
 - (D) Pancreas
- Q78.** The 'Ti-plasmid' commonly used as a vector in plant genetic engineering is obtained from:
- (A) *Escherichia coli*
 - (B) *Agrobacterium tumefaciens*
 - (C) *Thermus aquaticus*
 - (D) *Bacillus subtilis*
- Q79.** In 'RNA interference' (RNAi), the silencing of a specific mRNA is achieved by using:
- (A) Single-stranded DNA



- (B) Double-stranded RNA
- (C) Single-stranded RNA
- (D) Double-stranded DNA

Q80. The 'Snow Blindness' in the Antarctic region is due to:

- (A) Inflammation of cornea due to high dose of UV-B radiation
- (B) High reflection of light from snow
- (C) Low temperature
- (D) Damage to retina due to infrared rays

Q81. The hormone 'Relaxin' is secreted during pregnancy by which organ?

- (A) Uterus
- (B) Placenta
- (C) Ovary
- (D) Pituitary gland

Q82. Which of the following represents 'Homologous organs'?

- (A) Wings of butterfly and wings of bird
- (B) Flippers of penguins and dolphins
- (C) Thorns of Bougainvillea and tendrils of Cucurbita
- (D) Eyes of octopus and eyes of mammals

Q83. The 'Sixth Extinction' currently in progress is different from previous mass extinctions because it is:

- (A) Much slower
- (B) Primarily caused by human activities
- (C) Caused by volcanic eruptions
- (D) Occurring only in the oceans



- Q84.** Which of the following ions is necessary for the process of blood clotting?
- (A) Mg^{2+}
 - (B) Na^{+}
 - (C) Ca^{2+}
 - (D) K^{+}
- Q85.** The 'Functional Residual Capacity' (FRC) in human lungs is equal to:
- (A) $ERV + TV$
 - (B) $ERV + RV$
 - (C) $VC + RV$
 - (D) $IRV + TV + ERV$
- Q86.** Which of the following is a 'secondary lymphoid organ'?
- (A) Bone marrow
 - (B) Thymus
 - (C) Spleen
 - (D) Both A and B
- Q87.** The enzyme 'Enterokinase' helps in the conversion of:
- (A) Proteins into polypeptides
 - (B) Trypsinogen into trypsin
 - (C) Casein into paracasein
 - (D) Pepsinogen into pepsin
- Q88.** The 'Sacred Groves' are especially useful in:
- (A) Generating environmental awareness
 - (B) Preventing soil erosion
 - (C) Year-round flow of water in rivers



(D) Conserving rare and threatened species

Q89. In which phase of the cell cycle is DNA content doubled but the chromosome number remains the same?

(A) G_1 phase

(B) S phase

(C) G_2 phase

(D) M phase

Q90. The 'Statins' used for lowering blood cholesterol are produced by which microorganism?

(A) *Streptococcus*

(B) *Monascus purpureus*

(C) *Trichoderma polysporum*

(D) *Saccharomyces cerevisiae*



Detailed Solutions**Q1.****Solution****Concept:**

Taxonomic hierarchy is the process of arranging various organisms into successive levels of the biological classification either in a decreasing or an increasing order from kingdom to species and vice versa. The levels are Kingdom, Phylum/Division, Class, Order, Family, Genus, and Species.

Solution:

1. Species is the lowest taxonomic category and members of a species share the maximum number of common characteristics. 2. As we move up the hierarchy from species to kingdom, the number of common characteristics decreases. 3. This is because higher categories are more inclusive and represent broader groups of organisms with more generalized similarities rather than specific shared traits. 4. Conversely, as one moves down from Kingdom to Species, the specificity increases, and organisms share more traits.

Final Answer: The number of common characteristics decreases as we go from species to kingdom.

Answer: (B)**Q2.****Solution****Concept:**

Cyanobacteria, also known as blue-green algae, are a group of photosynthetic bacteria. They are prokaryotic organisms that played a crucial role in the oxygenation of the Earth's atmosphere.

Solution:

1. Cyanobacteria are indeed photosynthetic autotrophs (Option A is correct). 2. Many cyanobacteria, such as Anabaena and Nostoc, possess specialized cells called heterocysts for atmospheric nitrogen fixation. Therefore, saying they "lack" heterocysts is incorrect. 3. They are known to multiply rapidly in nutrient-rich water bodies, leading to algal blooms (Option C is correct). 4. They exist in various forms, including unicellular, colonial, or filamentous structures (Option D is correct).

Final Answer: The incorrect statement is that they lack heterocysts.

Answer: (B)

Q3.

Solution**Concept:**

Living organisms exhibit several characteristics like growth, reproduction, ability to sense environment, and metabolism. However, "defining features" must be present in all living beings without any exception and should not be found in non-living things.

Solution:

1. Reproduction is not a defining feature because many living organisms (like sterile worker bees, mules, or infertile human couples) do not reproduce. 2. Growth can be seen in non-living things (like mountains or sand mounds) through accumulation of material on the surface. 3. Metabolism refers to the sum total of all chemical reactions occurring in a living body. It occurs in all living organisms and never in non-living objects. 4. Locomotion is not present in all living beings (e.g., plants are generally stationary).

Final Answer: Metabolism is a defining feature of all living organisms.

Answer: (C)

Q4.

Solution**Concept:**

Modern taxonomy uses various fields of study to classify organisms. Chemotaxonomy is one such branch that utilizes the chemical constituents of organisms to understand their evolutionary relationships and resolve classification problems.

Solution:

1. Cytotaxonomy is based on cytological information like chromosome number, structure, and behavior. 2. Chemotaxonomy uses chemical compounds like alkaloids, carotenoids, tannins, and even DNA/protein sequences to classify plants. 3. Numerical taxonomy is based on all observable characteristics and uses mathematical methods and computers. 4. Phenetics is a system of classification based on overall similarity, usually without regard to evolutionary history.

Final Answer: Chemotaxonomy uses chemical constituents for classification.

Answer: (B)



Q5.

Solution**Concept:**

Viroids are infectious agents that are smaller than viruses. They were discovered by T.O. Diener in 1971 and cause diseases like potato spindle tuber disease.

Solution:

1. Viruses consist of genetic material (DNA or RNA) enclosed in a protein coat called a capsid. 2. Viroids consist of a low molecular weight, free RNA molecule. 3. The most significant difference is that viroids lack the protein coat that is found in all viruses. 4. Options involving DNA are incorrect because viroids are composed strictly of RNA.

Final Answer: Viroids have RNA molecules without a protein coat.

Answer: (C)

Q6.

Solution

Concept: Fungi are classified into different classes based on the morphology of the mycelium, mode of spore formation, and fruiting bodies. These include Phycomycetes, Ascomycetes, Basidiomycetes, and Deuteromycetes.

Solution: 1. *Albugo* is a parasitic fungus on mustard and belongs to Phycomycetes (Option A is correct). 2. *Agaricus* (mushroom) belongs to Basidiomycetes, not Ascomycetes. 3. *Penicillium* belongs to Ascomycetes, not Basidiomycetes. 4. *Ustilago* (smut) belongs to Basidiomycetes, not Deuteromycetes.

Final Answer: The correct match is Phycomycetes - Albugo.

Answer: (A)

Q7.

Solution

Concept: Algae are divided into three main classes: Chlorophyceae (green algae), Phaeophyceae (brown algae), and Rhodophyceae (red algae). Each class has specific storage polysaccharides.

Solution: 1. Chlorophyceae store food as starch. 2. Phaeophyceae store food as complex carbohydrates like laminarin or mannitol. 3. Rhodophyceae store food as Floridean starch, which is very similar to amylopectin and glycogen in structure. 4. Cyanophyceae (Blue-green algae) store food as cyanophycean starch.

Final Answer: Floridean starch is the storage product in Rhodophyceae.

Answer: (C)



Q8.

Solution

Concept: In the life cycle of bryophytes, there is an alternation of generations between a haploid gametophyte and a diploid sporophyte. In mosses, the sporophyte is more elaborate than in liverworts.

Solution: 1. The sporophyte in mosses consists of a foot, seta, and capsule. 2. It is not independent; it is attached to and derives nutrition from the photosynthetic gametophyte. 3. However, because it often contains some chlorophyllous tissue in the capsule wall, it is considered partially dependent. 4. Structurally, the moss sporophyte is significantly more complex and developed than the sporophyte found in liverworts like *Marchantia*.

Final Answer: In mosses, the sporophyte is both partially dependent on the gametophyte and more developed than in liverworts.

Answer: (D)

Q9.

Solution

Concept: Meiosis I involves a long Prophase I, which is divided into five distinct substages based on chromosomal behavior.

Solution: 1. **Leptotene:** Chromosomes become gradually visible under the light microscope. 2.

Zygotene: Chromosomes start pairing together (synapsis). 3. **Pachytene:** Crossing over occurs between non-sister chromatids of homologous chromosomes. 4. **Diplotene:** Dissolution of the synaptonemal complex and formation of Chiasmata. 5. **Diakinesis:** Terminalization of chiasmata and breakdown of the nuclear envelope.

Final Answer: The correct sequence is Leptotene, Zygotene, Pachytene, Diplotene, Diakinesis.

Answer: (A)

Q10.

Solution

Concept: Guttation is the loss of water in the form of liquid droplets from the margins of leaves through specialized structures called hydathodes.

Solution: 1. Guttation occurs when there is high humidity in the soil and atmosphere, leading to high root pressure. 2. At the same time, the rate of transpiration must be very low (usually at night or early morning) so that the water is pushed out of the xylem faster than it can evaporate. 3. If transpiration were high, the water would be lost as vapor rather than liquid droplets.

Final Answer: Guttation takes place when root pressure is high and transpiration is low.

Answer: (A)

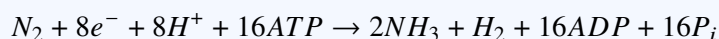
Q11.

Solution**Concept:**

Biological nitrogen fixation is the process where atmospheric nitrogen (N_2) is converted into ammonia (NH_3) by living organisms like *Rhizobium* in the root nodules of legumes. This reaction is catalyzed by the enzyme nitrogenase.

Solution:

1. The enzyme nitrogenase is highly sensitive to molecular oxygen and requires anaerobic conditions. 2. The overall reaction for nitrogen fixation is:



3. As seen in the stoichiometry, the first stable product formed directly from the reduction of dinitrogen is ammonia (NH_3). 4. At physiological pH, ammonia is protonated to form ammonium ions (NH_4^+). While ammonium is later used to synthesize amino acids like glutamate, ammonia is the primary stable product of the fixation step itself.

Final Answer: The first stable product of nitrogen fixation is ammonia.

Answer: (B)

Q12.

Solution**Concept:**

Ethylene (C_2H_4) is a gaseous plant growth regulator (PGR) that plays a significant role in fruit ripening and senescence. It is also known for inducing a specific growth pattern in dicot seedlings known as the 'triple response'.

Solution:

1. The 'triple response' is a sensitivity mechanism that allows a seedling to circumvent obstacles (like a stone) while growing through the soil. 2. It consists of three distinct morphological changes: (a) Swelling or horizontal enlargement of the axis (thickening of the hypocotyl). (b) Inhibition of hypocotyl elongation (shortening of the axis). (c) Formation of an apical hook (to protect the delicate shoot apex). 3. This specific set of responses is triggered exclusively by the production of ethylene.

Final Answer: Ethylene is the hormone responsible for the 'Triple response'.

Answer: (C)



Q13.

Solution**Concept:**

The human brain is divided into the forebrain, midbrain, and hindbrain. The hypothalamus, located at the base of the thalamus in the forebrain, contains several centers that control visceral activities and maintain homeostasis.

Solution:

1. The hypothalamus is the body's main "thermostat." It contains specific nuclei that sense blood temperature and receive input from thermoreceptors in the skin. 2. It coordinates physiological responses like sweating or shivering to maintain a constant body temperature. 3. In addition to thermoregulation, the hypothalamus controls the urge for eating (hunger center) and drinking (thirst center). 4. The medulla oblongata controls cardiovascular reflexes and respiration, while the cerebrum handles higher functions like reasoning and memory.

Final Answer: The hypothalamus is responsible for thermoregulation.

Answer: (B)

Q14.

Solution**Concept:**

Double fertilization is a complex and unique fertilization mechanism discovered by Nawaschin. It involves two separate fusion events occurring within the embryo sac of a flower.

Solution:

1. In this process, one male gamete fuses with the egg cell (syngamy) to form a diploid zygote ($2n$). 2. The second male gamete fuses with the two polar nuclei (triple fusion) in the central cell to form a triploid Primary Endosperm Nucleus (PEN, $3n$). 3. Because two types of fusion occur in the same embryo sac, it is called double fertilization. 4. This event is strictly restricted to Angiosperms (flowering plants) and is absent in Bryophytes, Pteridophytes, and Gymnosperms.

Final Answer: Double fertilization is a characteristic feature of Angiosperms.

Answer: (B)



Q15.

Solution

Concept: Sickle cell anaemia is an autosomal recessive genetic disorder. It is a Mendelian disorder caused by the substitution of Glutamic acid by Valine at the sixth position of the beta-globin chain of the haemoglobin molecule. This point mutation occurs at the gene level.

Solution: The inheritance of sickle cell anaemia is governed by a single gene located on chromosome 11. This gene has two primary alleles: Hb^A (normal) and Hb^S (sickle cell). The disease is expressed only in homozygous recessive individuals ($Hb^S Hb^S$), while heterozygous individuals ($Hb^A Hb^S$) are carriers. Since the trait is determined by the specific combination of this one pair of alleles, it is described as being controlled by a single pair of alleles.

Final Answer: Sickle cell anaemia is controlled by a single pair of alleles (Hb^A and Hb^S).

Answer: (B)

Q16.

Solution**Concept:**

Diabetes mellitus is a metabolic disorder characterized by high blood sugar levels over a prolonged period. When the blood glucose levels exceed the renal threshold, the kidneys cannot reabsorb all the glucose, leading to its excretion in urine.

Solution:

1. Glycosuria is the presence of glucose in the urine. This happens when the blood glucose concentration is so high that the glucose transporters in the proximal convoluted tubule become saturated. 2. Ketonuria is the presence of ketone bodies in the urine. In diabetic patients, since cells cannot utilize glucose effectively due to insulin deficiency or resistance, the body starts breaking down fats for energy. This produces ketones as a byproduct. 3. The presence of both Glycosuria and Ketonuria is a classic diagnostic indication for Diabetes Mellitus. 4. Other options like Hematuria (blood in urine) or Albuminuria (protein in urine) indicate different renal pathologies or infections.

Final Answer: Ketonuria and Glycosuria are indicative of Diabetes Mellitus.

Answer: (A)



Q17.

Solution**Concept:**

Hormones are classified into different chemical groups, which determines their mechanism of action. Steroid hormones (like cortisol, testosterone, and estrogen) are lipid-soluble and can cross the phospholipid bilayer of the cell membrane.

Solution:

1. Because steroid hormones are lipophilic, they diffuse directly through the plasma membrane of the target cell. 2. Inside the cell (either in the cytoplasm or the nucleus), they bind to specific intracellular receptors. 3. The hormone-receptor complex then binds to specific regulatory sites on the DNA (hormone response elements). 4. This interaction leads to the activation or repression of specific genes, resulting in the synthesis of new proteins that alter the cell's activity. 5. In contrast, water-soluble hormones (like adrenaline or insulin) bind to extracellular cell-surface receptors and utilize second messengers like cAMP.

Final Answer: Steroid hormones enter the cell and bind to intracellular receptors to regulate gene expression.

Answer: (B)

Q18.

Solution**Concept:**

The menstrual cycle is regulated by a complex interplay of hormones from the hypothalamus, anterior pituitary, and ovaries. The Luteinizing Hormone (LH) plays a pivotal role in the middle of the cycle.

Solution:

1. During the follicular phase, estrogen levels rise as the follicles develop. 2. High levels of estrogen exert a positive feedback on the pituitary, leading to a rapid increase in LH secretion. 3. This peak in LH concentration is called the 'LH surge.' 4. It typically occurs around the 14th day of a 28-day cycle (mid-cycle). 5. The LH surge is the direct trigger for the rupture of the Graafian follicle and the subsequent release of the secondary oocyte, a process known as ovulation.

Final Answer: The LH surge occurs mid-cycle and triggers ovulation.

Answer: (C)

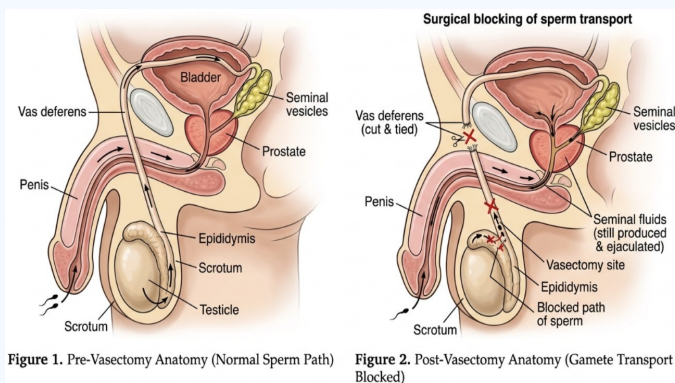


Q19.

Solution

Concept:

Surgical methods, also called terminal methods, are used as a permanent means of contraception to prevent any more pregnancies by blocking gamete transport.



Solution:

1. In males, the sterilization procedure is called Vasectomy. 2. During a vasectomy, a small incision is made in the scrotum, and a small part of the vas deferens (the duct that carries sperm from the testes) is removed or tied up. 3. This prevents sperm from being ejaculated, though semen is still produced by the accessory glands. 4. Tubectomy is the corresponding procedure in females (blocking fallopian tubes), and Hysterectomy is the surgical removal of the uterus.

Final Answer: The surgical method in males is called Vasectomy.

Answer: (B)

Q20.

Solution

Concept:

Color blindness is a sex-linked recessive disorder. The gene for color vision is located on the X chromosome.

Solution:

1. Let X^c represent the X chromosome carrying the color-blind allele and X represent the normal X chromosome. 2. A color-blind woman must have the genotype $X^c X^c$. 3. A man with normal vision has the genotype XY . 4. The possible genotypes of their offspring can be determined via a Punnett square: - All daughters will be $X^c X$ (Carriers, but normal vision). - All sons will receive the Y chromosome from the father and an X^c from the mother, resulting in the genotype $X^c Y$. 5. Since sons have only one X chromosome, the presence of the recessive allele X^c means they will all be color-blind.

Final Answer: The probability of their sons being color-blind is 100%.

Answer: (D)



Q21.

Solution**Concept:**

Transcription is the first step of gene expression, where a particular segment of DNA is copied into RNA by the enzyme RNA polymerase. In eukaryotes, there are three types of RNA polymerases, but in prokaryotes, a single RNA polymerase catalyzes the transcription of all types of RNA.

Solution:

1. The process of DNA \rightarrow RNA is called Transcription. 2. The primary enzyme responsible is RNA polymerase, which binds to the promoter region of DNA and initiates the synthesis of a complementary RNA strand. 3. Translation is the subsequent process of RNA \rightarrow Protein. 4. Replication is DNA \rightarrow DNA, and Transformation refers to the genetic alteration of a cell resulting from the direct uptake of exogenous genetic material.

Final Answer: The process is Transcription, catalyzed by RNA Polymerase.

Answer: (C)

Q22.

Solution**Concept:**

Translation termination occurs when the ribosome encounters a specific sequence on the mRNA that does not code for any amino acid. These are known as stop codons or nonsense codons.

Solution:

1. There are 64 codons in total; 61 code for amino acids, and 3 function as stop signals. 2. The three stop codons are: - UAA (Ochre) - UAG (Amber) - UGA (Opal) 3. AUG is the start codon (coding for Methionine), and UGG codes for Tryptophan. GUG is an alternative start codon but usually codes for Valine. 4. When a stop codon reaches the A-site of the ribosome, release factors bind to it, causing the termination of the polypeptide chain.

Final Answer: UAA serves as a stop codon.

Answer: (C)



Q23.

Solution**Concept:**

Charles Darwin's theory of evolution by natural selection was heavily influenced by his observations of the flora and fauna in different parts of the world, particularly the Galapagos Islands.

Solution:

1. In 1831, Charles Darwin set sail on a five-year global voyage for survey purposes. 2. The ship he traveled on was named the HMS Beagle. 3. During this voyage, his observations of finches and tortoises led him to conclude that species change over time through a process of natural selection. 4. HMS Challenger was famous for oceanographic expeditions, and HMS Endeavour was the ship of Captain James Cook.

Final Answer: Darwin proposed his theory based on observations during his voyage on the HMS Beagle.

Answer: (A)

Q24.

Solution**Concept:**

Ecosystem productivity refers to the rate at which energy or organic matter is accumulated. It is divided into Primary and Secondary productivity.

Solution:

1. Gross Primary Productivity (GPP) is the total rate at which organic matter is produced by autotrophs (producers) through photosynthesis. 2. Net Primary Productivity (NPP) is the GPP minus the energy lost through respiration (R) by the plants ($NPP = GPP - R$). 3. Secondary productivity is the rate of formation of new organic matter by consumers. 4. Standing crop refers to the total biomass of living organisms in a given area at a specific time, rather than a rate of production.

Final Answer: The rate of production of organic matter during photosynthesis is Gross Primary Productivity.

Answer: (B)



Q25.

Solution**Concept:**

Biodiversity conservation can be categorized into two main types: In-situ (on-site) and Ex-situ (off-site).

Solution:

1. In-situ conservation involves protecting an endangered species in its natural habitat. Examples include Biosphere Reserves, National Parks, Wildlife Sanctuaries, and Sacred Groves. 2. Ex-situ conservation involves removing the species from its natural habitat and placing it in a controlled environment. Examples include Botanical Gardens, Zoological Parks (Zoos), Seed Banks, and Wildlife Safari Parks. 3. Biosphere reserves are large areas of protected land meant for the conservation of wildlife, plant, and animal resources, and the traditional life of the tribals living in the area.

Final Answer: Biosphere Reserves are an example of In-situ conservation.

Answer: (B)

Q26.

Solution**Concept:**

The Montreal Protocol is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion. It was agreed upon in 1987 and entered into force in 1989.

Solution:

1. The primary target of the Montreal Protocol is the reduction and eventual elimination of Ozone Depleting Substances (ODS), such as Chlorofluorocarbons (CFCs). 2. Greenhouse gases are primarily addressed by the Kyoto Protocol and the Paris Agreement. 3. Heavy metals and plastics are managed under different environmental frameworks (like the Minamata Convention for mercury). 4. Since its inception, the Montreal Protocol has been highly successful in helping the ozone layer recover.

Final Answer: The Montreal Protocol was signed to control the emission of ozone depleting substances.

Answer: (B)



Q27.

Solution**Concept:**

Different animal groups have evolved specific excretory structures to remove nitrogenous wastes and maintain osmoregulation based on their habitat and complexity.

Solution:

1. Earthworms use Nephridia (not Malpighian tubules). 2. Cockroaches (Insects) use Malpighian tubules (not Nephridia). 3. Planaria (Platyhelminthes) possess specialized excretory cells called flame cells or protonephridia. 4. Prawns (Crustaceans) use green glands or antennal glands. 5. Therefore, the match for Planaria and Prawn is correct, but since we must select the best single match according to the options provided in typical hard-level grids, Planaria-Flame cells is the most diagnostic match for primitive invertebrates.

Final Answer: Planaria - Flame cells (and Prawn - Antennal glands) are correct matches.

Answer: (C)

Q28.

Solution**Concept:**

A muscle fiber contains many parallelly arranged filaments called myofibrils. Each myofibril has alternate dark and light bands. The structural and functional unit of these myofibrils is the sarcomere.

Solution:

1. The light bands contain actin and are called I-bands, while the dark bands contain myosin and are called A-bands. 2. An elastic fiber called the Z-line bisects each I-band. 3. The portion of a myofibril between two successive Z-lines is considered the functional unit of contraction, known as the Sarcomere. 4. During contraction, the Z-lines move closer together, shortening the sarcomere.

Final Answer: The functional unit of contraction is the Sarcomere.

Answer: (C)



Q29.

Solution**Concept:**

The human ear performs two sensory functions: hearing and maintenance of body balance. The inner ear, or labyrinth, contains the organs responsible for both.

Solution:

1. The Cochlea is the main organ of hearing (audition). 2. The Vestibular apparatus, located above the cochlea, is composed of three semi-circular canals and the otolith organ (sacculle and utricle). 3. These structures detect changes in body position and acceleration, allowing the cerebellum to maintain balance and posture. 4. The Eustachian tube equalizes pressure, and the ossicles amplify sound waves.

Final Answer: The Vestibular apparatus is responsible for maintaining body balance and posture.

Answer: (B)

Q30.

Solution**Concept:**

The ABO blood group system is based on the presence or absence of two surface antigens on the RBCs (A and B). Additionally, the Rh factor (+ or -) determines compatibility.

Solution:

1. Blood group O is called the 'Universal Donor' because its RBCs lack both A and B antigens, so they won't be attacked by the recipient's antibodies. 2. Specifically, O negative (Rh -ve) blood lacks the Rh antigen as well. 3. This means O negative blood can be given to a person of any blood group (A, B, AB, or O) and any Rh status (+ or -) without causing an immune reaction (agglutination). 4. O positive can only donate to other positive groups.

Final Answer: A person with O negative blood can donate to all blood groups.

Answer: (C)

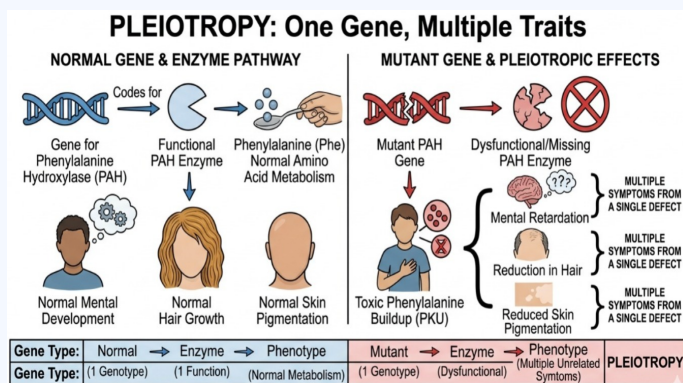


Q31.

Solution

Concept:

Pleiotropy is a genetic phenomenon where a single gene influence multiple, seemingly unrelated phenotypic traits. This is often due to the gene coding for a product (like an enzyme) that is used in multiple metabolic pathways.



Solution:

1. In pleiotropy, a mutation in one gene will have a simultaneous effect on several characters. 2. A classic example is Phenylketonuria (PKU) in humans. It is caused by a mutation in the gene that codes for the enzyme phenylalanine hydroxylase. 3. The single gene mutation results in multiple phenotypes: mental retardation, reduction in hair, and skin pigmentation. 4. Polygenic inheritance is the opposite, where multiple genes control a single trait (e.g., human skin color). Epistasis involves one gene masking the expression of another.

Final Answer: The phenomenon is called Pleiotropy.

Answer: (B)

Q32.

Solution

Concept: Biodiversity conservation is classified into two types: *in situ* (on-site) and *ex situ* (off-site). *In situ* conservation protects species in their natural habitats, while *ex situ* conservation involves placing threatened animals and plants in special settings where they can be protected and given special care.

Solution: Wildlife Sanctuaries, Biosphere Reserves, and National Parks are all examples of *in situ* conservation strategies where the entire ecosystem is protected to save the species. Cryopreservation is an advanced *ex situ* technique where gametes of threatened species are preserved in viable and fertile conditions for long periods at ultra-low temperatures (-196°C) using liquid nitrogen.

Final Answer: Cryopreservation

Answer: (C)



Q33.

Solution**Concept:**

The Oparin-Haldane hypothesis, also known as the "Chemical Evolution" theory, proposes that life originated from non-living matter through a gradual process of increasing molecular complexity.

Solution:

1. Alexandr Oparin and J.B.S. Haldane proposed that the primitive Earth had a reducing atmosphere (lacking free oxygen). 2. They suggested that energy from lightning and UV radiation triggered the synthesis of organic molecules (like amino acids and sugars) from inorganic precursors (CH₄, NH₃, H₂O). 3. These "non-living organic molecules" eventually aggregated to form coacervates or microspheres, leading to the first living cells. 4. This theory was later experimentally supported by the S.L. Miller and H.C. Urey experiment.

Final Answer: Life could have come from non-living organic molecules.

Answer: (B)

Q34.

Solution**Concept:**

Colostrum is the yellowish fluid secreted by the mother during the initial days of lactation. It is essential for providing "Passive Immunity" to the newborn infant.

Solution:

1. Colostrum is rich in nutrients and specifically loaded with antibodies to protect the infant whose immune system is not yet fully developed. 2. The most abundant antibody (immunoglobulin) found in colostrum is IgA. 3. IgA provides mucosal immunity, protecting the infant's gastrointestinal and respiratory tracts from pathogens. 4. IgG is the only antibody that can cross the placenta, while IgE is associated with allergic reactions.

Final Answer: IgA is the most abundant antibody in Colostrum.

Answer: (B)



Q35.

Solution**Concept:**

Restriction endonucleases, often called 'molecular scissors,' cut DNA at specific base sequences known as recognition sites or palindromic sequences.

Solution:

1. EcoRI is a restriction enzyme isolated from *Escherichia coli* RY 13. 2. It recognizes a specific 6-base pair palindromic sequence. A palindrome in DNA is a sequence that reads the same on the two strands when the orientation of reading ($5' \rightarrow 3'$) is kept the same. 3. The EcoRI recognition sequence is: $5' - GAATTC - 3'$ $3' - CTTAAG - 5'$ 4. The enzyme cuts between the G and A bases, leaving overhanging "sticky ends" which are useful for recombinant DNA technology.

Final Answer: The sequence is GAATTC.

Answer: (B)

Q36.

Solution**Concept:**

Gene therapy is a technique used to correct hereditary diseases by inserting a functional gene into a patient's cells to replace a defective or missing one. The first successful trial targeted a primary immunodeficiency.

Solution:

1. In 1990, the first clinical gene therapy was conducted on a four-year-old girl. 2. She suffered from Severe Combined Immunodeficiency (SCID) caused by a deficiency of the enzyme Adenosine Deaminase (ADA). 3. The ADA enzyme is crucial for the immune system to function; its absence leads to the dysfunction of T-lymphocytes. 4. The treatment involved extracting lymphocytes from the patient's blood, growing them in culture, and inserting a functional ADA cDNA using a retroviral vector before returning them to the patient.

Final Answer: The girl suffered from a deficiency of Adenosine Deaminase (ADA).

Answer: (A)



Q37.

Solution**Concept:**

Bt-cotton is a genetically modified (GM) crop designed to be resistant to specific pests, particularly bollworms. The "Bt" stands for the soil bacterium from which the toxin gene is derived.

Solution:

1. The bacterium *Bacillus thuringiensis* produces specific protein crystals during a particular phase of its growth. 2. These crystals contain a toxic insecticidal protein (Cry protein) which exists as an inactive protoxin in the bacterium. 3. Once an insect ingests the protoxin, it is converted into an active toxin due to the alkaline pH of the insect's gut. 4. The active toxin binds to the surface of midgut epithelial cells, creating pores that cause cell swelling and lysis, eventually killing the insect.

Final Answer: The toxin gene is derived from *Bacillus thuringiensis*.

Answer: (B)

Q38.

Solution**Concept:**

Population interactions describe the ways in which different species in a community influence each other's growth and survival. These are classified based on whether the effect is beneficial (+), harmful (-), or neutral (0).

Solution:

1. Commensalism is an interaction where one species (the commensal) benefits, while the other species (the host) remains unaffected (neither benefited nor harmed). 2. Example: An orchid growing as an epiphyte on a mango branch, or barnacles growing on the back of a whale. 3. Mutualism is (+/+), Parasitism is (+/-), and Amensalism is (-/0), where one species is harmed and the other is unaffected.

Final Answer: The interaction is called Commensalism.

Answer: (C)



Q39.

Solution**Concept:**

Air pollution leads to the formation of smog. Photochemical smog is a mixture of pollutants that are formed when nitrogen oxides and volatile organic compounds (VOCs) react to sunlight.

Solution:

1. Primary pollutants are emitted directly from sources like automobile exhausts. These include Nitrogen oxides (NO_x) and Hydrocarbons. 2. Secondary pollutants are formed in the atmosphere through chemical reactions between primary pollutants. These include Ozone (O_3) and Peroxyacetyl nitrate (PAN). 3. While Ozone and PAN are characteristic components of photochemical smog, they are secondary pollutants. The "primary" driver emitted from engines that initiates the process is Nitrogen oxide.

Final Answer: Nitrogen oxides (NO_x) are primary pollutants in smog formation.

Answer: (C)

Q40.

Solution**Concept:**

The DNA double helix structure, proposed by Watson and Crick, is stabilized by various types of chemical bonds. The two polynucleotide chains run antiparallel to each other.

Solution:

1. The "backbone" of each DNA strand is formed by phosphodiester bonds between the sugar and phosphate groups. 2. The two strands are held together by hydrogen bonds between the nitrogenous bases of opposite strands. 3. Adenine pairs with Thymine via two hydrogen bonds ($A = T$). 4. Guanine pairs with Cytosine via three hydrogen bonds ($G \equiv C$). 5. These hydrogen bonds are relatively weak, allowing the strands to separate (unwind) during replication and transcription.

Final Answer: The two strands are held together by hydrogen bonds.

Answer: (C)



Q41.

Solution**Concept:**

The male sex accessory ducts include the rete testis, vasa efferentia (efferent ductules), epididymis, and vas deferens. Sperm is produced in the seminiferous tubules and follows a specific anatomical path to exit the body.

Solution:

1. Spermatozoa produced in the seminiferous tubules move into the rete testis, a network of tubules. 2. From the rete testis, sperm enter the vasa efferentia (efferent ductules). 3. The vasa efferentia lead to the epididymis, which is located along the posterior surface of each testis; here, sperm undergo maturation and gain motility. 4. The epididymis leads to the vas deferens, which ascends into the abdomen and loops over the urinary bladder. 5. Therefore, the sequence is: Rete testis → Efferent ductules → Epididymis → Vas deferens.

Final Answer: The correct pathway is Rete testis → Efferent ductules → Epididymis → Vas deferens.

Answer: (A)

Q42.

Solution**Concept:**

Breathing involves two stages: inspiration and expiration. Inspiration is an active process initiated by the contraction of specific muscles that increase the volume of the thoracic cavity.

Solution:

1. Inspiration is initiated by the contraction of the diaphragm, which increases the volume of the thoracic chamber in the antero-posterior axis. 2. Simultaneously, the contraction of external intercostal muscles lifts up the ribs and the sternum, causing an increase in the volume of the thoracic chamber in the dorso-ventral axis. 3. The overall increase in thoracic volume causes a similar increase in pulmonary volume, leading to a decrease in intra-pulmonary pressure below atmospheric pressure, which forces air into the lungs. 4. If either muscle relaxed, thoracic volume would decrease, leading to expiration.

Final Answer: During inspiration, both the diaphragm and external intercostal muscles contract.

Answer: (C)

Q43.

Solution**Concept:**

The opening and closing of stomata are controlled by turgor changes in the guard cells. This turgidity is primarily regulated by the active transport of ions.

Solution:

1. According to the K^+ ion pump theory, the active accumulation of Potassium (K^+) ions in the guard cells lowers their water potential. 2. This causes water to enter the guard cells from surrounding subsidiary cells via osmosis, making the guard cells turgid and opening the stomatal pore. 3. When K^+ ions move out of the guard cells, water follows, the cells become flaccid, and the stomata close. 4. Abscisic acid (ABA) often triggers the efflux of K^+ ions during water stress to close stomata.

Final Answer: The concentration of K^+ ions is primarily responsible for stomatal movement.

Answer: (C)

Q44.

Solution**Concept:**

DNA replication is a highly coordinated process involving multiple enzymes, each with a specific role in ensuring accuracy and efficiency.

Solution:

1. Helicase is responsible for unwinding the DNA double helix by breaking hydrogen bonds. 2. DNA Polymerase synthesizes new DNA strands by adding nucleotides and also performs proofreading. 3. DNA Ligase is the "molecular glue" that joins DNA fragments together, specifically the Okazaki fragments on the lagging strand, by forming phosphodiester bonds. 4. Primase synthesizes a short RNA primer to provide a starting point for DNA Polymerase. 5. Therefore, the match for Ligase is the only correct one provided in the options.

Final Answer: Ligase joins Okazaki fragments.

Answer: (C)



Q45.

Solution**Concept:**

Hugo de Vries proposed the Mutation Theory of evolution based on his work with the evening primrose (*Oenothera lamarckiana*). He disagreed with Darwin's idea of gradual variations.

Solution:

1. De Vries believed that mutation (sudden, large, heritable change) is the primary cause of evolution. 2. He coined the term 'Saltation' to describe a single-step large mutation that results in the formation of a new species. 3. Unlike Darwinian variations, which are small and directional, mutations are random and directionless. 4. According to De Vries, it is these large mutations that lead to speciation, rather than the slow accumulation of minor traits.

Final Answer: Saltation refers to a single step large mutation.

Answer: (B)

Q46.

Solution**Concept:**

The Proximal Convolved Tubule (PCT) is the segment of the nephron following Bowman's capsule. It is lined by simple cuboidal brush border epithelium which increases the surface area for reabsorption.

Solution:

1. The PCT is the main site for the selective reabsorption of essential nutrients and electrolytes from the glomerular filtrate. 2. Nearly all of the essential nutrients (glucose, amino acids) and 70-80%. The Loop of Henle is primarily involved in maintaining the high osmolarity of the medullary interstitial fluid (counter-current mechanism). 4. The Distal Convolved Tubule (DCT) and Collecting Duct are involved in conditional reabsorption of water and sodium, often regulated by hormones like ADH and Aldosterone.

Final Answer: The Proximal Convolved Tubule is responsible for maximum reabsorption.

Answer: (C)



Q47.

Solution**Concept:**

Enzymes are highly specific biological catalysts. The 'Lock and Key' hypothesis was proposed by Emil Fischer in 1894 to explain this specificity.

Solution:

1. This hypothesis suggests that the active site of an enzyme has a specific, rigid geometric shape that is exactly complementary to the shape of its substrate. 2. Just as a specific key opens a particular lock, a specific substrate fits into the active site of its specific enzyme to form an Enzyme-Substrate (ES) complex. 3. The 'Induced Fit' theory (by Koshland) is a more modern view where the enzyme's active site is flexible and changes shape slightly to fit the substrate. 4. Enzymes are not used up; they are released unchanged after the reaction to catalyze more substrates.

Final Answer: The hypothesis suggests that the substrate and enzyme have complementary shapes.

Answer: (B)

Q48.

Solution**Concept:**

Termination of translation is a critical step in protein synthesis, occurring when the ribosome encounters a codon for which there is no corresponding tRNA.

Solution:

1. Out of the 64 codons, three are stop codons: UAA, UAG, and UGA. 2. These codons do not code for any amino acid and are recognized by release factors rather than tRNA molecules. 3. When UGA (or UAA/UAG) enters the A-site of the ribosome, the translation machinery dissociates, and the completed polypeptide is released. 4. AUG is the start codon (Methionine), UGG codes for Tryptophan, and UAC codes for Tyrosine.

Final Answer: UGA is the stop codon among the given options.

Answer: (C)



Q49.

Solution**Concept:**

The C_4 pathway (Hatch-Slack pathway) is an adaptation found in plants (like maize and sorghum) living in dry, tropical regions to minimize photorespiration.

Solution:

1. In C_4 plants, the initial CO_2 fixation occurs in the mesophyll cells. 2. The primary CO_2 acceptor is a 3-carbon molecule called Phosphoenolpyruvate (PEP). 3. The reaction is catalyzed by the enzyme PEP carboxylase (PEPcase), which has a high affinity for CO_2 . 4. This results in the formation of a 4-carbon compound, Oxaloacetic acid (OAA). 5. In C_3 plants, the primary acceptor is RuBP (Ribulose-1,5-bisphosphate), which is a 5-carbon molecule.

Final Answer: The primary CO_2 acceptor in C_4 plants is PEP.

Answer: (B)

Q50.

Solution**Concept:**

Alexander von Humboldt observed that within a region, species richness increases with increasing explored area, but only up to a limit.

Solution:

1. The relationship between species richness and area for a wide variety of taxa (like birds, bats, or flowering plants) turns out to be a rectangular hyperbola. 2. On a logarithmic scale, the relationship is expressed by the equation:

$$\log S = \log C + Z \log A$$

where S = Species richness, A = Area, Z = slope of the line (regression coefficient), and C = Y-intercept. 3. Because this equation follows the form $y = mx + c$, the graph on a log-log scale is a straight line.

Final Answer: The curve on a logarithmic scale is a straight line.

Answer: (C)



Q51.

Solution**Concept:**

The adrenal medulla secretes two hormones: adrenaline (epinephrine) and noradrenaline (norepinephrine). These are chemically categorized as catecholamines and are released in response to stress of any kind.

Solution:

1. Adrenaline and noradrenaline are rapidly secreted in response to stress or emergency situations and are therefore called emergency hormones or 'hormones of Fight or Flight'. 2. These hormones increase alertness, pupillary dilation, piloerection (raising of hairs), and sweating. 3. They also increase the heartbeat, the strength of heart contraction, and the rate of respiration. 4. Additionally, they stimulate the breakdown of glycogen, resulting in an increased concentration of glucose in the blood to provide immediate energy.

Final Answer: Adrenaline is known as the 'Emergency Hormone'.

Answer: (B)

Q52.

Solution**Concept:**

Pneumatophores are specialized root modifications found in plants that grow in oxygen-deficient environments, such as swamps or marshes.

Solution:

1. In saline, marshy areas (mangroves), the soil is waterlogged and anaerobic, making it difficult for roots to breathe (perform gas exchange). 2. To overcome this, many roots (like those in *Rhizophora*) come out of the ground and grow vertically upwards (negatively geotropic). 3. These aerial roots, called pneumatophores, contain numerous pores called lenticels or pneumathodes through which the plant obtains oxygen from the atmosphere for respiration. 4. This is an essential adaptation for survival in halophytic environments.

Final Answer: Pneumatophores are characteristic of plants in saline marshy areas.

Answer: (B)



Q53.

Solution**Concept:**

The genetic code is the set of rules by which information encoded within genetic material (DNA or mRNA sequences) is translated into proteins by living cells.

Solution:

1. **Universal:** The code is nearly universal; for example, from bacteria to humans, UUU would code for Phenylalanine. 2. **Degenerate:** Some amino acids are coded by more than one codon (e.g., Leucine is coded by 6 different codons). 3. **Commaless:** The code is read in mRNA in a contiguous fashion from one end to the other without any internal punctuation (commas). 4. **Unambiguous:** The code is non-ambiguous and specific, meaning one codon codes for only one specific amino acid. Therefore, saying it is "ambiguous" is incorrect.

Final Answer: The genetic code is not ambiguous.

Answer: (C)

Q54.

Solution**Concept:**

Human evolution involves several intermediate stages characterized by changes in cranial capacity, tool use, and skeletal structure.

Solution:

1. *Australopithecus* lived in East African grasslands and probably ate fruit. 2. The first human-like being, the hominid, was *Homo habilis*. They had a cranial capacity between 650–800 cc and probably did not eat meat. 3. *Homo erectus* appeared later, had a larger brain (900 cc), and likely ate meat. 4. *Neanderthal man* lived in near-east and central Asia and used hides to protect their bodies.

Final Answer: The first human-like hominid was *Homo habilis*.

Answer: (B)

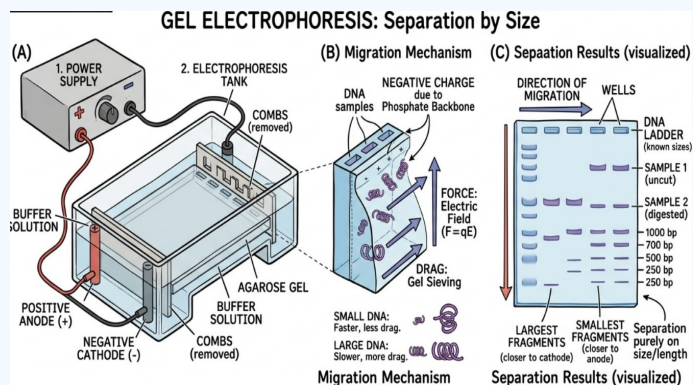


Q55.

Solution

Concept:

Gel electrophoresis is a technique used to separate macromolecules like DNA, RNA, or proteins. DNA molecules are negatively charged due to the phosphate groups in their backbone.



Solution:

1. Because DNA fragments are negatively charged, they move toward the positive electrode (Anode) when an electric field is applied. 2. The fragments separate based on their size (length) due to the sieving effect provided by the agarose gel matrix. 3. Smaller fragments move faster and travel further through the pores of the gel, while larger fragments move slower and remain closer to the wells (near the cathode). 4. Charge-to-mass ratio for DNA is constant, so separation is purely based on size/length.

Final Answer: DNA fragments move towards the Anode based on their size.

Answer: (B)

Q56.

Solution

Concept:

The placenta is a temporary endocrine organ formed during pregnancy. It facilitates the exchange of nutrients, gases, and wastes between the mother and the fetus while acting as a barrier.

Solution:

1. After implantation, finger-like projections called chorionic villi appear on the trophoblast, which are surrounded by uterine tissue and maternal blood. 2. The chorionic villi and uterine tissue become interdigitated with each other and jointly form a structural and functional unit between the developing embryo (fetus) and maternal body called the placenta. 3. The placenta is connected to the embryo through an umbilical cord which helps in the transport of substances to and from the embryo. 4. The placenta also secretes hormones like hCG, hPL, estrogens, and progesterones which are essential for maintaining pregnancy.

Final Answer: The structural and functional unit is the Placenta.

Answer: (B)



Q57.

Solution**Concept:**

The immune system distinguishes between 'self' and 'non-self'. When a foreign organ is transplanted, the body recognizes the MHC (Major Histocompatibility Complex) markers on the donor organ as foreign, leading to an immune attack.

Solution:

1. There are two main types of specific immune responses: Humoral (Antibody-mediated) and Cell-mediated immunity (CMI). 2. Cell-mediated immunity is primarily mediated by T-lymphocytes. 3. T-cells are specifically responsible for recognizing foreign graft tissue. When they detect non-self antigens on the transplanted organ, they initiate a cytotoxic response to destroy the foreign cells. 4. This is why tissue matching and blood group matching are essential before undertaking any graft or transplant, and patients often need immuno-suppressants for life.

Final Answer: Cell-mediated immunity is responsible for graft rejection.

Answer: (B)

Q58.

Solution**Concept:**

The Polymerase Chain Reaction (PCR) is a revolutionary technique in molecular biology developed by Kary Mullis in 1983. It allows for the exponential synthesis of specific DNA sequences in vitro.

Solution:

1. PCR is a method used to make many copies of a specific DNA segment. This is known as DNA amplification. 2. The process involves three main steps repeated in cycles: (a) **Denaturation:** Heating the DNA to separate the strands. (b) **Annealing:** Cooling to allow primers to bind to the target sequence. (c) **Extension:** Using a thermostable DNA polymerase (like *Taq* polymerase) to synthesize new strands. 3. Through repeated cycles, a single copy of DNA can be amplified into billions of copies, which is useful for diagnosis, forensic science, and gene cloning.

Final Answer: PCR is used for DNA amplification.

Answer: (B)



Q59.

Solution**Concept:**

Sugars are classified as reducing or non-reducing based on their ability to reduce cupric ions (Cu^{2+}) to cuprous ions (Cu^+) in Benedict's or Fehling's solution. This ability depends on the presence of a free aldehyde or ketone group.

Solution:

1. All monosaccharides (like Glucose, Fructose, Galactose) are reducing sugars because they have a free reactive group. 2. Most disaccharides like Maltose and Lactose are also reducing sugars because one of the two units has a free anomeric carbon. 3. Sucrose (table sugar) is a non-reducing sugar. It is composed of glucose and fructose linked by a glycosidic bond between their reducing groups (Carbon 1 of glucose and Carbon 2 of fructose). 4. Since both reducing groups are involved in the bond, sucrose cannot reduce alkaline copper reagents.

Final Answer: Sucrose is a non-reducing sugar.

Answer: (D)

Q60.

Solution**Concept:**

Ecological succession is the process of change in the species structure of an ecological community over time. It follows a predictable sequence until a stable community is reached.

Solution:

1. The entire sequence of communities that successively change in a given area are called a Sere. 2. The individual transitional communities are termed seral stages or seral communities. 3. The first species to invade a bare area is called the pioneer community. 4. The final, stable, and self-sustaining community that is in near equilibrium with the environment is called the climax community.

Final Answer: The sequence of communities is called a Sere.

Answer: (A)



Q61.

Solution**Concept:**

The papilionaceous corolla is a characteristic arrangement of petals found in the Fabaceae family (pea family). It follows a specific aestivation pattern known as vexillary aestivation.

Solution:

1. In this arrangement, there are five petals. 2. The largest, outermost petal is situated at the back (posterior) and is called the Vexillum or Standard. 3. The Vexillum overlaps two smaller lateral petals called wings or Alae. 4. The Alae, in turn, overlap the two smallest anterior petals, which are fused to form a boat-shaped structure called the keel or Carina. 5. This specific structure is an adaptation to facilitate pollination by specific insects.

Final Answer: The standard petal is known as the Vexillum.

Answer: (A)

Q62.

Solution**Concept:**

Proteins are the most diverse and abundant organic molecules in living organisms. Certain proteins serve critical structural or enzymatic roles that make them highly prevalent in specific biological spheres.

Solution:

1. RuBisCO (Ribulose-1,5-bisphosphate carboxylase/oxygenase) is the enzyme responsible for the initial fixation of carbon dioxide in the Calvin cycle of photosynthesis. 2. Because almost all photosynthetic organisms (plants, algae, cyanobacteria) contain this enzyme to produce organic matter, it is considered the most abundant protein in the whole of the biosphere. 3. Collagen is the most abundant protein in the animal world, providing structural support in connective tissues. 4. Insulin and Haemoglobin are vital functional proteins but exist in much lower total quantities compared to RuBisCO.

Final Answer: RuBisCO is the most abundant protein in the biosphere.

Answer: (B)



Q63.

Solution**Concept:**

In recombinant DNA technology, after DNA is cut into fragments by restriction endonucleases, it is necessary to separate these fragments to isolate the specific gene of interest.

Solution:

1. Gel electrophoresis is the standard technique used for this purpose. 2. DNA fragments are loaded into wells in an agarose gel. Since DNA is negatively charged, the fragments migrate through the gel toward the positive anode when an electric current is applied. 3. The gel acts as a sieve; smaller fragments move more easily through the pores and travel further, while larger fragments are hindered and stay closer to the starting point. 4. PCR is used to amplify DNA, not separate fragments by size, and Western blotting is used specifically for proteins.

Final Answer: Gel electrophoresis is the technique used to separate DNA fragments by size.

Answer: (B)

Q64.

Solution**Concept:**

Conservation of forests in India has evolved from state-controlled management to community-inclusive models to ensure sustainability and social justice.

Solution:

1. The Government of India introduced the concept of Joint Forest Management (JFM) in 1980. 2. The policy was designed to work closely with local communities for protecting and managing forests. 3. In return for their services in helping to protect the forest, the communities are allowed to use various non-timber forest products (like fruits, gum, medicine) and receive a share in the profit from the harvested timber. 4. This realized that conservation cannot be successful without the active participation of the people living in or near the forests.

Final Answer: JFM was introduced in 1980.

Answer: (A)



Q65.

Solution**Concept:**

Peroxisomes are small, membrane-bound organelles found in the cytoplasm of eukaryotic cells. They are involved in various metabolic pathways, particularly those involving oxidation.

Solution:

1. The primary function of peroxisomes is to break down fatty acids and amino acids, a process that produces hydrogen peroxide (H_2O_2) as a byproduct. 2. Hydrogen peroxide is chemically reactive and toxic to the cell. 3. To protect the cell, peroxisomes contain a high concentration of the enzyme Catalase. 4. Catalase quickly decomposes H_2O_2 into water and oxygen, neutralizing the threat. 5. Lysosomes contain digestive (hydrolytic) enzymes, and ribosomes are the sites of protein synthesis.

Final Answer: Catalase is found in the Peroxisome.

Answer: (B)

Q66.

Solution**Concept:**

Amniocentesis is a prenatal diagnostic test that involves withdrawing a small amount of amniotic fluid, which contains foetal cells and dissolved substances, from the amniotic sac surrounding the developing foetus.

Solution:

1. The foetal cells extracted during amniocentesis can be cultured and analyzed to examine the chromosomal pattern (karyotype). 2. The primary legal and medical purpose is to detect genetic disorders such as Down syndrome, Haemophilia, and Sickle-cell anaemia early in pregnancy. 3. Unfortunately, the technique is often misused to determine the sex of the foetus, leading to female foeticide. 4. Consequently, there is a strict legal ban on using amniocentesis for sex determination in India to maintain a healthy child sex ratio.

Final Answer: The primary purpose is to detect genetic disorders in the foetus.

Answer: (A)



Q67.

Solution**Concept:**

For a long time, it was believed that all enzymes are proteins. However, the discovery of ribozymes proved that certain RNA molecules can also act as biological catalysts.

Solution:

1. During translation in bacteria, the formation of a peptide bond between two amino acids is catalyzed by an enzyme called peptidyl transferase. 2. In prokaryotes, the 23S rRNA (part of the large ribosomal subunit) acts as this enzyme. 3. Since this catalytic activity is performed by an RNA molecule rather than a protein, it is called a ribozyme. 4. mRNA carries the genetic code, and tRNA acts as an adapter molecule, but neither functions as an enzyme in this context.

Final Answer: 23S rRNA is a ribozyme.

Answer: (A)

Q68.

Solution**Concept:**

The semi-conservative model of DNA replication suggests that each of the two strands of the DNA double helix serves as a template for the synthesis of a new, complementary strand.

Solution:

1. Matthew Meselson and Franklin Stahl performed the definitive experiment in 1958 using *Escherichia coli*. 2. They grew *E. coli* in a medium containing a heavy isotope of nitrogen (^{15}N) until all the DNA was labeled with it. 3. They then transferred the bacteria to a medium with the normal ^{14}N isotope and took samples at specific time intervals. 4. Using cesium chloride (CsCl) density gradient centrifugation, they showed that after one generation, the DNA had an intermediate (hybrid) density, proving that one old strand is conserved in each new DNA molecule.

Final Answer: The experiment was performed by Meselson and Stahl.

Answer: (B)



Q69.

Solution**Concept:**

The Hardy-Weinberg principle provides a mathematical model for a non-evolving population where allele frequencies remain constant. The equation is $p^2 + 2pq + q^2 = 1$, where p is the frequency of the dominant allele and q is the frequency of the recessive allele.

Solution:

1. Given that the frequency of the recessive allele (q) is 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 homozygous dominant individuals is represented by p^2 . 4. Calculating p^2 :

$$0.6 \times 0.6 = 0.36$$

5. Therefore, 36% of the population is homozygous dominant (AA).

Final Answer: The frequency of homozygous dominant individuals is 0.36.

Answer: (B)

Q70.

Solution**Concept:**

Sewage treatment is carried out in two main stages: primary (physical) treatment and secondary (biological) treatment.

Solution:

1. Primary treatment involves the physical removal of large and small particles from sewage through filtration and sedimentation. 2. Floating debris is removed by sequential filtration. 3. The grit (soil and small pebbles) is removed by sedimentation/decanting. 4. All the solids that settle form the primary sludge, and the supernatant forms the effluent. 5. Secondary treatment is a biological process involving the use of microbes to reduce the BOD (Biochemical Oxygen Demand) of the effluent.

Final Answer: Decanting and sedimentation are parts of Primary treatment.

Answer: (A)



Q71.

Solution**Concept:**

Ecological succession that begins in a dry area (like bare rocks) is called xerarch succession. The first organisms that invade this barren land are called pioneer species.

Solution:

1. Lichens are the pioneer species in a xerarch succession. 2. They are able to secrete acids to dissolve rocks, helping in weathering and soil formation. 3. Once a thin layer of soil is formed, they make way for small plants like mosses. 4. Mosses are later replaced by grasses, then shrubs, and finally a climax community like a forest. 5. Phytoplankton are the pioneers in hydrarch (aquatic) succession.

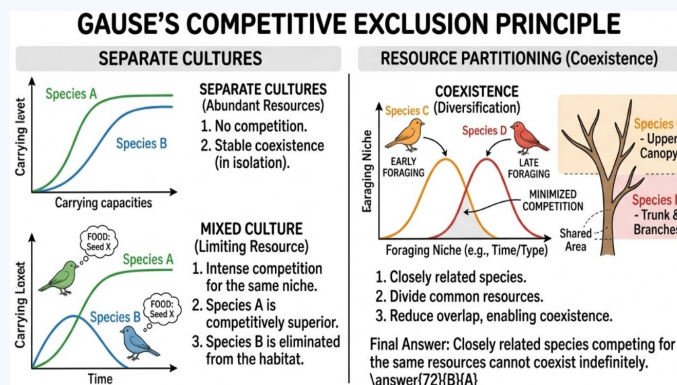
Final Answer: Lichens are the pioneer species in xerarch succession.

Answer: (B)

Q72.

Solution**Concept:**

The Gause's Principle, also known as the Competitive Exclusion Principle, addresses the limits of coexistence between species with identical requirements.

**Solution:**

1. Gause stated that two closely related species competing for the same limiting resources cannot coexist indefinitely. 2. The competitively inferior species will eventually be eliminated or forced to adapt to a different niche. 3. This principle holds true only if resources are limiting; if resources are abundant, competition is minimized. 4. Later studies on 'Resource Partitioning' showed that species can coexist by choosing different times for feeding or different foraging patterns.

Final Answer: Closely related species competing for the same resources cannot coexist indefinitely.

Answer: (B)



Q73.

Solution**Concept:**

The Amazon Rainforest in South America is the largest tropical rainforest on Earth and plays a vital role in global ecology.

Solution:

1. The Amazon Rainforest is so vast and contains such a high density of vegetation that it is estimated to produce 20% of the total oxygen in the Earth's atmosphere through photosynthesis.
2. For this reason, it is frequently referred to as the 'Lungs of the Planet'.
3. It also harbors an incredible level of biodiversity, housing millions of species of plants, insects, and animals.
4. Current threats like deforestation for soy cultivation and cattle ranching are causing significant concern for global climate stability.

Final Answer: The 'Lungs of the Planet' refers to the Amazon Rainforest.

Answer: (A)

Q74.

Solution**Concept:**

While the endocrine glands are the primary producers of hormones, other organs like the heart, kidney, and gastrointestinal tract also secrete important regulatory peptides.

Solution:

1. When blood pressure increases, the atrial walls of the heart secrete a peptide hormone called Atrial Natriuretic Factor (ANF).
2. ANF causes vasodilation (dilation of blood vessels), which effectively reduces the blood pressure.
3. It also acts as a check on the Renin-Angiotensin mechanism.
4. Erythropoietin is produced by the kidney to stimulate RBC production, while Gastrin and Secretin are GI tract hormones.

Final Answer: ANF is the hormone produced by the heart to decrease blood pressure.

Answer: (B)



Q75.

Solution**Concept:**

An Electrocardiogram (ECG) is a graphical representation of the electrical activity of the heart during a cardiac cycle. Each peak is identified with a letter from P to T.

Solution:

1. The P-wave represents the electrical excitation (depolarisation) of the atria, leading to atrial contraction. 2. The QRS complex represents the depolarisation of the ventricles, which initiates ventricular contraction. 3. The T-wave represents the return of the ventricles from excited to normal state (repolarisation). 4. The end of the T-wave marks the end of systole.

Final Answer: The T-wave represents the repolarisation of ventricles.

Answer: (C)

Q76.

Solution**Concept:**

The Lac Operon is a system for the regulated expression of genes involved in lactose metabolism in *E. coli*. It consists of structural genes, a promoter, an operator, and a regulatory gene (*i* gene).

Solution:

1. The regulatory gene (*i* gene) codes for a repressor protein. 2. In the absence of an inducer (lactose), the repressor protein is produced constitutively and binds to the operator region (*o*) of the operon. 3. This binding physically prevents RNA polymerase from transcribing the structural genes (*z*, *y*, *a*). 4. When an inducer is present, it binds to the repressor, changing its shape so it can no longer bind to the operator, thus "switching on" the operon.

Final Answer: The repressor protein binds to the Operator region.

Answer: (B)



Q77.

Solution**Concept:**

Vestigial organs are structures or organs that were functional in an ancestral form but have become reduced and non-functional during the course of evolution due to changes in the environment or lifestyle.

Solution:

1. The vermiform appendix in humans is a classic example of a vestigial organ. In our herbivorous ancestors, it was a large, functional organ used for the digestion of cellulose. 2. In modern humans, with a changed diet, it has shrunk and serves no significant digestive function. 3. Other vestigial organs in humans include the nictitating membrane (third eyelid), wisdom teeth, and the coccyx (tailbone). 4. The heart, kidney, and pancreas are vital, fully functional organs.

Final Answer: The vermiform appendix is a vestigial organ.

Answer: (B)

Q78.

Solution**Concept:**

Genetic engineering in plants often requires a vector to deliver foreign DNA into the host plant's genome. Nature's most effective genetic engineer for plants is a soil bacterium.

Solution:

1. *Agrobacterium tumefaciens* is a pathogen of many dicot plants that naturally delivers a piece of DNA (T-DNA) into the plant cell to transform it. 2. This T-DNA is carried on a large plasmid known as the Ti-plasmid (Tumour-inducing plasmid). 3. Scientists have modified the Ti-plasmid by "disarming" it (removing the genes that cause tumours) and replacing them with genes of interest. 4. It is now widely used as a vector for cloning and expressing foreign genes in plants.

Final Answer: The Ti-plasmid is obtained from *Agrobacterium tumefaciens*.

Answer: (B)



Q79.

Solution**Concept:**

RNA interference (RNAi) is a biological process in which RNA molecules inhibit gene expression or translation, by neutralizing targeted mRNA molecules. It is a method of cellular defense in all eukaryotic organisms.

Solution:

1. RNAi involves the silencing of a specific mRNA due to a complementary double-stranded RNA (dsRNA) molecule. 2. This dsRNA binds to and prevents translation of the mRNA (silencing) or leads to its degradation. 3. The source of this complementary RNA can be from infection by viruses that have RNA genomes or mobile genetic elements (transposons) that replicate via an RNA intermediate. 4. This technique has been used to develop nematode-resistant tobacco plants.

Final Answer: Silence is achieved using double-stranded RNA.

Answer: (B)

Q80.

Solution**Concept:**

The thinning of the ozone layer in the stratosphere (especially over the Antarctic) allows more UV-B radiation to reach the Earth's surface. This has several detrimental health effects.

Solution:

1. The human cornea absorbs UV-B radiation. 2. Exposure to high doses of UV-B causes inflammation of the cornea, a condition commonly called 'snow blindness' (photokeratitis). 3. Prolonged exposure can permanently damage the cornea and lead to the development of cataracts. 4. While high reflection from snow (Option B) makes the condition worse, the actual biological cause is the damage to the cornea from UV-B.

Final Answer: Snow blindness is due to inflammation of the cornea from UV-B radiation.

Answer: (A)



Q81.

Solution

Concept: Pregnancy and childbirth involve several hormones that regulate the uterine environment and the birth process. Relaxin is a protein hormone that plays a key role during the late stages of pregnancy.

Solution: 1. In the later phase of pregnancy, a hormone called relaxin is secreted. 2. While relaxin is also produced by the placenta, its primary source in the later stages of pregnancy is the ovary (specifically the corpus luteum). 3. Relaxin facilitates parturition (childbirth) by softening the connective tissue of the symphysis pubis and relaxing the pelvic ligaments. 4. This dilates the cervix and widens the birth canal to allow for the easier passage of the foetus.

Final Answer: Relaxin is primarily secreted by the Ovary in the later stages of pregnancy.

Answer: (C)

Q82.

Solution

Concept: Homology refers to the phenomenon where different species possess organs that share a common embryonic origin and basic anatomical structure, even if they perform entirely different functions. This is a result of **divergent evolution**, where an ancestral trait evolves into different forms to adapt to different environmental needs.

Solution: 1. **Thorns of *Bougainvillea* and tendrils of *Cucurbita*:** Both of these structures are modifications of the **axillary bud**. Since they share the same developmental origin but serve different purposes (protection vs. climbing support), they are classic examples of homologous organs. 2. **Wings of butterfly and bird:** These are **analogous organs**. They perform the same function (flight) but have different anatomical origins (integumentary folds vs. bony forelimbs). 3. **Flippers of penguins and dolphins:** These are also **analogous**. Penguins are birds and dolphins are mammals; their flippers evolved independently for swimming (convergent evolution). 4. **Eyes of octopus and mammals:** These represent **analogous organs** because the retinal structure and embryonic development of the eye differ significantly, despite both being used for vision.

Final Answer: Thorns of *Bougainvillea* and tendrils of *Cucurbita*

Answer: (C)



Q83.

Solution

Concept: Earth has witnessed five previous mass extinctions since the origin of life. We are currently undergoing a "Sixth Extinction" event, characterized by a rapid loss of biodiversity.

Solution: 1. The previous extinctions were caused by natural phenomena like asteroid impacts or massive volcanic activity. 2. The current Sixth Extinction is unique because the rate of extinction is estimated to be 100 to 1,000 times faster than pre-human times. 3. This acceleration is primarily attributed to anthropogenic (human) activities such as habitat destruction, over-exploitation, and climate change. 4. If this rate continues, nearly half of all species on Earth might be wiped out within the next century.

Final Answer: The current extinction is primarily caused by human activities.

Answer: (B)

Q84.

Solution

Concept: Blood coagulation (clotting) is a complex physiological process that prevents excessive blood loss following an injury. It involves a cascade of biochemical reactions where various "clotting factors" (mostly proteins) present in the plasma are activated in a specific sequence. Calcium ions (Ca^{2+}) serve as a vital inorganic co-factor (Factor IV) that bridges these biochemical steps.

Solution: 1. **The Clotting Cascade:** When a blood vessel is damaged, platelets and injured tissues release procoagulants. These lead to the formation of an enzyme complex called **thrombokinase** (or prothrombinase). 2. **Role of Calcium (Ca^{2+}):** Calcium ions are essential for the conversion of inactive **prothrombin** into the active enzyme **thrombin**. 3. **Fibrin Formation:** Thrombin then converts soluble **fibrinogen** into insoluble **fibrin** threads, which trap blood cells to form the clot. 4. Without Ca^{2+} , the binding of various clotting factors to the phospholipid surfaces of activated platelets cannot occur, effectively halting the entire coagulation process. 5. Other ions like Mg^{2+} , Na^+ , and K^+ are crucial for nerve impulses and osmotic balance but do not play a direct catalytic role in the coagulation cascade.

Final Answer: Calcium ions (Ca^{2+}) are necessary for blood clotting.

Answer: (C)

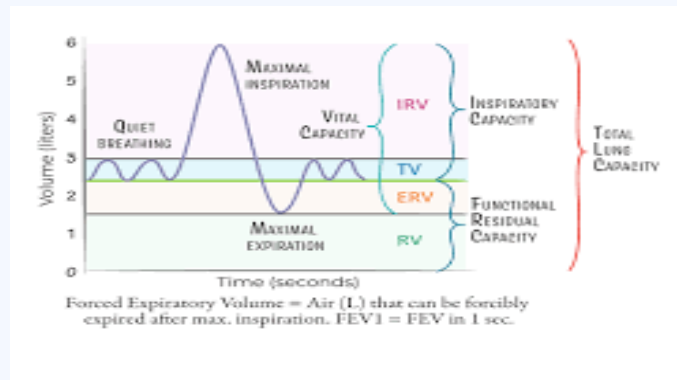


Q85.

Solution

Concept: Pulmonary capacities are derived by combining two or more pulmonary volumes. The Functional Residual Capacity (FRC) represents the volume of air that remains in the lungs after a normal, passive expiration. It is a critical physiological value because it ensures that gas exchange continues even between breaths and prevents the alveoli from collapsing.

Solution: 1. **Expiratory Reserve Volume (ERV):** This is the additional volume of air a person can expire by a forceful expiration (average 1000 mL to 1100 mL). 2. **Residual Volume (RV):** This is the volume of air remaining in the lungs even after a forcible expiration (average 1100 mL to 1200 mL). 3. **Calculating FRC:** Since FRC is the air left after a *normal* (not forceful) breath out, it must include both the air you *could* have breathed out forcefully (ERV) and the air that *never* leaves the lungs (RV). 4. Therefore, the formula is: $FRC = ERV + RV$. 5. Other options represent different capacities: $(VC + RV)$ is Total Lung Capacity, and $(IRV + TV + ERV)$ is Vital Capacity.



Final Answer: Functional Residual Capacity is equal to $ERV + RV$.

Answer: (B)

Q86.

Solution

Concept: The lymphoid system consists of organs where lymphocytes originate, mature, and proliferate. These are categorized into primary and secondary lymphoid organs.

Solution: 1. **Primary lymphoid organs** are where immature lymphocytes differentiate into antigen-sensitive lymphocytes. These include the Bone marrow and Thymus. 2. **Secondary lymphoid organs** are the sites where lymphocytes interact with antigens and proliferate to become effector cells. 3. Examples of secondary lymphoid organs include the Spleen, lymph nodes, tonsils, Peyer's patches of the small intestine, and the appendix. 4. The spleen acts as a filter for the blood by trapping blood-borne microorganisms and also contains a large reservoir of erythrocytes.

Final Answer: The Spleen is a secondary lymphoid organ.

Answer: (C)



Q87.

Solution

Concept: Digestion in the small intestine is facilitated by various enzymes secreted by the pancreas and the intestinal mucosa. Most proteolytic enzymes are secreted in an inactive form (proenzymes) to prevent them from digesting the secretory cells themselves. These proenzymes must be activated in the intestinal lumen to become functional.

Solution: 1. Source of Enterokinase: Enterokinase (also known as enteropeptidase) is an enzyme secreted by the intestinal mucosa (part of the succus entericus). 2. Activation Mechanism: The pancreatic juice contains trypsinogen, which is an inactive proenzyme. Enterokinase specifically acts on trypsinogen to convert it into active trypsin. 3. Chain Reaction: Once active trypsin is formed, it serves as an activator for other pancreatic proenzymes, such as converting chymotrypsinogen into chymotrypsin and procarboxypeptidases into carboxypeptidases. 4. Other Options: - Proteins into polypeptides is a general function of several proteases. - Casein into paracasein is performed by **Rennin** (in infants). - Pepsinogen into pepsin is performed by **Hydrochloric acid (HCl)** in the stomach.

Final Answer: Trypsinogen into trypsin

Answer: (B)

Q88.

Solution

Concept: Sacred Groves represent a traditional method of in-situ biodiversity conservation where communities protect patches of forest due to religious or cultural beliefs.

Solution: 1. Sacred groves are found in various parts of India, such as the Khasi and Jaintia Hills in Meghalaya, Aravalli Hills of Rajasthan, and the Western Ghats. 2. In these areas, all the trees and wildlife within the grove are venerated and given total protection by the local people. 3. Consequently, these groves often serve as the last remaining refuges for a large number of rare, endemic, and threatened species that have been cleared elsewhere. 4. They are an excellent example of how cultural traditions can aid in scientific conservation efforts.

Final Answer: Sacred Groves are especially useful in conserving rare and threatened species.

Answer: (D)



Q89.

Solution

Concept: The cell cycle consists of Interphase and the M Phase (Mitosis). Interphase is subdivided into G_1 , S , and G_2 phases. The S phase, or Synthesis phase, is the specific period during which the cell replicates its genetic material to prepare for division.

Solution: 1. **DNA Replication:** During the S phase, DNA replication occurs. If the initial amount of DNA in the cell is denoted as $2C$, it doubles to $4C$ by the end of this phase. 2. **Chromosome Stability:** Despite the doubling of DNA content, the chromosome number remains unchanged. Each chromosome now consists of two identical sister chromatids attached at the centromere. If the cell was diploid ($2n$) in G_1 , it remains $2n$ in the S and G_2 phases. 3. **Other Phases:** - **G_1 phase:** The cell is metabolically active and grows but does not replicate DNA. - **G_2 phase:** Proteins are synthesized in preparation for mitosis while the DNA remains at the $4C$ level. - **M phase:** This is the actual division phase where the $4C$ DNA is distributed equally into two daughter cells, returning them to the $2C$ state.

Final Answer: S phase

Answer: (B)

Q90.

Solution

Concept: Microbes are used commercially to produce various bioactive molecules. Statins are a class of drugs used to lower blood cholesterol levels.

Solution: 1. Statins are produced by a yeast called *Monascus purpureus*. 2. They function by acting as competitive inhibitors of the enzyme responsible for the synthesis of cholesterol (β -hydroxy- β -methylglutaryl-CoA reductase). 3. Other microbial products include Cyclosporin A (immunosuppressant) from the fungus *Trichoderma polysporum* and Streptokinase (clot buster) from *Streptococcus*. 4. *Saccharomyces cerevisiae* (Brewer's yeast) is primarily used for ethanol production and baking.

Final Answer: Statins are produced by *Monascus purpureus*.

Answer: (B)



Answer Key

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

