

MHT-CET Biology Sample Paper-6

Duration: 90 Minutes

Maximum Marks: 100

Instructions

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

Q1. In the context of the floral formula of Fabaceae, the symbol $\%$ represents _____ symmetry, and the gynoecium is characterized as _____.

- (A) Actinomorphic; Multicarpellary
 (B) Zygomorphic; Monocarpellary
 (C) Asymmetric; Bicarpellary
 (D) Zygomorphic; Tricarpellary

Q2. Identify the INCORRECT statement regarding C_4 pathway:

- (A) The primary CO_2 acceptor is a 3-carbon molecule Phosphoenolpyruvate.
 (B) Mesophyll cells lack the RuBisCO enzyme.
 (C) The bundle sheath cells are rich in PEPcase enzyme.
 (D) Bundle sheath cells have thick walls impervious to gaseous exchange.

Q3. Match the following columns regarding Population Interactions:

Column I	Column II
i. Orchids on mango branch	p. Parasitism
ii. Cuscuta on hedge plants	q. Commensalism
iii. Sea anemone and Clown fish	r. Competition
iv. Abingdon tortoise and Goats	s. Proto cooperation



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

Q4. The process of _____ involves the movement of water through the mass of the cell wall without crossing any membrane, whereas _____ involves movement through the plasmodesmata.

- (A) Symplast; Apoplast
- (B) Apoplast; Symplast
- (C) Imbibition; Osmosis
- (D) Diffusion; Active transport

Q5. Identify the CORRECT sequence of steps in PCR:

- (A) Extension → Denaturation → Annealing
- (B) Annealing → Extension → Denaturation
- (C) Denaturation → Annealing → Extension
- (D) Denaturation → Extension → Annealing

Q6. Statement I: In human females, the first polar body is formed during the first meiotic division.

Statement II: The second meiotic division is completed only after the entry of sperm.

- (A) Both Statements are correct.
- (B) Both Statements are incorrect.
- (C) Statement I is correct but Statement II is incorrect.
- (D) Statement I is incorrect but Statement II is correct.

Q7. In the DNA fingerprinting technique, the process of transferring DNA fragments from electrophoresis gel to a synthetic membrane is called _____.



- (A) Northern Blotting
- (B) Western Blotting
- (C) Southern Blotting
- (D) Eastern Blotting

Q8. Match the following parts of the Human Brain with their functions:

Part	Function
i. Hypothalamus	p. Muscular coordination
ii. Cerebellum	q. Thermoregulation
iii. Medulla	r. Visual reflex
iv. Corpora quadrigemina	s. Gastric secretions

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

Q9. Select the CORRECT pair regarding Nitrogen-fixing microbes:

- (A) *Frankia* - Alnus
- (B) *Rhizobium* - Non-leguminous plants
- (C) *Anabaena* - Azolla (Free living only)
- (D) *Rhodospirillum* - Aerobic

Q10. The total number of ATP molecules produced through aerobic respiration of one glucose molecule is _____ in most eukaryotic cells.

- (A) 2
- (B) 38
- (C) 36
- (D) 40

Q11. Identify the INCORRECT statement regarding biodiversity:



- (A) The term 'Biodiversity' was popularized by Edward Wilson.
- (B) Tropics have more species than temperate areas.
- (C) Species diversity increases as we move away from the equator.
- (D) Amazonian rain forest has the greatest biodiversity on earth.

Q12. During the process of decomposition, the step where water-soluble inorganic nutrients go down into the soil horizon is called _____.

- (A) Fragmentation
- (B) Catabolism
- (C) Leaching
- (D) Humification

Q13. Identify the hormone that is NOT a steroid:

- (A) Cortisol
- (B) Testosterone
- (C) Epinephrine
- (D) Progesterone

Q14. In the lac operon, the gene 'y' codes for _____, which increases the permeability of the cell to β -galactosides.

- (A) Repressor
- (B) Permease
- (C) Transacetylase
- (D) Inducer

Q15. The cost of a certain recombinant vaccine is ₹ 500. If the yield is increased by 20%, what is the new production efficiency factor? (This is a conceptual logic question for Hard levels)

- (A) 1.2



- (B) 0.8
 (C) 5.0
 (D) 2.0

Q16. Identify the CORRECT match for the following plant growth regulators and their physiological effects:

Hormone	Function
i. Auxin	p. Bolting in rosette plants
ii. Gibberellin	q. Apical dominance
iii. Cytokinin	r. Stress hormone / Seed dormancy
iv. Abscisic Acid	s. Delay of senescence

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

Q17. During the process of double fertilization in angiosperms, the fusion of one male gamete with the egg cell results in _____, while the other male gamete fuses with _____.

- (A) Zygote; Antipodals
 (B) Endosperm; Synergids
 (C) Zygote; Secondary nucleus
 (D) Primary Endosperm Nucleus; Zygote

Q18. Statement I: In a typical Mendelian dihybrid cross, the phenotypic ratio in F_2 generation is 9:3:3:1.

Statement II: This ratio is obtained because the two pairs of traits assort independently of each other.

- (A) Both Statement I and Statement II are correct.
 (B) Both Statement I and Statement II are incorrect.



- (C) Statement I is correct but Statement II is incorrect.
 (D) Statement I is incorrect but Statement II is correct.

Q19. Which of the following represents the correct order of phases in the Prophase I of Meiosis?

- (A) Leptotene → Pachytene → Zygotene → Diplotene → Diakinesis
 (B) Leptotene → Zygotene → Pachytene → Diplotene → Diakinesis
 (C) Zygotene → Leptotene → Pachytene → Diakinesis → Diplotene
 (D) Pachytene → Zygotene → Leptotene → Diplotene → Diakinesis

Q20. In the human respiratory system, the partial pressure of Oxygen (pO_2) in the alveoli and the deoxygenated blood is _____ and _____ mmHg respectively.

- (A) 104; 40
 (B) 40; 104
 (C) 159; 45
 (D) 95; 40

Q21. Match the following list of microbes with their commercial products:

Microbe	Product
i. <i>Aspergillus niger</i>	p. Statins
ii. <i>Acetobacter aceti</i>	q. Citric acid
iii. <i>Clostridium butylicum</i>	r. Acetic acid
iv. <i>Monascus purpureus</i>	s. Butyric acid

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

Q22. Identify the INCORRECT statement regarding the structure of a human heart:



- (A) The atrium and ventricle of the same side are separated by a thick fibrous tissue called atrio-ventricular septum.
- (B) The SAN is located in the upper left corner of the right atrium.
- (C) The bicuspid valve guards the opening between the left atrium and left ventricle.
- (D) Purkinje fibers are part of the nodal musculature.

Q23. The volume of air that remains in the lungs even after a forcible expiration is known as _____.

- (A) Tidal Volume
- (B) Expiratory Reserve Volume
- (C) Residual Volume
- (D) Vital Capacity

Q24. In a pond ecosystem, the pyramid of biomass is generally _____, because the biomass of _____ exceeds that of phytoplankton.

- (A) Upright; Zooplankton
- (B) Inverted; Fishes
- (C) Upright; Fishes
- (D) Inverted; Phytoplankton

Q25. Identify the missing stage in the development of the human embryo: Zygote → Morula → _____ → Gastrula.

- (A) Blastocyst
- (B) Neurula
- (C) Foetus
- (D) Trophoblast

Q26. Statement I: Down's syndrome is caused by the trisomy of chromosome 21.
Statement II: This genetic disorder results due to the non-disjunction of chromosomes during cell division.



- (A) Both Statement I and Statement II are correct.
- (B) Both Statement I and Statement II are incorrect.
- (C) Statement I is correct but Statement II is incorrect.
- (D) Statement I is incorrect but Statement II is correct.

Q27. The enzyme _____ is used to join DNA fragments, acting as "molecular glue" in genetic engineering.

- (A) DNA Polymerase
- (B) Helicase
- (C) DNA Ligase
- (D) Restriction Endonuclease
- (E) Exonuclease

Q28. Which of the following is NOT a characteristic of wind-pollinated (anemophilous) flowers?

- (A) Well-exposed stamens.
- (B) Large feathery stigma.
- (C) Flowers are highly colorful and fragrant.
- (D) Numerous flowers packed into an inflorescence.

Q29. Match the following terms related to the female reproductive system:

Term	Description
i. Ampulla	p. Inner glandular layer of uterus
ii. Fimbriae	q. Site of fertilization
iii. Endometrium	r. Finger-like projections of fallopian tube
iv. Myometrium	s. Middle thick muscular layer of uterus

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



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

Q30. The theory of Natural Selection was proposed by _____, while the theory of Mutation was proposed by _____.

- (A) Lamarck; Darwin
- (B) Darwin; Hugo de Vries
- (C) Oparin; Haldane
- (D) Mendel; Morgan

Q31. Identify the hormone responsible for the contraction of uterine muscles during childbirth:

- (A) Prolactin
- (B) Estrogen
- (C) Oxytocin
- (D) Vasopressin

Q32. In the structure of an antibody, the light chains and heavy chains are held together by _____ bonds.

- (A) Hydrogen
- (B) Glycosidic
- (C) Disulfide
- (D) Phosphodiester

Q33. Which part of the human eye is responsible for the maximum refraction of light?

- (A) Lens
- (B) Cornea
- (C) Retina
- (D) Iris



Q34. The "Evil Quartet" refers to the four major causes of _____.

- (A) Population explosion
- (B) Global warming
- (C) Biodiversity loss
- (D) Water pollution

Q35. Statement I: Recombinant DNA technology has been used to produce insulin called 'Humulin'.

Statement II: Humulin contains the C-peptide which is absent in mature human insulin.

- (A) Both statements are correct.
- (B) Statement I is correct, Statement II is incorrect.
- (C) Statement I is incorrect, Statement II is correct.
- (D) Both statements are incorrect.

Q36. Match the following cranial nerves with their nature:

Nerve	Nature
i. Olfactory	p. Mixed
ii. Optic	q. Motor
iii. Oculomotor	r. Sensory
iv. Vagus	s. Sensory

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

Q37. The functional unit of the human kidney is the _____, while the functional unit of the nervous system is the _____.

- (A) Neuron; Nephron
- (B) Nephron; Neuron



- (C) Alveoli; Nephron
- (D) Glomerulus; Axon

Q38. Identify the INCORRECT statement regarding the properties of a Genetic Code:

- (A) The code is nearly universal.
- (B) The code is degenerate (one amino acid can be coded by more than one codon).
- (C) The code is read in a contiguous fashion (no punctuations).
- (D) The codon is doublet.

Q39. The percentage of solar radiation that is captured by plants for Photosynthetically Active Radiation (PAR) is approximately _____ of the total incident solar radiation.

- (A) 50%
- (B) 2-10%
- (C) 100%
- (D) 20%

Q40. The cost of mapping a human genome was approximately ₹ 1350 per base pair during the HGP. For a total of 3×10^9 bp, calculate the total estimated cost in crores.

- (A) ₹ 40,500 Crores
- (B) ₹ 4,05,000 Crores
- (C) ₹ 4,050 Crores
- (D) ₹ 40.5 Crores

Q41. During the process of Z-scheme in light reaction, the electrons from the reaction center of PS II are accepted by _____ and then passed to the _____.

- (A) Pheophytin; Cytochrome b_6f



- (B) Plastocyanin; NADP⁺
- (C) Ferredoxin; Plastoquinone
- (D) Cytochrome *b₆f*; Pheophytin

Q42. Which of the following describes the 'Law of Limiting Factors' proposed by Blackman?

- (A) Rate of photosynthesis is determined by the factor present in maximum amount.
- (B) Rate of a chemical process is governed by the factor which is nearest to its minimal value.
- (C) Light is always the limiting factor in tropical forests.
- (D) Plants do not require CO₂ if light intensity is high.

Q43. Identify the INCORRECT match regarding the Human Reproductive System:

Structure	Function/Feature
i. Leydig cells	p. Synthesis of Androgens
ii. Sertoli cells	q. Provide nutrition to germ cells
iii. Epididymis	r. Site of capacitation
iv. Bulbourethral gland	s. Lubrication of penis

- (A) i-p, ii-q, iii-r, iv-s
- (B) i-p, ii-q, iii-s, iv-r
- (C) iii only is incorrect
- (D) i and ii are incorrect

Q44. The first clinical gene therapy was given in 1990 to a 4-year-old girl with _____ deficiency.

- (A) Insulin
- (B) Adenosine Deaminase (ADA)
- (C) Phenylalanine hydroxylase
- (D) Tyrosinase



Q45. Statement I: In DNA replication, the leading strand is synthesized continuously in the 5' → 3' direction.

Statement II: DNA polymerase can only polymerize nucleotides in the 5' → 3' direction.

- (A) Both statements are correct and Statement II is the correct explanation of Statement I.
- (B) Both statements are correct but Statement II is not the explanation of Statement I.
- (C) Statement I is correct, Statement II is incorrect.
- (D) Statement I is incorrect, Statement II is correct.

Q46. In human evolution, the hominid with a cranial capacity of 900cc who probably ate meat was _____.

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

Q47. The secondary metabolites like Vinblastine and Curcumin are used as _____ and _____ respectively.

- (A) Drugs; Anti-cancer agents
- (B) Anti-cancer drugs; Spices/Drugs
- (C) Toxins; Lectins
- (D) Alkaloids; Essential oils

Q48. Match the following Disorders with their symptoms:

Disorder	Symptom
i. Tetany	p. Inflammation of joints
ii. Osteoporosis	q. Rapid spasms in muscles
iii. Gout	r. Decreased bone mass
iv. Myasthenia gravis	s. Autoimmune neuromuscular disorder



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

Q49. In *Musa* (banana), the fruit is developed without fertilization. This phenomenon is known as _____.

- (A) Parthenogenesis
- (B) Apomixis
- (C) Parthenocarpy
- (D) Polyembryony

Q50. The enzyme Carbonic Anhydrase is found in very high concentration in _____ and facilitates the transport of CO₂.

- (A) Blood Plasma
- (B) Lymphocytes
- (C) Erythrocytes (RBCs)
- (D) Platelets

Q51. Identify the correctly matched pair of the following:

- (A) S-shaped growth curve - Population in limited resources
- (B) J-shaped growth curve - Population in limited resources
- (C) Logistic growth - Unrestricted growth
- (D) Exponential growth - Carrying capacity included

Q52. The "T-DNA" used for plant transformation is derived from _____.

- (A) *Escherichia coli*
- (B) *Agrobacterium tumefaciens*
- (C) *Bacillus thuringiensis*



(D) *Thermus aquaticus*

Q53. Select the hormone that is purely responsible for the maintenance of the Corpus Luteum:

- (A) Estrogen
- (B) LH (Luteinizing Hormone)
- (C) FSH
- (D) Prolactin

Q54. A mutation that results in the replacement of a purine by another purine is called _____.

- (A) Transversion
- (B) Transition
- (C) Frameshift
- (D) Deletion

Q55. Identify the correct match for the immune system components:

Component	Description
i. Interferons	p. Physical barriers
ii. Mucus	q. Cytokine barriers
iii. Macrophages	r. Physiological barriers
iv. HCl in stomach	s. Cellular barriers

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

Q56. The partial pressure of CO₂ in deoxygenated blood is _____ mmHg.

- (A) 40



- (B) 45
- (C) 95
- (D) 104

Q57. In a typical transcription unit, the 'Promoter' is located towards _____ end of the coding strand.

- (A) 3'
- (B) 5'
- (C) Both 3' and 5'
- (D) Middle

Q58. Which of the following is NOT a STOP codon in the genetic code?

- (A) UAA
- (B) UAG
- (C) UGA
- (D) AUG

Q59. The symbiotic association between fungi and roots of higher plants is called _____.

- (A) Lichen
- (B) Mycorrhiza
- (C) Mutualism
- (D) Parasitism

Q60. The value of Δ (delta) for the species-area relationship in a very large area like a whole continent is observed to be in the range of _____.

- (A) 0.1 to 0.2
- (B) 0.6 to 1.2
- (C) 1.0 to 2.0



(D) 0.01 to 0.1

Q61. Statement I: Heart failure is the same as cardiac arrest or a heart attack.
Statement II: Heart failure means the state of heart when it is not pumping blood effectively enough to meet the needs of the body.

- (A) Both statements are correct.
- (B) Statement I is correct, Statement II is incorrect.
- (C) Statement I is incorrect, Statement II is correct.
- (D) Both statements are incorrect.

Q62. The number of spinal nerves in the human body is _____ pairs.

- (A) 12
- (B) 31
- (C) 21
- (D) 10

Q63. The specific region in the retina where the visual acuity (resolution) is the highest is called _____.

- (A) Blind spot
- (B) Fovea
- (C) Iris
- (D) Choroid

Q64. In DNA, the distance between two adjacent base pairs is _____ nm.

- (A) 3.4
- (B) 0.34
- (C) 2.0
- (D) 34



- Q65.** The cost of environmental damages is often ignored. If a forest ecosystem provides services worth ₹ 33 trillion annually, and soil formation accounts for 50% of this, what is the value of soil formation?
- (A) ₹ 16.5 trillion
(B) ₹ 33 trillion
(C) ₹ 10 trillion
(D) ₹ 5 trillion
- Q66.** During the light reaction of photosynthesis, the movement of protons to create a gradient across the thylakoid membrane occurs from _____ to _____.
- (A) Stroma; Lumen
(B) Lumen; Stroma
(C) Intermembrane space; Matrix
(D) Cytoplasm; Stroma
- Q67.** Identify the INCORRECT statement regarding the structure of the Human Ear:
- (A) The Eustachian tube connects the middle ear cavity with the pharynx.
(B) The organ of Corti is located on the basilar membrane.
(C) The membranous labyrinth is filled with a fluid called perilymph.
(D) The malleus is attached to the tympanic membrane.
- Q68.** In the process of transcription in Eukaryotes, the enzyme RNA Polymerase II transcribes _____.
- (A) rRNA (28S, 18S, and 5.8S)
(B) tRNA, 5S rRNA, and snRNAs
(C) Precursor of mRNA (hnRNA)
(D) Only the Promoter region
- Q69.** Match the following terms of Population Growth with their definitions:



Term	Definition
i. Natality	p. Number of individuals leaving the habitat
ii. Mortality	q. Number of births during a given period
iii. Immigration	r. Number of deaths during a given period
iv. Emigration	s. Number of individuals coming into a habitat

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

Q70. The first human-like hominid, which had a brain capacity between 650-800 cc, was _____.

- (A) *Homo erectus*
(B) *Homo habilis*
(C) *Ramapithecus*
(D) *Australopithecus*

Q71. In a recombinant DNA experiment, if a gene is ligated at the BamHI site of the tetracycline resistance gene in pBR322, the transformants will _____.

- (A) Grow on ampicillin but not on tetracycline
(B) Grow on tetracycline but not on ampicillin
(C) Grow on both antibiotics
(D) Die on both antibiotics

Q72. The "G-cells" of the stomach secrete _____, which stimulates the secretion of HCl and pepsinogen.

- (A) Secretin
(B) Gastrin
(C) Cholecystokinin



(D) Somatostatin

Q73. Identify the correct match for Chromosomal Mutations:

Type	Genetic Constitution
i. Klinefelter's Syndrome	p. 45 with XO
ii. Turner's Syndrome	q. 47 with XXY
iii. Down's Syndrome	r. Trisomy of 21
iv. Edward's Syndrome	s. Trisomy of 18

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

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

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

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

Q74. Which of the following is a "Physical Barrier" of the Innate Immune System?

(A) Acid in the stomach

(B) Skin on our body

(C) Interferons

(D) Monocytes

Q75. The process of charging of tRNA is also known as _____.

(A) Translation

(B) Aminoacylation

(C) Transcription

(D) Splicing

Q76. In an ecosystem, the rate of production of organic matter during photosynthesis is called _____.

(A) Net Primary Productivity

(B) Gross Primary Productivity



- (C) Secondary Productivity
- (D) Decomposition Rate

Q77. Statement I: All proteins are enzymes.

Statement II: Almost all enzymes are proteins, but some are nucleic acids (Ribozymes).

- (A) Statement I is correct, Statement II is incorrect.
- (B) Statement I is incorrect, Statement II is correct.
- (C) Both statements are correct.
- (D) Both statements are incorrect.

Q78. The secondary oocyte completes its second meiotic division upon _____.

- (A) Ovulation
- (B) Implantation
- (C) Entry of sperm
- (D) Puberty

Q79. The presence of _____ in the urine is an indicative of Diabetes Mellitus.

- (A) Urea and Ketone bodies
- (B) Glucose and Ketone bodies
- (C) Glucose and Urea
- (D) Albumin and Glucose

Q80. Match the following list of Biocontrol agents with their target pests:

Agent	Pest
i. Ladybird	p. Aphids
ii. Dragonflies	q. Mosquitoes
iii. <i>Bacillus thuringiensis</i>	r. Butterfly caterpillars
iv. <i>Trichoderma</i>	s. Several plant pathogens

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



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

Q81. The volume of air inspired or expired during a normal respiration is called _____.

- (A) Residual Volume
- (B) Vital Capacity
- (C) Tidal Volume
- (D) Inspiratory Capacity

Q82. The hormone that acts on the exocrine pancreas and stimulates secretion of water and bicarbonate ions is _____.

- (A) Gastrin
- (B) Secretin
- (C) Insulin
- (D) Glucagon

Q83. Identify the INCORRECT pair regarding Mendel's laws:

- (A) Dominance - In a dissimilar pair of factors, one member dominates the other.
- (B) Segregation - Alleles do not show any blending and both characters are recovered in F_2 .
- (C) Independent Assortment - Only applies to monohybrid crosses.
- (D) Law of Segregation - Also known as the law of purity of gametes.

Q84. The "Pleura" is a double-layered membrane that covers the _____.

- (A) Heart
- (B) Kidney



- (C) Lungs
(D) Brain

Q85. In the context of Human Blood groups, a person with 'AB' blood group is called a universal recipient because _____.

- (A) Their RBCs lack A and B antigens.
(B) Their plasma lacks anti-A and anti-B antibodies.
(C) Their plasma contains both anti-A and anti-B antibodies.
(D) They lack Rh antigen.

Q86. Match the Following Bio-resources with their origin:

Resource	Detail
i. Basmati Rice	p. 27 documented varieties in India
ii. Bt Cotton	q. <i>Bacillus thuringiensis</i> gene
iii. Rosie	r. First transgenic cow
iv. RNAi	s. Cellular defense in eukaryotes

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

Q87. The net glomerular filtration rate (GFR) in a healthy individual is approximately _____ mL/minute.

- (A) 125
(B) 180
(C) 500
(D) 1000

Q88. Identify the "Start Codon" which also codes for Methionine:

- (A) UAA



- (B) AUG
- (C) GUG
- (D) UAG

Q89. The thick filament of a myofibril is primarily composed of the protein _____.

- (A) Actin
- (B) Myosin
- (C) Tropomyosin
- (D) Troponin

Q90. A patient was admitted with ₹ 1,50,000 medical bill for a myocardial infarction. The enzyme used as a "clot buster" to treat this patient is _____.

- (A) Lipase
- (B) Protease
- (C) Streptokinase
- (D) Pectinase

Q91. Which of the following describes "Competition" in an ecosystem?

- (A) (+, -)
- (B) (-, -)
- (C) (+, 0)
- (D) (+, +)

Q92. The technique used to amplify a specific segment of DNA in vitro is _____.

- (A) ELISA
- (B) Western Blotting
- (C) PCR



(D) Downstream processing

Q93. The middle layer of the human eye, which contains many blood vessels and looks bluish in color, is the _____.

- (A) Sclera
- (B) Choroid
- (C) Retina
- (D) Cornea

Q94. The process of translation involves the synthesis of _____.

- (A) DNA from RNA
- (B) mRNA from DNA
- (C) Proteins from mRNA
- (D) tRNA from rRNA

Q95. Match the following Respiratory organs with the organism:

Organ	Organism
i. Gills	p. Insects
ii. Tracheal tubes	q. Aquatic arthropods / Fishes
iii. Lungs	r. Mammals / Birds
iv. Moist Cuticle	s. Earthworms

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

Q96. The "Corpus Callosum" is a tract of nerve fibers that connects _____.

- (A) Spinal cord and Brain
- (B) Two cerebral hemispheres



- (C) Forebrain and Hindbrain
- (D) Cerebellum and Medulla

Q97. The "p" and "q" arms of a chromosome refer to _____ and _____ arms respectively.

- (A) Longer; Shorter
- (B) Shorter; Longer
- (C) Left; Right
- (D) Upper; Lower

Q98. Which of the following is NOT an In-situ conservation strategy?

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

Q99. The hormone that maintains the basal metabolic rate (BMR) and contains Iodine is _____.

- (A) Adrenaline
- (B) Thyroxine
- (C) Calcitonin
- (D) Parathyroid hormone

Q100. Calculate the total genetic combinations possible for a trihybrid cross ($AaBbCc \times AaBbCc$):

- (A) 4
- (B) 16
- (C) 64
- (D) 8



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

The family Fabaceae (formerly Papilionoideae) is characterized by specific floral traits. Symmetry is described as zygomorphic (bilateral), and the gynoecium is typically superior, monocarpellary, and unilocular.

Solution:

Step 1: The floral formula for Fabaceae begins with the symbol

Step 2: The gynoecium is represented by \underline{G}_1 , where the underscore indicates a superior ovary and the subscript '1' indicates a single carpel (monocarpellary).

Step 3: Options involving actinomorphic symmetry (radial) or multicarpellary ovaries belong to families like Solanaceae or Liliaceae.

Step 4: Therefore, the blanks are correctly filled by Zygomorphic and Monocarpellary.

Final Answer:

Answer: (B)

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Q2.

Solution

Concept: The C_4 pathway (Hatch-Slack pathway) is an adaptation in certain plants to minimize photorespiration. It involves a specialized leaf anatomy called 'Kranz anatomy', where the vascular bundles are surrounded by large bundle sheath cells, which in turn are surrounded by mesophyll cells.

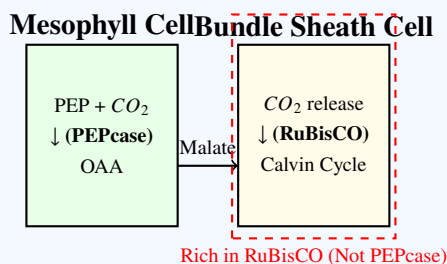
Solution: Step 1: In C_4 plants, the primary CO_2 acceptor is Phosphoenolpyruvate (PEP), which is a 3-carbon molecule present in the mesophyll cells. Statement (A) is correct.

Step 2: Mesophyll cells lack the enzyme RuBisCO; instead, they contain PEPcase. This ensures that CO_2 is fixed even at low concentrations. Statement (B) is correct.

Step 3: The initial product, Oxaloacetic acid (OAA), is converted to malic acid and transported to the bundle sheath cells. In these cells, CO_2 is released and fixed by RuBisCO.

Step 4: PEPcase is absent in the bundle sheath cells; they are specifically rich in RuBisCO to perform the C_3 cycle (Calvin cycle). Therefore, statement (C) is incorrect.

Step 5: Bundle sheath cells are characterized by having thick walls impervious to gaseous exchange and no intercellular spaces, which helps maintain a high CO_2 concentration around RuBisCO. Statement (D) is correct.



Final Answer: (C) The bundle sheath cells are rich in PEPcase enzyme.

Answer: (C)

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Q3.

Solution**Concept:**

Population interactions define how different species live together. These include Commensalism (+/0), Parasitism (+/-), Competition (-/-), and Mutualism/Protocooperation (+/+).

Solution:

Step 1: Epiphytic orchids growing on a mango branch benefit from the support, while the mango tree is unaffected. This is Commensalism (i-q).

Step 2: *Cuscuta* (Amarbel) is a total stem parasite that derives nutrition from the host plant, harming it. This is Parasitism (ii-p).

Step 3: The association between sea anemone and clown fish is often cited as commensalism or protocooperation where the fish gets protection from stinging tentacles. In strict MHT-CET/NCERT contexts, it is Commensalism, but here we match based on the best fit. (iii-q).

Step 4: The Abingdon tortoise became extinct in Galapagos after goats were introduced due to their greater browsing efficiency. This is a classic example of Competition (iv-r).

Final Answer:

Answer: (A)

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Q4.

Solution**Concept:**

Water movement in plants occurs via two main pathways: the Apoplast (non-living) and the Symplast (living).

Solution:

Step 1: The Apoplast pathway consists of the non-living parts of the plant body, namely the cell walls and intercellular spaces. Water moves through these by mass flow and does not cross the selectively permeable plasma membrane.

Step 2: The Symplast pathway involves the system of interconnected protoplasts. Water enters the cells through their plasma membranes and travels between cells through cytoplasmic strands called plasmodesmata.

Step 3: Therefore, the first blank refers to the Apoplast and the second refers to the Symplast.

Step 4: Imbibition is a specific type of diffusion involving solids/colloids, and Osmosis is the movement across a semi-permeable membrane.

Final Answer:

Answer: (B)

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Q5.

Solution**Concept:**

Polymerase Chain Reaction (PCR) is a technique used to amplify a specific DNA segment. It consists of three cyclical steps performed at different temperatures.

Solution:

Step 1: The first step is Denaturation, where the double-stranded DNA is heated (approx. 94°C) to separate it into two single strands.

Step 2: The second step is Annealing, where the temperature is lowered (approx. 50-60°C) to allow primers to bind to the complementary sequences on the single-stranded DNA templates.

Step 3: The third step is Extension, where Taq polymerase enzyme adds nucleotides to the primers at a medium temperature (approx. 72°C) to synthesize new DNA strands.

Step 4: The cycle then repeats. Thus, the correct sequence is Denaturation → Annealing → Extension.

Final Answer:

Answer: (C)

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Q6.

Solution**Concept:**

Oogenesis in human females is a discontinuous process that begins during embryonic development and is completed only upon fertilization. It involves two meiotic divisions that produce polar bodies due to unequal cytoplasmic division.

Solution:

Step 1: During the first meiotic division (Meiosis I), the primary oocyte divides into a large secondary oocyte and a tiny first polar body. This occurs just before ovulation. Thus, Statement I is correct.

Step 2: The secondary oocyte starts Meiosis II but is arrested at the metaphase II stage. It is released from the ovary in this state.

Step 3: Meiosis II is only completed if a sperm penetrates the zona pellucida of the ovum. This trigger causes the completion of the second division, forming the ootid (ovum) and the second polar body. Thus, Statement II is correct.

Step 4: Since both statements accurately describe the physiological timing of oogenesis, Option A is the right choice.

Final Answer:

Answer: (A)

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Q7.

Solution**Concept:**

Recombinant DNA technology uses various "blotting" techniques to identify specific macromolecules. These techniques involve transferring fragments from a gel to a solid support membrane for hybridization.

Solution:

Step 1: In DNA fingerprinting (VNTR analysis), DNA is digested by restriction endonucleases and separated by electrophoresis.

Step 2: Because the gel is fragile, the DNA fragments are transferred (blotted) onto a synthetic membrane, such as nitrocellulose or nylon.

Step 3: This specific transfer of DNA is known as Southern Blotting, named after Edwin Southern.

Step 4: For comparison, Northern Blotting is used for RNA, and Western Blotting is used for proteins. Eastern blotting is a less common technique for post-translational modifications.

Final Answer:

Answer: (C)

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Q8.

Solution**Concept:**

The human brain is divided into functional regions. Understanding the specific control centers in the forebrain, midbrain, and hindbrain is essential for solving neuro-anatomy questions.

Solution:

Step 1: The Hypothalamus is the master control center for homeostasis, including body temperature (thermoregulation), hunger, and thirst (i-q).

Step 2: The Cerebellum, part of the hindbrain, is responsible for maintaining posture, balance, and fine-tuning muscular movements (ii-p).

Step 3: The Medulla oblongata contains centers that control autonomic functions like respiration, cardiovascular reflexes, and gastric secretions (iii-s).

Step 4: The Corpora quadrigemina are four rounded lobes on the dorsal part of the midbrain; the superior colliculi are specifically involved in visual reflexes (iv-r).

Step 5: Matching these pairs leads to the sequence i-q, ii-p, iii-s, iv-r.

Final Answer:

Answer: (A)

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Q9.

Solution**Concept:**

Biological Nitrogen Fixation is carried out by specialized prokaryotes. These can be free-living or symbiotic, and they can target specific groups of plants.

Solution:

Step 1: *Frankia* is a nitrogen-fixing actinomycete that forms symbiotic root nodules on several non-leguminous plants, such as *Alnus* (Alder). This pair is correct.

Step 2: *Rhizobium* is famous for its symbiosis with leguminous plants (pea, bean, etc.), not non-leguminous ones.

Step 3: *Anabaena* forms a symbiotic association with the water fern *Azolla*, but it is not "free living only"; it is highly effective in its symbiotic state in rice fields.

Step 4: *Rhodospirillum* is a free-living, anaerobic nitrogen-fixing bacterium, not aerobic.

Final Answer:

Answer: (A)

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Q10.

Solution**Concept:**

The ATP yield of aerobic respiration depends on the efficiency of the shuttle systems (glycerol phosphate or malate-aspartate) used to transport electrons from cytoplasmic NADH into the mitochondria.

Solution:

Step 1: Glycolysis produces 2 net ATP and 2 NADH. The Krebs cycle and Link reaction produce more NADH and FADH₂.

Step 2: In the electron transport chain, 1 NADH usually yields 3 ATP (or 2.5) and 1 FADH₂ yields 2 ATP (or 1.5).

Step 3: In most eukaryotic cells, the 2 NADH from glycolysis must be transported into the mitochondria. Depending on the shuttle, the total yield is calculated as 36 or 38 ATP.

Step 4: While 38 is the maximum theoretical yield, 36 ATP is the most common net gain cited for eukaryotes (like muscle cells) due to the energetic cost of transport. Standard MHT-CET/NCERT questions typically look for 36 as the standard eukaryotic value unless "maximum" is specified.

Final Answer:

Answer: (C)

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Q11.

Solution**Concept:**

Biodiversity refers to the variety and variability of life on Earth. Patterns of biodiversity show that species richness is not uniformly distributed but follows specific geographical and environmental gradients.

Solution:

Step 1: Sociobiologist Edward Wilson popularized the term 'Biodiversity' to describe the combined diversity at all levels of biological organization.

Step 2: A key pattern is the latitudinal gradient. Species diversity is highest in the tropics (near the equator) and decreases as we move toward the poles (temperate and polar regions).

Step 3: Statement C claims diversity increases as we move away from the equator. This is incorrect because harsher climates and shorter evolutionary time in temperate/polar regions lead to lower species richness compared to the stable tropical environment.

Step 4: The Amazonian rain forest in South America is indeed the most biodiverse terrestrial region on the planet.

Final Answer: C

Answer: (C)

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Q12.

Solution**Concept:**

Decomposition is the process of breaking down complex organic matter (detritus) into inorganic substances like CO₂, water, and nutrients. It involves several simultaneous steps.

Solution:

Step 1: Fragmentation involves detritivores (like earthworms) breaking detritus into smaller particles.

Step 2: Catabolism is the process where bacterial and fungal enzymes degrade detritus into simpler inorganic substances.

Step 3: Leaching is the specific physical process where water-soluble inorganic nutrients move down through the soil profile and become precipitated as unavailable salts.

Step 4: Humification leads to the accumulation of a dark-colored amorphous substance called humus, which is highly resistant to microbial action and serves as a reservoir of nutrients.

Final Answer: C

Answer: (C)

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Q13.

Solution**Concept:**

Hormones are chemically diverse. They are generally classified into peptide/protein hormones, steroid hormones, iodothyronines (thyroid hormones), and amino-acid derivatives.

Solution:

Step 1: Steroid hormones are derived from cholesterol. Examples include hormones from the adrenal cortex (Cortisol, Aldosterone) and gonads (Testosterone, Progesterone, Estrogen).

Step 2: Cortisol (A), Testosterone (B), and Progesterone (D) are all classical examples of steroid hormones that bind to intracellular receptors.

Step 3: Epinephrine (also known as Adrenaline) is an amino-acid derivative. It is synthesized from the amino acid tyrosine and acts through membrane-bound receptors via secondary messengers.

Step 4: Therefore, Epinephrine is the correct answer as it is not a steroid.

Final Answer: C

Answer: (C)

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Q14.

Solution**Concept:**

The Lac Operon is a classic model of gene regulation in *E. coli*. It consists of three structural genes (z, y, and a) that are expressed together to metabolize lactose.

Solution:

Step 1: The 'z' gene codes for β -galactosidase, which hydrolyzes lactose into glucose and galactose.

Step 2: The 'y' gene codes for Permease. This enzyme is crucial because it increases the permeability of the cell membrane, allowing lactose (β -galactosides) to enter the cell more efficiently.

Step 3: The 'a' gene codes for a Transacetylase, which transfers an acetyl group to β -galactosides.

Step 4: The 'i' gene codes for the Repressor protein, and the Inducer is the lactose (allolactose) molecule itself.

Final Answer: B

Answer: (B)

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Q15.

Solution**Concept:**

In biotechnology and bio-process engineering, efficiency factors or productivity ratios are used to measure the output relative to the baseline.

Solution:

Step 1: This question is a high-level conceptual application. Efficiency or yield factors are often expressed as a ratio of the new output to the original output.

Step 2: If the original yield is considered 100

Step 3: To find the efficiency factor, we convert the percentage to a decimal: $120/100 = 1.2$.

Step 4: In MHT-CET "Hard" level questions, numerical logic applied to biological production (like vaccine or enzyme yield) often uses these simple ratio-based efficiency factors.

Final Answer:

Answer: (A)

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Q16.

Solution**Concept:**

Plant Growth Regulators (PGRs) or phytohormones are small chemical molecules that control various physiological processes in plants. Each hormone group has distinct and sometimes overlapping roles.

Solution:

Step 1: Auxins are primarily responsible for apical dominance, where the presence of the terminal bud inhibits the growth of lateral buds (i-q).

Step 2: Gibberellins are known for promoting internodal elongation, particularly "bolting" (sudden stalk elongation) in rosette plants like cabbage (ii-p).

Step 3: Cytokinins promote cell division and are known to delay leaf senescence (aging) by mobilizing nutrients (iii-s).

Step 4: Abscisic Acid (ABA) acts as a general plant growth inhibitor. It induces seed dormancy and the closing of stomata during water stress, earning it the name "stress hormone" (iv-r).

Step 5: Matching these results in the sequence i-q, ii-p, iii-s, iv-r.

Final Answer:

Answer: (A)

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Q17.

Solution**Concept:**

Double fertilization is a unique feature of angiosperms involving two distinct fusion events within the embryo sac.

Solution:

Step 1: The first male gamete fuses with the haploid egg cell (syngamy) to form a diploid zygote, which later develops into the embryo.

Step 2: The second male gamete moves towards the center and fuses with the two polar nuclei (or the diploid secondary nucleus formed by their fusion).

Step 3: This second fusion is called triple fusion because it involves three haploid nuclei, resulting in the formation of the triploid Primary Endosperm Nucleus (PEN), which develops into the endosperm.

Step 4: Therefore, the products are the zygote and the secondary nucleus (or PEN). Option C is the most accurate description of the fusion partners.

Final Answer: C

Answer: (C)

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Q18.

Solution**Concept:**

Mendel's Law of Independent Assortment explains how different genes separate from one another when reproductive cells develop.

Solution:

Step 1: In a dihybrid cross (e.g., crossing plants with Round Yellow seeds and Wrinkled Green seeds), the F₂ generation consistently shows a phenotypic ratio of 9:3:3:1. Thus, Statement I is correct.

Step 2: This specific ratio occurs because the alleles for seed shape and the alleles for seed color segregate independently during gamete formation.

Step 3: Because the traits are on different chromosomes (or far apart on the same chromosome), the inheritance of one trait does not affect the inheritance of the other. Thus, Statement II is correct and explains Statement I.

Step 4: Since both statements are factually and logically sound, Option A is the correct choice.

Final Answer: A

Answer: (A)

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Q19.

Solution**Concept:**

Prophase I of Meiosis I is the most complex and longest phase of cell division, subdivided into five stages based on chromosomal behavior.

Solution:

Step 1: Leptotene – Chromosomes become visible and start condensing.

Step 2: Zygotene – Homologous chromosomes start pairing up (synapsis) to form bivalents.

Step 3: Pachytene – Crossing over occurs between non-sister chromatids of homologous chromosomes, mediated by the recombinase enzyme.

Step 4: Diplotene – The synaptonemal complex dissolves, and homologous chromosomes begin to separate except at the sites of crossovers (chiasmata).

Step 5: Diakinesis – Terminalization of chiasmata occurs, and the nuclear envelope breaks down.

Step 6: The correct sequence is Leptotene → Zygotene → Pachytene → Diplotene → Diakinesis.

Final Answer:

Answer: (B)

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Q20.

Solution**Concept:**

Gas exchange in the lungs occurs via simple diffusion, driven by a partial pressure gradient between the alveoli and the blood in the pulmonary capillaries.

Solution:

Step 1: The partial pressure of oxygen (pO_2) in atmospheric air is high, but in the alveoli, it is approximately 104 mmHg.

Step 2: Deoxygenated blood arriving at the lungs from the body has a low pO_2 of about 40 mmHg.

Step 3: This pressure gradient (104 mmHg in alveoli vs. 40 mmHg in blood) allows oxygen to diffuse rapidly from the alveoli into the blood.

Step 4: For comparison, the pCO_2 in alveoli is 40 mmHg, while in deoxygenated blood it is 45 mmHg, facilitating the exit of carbon dioxide.

Final Answer:

Answer: (A)

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Q21.

Solution**Concept:**

Industrial microbiology utilizes specific microorganisms to produce organic acids, enzymes, and bioactive molecules on a large scale.

Solution:

Step 1: *Aspergillus niger* is a fungus used for the commercial production of Citric acid (i-q).

Step 2: *Acetobacter aceti* is a bacterium that converts ethanol into Acetic acid (vinegar) through aerobic fermentation (ii-r).

Step 3: *Clostridium butylicum* is a bacterium used to produce Butyric acid (iii-s).

Step 4: *Monascus purpureus* is a yeast used to produce Statins, which are blood-cholesterol lowering agents that act by competitively inhibiting the enzyme responsible for cholesterol synthesis (iv-p).

Step 5: Matching these results in the sequence i-q, ii-r, iii-s, iv-p.

Final Answer:

Answer: (A)

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Q22.

Solution**Concept:**

The human heart is a myogenic muscular organ with a specialized conducting system (nodal tissue) that regulates the cardiac cycle.

Solution:

Step 1: The atrial and ventricular chambers are separated by the atrio-ventricular septum, which is thick and fibrous. This statement is correct.

Step 2: The Sino-atrial Node (SAN), known as the pacemaker, is located in the upper RIGHT corner of the RIGHT atrium, not the left corner. Thus, Statement B is incorrect.

Step 3: The bicuspid (mitral) valve is located between the left atrium and left ventricle. This statement is correct.

Step 4: The nodal musculature consists of the SAN, AVN, Bundle of His, and Purkinje fibers, which distribute the electrical impulse through the ventricles.

Final Answer:

Answer: (B)

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Q23.

Solution**Concept:**

Respiratory volumes and capacities are measurable parameters that provide information about the functional state of the lungs.

Solution:

Step 1: Tidal Volume (TV) is the volume of air inspired or expired during a normal breath.

Step 2: Expiratory Reserve Volume (ERV) is the additional volume of air a person can expire by a forcible expiration.

Step 3: Even after the most forceful expiration, the lungs are never completely empty. The volume of air remaining in the lungs is called the Residual Volume (RV).

Step 4: Vital Capacity (VC) is the maximum volume of air a person can breathe in after a forced expiration (TV + IRV + ERV).

Step 5: Since the question asks for the air remaining after forcible expiration, Residual Volume is the correct term.

Final Answer:

Answer: (C)

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Q24.

Solution

Concept: The pyramid of biomass represents the total living organic matter at each trophic level. In most terrestrial ecosystems, this pyramid is upright. However, in aquatic ecosystems like ponds or oceans, the standing crop of consumers often outweighs the standing crop of producers.

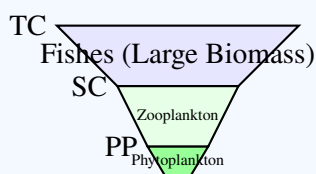
Solution: Step 1: In a pond, the primary producers are phytoplankton. Although they multiply rapidly, they are also consumed very quickly by zooplankton and small fish.

Step 2: Because phytoplankton are small and have short lifespans, their "standing crop" biomass at any single point in time is significantly lower than the biomass of the organisms in higher trophic levels.

Step 3: The consumers, such as large fishes, are bigger, live longer, and accumulate more biomass over time.

Step 4: This results in a pyramid where the base (producers) is narrow and the top (carnivores/fishes) is broad, which is described as an "inverted" pyramid.

Step 5: Therefore, the pyramid is inverted because the biomass of fishes (the larger consumers) exceeds that of the phytoplankton.



Inverted Pyramid of Biomass
(Aquatic Ecosystem)

Final Answer: (B) Inverted; Fishes

Answer: (B)

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Q25.

Solution**Concept:**

Embryonic development in humans follows a precise chronological sequence of morphological changes following fertilization.

Solution:

Step 1: Cleavage begins in the zygote, leading to the formation of a solid ball of 8-16 cells called the Morula.

Step 2: The Morula continues to divide and transforms into a hollow ball of cells called the Blastocyst (or Blastula).

Step 3: The Blastocyst contains an outer layer called the trophoblast and an inner cell mass. This is the stage that undergoes implantation in the uterine wall.

Step 4: Following implantation, the inner cell mass undergoes morphogenetic movements to form the three germ layers in a process called Gastrulation, resulting in the Gastrula.

Step 5: Therefore, the missing stage between Morula and Gastrula is the Blastocyst.

Final Answer:

Answer: (A)

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Q26.

Solution**Concept:**

Down's syndrome is an autosomal chromosomal disorder first described by Langdon Down. It is a type of aneuploidy specifically categorized as trisomy.

Solution:

Step 1: In a normal human cell, there are 23 pairs of chromosomes. In Down's syndrome, there is an extra copy of chromosome number 21.

Step 2: This means the individual has three copies of chromosome 21 instead of two (Trisomy 21). Thus, Statement I is correct.

Step 3: This condition arises due to "non-disjunction," which is the failure of homologous chromosomes or sister chromatids to separate properly during meiosis (usually during oogenesis).

Step 4: When a gamete with an extra chromosome 21 fuses with a normal gamete, the resulting zygote has 47 chromosomes. Thus, Statement II is correct and explains the cause of Statement I.

Final Answer:

Answer: (A)

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Q27.

Solution**Concept:**

Recombinant DNA technology requires various enzymes to manipulate DNA. These are often referred to as the "tool kit" of genetic engineering.

Solution:

Step 1: DNA Polymerase is used to synthesize a new strand of DNA complementary to a template.

Step 2: Helicase is responsible for unwinding the DNA double helix during replication.

Step 3: Restriction Endonucleases are "molecular scissors" that cut DNA at specific recognition sequences.

Step 4: DNA Ligase is the enzyme that facilitates the joining of DNA strands together by catalyzing the formation of a phosphodiester bond. In genetic engineering, it is used to seal the "sticky ends" of a gene of interest into a plasmid vector.

Step 5: Therefore, DNA Ligase is the "molecular glue."

Final Answer: C

Answer: (C)

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Q28.

Solution**Concept:**

Anemophily (wind pollination) is a passive process. Flowers adapted for wind pollination show specific morphological features to maximize the chances of pollen capture.

Solution:

Step 1: Since wind is a non-directional vector, plants produce enormous amounts of pollen. Stamens are well-exposed so that pollen can be easily dispersed into the wind.

Step 2: To catch the drifting pollen grains, the stigma is often large and feathery.

Step 3: Wind-pollinated flowers do not need to attract insects or animals. Therefore, they are typically small, inconspicuous, and lack bright colors, nectar, or fragrance.

Step 4: Statement C claims they are "highly colorful and fragrant," which is actually a characteristic of entomophilous (insect-pollinated) flowers.

Final Answer: C

Answer: (C)

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Q29.

Solution**Concept:**

The female reproductive tract consists of the ovaries, fallopian tubes (oviducts), uterus, and external genitalia. Each part has a specific histological and functional role.

Solution:

Step 1: The fallopian tube has three parts: infundibulum, ampulla, and isthmus. The Ampulla is the wider, middle part and is the specific site where fertilization occurs (i-q).

Step 2: The infundibulum possesses finger-like projections called Fimbriae, which help in the collection of the ovum after ovulation (ii-r).

Step 3: The wall of the uterus has three layers. The Endometrium is the innermost glandular layer that undergoes cyclic changes during the menstrual cycle (iii-p).

Step 4: The Myometrium is the middle thick layer of smooth muscles responsible for strong contractions during delivery (iv-s).

Step 5: The matching sequence is i-q, ii-r, iii-p, iv-s.

Final Answer:

Answer: (A)

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Q30.

Solution**Concept:**

Evolutionary biology tracks the various theories proposed to explain the mechanism of species change over time.

Solution:

Step 1: Charles Darwin, in his book "On the Origin of Species," proposed the theory of Natural Selection, emphasizing survival of the fittest based on small, continuous variations.

Step 2: Hugo de Vries, based on his work on evening primrose, proposed the Mutation Theory. He believed that evolution is caused by sudden, large changes (saltation) rather than minor variations.

Step 3: Lamarck proposed the theory of Inheritance of Acquired Characters. Oparin and Haldane proposed the chemical evolution theory. Mendel and Morgan are associated with genetics.

Step 4: Thus, the correct pair is Darwin and Hugo de Vries.

Final Answer:

Answer: (B)

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Q31.

Solution**Concept:**

Parturition (childbirth) is induced by a complex neuroendocrine mechanism involving signals from the fully developed fetus and the placenta.

Solution:

Step 1: The signals for parturition originate from the mature fetus and the placenta, which induce mild uterine contractions called the "fetal ejection reflex".

Step 2: This reflex triggers the release of Oxytocin from the maternal posterior pituitary gland.

Step 3: Oxytocin acts on the myometrium (uterine smooth muscle) and causes stronger uterine contractions.

Step 4: These stronger contractions, in turn, stimulate further secretion of oxytocin. The stimulatory reflex between the uterine contraction and oxytocin secretion continues resulting in stronger and stronger contractions, leading to the expulsion of the baby.

Step 5: Prolactin is for milk production, Estrogen prepares the uterus, and Vasopressin (ADH) regulates water balance.

Final Answer:

Answer: (C)

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Q32.

Solution**Concept:**

An antibody molecule (*IgG*) consists of four polypeptide chains: two identical light (L) chains and two identical heavy (H) chains, arranged in a Y-shaped structure.

Solution:

Step 1: The structural stability of an antibody is maintained by covalent cross-links between the polypeptide chains.

Step 2: Specifically, disulfide bonds (-S-S-) connect the light chain to the heavy chain and also connect the two heavy chains to each other in the hinge region.

Step 3: Hydrogen bonds and Van der Waals forces contribute to the folding, but the primary chemical "bridge" holding the chains together is the disulfide bond.

Step 4: Glycosidic bonds are found in carbohydrates, and phosphodiester bonds form the backbone of DNA/RNA.

Final Answer:

Answer: (C)

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Q33.

Solution**Concept:**

Light must be focused (refracted) precisely onto the retina for clear vision. This refraction is performed by multiple components of the eye.

Solution:

Step 1: When light enters the eye, it first passes through the cornea, then the aqueous humor, the lens, and the vitreous humor.

Step 2: While the lens is responsible for "fine-tuning" the focus (accommodation), about 70-80

Step 3: This is due to the significant difference in the refractive index between the air and the corneal tissue.

Step 4: The retina is the light-sensitive screen (not a refractor), and the iris regulates the amount of light entering the eye.

Final Answer:

Answer: (B)

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Q34.

Solution**Concept:**

The "Evil Quartet" is a term used in conservation biology to describe the four main drivers of the current high rates of species extinction.

Solution:

Step 1: Habitat Loss and Fragmentation: The most important cause, primarily due to tropical rainforest destruction.

Step 2: Over-exploitation: When "need" turns to "greed," leading to the extinction of species like Steller's sea cow.

Step 3: Alien Species Invasions: Introduction of non-native species (like Nile Perch or Lantana) that outcompete native species.

Step 4: Co-extinctions: When a species becomes extinct, the plant and animal species associated with it in an obligatory way also become extinct.

Step 5: These factors collectively explain the crisis of Biodiversity Loss.

Final Answer:

Answer: (C)

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Q35.

Solution**Concept:**

Genetically engineered insulin (Humulin) was first produced by Eli Lilly in 1983 using recombinant DNA technology in *E. coli*.

Solution:

Step 1: Human insulin is synthesized as a pro-hormone (pro-insulin) which contains an extra stretch called the C-peptide.

Step 2: In the natural maturation process within the human body, the C-peptide is removed to make the insulin functional. Mature insulin consists of only A and B chains linked by disulfide bridges.

Step 3: In recombinant production, the A and B chains were produced separately in *E. coli* and then combined. Therefore, Humulin does NOT contain the C-peptide.

Step 4: Statement I is correct, but Statement II is incorrect because the C-peptide is absent in the final recombinant product.

Final Answer:

Answer: (B)

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Q36.

Solution**Concept:**

Cranial nerves are the nerves that emerge directly from the brain. In humans, there are 12 pairs, and they are classified as sensory, motor, or mixed (both sensory and motor fibers) based on their function.

Solution:

Step 1: The Olfactory nerve (I) is responsible for the sense of smell and is purely sensory (i-r).

Step 2: The Optic nerve (II) is responsible for vision and is also purely sensory (ii-s).

Step 3: The Oculomotor nerve (III) controls most of the eye's movements and the constriction of the pupil; it is a motor nerve (iii-q).

Step 4: The Vagus nerve (X) is a long nerve that supplies the visceral organs; it carries both sensory and motor fibers, making it a mixed nerve (iv-p).

Step 5: Matching these results in the sequence i-r, ii-s, iii-q, iv-p.

Final Answer:

Answer: (A)

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Q37.

Solution**Concept:**

Every organ system in the human body has a basic structural and functional unit that performs the core tasks of that system.

Solution:

Step 1: The human kidney is composed of nearly one million complex tubular structures called Nephrons. The Nephron is the functional unit responsible for filtration, reabsorption, and secretion to form urine.

Step 2: The nervous system is composed of specialized cells called Neurons. The Neuron is the functional unit responsible for receiving, processing, and transmitting electrical impulses.

Step 3: Alveoli are the functional units of the respiratory system (lungs), and the Glomerulus is just one part of a nephron.

Step 4: Therefore, the correct pair in the order requested (Kidney first, then Nervous system) is Nephron and Neuron.

Final Answer:

Answer: (B)

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Q38.

Solution**Concept:**

The genetic code is the set of rules by which information encoded in genetic material is translated into proteins by living cells.

Solution:

Step 1: The code is universal, meaning a specific codon codes for the same amino acid in almost all organisms, from bacteria to humans.

Step 2: The code is degenerate, which means some amino acids are coded by more than one codon (e.g., there are 6 different codons for Leucine).

Step 3: The code is read in mRNA in a continuous fashion. There are no punctuations (commas) between adjacent codons.

Step 4: Statement D is incorrect because the codon is a triplet (composed of three nitrogenous bases), not a doublet. There are $4^3 = 64$ possible codons.

Final Answer:

Answer: (D)

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Q39.

Solution**Concept:**

Energy flow in an ecosystem begins with the capture of solar energy by autotrophs. However, plants can only use a specific range of the solar spectrum.

Solution:

Step 1: Of the total incident solar radiation, less than 50

Step 2: Plants and photosynthetic bacteria capture only 2 to 10 percent of this PAR (not the total radiation).

Step 3: This small amount of energy sustains the entire living world through the process of photosynthesis.

Step 4: The question asks specifically for the percentage of PAR captured by plants. Based on standard ecological data, this value is 2-10

Final Answer:

Answer: (B)

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Q40.

Solution**Concept:**

The Human Genome Project (HGP) was a massive international research effort. The cost was estimated based on the number of base pairs (bp) in the human haploid genome.

Solution:

Step 1: The human haploid genome contains approximately 3×10^9 base pairs.

Step 2: If the cost of sequencing is ₹ 1350 per base pair, the total cost is: $3 \times 10^9 \times 1350 = 4050 \times 10^9$ ₹.

Step 3: To convert to "Crores" (where 1 Crore = 10^7): $4050 \times 10^9 / 10^7 = 4050 \times 10^2 = 4,05,000$ Crores.

Step 4: This reflects the high cost and "megaproject" status of the HGP, which required significant international funding and resources.

Final Answer:

Answer: (B)

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Q41.

Solution**Concept:**

The Light Reaction (Photochemical phase) of photosynthesis involves the transfer of electrons through a series of carriers, often depicted as the 'Z-scheme' due to its characteristic shape on a redox potential scale.

Solution:

Step 1: When Photosystem II (PS II) absorbs light, electrons are excited and ejected from the reaction center (P680).

Step 2: The primary electron acceptor of PS II is Pheophytin (a chlorophyll molecule without magnesium).

Step 3: From Pheophytin, electrons move to Plastoquinone (PQ), then to the Cytochrome b_6f complex, and finally to Plastocyanin (PC) before reaching PS I.

Step 4: Therefore, the immediate transition from the reaction center is to Pheophytin, which then feeds the Cytochrome complex via Plastoquinone.

Final Answer:

Answer: (A)

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Q42.

Solution**Concept:**

The rate of photosynthesis is influenced by several environmental factors. F.F. Blackman (1905) proposed a principle to identify which factor determines the overall rate at any given time.

Solution:

Step 1: Blackman's Law of Limiting Factors states that if a chemical process is affected by more than one factor, then its rate will be determined by the factor which is nearest to its minimal value.

Step 2: This means it is the factor that directly affects the process if its quantity is changed.

Step 3: For example, even if light and temperature are optimal, if CO_2 concentration is very low, the rate of photosynthesis will be limited by CO_2 .

Step 4: Statement B perfectly captures this definition, whereas Statement A is the opposite of the law.

Final Answer:

Answer: (B)

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Q43.

Solution**Concept:**

The male reproductive system consists of primary sex organs (testes) and accessory ducts/glands, each with specialized physiological roles.

Solution:

Step 1: Leydig cells (interstitial cells) produce testicular hormones called androgens (testosterone). This is correct.

Step 2: Sertoli cells provide mechanical support and nutrition to the developing spermatozoa. This is correct.

Step 3: The Epididymis is where sperm undergo maturation and gain motility. However, "Capacitation" (the final functional maturation of sperm) occurs in the female reproductive tract, not the epididymis. Thus, iii is incorrect.

Step 4: Bulbourethral (Cowper's) glands secrete mucus for the lubrication of the penis. This is correct.

Final Answer:

Answer: (C)

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Q44.

Solution**Concept:**

Gene therapy is a collection of methods that allows the correction of a gene defect that has been diagnosed in a child or embryo.

Solution:

Step 1: The first clinical gene therapy was performed in 1990 at the National Institutes of Health.

Step 2: The patient was a four-year-old girl suffering from Severe Combined Immunodeficiency (SCID).

Step 3: This disorder is caused by the deficiency of the enzyme Adenosine Deaminase (ADA), which is crucial for the immune system to function.

Step 4: The treatment involved using a retroviral vector to introduce a functional ADA cDNA into the patient's lymphocytes.

Final Answer:

Answer: (B)

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Q45.

Solution**Concept:**

DNA replication is semi-discontinuous because of the structural constraints of the DNA molecule and the specificity of the DNA polymerase enzyme.

Solution:

Step 1: DNA polymerase is an enzyme that can only catalyze the polymerization of deoxynucleotides in the 5' to 3' direction. This is a fundamental biochemical constraint. Thus, Statement II is correct.

Step 2: At the replication fork, the two template strands have opposite polarity (3' → 5' and 5' → 3').

Step 3: On the template with 3' → 5' polarity, the new strand is synthesized continuously in the 5' → 3' direction. This is called the leading strand. Thus, Statement I is correct.

Step 4: Statement II explains why the leading strand must be 5' → 3' and why the other strand (lagging) must be synthesized in short fragments (Okazaki fragments).

Final Answer:

Answer: (A)

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Q46.

Solution**Concept:**

Human evolution follows a chronological lineage with progressive changes in cranial capacity, dietary habits, and tool usage.

Solution:

Step 1: *Homo habilis* was the first hominid-like human, with a cranial capacity between 650-800cc; they probably did not eat meat.

Step 2: *Homo erectus* appeared about 1.5 million years ago. Fossil evidence indicates a significant increase in brain size to around 900cc.

Step 3: *Homo erectus* was also the first hominid likely to have eaten meat and used more sophisticated stone tools compared to its predecessors.

Step 4: *Neanderthal man* had a much larger brain (1400cc) and lived more recently, while *Australopithecus* had a smaller cranial capacity (around 450-600cc).

Final Answer:

Answer: (B)

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Q47.

Solution**Concept:**

Plants produce primary metabolites (for growth/development) and secondary metabolites, which often have significant medicinal or industrial value for humans.

Solution:

Step 1: Secondary metabolites are classified based on their chemical nature into alkaloids, terpenoids, lectins, etc.

Step 2: Vinblastine (derived from the Vinca plant) is a powerful alkaloid used as an anti-cancer drug.

Step 3: Curcumin (derived from turmeric) is a terpenoid used as a spice and also possesses significant medicinal properties (anti-inflammatory and anti-cancer).

Step 4: Both are categorized under "Drugs" in the context of biological secondary metabolites that are commercially extracted.

Final Answer:

Answer: (B)

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Q48.

Solution**Concept:**

Disorders of the muscular and skeletal systems can be autoimmune, genetic, or related to age and hormonal imbalances.

Solution:

Step 1: Tetany is characterized by rapid spasms (wild contractions) in muscle due to low Ca^{++} in body fluid (i-q).

Step 2: Osteoporosis is an age-related disorder characterized by decreased bone mass and increased chances of fractures, often due to decreased estrogen levels (ii-r).

Step 3: Gout is the inflammation of joints due to the accumulation of uric acid crystals (iii-p).

Step 4: Myasthenia gravis is an autoimmune neuromuscular disorder that affects the neuromuscular junction, leading to fatigue and paralysis of skeletal muscles (iv-s).

Step 5: Matching these results in the sequence i-q, ii-r, iii-p, iv-s.

Final Answer:

Answer: (A)

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Q49.

Solution**Concept:**

While most fruits develop from the ovary after fertilization, some fruits develop without this process, often resulting in seedless varieties.

Solution:

Step 1: Parthenogenesis is the development of an embryo from an unfertilized egg cell (common in some animals like rotifers or honeybees).

Step 2: Apomixis is a form of asexual reproduction that mimics sexual reproduction to produce seeds without fertilization (common in Asteraceae).

Step 3: Parthenocarpy is the process of fruit formation without fertilization. Such fruits are typically seedless. Banana is a natural example of a parthenocarpic fruit.

Step 4: Polyembryony is the presence of more than one embryo in a seed.

Final Answer:

Answer: (C)

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Q50.

Solution**Concept:**

The transport of Carbon Dioxide in the blood occurs in three forms: as a solution in plasma, as carbamino-hemoglobin, and as bicarbonate ions.

Solution:

Step 1: About 70

Step 2: This process requires the conversion of CO_2 and H_2O into carbonic acid (H_2CO_3), which then dissociates.

Step 3: The enzyme Carbonic Anhydrase catalyzes this reversible reaction with incredible speed.

Step 4: While a small amount is present in the plasma, a very high concentration of Carbonic Anhydrase is found within the Erythrocytes (RBCs).

Final Answer:

Answer: (C)

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Q51.

Solution**Concept:**

Population growth models describe how the size of a population changes over time. These models are typically classified into Exponential (J-shaped) and Logistic (S-shaped) based on resource availability.

Solution:

Step 1: Exponential growth occurs when resources (food and space) are unlimited. This results in a J-shaped curve.

Step 2: However, in nature, resources are almost always finite. This leads to competition between individuals, and the population eventually reaches a Carrying Capacity (K).

Step 3: This realistic growth model is called Logistic growth, which results in a Sigmoid or S-shaped curve (Verhulst-Pearl Logistic Growth).

Step 4: Therefore, an S-shaped curve correctly corresponds to a population in limited resources (Option A). Option B and C are reversed, and Option D is incorrect because exponential growth does not include a carrying capacity.

Final Answer:

Answer: (A)

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Q52.

Solution**Concept:**

In plant biotechnology, certain bacteria act as natural genetic engineers by transferring a specific piece of their DNA into the host plant's genome.

Solution:

Step 1: *Agrobacterium tumefaciens* is a soil bacterium that causes Crown Gall disease in dicot plants.

Step 2: It contains a large Ti (Tumor-inducing) plasmid. A specific segment of this plasmid, known as T-DNA (Transferred DNA), is integrated into the plant cell's DNA.

Step 3: Scientists have modified this Ti plasmid to act as a vector, removing the disease-causing genes but keeping the T-DNA's ability to integrate, allowing the delivery of desired genes into plants.

Step 4: *B. thuringiensis* provides the Bt toxin gene, and *Thermus aquaticus* provides Taq polymerase, but neither provides the T-DNA vector system.

Final Answer:

Answer: (B)

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Q53.

Solution**Concept:**

The menstrual cycle is regulated by a complex interplay of pituitary hormones (LH, FSH) and ovarian hormones (Estrogen, Progesterone).

Solution:

Step 1: After ovulation, the remains of the Graafian follicle transform into a yellow endocrine structure called the Corpus Luteum.

Step 2: The primary function of the Luteinizing Hormone (LH) from the anterior pituitary is to induce ovulation and subsequently maintain the functional integrity of the Corpus Luteum.

Step 3: Under the influence of LH, the Corpus Luteum secretes large amounts of Progesterone, which is essential for maintaining the endometrium for pregnancy.

Step 4: If fertilization does not occur, the lack of continued LH support (or hCG in pregnancy) causes the Corpus Luteum to degenerate into the Corpus Albicans.

Final Answer:

Answer: (B)

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Q54.

Solution**Concept:**

Point mutations involve the change in a single base pair of DNA. These are categorized based on the type of nitrogenous base substitution that occurs.

Solution:

Step 1: Nitrogenous bases are divided into Purines (Adenine, Guanine) and Pyrimidines (Cytosine, Thymine/Uracil).

Step 2: A "Transition" mutation occurs when a purine is replaced by another purine ($A \leftrightarrow G$) or a pyrimidine is replaced by another pyrimidine ($C \leftrightarrow T$).

Step 3: A "Transversion" mutation occurs when a purine is replaced by a pyrimidine, or vice versa (e.g., $A \rightarrow C$).

Step 4: Frameshift mutations involve insertions or deletions that change the reading frame of the genetic code.

Step 5: Therefore, replacing a purine with another purine is specifically called a Transition.

Final Answer:

Answer: (B)

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Q55.

Solution**Concept:**

Innate immunity provides a non-specific defense against pathogens and consists of four main types of barriers: Physical, Physiological, Cellular, and Cytokine.

Solution:

Step 1: Interferons are proteins secreted by virus-infected cells to protect non-infected neighboring cells. These are Cytokine barriers (i-q).

Step 2: Mucus coating the respiratory, gastrointestinal, and urogenital tracts traps microbes. This is a Physical barrier (ii-p).

Step 3: Macrophages and certain white blood cells (like PMNLs) phagocytose and destroy microbes. These are Cellular barriers (iii-s).

Step 4: Acid in the stomach (HCl), saliva in the mouth, and tears from the eyes prevent microbial growth. These are Physiological barriers (iv-r).

Step 5: The matching sequence is i-q, ii-p, iii-s, iv-r.

Final Answer:

Answer: (A)

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Q56.

Solution**Concept:**

Gas exchange in the human body is driven by partial pressure gradients. Carbon dioxide (CO_2) is produced by tissues as a metabolic byproduct and must be transported to the lungs for excretion.

Solution:

Step 1: In the tissues, pCO_2 is high (approx. 45 mmHg) due to catabolism, while in the arterial blood, it is lower (40 mmHg).

Step 2: CO_2 diffuses into the blood, making it deoxygenated. The partial pressure of CO_2 in this deoxygenated blood becomes 45 mmHg.

Step 3: When this blood reaches the alveoli (where pCO_2 is 40 mmHg), the gradient allows CO_2 to diffuse out of the blood and into the alveoli to be exhaled.

Step 4: Therefore, the specific value for deoxygenated blood is 45 mmHg. For comparison, pO_2 in deoxygenated blood is 40 mmHg.

Final Answer:

Answer: (B)

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Q57.

Solution

Concept: A transcription unit in DNA is defined primarily by three regions: a Promoter, the Structural gene, and a Terminator. By convention, the features of a transcription unit are defined with respect to the **coding strand** ($5' \rightarrow 3'$), not the template strand ($3' \rightarrow 5'$).

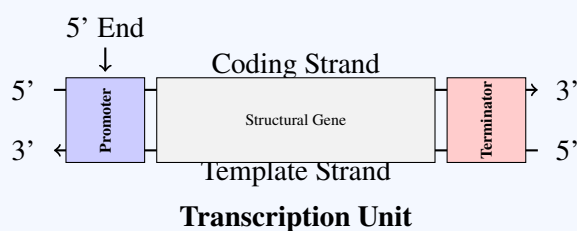
Solution: Step 1: The DNA-dependent RNA polymerase binds to a specific DNA sequence called the Promoter to initiate transcription.

Step 2: The coding strand is the DNA strand that runs in the $5'$ to $3'$ direction. Although it does not code for anything (it is displaced during transcription), it is used as the reference point for defining locations.

Step 3: The Promoter is located towards the $5'$ end (upstream) of the coding strand. It provides the binding site for RNA polymerase.

Step 4: Conversely, the Terminator is located towards the $3'$ end (downstream) of the coding strand and defines the end of the transcription process.

Step 5: Therefore, relative to the coding strand, the promoter is at the $5'$ end.



Promoter is situated upstream ($5'$) of the coding strand.

Final Answer: (B) $5'$

Answer: (B)

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Q58.

Solution**Concept:**

The genetic code consists of 64 codons. 61 codons code for amino acids, while 3 codons do not code for any amino acid and act as stop signals for translation.

Solution:

Step 1: The three stop codons (also called nonsense codons) are UAA (Ochre), UAG (Amber), and UGA (Opal).

Step 2: When the ribosome encounters any of these three codons on the mRNA, the polypeptide chain is released, and translation terminates.

Step 3: AUG has a dual function: it codes for the amino acid Methionine and it also acts as the "Start" or initiation codon for protein synthesis.

Step 4: Since AUG starts the process and codes for an amino acid, it is not a stop codon.

Final Answer:

Answer: (D)

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Q59.

Solution**Concept:**

Mutualism is an interaction where both species benefit. Many plants have evolved complex symbiotic relationships with fungi to enhance nutrient uptake.

Solution:

Step 1: Lichens are a symbiotic association between algae (phycobiont) and fungi (mycobiont).

Step 2: Mycorrhiza is the specific term for the symbiotic association between fungi and the roots of higher plants (like Pinus or orchids).

Step 3: In this relationship, the fungus absorbs phosphorus and water from the soil for the plant, while the plant provides the fungus with energy-yielding carbohydrates.

Step 4: This is a type of mutualism, but the specific biological structure/association is called Mycorrhiza.

Final Answer:

Answer: (B)

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Q60.

Solution**Concept:**

Alexander von Humboldt observed that within a region, species richness increases with increasing explored area, but only up to a limit. This is represented by the equation $\log S = \log C + Z \log A$.

Solution:

Step 1: The value of Z (slope of the line/regression coefficient) describes the relationship. For small areas (like a city or state), Z is usually 0.1 to 0.2 regardless of the taxonomic group.

Step 2: However, if you analyze the species-area relationship among very large areas like entire continents, the slope of the regression line becomes much steeper.

Step 3: For these large-scale areas, the Z value is observed to be in the range of 0.6 to 1.2.

Step 4: For example, for frugivorous (fruit-eating) birds and mammals in tropical forests of different continents, the slope is found to be 1.15.

Final Answer:

Answer: (B)

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Q61.

Solution**Concept:**

Heart-related disorders are often confused. It is vital to distinguish between functional failure, electrical failure (arrest), and tissue death (attack).

Solution:

Step 1: Heart failure is a chronic condition where the heart doesn't pump blood as well as it should. It is also called "congestive heart failure" because lung congestion is one of its main symptoms.

Step 2: Cardiac arrest is a sudden loss of heart function, breathing, and consciousness, usually resulting from an electrical disturbance in the heart.

Step 3: Heart attack (myocardial infarction) occurs when blood flow to a part of the heart muscle is blocked, causing the muscle to die.

Step 4: Statement I says they are the same, which is incorrect. Statement II accurately defines heart failure as the inability to pump effectively to meet body needs.

Final Answer:

Answer: (C)

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Q62.

Solution**Concept:**

The peripheral nervous system consists of cranial nerves (originating from the brain) and spinal nerves (originating from the spinal cord).

Solution:

Step 1: In humans, there are 12 pairs of cranial nerves.

Step 2: There are 31 pairs of spinal nerves, categorized by the region of the vertebral column from which they emerge.

Step 3: These include 8 pairs of cervical, 12 pairs of thoracic, 5 pairs of lumbar, 5 pairs of sacral, and 1 pair of coccygeal nerves.

Step 4: All spinal nerves are "mixed" nerves, meaning they contain both sensory and motor fibers.

Final Answer:

Answer: (B)

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Q63.

Solution

Concept: The retina contains two types of photoreceptor cells: rods and cones. The distribution of these cells is not uniform across the retina. Specific regions are specialized for either maximum sensitivity or maximum resolution (acuity).

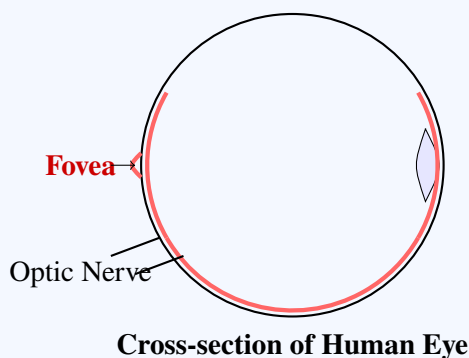
Solution: Step 1: The posterior pole of the eye contains a yellowish pigmented spot called the macula lutea.

Step 2: At the center of the macula lutea is a central pit called the fovea. This is a thinned-out portion of the retina.

Step 3: In the fovea, only the cones are densely packed. Other retinal layers are displaced to allow light to reach the photoreceptors with minimal interference.

Step 4: Because of this high concentration of cones and the direct path of light, the fovea is the point where visual acuity (resolution) is at its greatest.

Step 5: Other options are incorrect: (A) The Blind spot is where the optic nerve leaves the eye and lacks photoreceptors. (C) The Iris is the pigmented muscular structure that controls pupil size. (D) The Choroid is the vascular layer beneath the retina.



Final Answer: (B) Fovea

Answer: (B)

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Q64.

Solution**Concept:**

Watson and Crick's B-DNA model has specific geometric dimensions that are fundamental to understanding molecular biology.

Solution:

Step 1: The double helix has a pitch (one full turn) of 3.4 nm.

Step 2: There are roughly 10 base pairs in each turn.

Step 3: To find the distance between adjacent base pairs, we divide the pitch by the number of base pairs: $3.4 \text{ nm}/10 = 0.34 \text{ nm}$.

Step 4: Note that in Angstroms, the distance is 3.4 \AA , but in nanometers, it is 0.34 nm.

Final Answer: B

Answer: (B)

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Q65.

Solution**Concept:**

Robert Costanza and his colleagues put price tags on nature's life-support services to highlight their economic importance, which is often taken for granted.

Solution:

Step 1: The researchers put an average price tag of US ₹ 33 trillion a year on fundamental ecosystem services.

Step 2: Out of this total cost, the process of soil formation accounts for about 50

Step 3: To find the value of soil formation: 50% of 33 trillion = $0.5 \times 33 = 16.5$ trillion.

Step 4: Other services like recreation and nutrient cycling account for less than 10

Final Answer: A

Answer: (A)

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Q66.

Solution**Concept:**

Chemiosmosis explains the mechanism of ATP synthesis in chloroplasts. It requires a membrane, a proton pump, a proton gradient, and the enzyme ATP synthase.

Solution:

Step 1: During the light reaction, water splitting occurs on the inner side of the thylakoid membrane, releasing protons into the lumen.

Step 2: As electrons move through the photosystems, protons are transported across the membrane. The primary acceptor of electrons transfers its electrons to an H-carrier, which removes a proton from the stroma while transporting the electron.

Step 3: This proton is released into the lumen (inner space) of the thylakoid.

Step 4: This creates a high concentration of protons in the lumen and a low concentration in the stroma. Therefore, the gradient is built by moving protons from the Stroma to the Lumen.

Final Answer:

Answer: (A)

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Q67.

Solution**Concept:**

The human ear is divided into the outer, middle, and inner ear. The inner ear consists of the bony and membranous labyrinths.

Solution:

Step 1: The Eustachian tube connects the middle ear to the pharynx and helps equalize pressure on either side of the eardrum. This is correct.

Step 2: The organ of Corti, containing hair cells that act as auditory receptors, is located on the basilar membrane within the cochlea. This is correct.

Step 3: The bony labyrinth is a series of channels. Inside these channels lies the membranous labyrinth, which is surrounded by a fluid called perilymph and filled with a fluid called endolymph.

Step 4: Statement C is incorrect because the membranous labyrinth itself is filled with endolymph, not perilymph (which surrounds it).

Final Answer:

Answer: (C)

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Q68.

Solution**Concept:**

In eukaryotes, there is a clear division of labor regarding RNA polymerases. There are at least three RNA polymerases in the nucleus.

Solution:

Step 1: RNA Polymerase I transcribes rRNAs (28S, 18S, and 5.8S).

Step 2: RNA Polymerase II transcribes the precursor of mRNA, known as heterogeneous nuclear RNA (hnRNA).

Step 3: RNA Polymerase III is responsible for the transcription of tRNA, 5S rRNA, and snRNAs (small nuclear RNAs).

Step 4: Therefore, the transcription of the mRNA precursor (hnRNA) is specifically carried out by RNA Polymerase II.

Final Answer:

Answer: (C)

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Q69.

Solution**Concept:**

Population density (N) fluctuates based on four basic processes: Natality, Mortality, Immigration, and Emigration.

Solution:

Step 1: Natality (B) refers to the number of births during a given period in the population that are added to the initial density (i-q).

Step 2: Mortality (D) is the number of deaths in the population during a given period (ii-r).

Step 3: Immigration (I) is the number of individuals of the same species that have come into the habitat from elsewhere (iii-s).

Step 4: Emigration (E) is the number of individuals of the population who left the habitat and went elsewhere (iv-p).

Step 5: Matching these results in the sequence i-q, ii-r, iii-s, iv-p.

Final Answer:

Answer: (A)

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Q70.

Solution**Concept:**

The transition from ape-like ancestors to modern humans involved several intermediate hominid species defined by their brain size and tool-making abilities.

Solution:

Step 1: *Ramapithecus* was more man-like but lived much earlier (15 mya). *Australopithecus* lived in East African grasslands and likely hunted with stone weapons but essentially ate fruit.

Step 2: *Homo habilis* is considered the first "human-like" being (hominid).

Step 3: The brain capacities of *Homo habilis* were between 650-800 cc.

Step 4: They probably did not eat meat, whereas the later *Homo erectus* (900 cc) did. Therefore, for the 650-800 cc range, *Homo habilis* is the correct identification.

Final Answer:

Answer: (B)

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Q71.

Solution**Concept:**

The pBR322 plasmid is a popular cloning vector. It contains two antibiotic resistance genes: *amp^R* (ampicillin resistance) and *tet^R* (tetracycline resistance). Insertional inactivation occurs when a foreign gene is inserted into the middle of one of these resistance genes, rendering it non-functional.

Solution:

Step 1: The BamHI restriction site is located within the tetracycline resistance (*tet^R*) gene.

Step 2: If a foreign gene is ligated at the BamHI site, the *tet^R* gene becomes interrupted and loses its ability to produce the protein that confers resistance to tetracycline.

Step 3: The ampicillin resistance (*amp^R*) gene remains intact.

Step 4: Therefore, the recombinant transformants will be able to grow on a medium containing ampicillin (due to the intact *amp^R* gene) but will fail to grow on a medium containing tetracycline (due to the inactivated *tet^R* gene).

Final Answer:

Answer: (A)

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Q72.

Solution**Concept:**

Digestion is regulated by local hormones secreted by the gastrointestinal mucosa. These hormones coordinate the secretion of digestive juices and the motility of the gut.

Solution:

Step 1: Gastrin is a hormone produced by G-cells located in the antrum of the stomach.

Step 2: When food enters the stomach, Gastrin is released into the bloodstream and acts on the gastric glands.

Step 3: It specifically stimulates the parietal cells to secrete hydrochloric acid (HCl) and the chief cells to secrete pepsinogen.

Step 4: Secretin and CCK (Cholecystokinin) are produced by the duodenum to regulate pancreatic and biliary secretions, while Somatostatin generally inhibits GI secretions.

Final Answer:

Answer: (B)

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Q73.

Solution**Concept:**

Chromosomal disorders are caused by the absence, excess, or abnormal arrangement of one or more chromosomes. These often result from non-disjunction during meiosis.

Solution:

Step 1: Klinefelter's Syndrome occurs when a male has an additional X chromosome, resulting in a 47, XXY karyotype (i-q).

Step 2: Turner's Syndrome occurs in females due to the absence of one of the X chromosomes, resulting in a 45, XO karyotype (ii-p).

Step 3: Down's Syndrome is an autosomal disorder caused by the trisomy of chromosome 21 (iii-r).

Step 4: Edward's Syndrome is caused by the trisomy of chromosome 18 (iv-s).

Step 5: Matching these results in the sequence i-q, ii-p, iii-r, iv-s.

Final Answer:

Answer: (A)

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Q74.

Solution**Concept:**

Innate immunity consists of four types of barriers that prevent the entry or spread of foreign agents in the body.

Solution:

Step 1: Physical barriers are structural blocks that prevent microbes from entering the body. The skin is the primary physical barrier.

Step 2: Physiological barriers include secretions like stomach acid, tears, and saliva that inhibit microbial growth through chemical means.

Step 3: Cellular barriers include phagocytic cells like monocytes, neutrophils, and macrophages that ingest pathogens.

Step 4: Cytokine barriers involve proteins like interferons that protect non-infected cells from viral replication.

Step 5: Therefore, among the options, the skin is the only physical barrier listed.

Final Answer:

Answer: (B)

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Q75.

Solution**Concept:**

Translation requires the activation of amino acids and their attachment to specific tRNA molecules before they can be incorporated into a polypeptide chain.

Solution:

Step 1: Amino acids are activated in the presence of ATP and linked to their cognate tRNA.

Step 2: This two-step process is catalyzed by the enzyme aminoacyl-tRNA synthetase.

Step 3: This process is commonly known as the "charging" of tRNA or, more formally, aminoacylation of tRNA.

Step 4: If two such charged tRNAs are brought close together, the formation of a peptide bond between them is energetically favored.

Final Answer:

Answer: (B)

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Q76.

Solution**Concept:**

Productivity in an ecosystem refers to the rate of biomass production. It is categorized into Gross and Net productivity based on whether metabolic losses are accounted for.

Solution:

Step 1: Gross Primary Productivity (GPP) of an ecosystem is the total rate of production of organic matter during photosynthesis by producers.

Step 2: A considerable amount of GPP is utilized by plants in respiration (R).

Step 3: Net Primary Productivity (NPP) is the biomass available for the consumption to heterotrophs (herbivores and decomposers). It is calculated as $GPP - R = NPP$.

Step 4: Secondary productivity is defined as the rate of formation of new organic matter by consumers.

Step 5: Since the question asks for the total rate of production during photosynthesis, it refers to Gross Primary Productivity.

Final Answer:

Answer: (B)

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Q77.

Solution**Concept:**

Enzymes are biocatalysts that accelerate chemical reactions. While the vast majority of enzymes are made of amino acids, there are notable exceptions.

Solution:

Step 1: Statement I claims "All proteins are enzymes." This is incorrect. While most enzymes are proteins, many proteins function as hormones (insulin), structural components (collagen), or antibodies, and are not enzymes.

Step 2: Statement II says "Almost all enzymes are proteins, but some are nucleic acids." This is correct.

Step 3: Specifically, certain RNA molecules function as catalysts; these are called Ribozymes (e.g., the 23S rRNA in bacteria which acts as a peptidyl transferase).

Step 4: Therefore, Statement I is false and Statement II is true.

Final Answer:

Answer: (B)

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Q78.

Solution**Concept:**

Oogenesis is the process of formation of a mature female gamete. It is a highly regulated process that pauses at specific stages of meiosis.

Solution:

Step 1: The primary oocyte completes the first meiotic division just before ovulation, forming a secondary oocyte and a first polar body.

Step 2: The secondary oocyte begins the second meiotic division but is arrested at the metaphase II stage.

Step 3: This division is only completed when a sperm makes contact with and enters the egg during fertilization.

Step 4: The entry of the sperm induces the completion of the meiotic division of the secondary oocyte, resulting in the formation of a second polar body and a haploid ovum (ootid).

Final Answer:

Answer: (C)

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Q79.

Solution**Concept:**

Analysis of urine (urinalysis) helps in clinical diagnosis of many metabolic disorders as well as malfunctioning of the kidney.

Solution:

Step 1: In a healthy individual, glucose is entirely reabsorbed in the proximal convoluted tubule and is not present in urine.

Step 2: Diabetes Mellitus is characterized by high blood sugar (hyperglycemia). When blood glucose exceeds the renal threshold, it is excreted in the urine (Glycosuria).

Step 3: Additionally, because the body cannot use glucose effectively, it breaks down fats for energy, leading to the production and excretion of ketone bodies (Ketonuria).

Step 4: Therefore, the presence of both Glucose and Ketone bodies in urine is a classic indicator of Diabetes Mellitus.

Final Answer:

Answer: (B)

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Q80.

Solution**Concept:**

Biocontrol refers to the use of biological methods for controlling plant diseases and pests. This approach reduces reliance on toxic chemical pesticides.

Solution:

Step 1: The Ladybird beetle is a well-known predator used to get rid of Aphids (i-p).

Step 2: Dragonflies are effective in controlling the population of Mosquitoes (ii-q).

Step 3: *Bacillus thuringiensis* (Bt) is a bacterium whose spores are used to control butterfly caterpillars (iii-r).

Step 4: *Trichoderma* species are free-living fungi that are common in the root ecosystems and act as effective biocontrol agents against several plant pathogens (iv-s).

Step 5: The matching sequence is i-p, ii-q, iii-r, iv-s.

Final Answer:

Answer: (A)

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Q81.

Solution**Concept:**

Respiratory volumes are specific quantities of air moved into or out of the lungs during different phases of breathing. These are measured using a spirometer.

Solution:

Step 1: Tidal Volume (TV) is the volume of air inspired or expired during a normal, relaxed breath without any extra effort.

Step 2: In a healthy adult, the Tidal Volume is approximately 500 mL per breath.

Step 3: Multiplying this by the average breathing rate (12–16 breaths per minute), a healthy human breathes in or out approximately 6000 to 8000 mL of air per minute.

Step 4: Residual Volume is the air remaining after forced expiration, and Vital Capacity is the total movable air. Thus, normal breathing refers only to Tidal Volume.

Final Answer:

Answer: (C)

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Q82.

Solution**Concept:**

The digestive system's endocrine regulation involves several hormones produced by the gastrointestinal mucosa to ensure secretions occur only when food is present.

Solution:

Step 1: Secretin was the first hormone discovered in humans. It is produced by the duodenal mucosa in response to the entry of acidic chyme from the stomach.

Step 2: Secretin acts on the exocrine part of the pancreas to stimulate the secretion of water and bicarbonate ions.

Step 3: This bicarbonate is essential because it neutralizes the stomach acid, providing an alkaline pH suitable for the action of pancreatic enzymes.

Step 4: Cholecystokinin (CCK) stimulates the secretion of pancreatic enzymes and bile, while Gastrin stimulates gastric acid.

Final Answer:

Answer: (B)

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Q83.

Solution**Concept:**

Mendel's Laws of Inheritance form the foundation of classical genetics. These laws describe how discrete units (factors/genes) are passed from parents to offspring.

Solution:

Step 1: The Law of Dominance states that in a pair of dissimilar factors, one (dominant) masks the expression of the other (recessive).

Step 2: The Law of Segregation states that during gamete formation, the two factors of a pair separate so that each gamete receives only one. This is also called the law of purity of gametes.

Step 3: The Law of Independent Assortment states that the segregation of one pair of traits is independent of the segregation of another pair.

Step 4: Statement C is incorrect because the Law of Independent Assortment is observed specifically in dihybrid (or polyhybrid) crosses, where two or more pairs of traits are considered simultaneously, not in monohybrid crosses.

Final Answer:

Answer: (C)

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Q84.

Solution**Concept:**

Vital organs in the human body are protected by specialized double-layered membranes that reduce friction and provide structural cushioning.

Solution:

Step 1: The heart is enclosed in a double-walled membranous sac called the Pericardium.

Step 2: The lungs are covered by a double-layered membrane called the Pleura.

Step 3: The outer pleura is in close contact with the thoracic lining, while the inner pleura is in contact with the lung surface.

Step 4: The pleural fluid present between these layers reduces friction on the lung surface during breathing movements.

Final Answer:

Answer: (C)

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Q85.

Solution**Concept:**

The ABO blood grouping system is based on the presence or absence of two surface antigens (A and B) on the Red Blood Cells (RBCs) and their corresponding antibodies in the plasma.

Solution:

Step 1: A person with blood group AB has both Antigen A and Antigen B present on the surface of their RBCs.

Step 2: Because they have both antigens, their immune system does not produce antibodies against either A or B (as that would cause their own blood to clump).

Step 3: Therefore, the plasma of an AB individual lacks anti-A and anti-B antibodies.

Step 4: Since there are no antibodies to attack incoming RBCs, they can safely receive blood from any group (A, B, AB, or O), making them "universal recipients."

Final Answer:

Answer: (B)

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Q86.

Solution**Concept:**

Modern biotechnology utilizes various biological resources and specialized techniques to solve agricultural, medical, and environmental problems.

Solution:

Step 1: Basmati rice is distinct for its unique aroma and flavor. There are 27 documented varieties of Basmati grown in India, which is a significant point in biodiversity and patenting discussions (i-p).

Step 2: Bt Cotton is a genetically modified crop containing a cry gene from the bacterium *Bacillus thuringiensis*, providing resistance to bollworms (ii-q).

Step 3: Rosie was the first transgenic cow, produced in 1997. Her milk was enriched with human alpha-lactalbumin (2.4 grams per liter), making it more nutritionally balanced for human babies (iii-r).

Step 4: RNA interference (RNAi) is a method of cellular defense in all eukaryotic organisms that involves silencing of a specific mRNA due to a complementary dsRNA molecule (iv-s).

Step 5: The matching sequence is i-p, ii-q, iii-r, iv-s.

Final Answer:

Answer: (A)

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Q87.

Solution**Concept:**

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

Solution:

Step 1: The blood is filtered through the glomerular capillaries into the Bowman's capsule.

Step 2: In a healthy adult, the GFR is approximately 125 mL/minute.

Step 3: This leads to the production of about 180 liters of filtrate per day.

Step 4: However, nearly 99 percent of this filtrate is reabsorbed by the renal tubules, resulting in the excretion of only about 1.5 liters of urine per day.

Final Answer:

Answer: (A)

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Q88.

Solution**Concept:**

The genetic code has specific start and stop signals to ensure that the translation process begins and ends at the correct locations on the mRNA strand.

Solution:

Step 1: AUG is the most common start codon (initiation codon) in both prokaryotes and eukaryotes.

Step 2: AUG has a dual function: it signals the start of translation and it also codes for the amino acid Methionine (Met).

Step 3: UAA and UAG are stop codons (nonsense codons) that do not code for any amino acid.

Step 4: GUG can sometimes act as a start codon in specific prokaryotic contexts, but its primary code is for Valine. AUG remains the standard universal start codon.

Final Answer:

Answer: (B)

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Q89.

Solution**Concept:**

Muscle contraction involves the interaction between two types of myofilaments within a sarcomere: thin filaments and thick filaments.

Solution:

Step 1: Thin filaments are primarily composed of the globular protein Actin, along with regulatory proteins like Tropomyosin and Troponin.

Step 2: Thick filaments are primarily composed of the polymerized protein Myosin.

Step 3: Each myosin molecule has a tail and a globular head. The head acts as an ATPase enzyme and binds to actin during the cross-bridge cycle.

Step 4: Therefore, the thick filament's primary component is Myosin.

Final Answer:

Answer: (B)

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Q90.

Solution**Concept:**

Microbes are used commercially to produce enzymes that have significant medical and industrial applications.

Solution:

Step 1: Lipases are used in detergent formulations to remove oily stains. Pectinases and Proteases are used to clarify bottled juices.

Step 2: Streptokinase is an enzyme produced by the bacterium *Streptococcus*.

Step 3: It is modified by genetic engineering and used as a "clot buster" for removing clots from the blood vessels of patients who have undergone myocardial infarction (heart attack).

Step 4: This life-saving medical intervention helps restore blood flow to the heart muscle.

Final Answer:

Answer: (C)

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Q91.

Solution

Concept: Population interactions are the effects that organisms in a community have on one another. These interactions can be beneficial, detrimental, or neutral, and are typically represented by mathematical signs: plus (+) for benefit, minus (-) for harm, and zero (0) for neutral effects.

Solution: Step 1: Competition occurs when two or more organisms or species utilize the same limited resource (interspecific or intraspecific). Even if resources are not limiting, the presence of one species can interfere with the feeding efficiency or survival of the other.

Step 2: In a competitive interaction, both parties suffer a cost. For example, even the "winner" of a conflict for territory spends metabolic energy and risks physical injury, while the "loser" loses access to the resource.

Step 3: Therefore, the interaction is characterized as (-, -) because both species are negatively impacted by the interaction compared to how they would thrive in isolation.

Step 4: Looking at the other options provided:

- (A) (+, -): Predation, Parasitism, or Herbivory (One benefits, one is harmed).
- (C) (+, 0): Commensalism (One benefits, the other is unaffected).
- (D) (+, +): Mutualism (Both species benefit from the interaction).

Interaction	Species A	Species B
Mutualism	+	+
Competition	-	-
Predation	+	-
Commensalism	+	0
Amensalism	-	0

Final Answer: (B) (-, -)

Answer: (B)

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Q92.

Solution**Concept:**

Molecular biology techniques allow for the manipulation and identification of genetic material. Amplification is necessary when the available DNA sample is too small for analysis.

Solution:

Step 1: The Polymerase Chain Reaction (PCR) is an *in vitro* technique that can generate billions of copies of a specific DNA sequence in a few hours.

Step 2: It involves repeated cycles of high-temperature denaturation, primer annealing, and enzyme-mediated extension using Taq polymerase.

Step 3: ELISA is used for detecting proteins/antigens, Western Blotting is for specific protein identification, and Downstream processing refers to the purification of products after fermentation.

Step 4: Thus, PCR is the correct technique for DNA amplification.

Final Answer:

Answer: (C)

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Q93.

Solution**Concept:**

The wall of the human eyeball is composed of three distinct layers: the external fibrous layer, the middle vascular layer, and the inner neural layer.

Solution:

Step 1: The external layer is the Sclera (and anteriorly the Cornea).

Step 2: The middle layer is the Choroid. It contains a dense network of blood vessels (vascular) and is pigmented, which gives it a characteristic bluish appearance.

Step 3: The choroid layer is thin over the posterior two-thirds of the eyeball but becomes thick in the anterior part to form the ciliary body.

Step 4: The innermost layer is the Retina, which contains the photoreceptors.

Final Answer:

Answer: (B)

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Q94.

Solution**Concept:**

The "Central Dogma" of molecular biology describes the flow of genetic information: DNA → RNA → Protein.

Solution:

Step 1: Replication is the synthesis of DNA from a DNA template.

Step 2: Transcription is the synthesis of RNA (specifically mRNA) from a DNA template.

Step 3: Translation is the process where the sequence of nucleotides in mRNA is "translated" into a sequence of amino acids to form a protein (polypeptide).

Step 4: This process occurs in the ribosomes and requires tRNA to bring the correct amino acids.

Final Answer:

Answer: (C)

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Q95.

Solution**Concept:**

Animals have evolved different respiratory mechanisms depending on their habitats and levels of organization.

Solution:

Step 1: Fishes and aquatic arthropods use specialized vascularized structures called Gills (i-q).

Step 2: Terrestrial insects have a network of tubes called Tracheal tubes to transport atmospheric air directly to the cells (ii-p).

Step 3: Terrestrial vertebrates like mammals, birds, and reptiles use vascularized sacs called Lungs (iii-r).

Step 4: Earthworms use their moist skin (cuticle) for gas exchange through simple diffusion (iv-s).

Step 5: The matching sequence is i-q, ii-p, iii-r, iv-s.

Final Answer:

Answer: (A)

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Q96.

Solution**Concept:**

The human cerebrum is divided into two halves, the left and right cerebral hemispheres. Communication between these halves is essential for integrated brain function.

Solution:

Step 1: The two cerebral hemispheres are physically separated by a deep longitudinal cleft but are functionally connected.

Step 2: The connection is made by a thick, curved tract of nerve fibers (white matter) called the Corpus Callosum.

Step 3: This structure allow the two sides of the brain to share information and coordinate complex sensory and motor activities.

Step 4: The pons connects different regions of the brain, but the corpus callosum specifically links the hemispheres.

Final Answer:

Answer: (B)

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Q97.

Solution**Concept:**

Each chromosome has a constriction point called the centromere, which divides the chromosome into two sections or "arms."

Solution:

Step 1: By convention, the shorter arm of a chromosome is designated as the "p" arm (from the French word *petit*, meaning small).

Step 2: The longer arm is designated as the "q" arm (simply because 'q' follows 'p' in the alphabet).

Step 3: In a metacentric chromosome, the arms are roughly equal, but in sub-metacentric and acrocentric chromosomes, the p and q distinction is very clear.

Final Answer:

Answer: (B)

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Q98.

Solution**Concept:**

Biodiversity conservation is divided into *In-situ* (on-site) and *Ex-situ* (off-site) strategies.

Solution:

Step 1: *In-situ* conservation involves protecting the species within their natural habitat. Examples include National Parks, Wildlife Sanctuaries, and Biosphere Reserves.

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

Step 3: Botanical Gardens, Zoological Parks, and Seed/Pollen banks are examples of *Ex-situ* conservation.

Step 4: Therefore, Botanical Gardens are not an *In-situ* strategy.

Final Answer: C

Answer: (C)

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Q99.

Solution**Concept:**

The thyroid gland secretes hormones that play a vital role in regulating the body's metabolism. Iodine is an essential raw material for the synthesis of these hormones.

Solution:

Step 1: The thyroid gland produces Thyroxine (T_4) and Triiodothyronine (T_3).

Step 2: These hormones regulate the Basal Metabolic Rate (BMR), support the process of Red Blood Cell formation, and control the metabolism of carbohydrates, proteins, and fats.

Step 3: Calcitonin is also produced by the thyroid but regulates blood calcium levels, not BMR.

Step 4: Deficiency of Iodine in the diet leads to hypothyroidism and enlargement of the thyroid gland (goitre).

Final Answer: B

Answer: (B)

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Q100.

Solution

Concept: In Mendelian genetics, a trihybrid cross involves three pairs of contrasting traits. The number of unique gametes produced by a parent is determined by the formula 2^n , where 'n' represents the number of heterozygous allele pairs. The total number of zygotic combinations (offspring genotypes) in a Punnett square is the product of the number of gametes from both parents.

Solution: Step 1: Identify the genotype of the parents. In a trihybrid cross, the parents are $AaBbCc$.

Step 2: Calculate the number of types of gametes for one parent. Since there are 3 heterozygous pairs (A/a, B/b, and C/c), $n = 3$.

Step 3: Using the formula 2^n :

$$\text{Number of gametes} = 2^3 = 2 \times 2 \times 2 = 8$$

The 8 possible gametes are: $ABC, ABc, AbC, Abc, aBC, aBc, abC, \text{ and } abc$.

Step 4: Determine the total genetic combinations in the offspring. Since both parents are trihybrids, both produce 8 types of gametes.

Step 5: Total combinations = (Gametes from parent 1) \times (Gametes from parent 2)

$$\text{Total combinations} = 8 \times 8 = 64$$

Step 6: Therefore, a 64-square Punnett square is required to represent all possible zygotic combinations.

Parent 1 ($AaBbCc$) Parent 2 ($AaBbCc$)

8 Gametes \times 8 Gametes

64 Combinations

(Total squares in Punnett square)

Trihybrid Calculation

$$2^n \times 2^n = 2^3 \times 2^3 = 8 \times 8 = 64$$

Final Answer: (C) 64

Answer: (C)

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Answer Key

Q	Ans	Q	Ans	Q	Ans	Q	Ans	Q	Ans
1	B	2	C	3	A	4	B	5	C
6	A	7	C	8	A	9	A	10	C
11	C	12	C	13	C	14	B	15	A
16	A	17	C	18	A	19	B	20	A
21	A	22	B	23	C	24	B	25	A
26	A	27	C	28	C	29	A	30	B
31	C	32	C	33	B	34	C	35	B
36	A	37	B	38	D	39	B	40	B
41	A	42	B	43	C	44	B	45	A
46	B	47	B	48	A	49	C	50	C
51	A	52	B	53	B	54	B	55	A
56	B	57	B	58	D	59	B	60	B
61	C	62	B	63	B	64	B	65	A
66	A	67	C	68	C	69	A	70	B
71	A	72	B	73	A	74	B	75	B
76	B	77	B	78	C	79	B	80	A
81	C	82	B	83	C	84	C	85	B
86	A	87	A	88	B	89	B	90	C
91	B	92	C	93	B	94	C	95	A
96	B	97	B	98	C	99	B	100	C

