

# NEET-UG Biology Sample Paper-8

Duration: 1 Hour

Maximum Marks: 360

## Instructions

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

**Q1.** Which of the following is/are the connotation of theory of special creation?

- (A) All living organisms were created as such.
- (B) The diversity will be same in future.
- (C) Earth is about 4000 years old.
- (D) All of these

**Q2.** A problem associated with nuclear power plants is:

- (A) Emission of hazardous radionuclides
- (B) Disposal of radioactive waste
- (C) Thermal pollution
- (D) All of the above

**Q3.** Three levels of biodiversity are

- (A) Genetic diversity, species diversity and ecological diversity
- (B) Species diversity, ecological diversity and habitat diversity
- (C) Geography diversity, genetic diversity and habitat diversity
- (D) Ecological diversity, species diversity and community diversity

**Q4.** The biggest constraint of plant breeding is:



- (A) Availability of desirable gene in the crop and its wild relatives
- (B) Infrastructure
- (C) Trained manpower
- (D) Transfer of genes from unrelated sources

**Q5.** Which one of the following is a characteristic feature of cropland ecosystem?

- (A) Absence of soil organisms
- (B) Least genetic diversity
- (C) Absence of weeds
- (D) Ecological succession

**Q6.** The reason for infertility could be:

- (A) Physical or psychological.
- (B) Congenital or immunological.
- (C) Drugs or diseases.
- (D) All of the above.

**Q7.** Plants can be made disease resistant through

- (A) Colchicine
- (B) X-ray treatment
- (C) Breeding with wild relatives
- (D) Hormone treatment

**Q8.** The species which are very few in number in the world are known as

- (A) Living fossils
- (B) Endangered
- (C) Threatened
- (D) Rare



**Q9.** In which of the following industrial areas is biotechnology applicable?

- (A) Health care
- (B) Environment
- (C) Agriculture
- (D) All of the above

**Q10.** The modes of reproduction found in algae are

- (A) Vegetative
- (B) Asexual
- (C) Sexual
- (D) All of these

**Q11.** Which of the following represents the correct sequence of the cell cycle?

- (A)  $G_1 \rightarrow G_2 \rightarrow S \rightarrow M$
- (B)  $G_1 \rightarrow S \rightarrow G_2 \rightarrow M$
- (C)  $S \rightarrow G_1 \rightarrow G_2 \rightarrow M$
- (D)  $M \rightarrow G_1 \rightarrow G_2 \rightarrow S$

**Q12.** The term 'Linkage' was coined by:

- (A) T.H. Morgan
- (B) Gregor Mendel
- (C) G.H. Hardy
- (D) Hugo de Vries

**Q13.** The primary  $\text{CO}_2$  acceptor in  $C_4$  plants is:

- (A) RuBP (Ribulose-1,5-bisphosphate)
- (B) PEP (Phosphoenolpyruvate)
- (C) PGA (Phosphoglyceric acid)



(D) OAA (Oxaloacetic acid)

**Q14.** The 'Restriction' in Restriction Enzymes refers to:

- (A) Cleaving of phosphodiester bonds only at the ends of DNA.
- (B) Limiting the growth of bacteriophages in the host bacteria.
- (C) Preventing the transcription of DNA into RNA.
- (D) Restricting the enzyme action to only single-stranded DNA.

**Q15.** The process of conversion of ammonia to nitrites and then to nitrates is called:

- (A) Nitrogen fixation
- (B) Denitrification
- (C) Nitrification
- (D) Ammonification

**Q16.** Which of the following is correct regarding the partial pressure of Oxygen ( $pO_2$ ) and Carbon dioxide ( $pCO_2$ ) in systemic arteries?

- (A)  $pO_2 = 40$  mm Hg;  $pCO_2 = 45$  mm Hg
- (B)  $pO_2 = 95$  mm Hg;  $pCO_2 = 40$  mm Hg
- (C)  $pO_2 = 104$  mm Hg;  $pCO_2 = 40$  mm Hg
- (D)  $pO_2 = 45$  mm Hg;  $pCO_2 = 40$  mm Hg

**Q17.** In a dihybrid cross ( $AaBb \times AaBb$ ), what is the probability of obtaining an offspring with the genotype  $aabb$ ?

- (A)  $1/4$
- (B)  $1/8$
- (C)  $1/16$
- (D)  $9/16$

**Q18.** The 'Evil Quartet' refers to the four major causes of:



- (A) Population explosion
- (B) Biodiversity losses
- (C) Atmospheric pollution
- (D) Global warming

**Q19.** Which part of the human brain is primarily responsible for the regulation of body temperature and the urge to eat?

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

**Q20.** The process of 'Polymerase Chain Reaction' (PCR) requires which of the following specifically?

- (A) DNA Ligase and RNA Primer
- (B) Thermostable DNA polymerase and Chemically synthesized oligonucleotides
- (C) Restriction endonucleases and Palindromic sequences
- (D) Ribonucleoside triphosphates and Reverse transcriptase

**Q21.** The process of guttation takes place when:

- (A) Root pressure is high and the rate of transpiration is low.
- (B) Root pressure is low and the rate of transpiration is high.
- (C) Both root pressure and transpiration are high.
- (D) Both root pressure and transpiration are low.

**Q22.** Which of the following hormones is NOT secreted by the human placenta?

- (A) hCG (Human Chorionic Gonadotropin)
- (B) hPL (Human Placental Lactogen)



- (C) Estrogens
- (D) LH (Luteinizing Hormone)

**Q23.** During DNA replication, the term 'Leading Strand' refers to the strand that is synthesized:

- (A) In small fragments called Okazaki fragments.
- (B) Continuously in the 5' → 3' direction towards the replication fork.
- (C) Continuously in the 3' → 5' direction away from the replication fork.
- (D) Discontinuously in the 5' → 3' direction.

**Q24.** In a musculoskeletal system, the 'All-or-None' principle states that:

- (A) All muscles in a group contract together.
- (B) A muscle fiber contracts completely or not at all in response to a threshold stimulus.
- (C) The entire muscle organ contracts to its maximum strength every time.
- (D) All motor units are activated simultaneously.

**Q25.** The relationship between 'Cattle Egret' and 'Grazing Cattle' is an example of:

- (A) Mutualism
- (B) Commensalism
- (C) Parasitism
- (D) Amensalism

**Q26.** Which of the following is the most significant trend in the evolution of modern man (*Homo sapiens*) from their ancestors?

- (A) Shortening of jaws
- (B) Binocular vision
- (C) Increasing cranial capacity
- (D) Upright posture



- Q27.** The 'Double Fertilization' is a unique characteristic feature of:
- (A) Bryophytes
  - (B) Pteridophytes
  - (C) Gymnosperms
  - (D) Angiosperms
- Q28.** According to the 'Competitive Exclusion Principle', two closely related species competing for the same resources cannot co-exist indefinitely. This principle was proposed by:
- (A) G.F. Gause
  - (B) Robert May
  - (C) Connell
  - (D) Alexander von Humboldt
- Q29.** The 'Linker DNA' in a nucleosome is associated with which histone protein?
- (A) H2A
  - (B) H2B
  - (C) H3
  - (D) H1
- Q30.** In an ecosystem, the rate of production of organic matter during photosynthesis is termed as:
- (A) Net Primary Productivity (NPP)
  - (B) Gross Primary Productivity (GPP)
  - (C) Secondary Productivity
  - (D) Net Community Productivity
- Q31.** Which of the following is the correct order of the layers of the adrenal cortex from the outside to the inside?



- (A) Zona fasciculata → Zona reticularis → Zona glomerulosa
- (B) Zona glomerulosa → Zona fasciculata → Zona reticularis
- (C) Zona reticularis → Zona fasciculata → Zona glomerulosa
- (D) Zona glomerulosa → Zona reticularis → Zona fasciculata

**Q32.** The volume of air that remains in the lungs even after a forcible expiration is called:

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

**Q33.** In human females, the first polar body is formed during which of the following stages?

- (A) After the completion of Meiosis II
- (B) During the transition of primary oocyte to secondary oocyte
- (C) During the entry of sperm into the ovum
- (D) At the time of birth

**Q34.** Which of the following organisms is used as a 'Bio-control agent' against butterfly caterpillars?

- (A) *Trichoderma*
- (B) *Baculoviruses*
- (C) *Bacillus thuringiensis*
- (D) *Ladybird*

**Q35.** Identify the correctly matched pair:

- (A) Parthenocarpy — Formation of fruit without fertilization
- (B) Apomixis — Formation of seeds with fertilization



- (C) Polyembryony — Formation of single embryo in a seed
- (D) Somatic hybridization — Fusion of two similar gametes

**Q36.** The 'Montreal Protocol' was signed in 1987 for the control of:

- (A) Greenhouse gases
- (B) Ozone depleting substances
- (C) Plastic waste
- (D) Bio-medical waste

**Q37.** The semi-conservative nature of DNA replication was first shown in *Escherichia coli* by:

- (A) Taylor et al.
- (B) Meselson and Stahl
- (C) Hershey and Chase
- (D) Watson and Crick

**Q38.** Which of the following is a 'Stop Codon' during the process of translation?

- (A) AUG
- (B) UGG
- (C) UAA
- (D) GUG

**Q39.** The phenomenon where a single gene can exhibit multiple phenotypic expressions is known as:

- (A) Epistasis
- (B) Pleiotropy
- (C) Polygenic inheritance
- (D) Co-dominance



- Q40.** The process of 'Leaching' in decomposition refers to:
- (A) Breakdown of detritus into smaller particles.
  - (B) Water-soluble inorganic nutrients going down into the soil horizon.
  - (C) Fungal and bacterial enzymes degrading detritus.
  - (D) Accumulation of a dark colored amorphous substance.
- Q41.** Which hormone is responsible for the 'Milk Ejection Reflex'?
- (A) Prolactin
  - (B) Oxytocin
  - (C) Estrogen
  - (D) Progesterone
- Q42.** The functional unit of the human kidney is:
- (A) Nephridia
  - (B) Neuron
  - (C) Nephron
  - (D) Henle's loop
- Q43.** Match the following: (1)  $C_3$  cycle (2)  $C_4$  cycle (3) Glycolysis (4) Krebs cycle  
(P) Cytoplasm (Q) Bundle sheath (R) Mesophyll (S) Mitochondrial matrix
- (A) 1-R, 2-Q, 3-P, 4-S
  - (B) 1-Q, 2-R, 3-P, 4-S
  - (C) 1-P, 2-Q, 3-R, 4-S
  - (D) 1-S, 2-P, 3-Q, 4-R
- Q44.** The presence of 'Pneumatophores' is a characteristic of:
- (A) Xerophytes
  - (B) Hydrophytes



- (C) Halophytes
- (D) Mesophytes

**Q45.** What is the ploidy level of the Endosperm in a typical Angiosperm?

- (A)  $n$
- (B)  $2n$
- (C)  $3n$
- (D)  $4n$

**Q46.** The 'Fluid Mosaic Model' of the plasma membrane, proposed by Singer and Nicolson, states that:

- (A) Proteins form a continuous layer on the inner and outer surface of lipids.
- (B) The membrane is a rigid structure made of carbohydrates.
- (C) The quasi-fluid nature of lipids enables lateral movement of proteins within the bilayer.
- (D) Lipids are sandwiched between two layers of proteins.

**Q47.** The process of 'Splicing' in eukaryotic transcription involves:

- (A) Removal of exons and joining of introns.
- (B) Removal of introns and joining of exons in a defined order.
- (C) Adding a methyl guanosine triphosphate cap to the 5' end.
- (D) Adding a poly-A tail to the 3' end.

**Q48.** Which of the following plant hormones is known as the 'Stress Hormone'?

- (A) Auxin
- (B) Gibberellin
- (C) Abscisic acid (ABA)
- (D) Cytokinin



- Q49.** The site of perception of light/dark duration in plants for flowering is the:
- (A) Shoot apex
  - (B) Stem
  - (C) Leaves
  - (D) Roots
- Q50.** In the 'Lac Operon', the 'Repressor' protein binds to which region to prevent transcription?
- (A) Promoter (*P*)
  - (B) Structural genes (*z, y, a*)
  - (C) Operator (*O*)
  - (D) Inducer
- Q51.** The 'Antibody' molecule is represented as  $H_2L_2$  because:
- (A) It has two heavy chains and two light chains.
  - (B) It has four heavy chains.
  - (C) It has two hydrogen and two lipid bonds.
  - (D) It consists of two helical and two linear proteins.
- Q52.** In 'Natural Selection', the process where more individuals acquire mean character value is called:
- (A) Directional selection
  - (B) Disruptive selection
  - (C) Stabilizing selection
  - (D) Adaptive radiation
- Q53.** Which of the following is an example of an 'Auto-immune disease'?
- (A) AIDS



- (B) Rheumatoid arthritis
- (C) Cancer
- (D) Malaria

**Q54.** Water potential ( $\Psi_w$ ) of pure water at standard temperature and pressure is:

- (A) 10
- (B) 100
- (C) Zero
- (D) Less than zero

**Q55.** The 'T-wave' in a standard ECG represents:

- (A) Depolarisation of auricles
- (B) Depolarisation of ventricles
- (C) Repolarisation of ventricles
- (D) Repolarisation of auricles

**Q56.** The 'Rivet Popper Hypothesis' used to explain the importance of biodiversity was proposed by:

- (A) Paul Ehrlich
- (B) Edward Wilson
- (C) David Tilman
- (D) Robert May

**Q57.** Which of the following is the correct pathway for the passage of urine in humans?

- (A) Kidney → Urethra → Urinary bladder → Ureter
- (B) Kidney → Ureter → Urinary bladder → Urethra
- (C) Kidney → Urinary bladder → Ureter → Urethra
- (D) Urinary bladder → Kidney → Ureter → Urethra



- Q58.** The part of the eye that is responsible for the maximum refraction of light is:
- (A) Lens
  - (B) Iris
  - (C) Cornea
  - (D) Retina
- Q59.** Which of the following is NOT a characteristic of 'Facilitated Transport'?
- (A) Requirement of special membrane proteins.
  - (B) Highly selective nature.
  - (C) Transport saturation.
  - (D) Uphill transport (against concentration gradient).
- Q60.** The secondary messenger involved in the mechanism of action of water-soluble hormones is:
- (A) cAMP
  - (B) ATP
  - (C) DNA
  - (D) mRNA
- Q61.** The 'Stirred-tank bioreactors' have been designed for:
- (A) Addition of preservatives to the product.
  - (B) Purification of the product.
  - (C) Availability of oxygen throughout the process.
  - (D) Ensuring anaerobic conditions in the culture vessel.
- Q62.** Which of the following is the 'Correct' matching of a microbe and its industrial product?
- (A) *Aspergillus niger* — Citric acid



- (B) *Acetobacter aceti* — Lactic acid
- (C) *Clostridium butylicum* — Acetic acid
- (D) *Lactobacillus* — Butyric acid

**Q63.** The 'Node of Ranvier' is found in:

- (A) Muscle fibers
- (B) Myelinated nerve fibers
- (C) Non-myelinated nerve fibers
- (D) Dendrites of a neuron

**Q64.** The 'Vital Capacity' (VC) of lungs can be represented as:

- (A)  $TV + ERV$
- (B)  $TV + IRV + ERV$
- (C)  $TV + IRV + RV$
- (D)  $IRV + ERV$

**Q65.** Which part of the 'Henle's Loop' is impermeable to water but allows transport of electrolytes?

- (A) Descending limb
- (B) Ascending limb
- (C) Proximal convoluted tubule
- (D) Distal convoluted tubule

**Q66.** Which of the following phyla is characterized by the presence of a 'Water Vascular System'?

- (A) Porifera
- (B) Ctenophora
- (C) Echinodermata
- (D) Mollusca



- Q67.** The 'Turner's Syndrome' in humans is caused by which chromosomal aberration?
- (A) Trisomy of chromosome 21
  - (B) Monosomy of X-chromosome (45, XO)
  - (C) Additional X-chromosome in males (47, XXY)
  - (D) Deletion of a part of chromosome 5
- Q68.** The 'Sertoli cells' found in the seminiferous tubules provide:
- (A) Testosterone for spermatogenesis
  - (B) Nutrition to the germ cells
  - (C) Enzymes for acrosome reaction
  - (D) Motility to the sperms
- Q69.** Which of the following is an example of 'Analogous organs'?
- (A) Forelimbs of a whale and a bat
  - (B) Flippers of a penguin and a dolphin
  - (C) Hearts of a man and a cheetah
  - (D) Thorns of Bougainvillea and tendrils of Cucurbita
- Q70.** The hormone 'Progesterone' is primarily secreted by the:
- (A) Graafian follicle
  - (B) Corpus luteum
  - (C) Pituitary gland
  - (D) Endometrium
- Q71.** The 'Pyramid of Energy' in an ecosystem is:
- (A) Always upright
  - (B) Always inverted



- (C) Either upright or inverted
- (D) Spindle shaped

**Q72.** Which of the following is the 'Respiratory Quotient' (RQ) of tripalmitin (a fat)?

- (A) 1.0
- (B) 0.9
- (C) 0.7
- (D) More than 1.0

**Q73.** In 'Emphysema', a chronic respiratory disorder, the main cause of decreased gas exchange is:

- (A) Inflammation of bronchioles
- (B) Accumulation of fluid in the lungs
- (C) Damage to alveolar walls
- (D) Spasm of smooth muscles in the trachea

**Q74.** The process of 'Vernalisation' refers to the promotion of flowering by:

- (A) Exposure to high temperature
- (B) Exposure to low temperature
- (C) Application of high light intensity
- (D) Short day photoperiods

**Q75.** The hormone 'Erythropoietin', which stimulates the formation of RBCs, is produced by:

- (A) The alpha cells of the pancreas
- (B) The JGA (Juxtaglomerular apparatus) of the kidney
- (C) The cells of the bone marrow
- (D) The adenohypophysis



- Q76.** The 'Statins' used for lowering blood cholesterol are commercially produced from:
- (A) *Monascus purpureus*
  - (B) *Trichoderma polysporum*
  - (C) *Saccharomyces cerevisiae*
  - (D) *Propionibacterium sharmanii*
- Q77.** In a dicotyledonous stem, the sequence of layers from the outside to the inside is:
- (A) Phellem → Phellogen → Phelloderm
  - (B) Phelloderm → Phellogen → Phellem
  - (C) Phellogen → Phellem → Phelloderm
  - (D) Phellem → Phelloderm → Phellogen
- Q78.** Which of the following is a 'Gaseous' plant growth regulator?
- (A) IAA
  - (B)  $GA_3$
  - (C) Ethylene
  - (D) Abscisic acid
- Q79.** The 'Glucocorticoids' stimulate all of the following EXCEPT:
- (A) Gluconeogenesis
  - (B) Lipolysis
  - (C) Proteolysis
  - (D) Cellular uptake and utilization of amino acids
- Q80.** The 'Functional Megaspore' in an angiosperm develops into:
- (A) Ovule



- (B) Endosperm
- (C) Embryo sac
- (D) Embryo

**Q81.** The 'Human Genome Project' (HGP) revealed that the total number of genes in a human cell is estimated to be approximately:

- (A) 80,000 to 100,000
- (B) 30,000
- (C) 1,50,000
- (D) 10,000

**Q82.** Which of the following is the 'pacemaker' of the human heart?

- (A) AV node (Atrioventricular node)
- (B) Purkinje fibers
- (C) SA node (Sinoatrial node)
- (D) Bundle of His

**Q83.** The 'Ecological Succession' that starts in a bare rocky area is known as:

- (A) Hydrarch succession
- (B) Xerarch succession
- (C) Halosere
- (D) Mesarch succession

**Q84.** Which enzyme is responsible for the 'unwinding' of the DNA double helix during replication?

- (A) DNA Polymerase
- (B) DNA Ligase
- (C) Helicase
- (D) Topoisomerase



- Q85.** The 'Tidal Volume' (TV) of a healthy human being is approximately:
- (A) 500 mL
  - (B) 1000 mL
  - (C) 2500 mL
  - (D) 6000 mL
- Q86.** Which of the following is the most abundant protein in the whole of the biosphere?
- (A) Collagen
  - (B) RuBisCO
  - (C) Hemoglobin
  - (D) Insulin
- Q87.** The 'Filiform apparatus' is a characteristic feature of:
- (A) Synergids
  - (B) Egg cell
  - (C) Antipodal cells
  - (D) Zygote
- Q88.** In the 'Hardy-Weinberg equation', the frequency of heterozygous individuals is represented by:
- (A)  $p^2$
  - (B)  $q^2$
  - (C)  $pq$
  - (D)  $2pq$
- Q89.** The 'UTRs' (Un-translated Regions) in an mRNA are present at:
- (A) Only at the 5' end.



- (B) Only at the 3' end.
- (C) Both at 5' end (before start codon) and 3' end (after stop codon).
- (D) In the middle of the coding sequence.

**Q90.** Which of the following is a 'Connecting Link' between reptiles and birds?

- (A) *Archaeopteryx*
- (B) *Ornithorhynchus* (Platypus)
- (C) *Latimeria*
- (D) *Seymouria*



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

The theory of special creation is a conventional religious belief regarding the origin of life and the universe. It is based on three main connotations: first, that all living organisms (species or types) we see today were created as such; second, that the diversity was always the same since creation and will be the same in the future; and third, that the Earth is about 4000 years old.

**Solution:**

1. The first point of the theory states that species do not change over time and were created in their current form. 2. The second point argues for constant biodiversity, denying evolutionary change or extinction/speciation in the biological sense. 3. The third point provides a specific, relatively young age for the Earth compared to scientific estimates (4.5 billion years). 4. Since all three statements are core tenets of this theory, the correct choice is "All of these".

**Final Answer:** The connotations include all the mentioned points.

**Answer: (D)**

**Q2.****Solution****Concept:**

Nuclear energy is often considered a "clean" source of energy regarding carbon emissions, but it poses significant environmental and safety risks. These include the accidental leakage of radioactive materials, the extreme difficulty in disposing of radioactive waste safely, and the thermal impact on water bodies used for cooling.

**Solution:**

1. Radioactive elements can be released into the environment through leaks or accidents, posing severe health risks like mutations and cancer. 2. Spent nuclear fuel remains radioactive for thousands of years, and finding stable geological repositories is a global challenge. 3. Cooling systems in nuclear plants discharge large volumes of hot water into nearby lakes or rivers, which decreases dissolved oxygen and harms aquatic life (thermal pollution). 4. As all these are recognized problems, the answer is "All of the above".

**Final Answer:** Nuclear power plants face all these listed operational and environmental issues.

**Answer: (D)**



Q3.

### Solution

#### Concept:

Biodiversity is the term popularized by sociobiologist Edward Wilson to describe the combined diversity at all the levels of biological organization. The three fundamental levels recognized are genetic, species, and ecological diversity.

#### Solution:

1. Genetic diversity refers to the variation within a single species at the genetic level (e.g., different strains of Rice or medicinal plants like *Rauwolfia vomitoria*). 2. Species diversity refers to the variety of species within a region (e.g., the Western Ghats have a greater amphibian species diversity than the Eastern Ghats). 3. Ecological diversity refers to the variety of ecosystems in a geographical area (e.g., India has deserts, rain forests, mangroves, coral reefs, wetlands, estuaries, and alpine meadows).

**Final Answer:** The three levels are genetic, species, and ecological diversity.

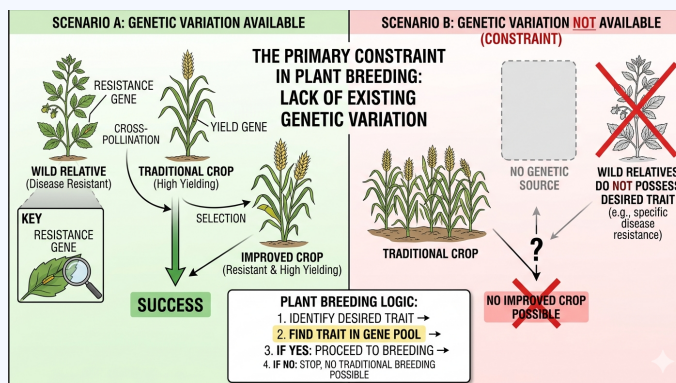
**Answer: (A)**

Q4.

### Solution

#### Concept:

Plant breeding is the purposeful manipulation of plant species in order to create desired plant types that are better suited for cultivation, give better yields, and are disease resistant. The primary raw material for this process is genetic variability.



#### Solution:

1. To improve a crop, breeders need a source of genes that provide the desired trait (like resistance to a specific fungus). 2. If the gene for a particular trait is not present in the existing crop varieties or their wild relatives, the breeder cannot use traditional breeding methods to introduce it. 3. While infrastructure and manpower are logistical needs, the fundamental biological "bottleneck" is whether the required genetic variation exists to begin with.

**Final Answer:** The availability of desirable genes in the crop and its wild relatives is the primary constraint.

**Answer: (A)**



Q5.

**Solution****Concept:**

An ecosystem can be natural or man-made. A cropland (agro-ecosystem) is a man-made ecosystem managed by humans for food production. Unlike natural ecosystems, these are simplified and heavily controlled.

**Solution:**

1. Croplands are typically monocultures, meaning only one species (or a few varieties) is grown over a large area. 2. This artificial selection significantly reduces the genetic diversity compared to a natural forest or grassland where many species and genetic variants coexist. 3. Other features like the absence of weeds or soil organisms are not characteristic features because they are often present despite human efforts to remove them. 4. Ecological succession is actively prevented in croplands to keep the field at the "pioneer" stage of the desired crop.

**Final Answer:** Least genetic diversity is a characteristic feature of a cropland ecosystem.

**Answer: (B)**

Q6.

**Solution**

**Concept:** Infertility is defined as the inability to conceive or produce children even after two years of unprotected sexual cohabitation. It is a complex medical condition that can stem from various sources in either the male or the female partner.

**Solution:** 1. **Physical/Congenital:** Structural abnormalities in the reproductive tract (like blocked fallopian tubes or undescended testes) or genetic conditions present from birth. 2. **Diseases/Drugs:** Infections (like STIs), chronic illnesses, or the side effects of certain medications and alcohol/tobacco use. 3. **Immunological/Psychological:** The production of anti-sperm antibodies or high levels of stress and emotional factors that disrupt the hormonal balance (H-P-G axis). 4. Since all these categories are scientifically recognized causes of infertility, the correct option is "All of the above."

**Final Answer:** Infertility is multifactorial, involving physical, medical, and psychological components.

**Answer: (D)**



Q7.

**Solution**

**Concept:** Developing disease resistance in plants is a primary goal of plant breeding to reduce dependence on fungicides and bactericides. This is achieved by identifying and incorporating resistance genes from various sources.

**Solution:** 1. **Wild Relatives:** Often, the wild ancestors of our modern crops possess natural resistance genes because they have co-evolved with pathogens in nature without human protection. 2. **Hybridization:** By crossing a high-yielding (but susceptible) variety with a wild relative (resistant but low-yielding), and then repeatedly backcrossing, breeders can "introgress" the resistance gene into the crop. 3. Other options: *Colchicine* induces polyploidy; *X-rays* cause random mutations (less targeted than finding existing genes); *Hormones* only affect growth, not genetic resistance.

**Final Answer:** Breeding with wild relatives is a classic and effective method to introduce natural resistance genes into cultivated crops.

Answer: (C)

Q8.

**Solution**

**Concept:** The International Union for Conservation of Nature (IUCN) categorizes species based on their population size, rate of decline, and geographical area to prioritize conservation efforts.

**Solution:** 1. **Rare Species:** These are species with small populations that are not yet "Endangered" or "Vulnerable" but are at risk due to their limited numbers or localized distribution. 2. **Endangered:** Species facing a very high risk of extinction in the near future. 3. **Threatened:** A broad umbrella term for species categorized as Vulnerable, Endangered, or Critically Endangered. 4. **Living Fossils:** Organisms that have remained essentially unchanged over millions of years (e.g., *Limulus*).

**Final Answer:** Species that are naturally few in number are defined as "Rare."

Answer: (D)

Q9.

**Solution**

**Concept:** Biotechnology is the use of living organisms or their components to produce products and processes for human benefit. It is an interdisciplinary field with wide-reaching impacts.

**Solution:** 1. **Health care (Red Biotech):** Production of insulin, vaccines, and gene therapy. 2. **Environment (Grey/White Biotech):** Bioremediation (using microbes to clean oil spills) and waste treatment. 3. **Agriculture (Green Biotech):** Creating Genetically Modified (GM) crops like Bt cotton for pest resistance and biofortified crops (Golden Rice). 4. Because biotechnology spans all these critical sectors, "All of the above" is the correct choice.

**Final Answer:** Biotechnology is applicable across health, environment, and agriculture.

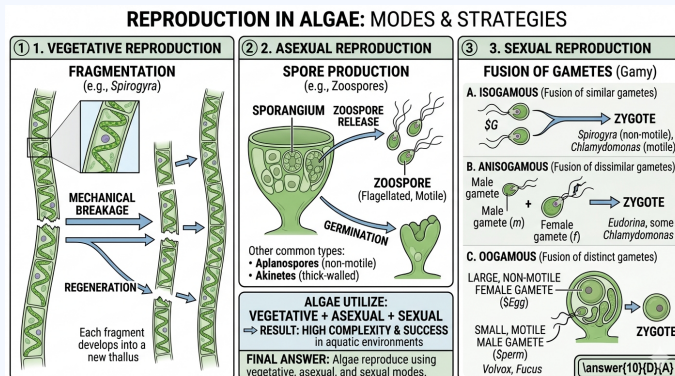
Answer: (D)



Q10.

## Solution

**Concept:** Algae exhibit a high degree of complexity and variety in their reproductive strategies, allowing them to thrive in diverse aquatic environments.



**Solution:** 1. **Vegetative:** Common through fragmentation, where each fragment develops into a new thallus (e.g., *Spirogyra*). 2. **Asexual:** Primarily through the production of different types of spores, most commonly zoospores (flagellated and motile). 3. **Sexual:** Through the fusion of two gametes. This can be *Isogamous* (similar size), *Anisogamous* (dissimilar size), or *Oogamous* (large non-motile female and small motile male gamete). 4. Since algae utilize all three methods, the correct answer is "All of these."

**Final Answer:** Algae reproduce using vegetative, asexual, and sexual modes.

Answer: (D)

Q11.

## Solution

**Concept:** The cell cycle is an ordered series of events involving cell growth and DNA replication that produces two new daughter cells. It is divided into Interphase and the M Phase (Mitosis).

**Solution:** 1. **Interphase:** This is the longest phase, consisting of:

- $G_1$  (**Gap 1**): Cell growth and preparation for DNA replication.
- **S (Synthesis)**: DNA replication occurs; the amount of DNA doubles.
- $G_2$  (**Gap 2**): Further growth and protein synthesis for spindle formation.

2. **M Phase:** The actual division phase (Mitosis/Meiosis). 3. The sequence is strictly  $G_1 \rightarrow S \rightarrow G_2 \rightarrow M$ .

**Final Answer:** DNA synthesis must follow the initial growth phase and precede the second growth phase and division.

Answer: (B)



Q12.

**Solution**

**Concept:** Linkage describes the tendency of genes located close together on the same chromosome to be inherited together during meiosis.

**Solution:** 1. **T.H. Morgan:** While working on *Drosophila melanogaster* (fruit flies), Morgan observed that some genes did not segregate independently (violating Mendel's law). He coined the term 'linkage' to describe this physical association of genes. 2. **Others:** Mendel formulated the basic laws of inheritance; Hardy co-formulated the Hardy-Weinberg principle; De Vries proposed the Mutation theory.

**Final Answer:** T.H. Morgan provided the experimental proof for linkage and coined the term.

Answer: (A)

Q13.

**Solution**

**Concept:**  $C_4$  plants have a specialized anatomy (Kranz anatomy) to minimize photorespiration and increase photosynthetic efficiency in high temperatures.

**Solution:** 1. **Mesophyll Cells:** In  $C_4$  plants, the initial fixation of  $CO_2$  occurs here. 2. **PEP (Phosphoenolpyruvate):** This 3-carbon molecule acts as the primary acceptor of  $CO_2$  in the presence of the enzyme PEP carboxylase (PEPcase). 3. **Result:** This forms OAA (Oxaloacetic acid), a 4-carbon compound, which is why they are called  $C_4$  plants. RuBP is the acceptor in  $C_3$  plants.

**Final Answer:** PEP is the primary acceptor in the mesophyll cells of  $C_4$  plants.

Answer: (B)

Q14.

**Solution**

**Concept:** Restriction enzymes (molecular scissors) are part of the defense mechanism of bacteria against invading viruses (bacteriophages).

**Solution:** 1. **Biological Role:** These enzymes "restrict" or limit the ability of a bacteriophage to infect and replicate within the bacterial cell by cutting up the viral DNA. 2. **Action:** They recognize specific palindromic sequences and cleave the DNA, rendering the viral genome non-functional. 3. The bacterium protects its own DNA from these enzymes through methylation.

**Final Answer:** The name refers to the natural function of restricting viral growth in host bacteria.

Answer: (B)



Q15.

**Solution**

**Concept:** The Nitrogen Cycle involves several biological and physical steps to convert atmospheric nitrogen into forms usable by plants and then back to the atmosphere.

**Solution:** 1. **Nitrification:** This is a two-step biological oxidation process:

- Ammonia ( $NH_3$ ) is oxidized to Nitrite ( $NO_2^-$ ) by bacteria like *Nitrosomonas*.
- Nitrite is further oxidized to Nitrate ( $NO_3^-$ ) by bacteria like *Nitrobacter*.

2. **Other processes:** Nitrogen fixation (Atmospheric  $N_2$  to  $NH_3$ ); Denitrification (Nitrate to  $N_2$ ); Ammonification (Organic nitrogen to  $NH_3$ ).

**Final Answer:** The conversion of ammonia to nitrates via nitrites is called Nitrification.

**Answer: (C)**

Q16.

**Solution**

**Concept:** Gas exchange in the human body depends on the pressure gradient of gases. Partial pressure is the pressure contributed by an individual gas in a mixture.

**Solution:** 1. **Alveoli:**  $pO_2$  is 104 mm Hg and  $pCO_2$  is 40 mm Hg. 2. **Systemic Arteries (Oxygenated Blood):** After exchange at the alveolar membrane, the blood leaving the lungs has a  $pO_2$  of approximately 95 mm Hg and a  $pCO_2$  of 40 mm Hg. 3. **Systemic Veins (Deoxygenated Blood):** After delivering  $O_2$  to tissues, the  $pO_2$  drops to 40 mm Hg and  $pCO_2$  rises to 45 mm Hg. 4. Option (B) correctly identifies the values for arterial blood.

**Final Answer:** Systemic arteries carry oxygenated blood with high  $pO_2$  (95 mm Hg) and low  $pCO_2$  (40 mm Hg).

**Answer: (B)**

Q17.

**Solution**

**Concept:** A dihybrid cross involving two heterozygous parents ( $AaBb \times AaBb$ ) follows Mendel's Law of Independent Assortment.

**Solution:** 1. Each parent produces four types of gametes:  $AB, Ab, aB, ab$  in equal proportions (1/4 each). 2. To obtain the genotype  $aabb$ , a gamete with 'ab' from the father must fuse with a gamete with 'ab' from the mother. 3. **Calculation:**  $Probability = (1/4 \text{ from Father}) \times (1/4 \text{ from Mother}) = 1/16$ . 4. In a standard 16-square Punnett square for a dihybrid cross, only one square represents the double recessive ( $aabb$ ) genotype.

**Final Answer:** The probability of a double recessive offspring in a dihybrid cross is 1/16.

**Answer: (C)**



Q18.

**Solution**

**Concept:** The "Evil Quartet" is a term used in conservation biology to describe the four main human-induced factors driving the current high rates of species extinction.

**Solution:** 1. **Habitat Loss and Fragmentation:** The most important cause (e.g., tropical rainforests). 2. **Over-exploitation:** Humans over-harvesting species (e.g., Steller's sea cow, Passenger pigeon). 3. **Alien Species Invasions:** Non-native species causing decline of indigenous species (e.g., Nile perch in Lake Victoria). 4. **Co-extinctions:** When a host species goes extinct, the parasites or mutualists unique to it also perish.

**Final Answer:** These four factors specifically describe the drivers of Biodiversity Loss.

Answer: (B)

Q19.

**Solution**

**Concept:** The forebrain contains the limbic system and the hypothalamus, which act as the control center for many autonomic functions and emotional responses.

**Solution:** 1. **Hypothalamus:** It contains centers that control body temperature (thermoregulation), cardiovascular resistance, and the "hunger and satiety" centers (urge for eating and drinking). 2. **Cerebellum:** Responsible for balance and coordination. 3. **Medulla:** Controls respiration, gastric secretions, and cardiovascular reflexes. 4. **Corpus callosum:** Connects the two cerebral hemispheres.

**Final Answer:** The hypothalamus serves as the body's thermostat and hunger regulator.

Answer: (C)

Q20.

**Solution**

**Concept:** PCR is a technique used to amplify a specific segment of DNA into millions of copies *in vitro*.

**Solution:** 1. **Taq Polymerase:** A thermostable DNA polymerase (isolated from *Thermus aquaticus*) is essential because it remains active during the high-temperature denaturation step (94°C). 2. **Primers:** Small, chemically synthesized oligonucleotides that are complementary to the regions of DNA. 3. **Nucleotides:** Deoxynucleoside triphosphates (dNTPs) are the building blocks. 4. Ligase is used in recombinant DNA construction, not PCR. Reverse transcriptase is for cDNA synthesis.

**Final Answer:** High-temperature stability and specific primers are the unique requirements of PCR.

Answer: (B)



Q21.

**Solution**

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

**Solution:** 1. **Root Pressure:** Under conditions of high soil moisture and low transpiration (like at night or early morning), water is pushed up the xylem by positive hydrostatic pressure (root pressure). 2. **Mechanism:** Since the air is humid and the stomata are closed/less active, water cannot escape as vapor. The pressure forces liquid water out through the hydathodes. 3. Therefore, high root pressure and low transpiration are the prerequisites.

**Final Answer:** Guttation occurs when water intake exceeds water loss through transpiration.

Answer: (A)

Q22.

**Solution**

**Concept:** The placenta acts as a temporary endocrine gland during pregnancy, producing several hormones essential for fetal growth and maintaining the pregnancy.

**Solution:** 1. **Placental Hormones:** It secretes hCG, hPL, estrogens, and progesterone. In the later phase, it also secretes relaxin (though primarily from the ovary/corpus luteum). 2. **LH (Luteinizing Hormone):** This is a gonadotropin secreted by the **anterior pituitary gland**, not the placenta. While hCG mimics the action of LH to maintain the corpus luteum, it is chemically distinct.

**Final Answer:** LH is a pituitary hormone, whereas the others listed are placental.

Answer: (D)

Q23.

**Solution**

**Concept:** DNA polymerase can only add nucleotides in the  $5' \rightarrow 3'$  direction. Because the two strands of the double helix are antiparallel, replication is "semi-discontinuous."

**Solution:** 1. **Leading Strand:** The template strand with  $3' \rightarrow 5'$  polarity allows the enzyme to move continuously toward the opening replication fork, synthesizing the new strand in the  $5' \rightarrow 3'$  direction. 2. **Lagging Strand:** The other template ( $5' \rightarrow 3'$ ) requires synthesis in short bursts (Okazaki fragments) moving away from the fork.

**Final Answer:** The leading strand is characterized by continuous  $5' \rightarrow 3'$  synthesis.

Answer: (B)



Q24.

**Solution**

**Concept:** This principle applies to individual excitable units, such as a single nerve fiber or a single muscle fiber.

**Solution:** 1. **Threshold Stimulus:** If a stimulus reaches the threshold intensity, the muscle fiber will contract with its maximum force for the existing conditions. 2. **Sub-threshold:** If the stimulus is below the threshold, no contraction occurs at all. 3. **Note:** This does *not* apply to the whole muscle "organ," which can show graded responses by recruiting more or fewer motor units.

**Final Answer:** The principle dictates a binary response (max or zero) at the cellular/fiber level.

**Answer: (B)**

Q25.

**Solution**

**Concept:** Population interactions are categorized based on whether the species involved are benefited (+), harmed (-), or unaffected (0).

**Solution:** 1. **Commensalism (+, 0):** One species benefits while the other is neither helped nor harmed. 2. **The Interaction:** Cattle egrets forage near grazing cattle. As the cattle move, they stir up insects from the vegetation. The egrets eat these insects (Benefit: +). The cattle derive no known benefit or harm from the birds' presence (Neutral: 0).

**Final Answer:** This is a classic example of commensalism.

**Answer: (B)**

Q26.

**Solution**

**Concept:** Human evolution is characterized by several morphological and neurological changes over millions of years.

**Solution:** 1. While upright posture and binocular vision were critical early developments, the most consistent and defining trend throughout the *Homo* lineage (from *H. habilis* to *H. erectus* to *H. sapiens*) is the **increase in brain size**. 2. **Cranial Capacities:**

- *Homo habilis*: 650–800 cc
- *Homo erectus*: 900 cc
- *Neanderthal*: 1400 cc
- *Modern Man*: 1350–1500 cc

3. This increase facilitated complex tool-making, language, and social structures.

**Final Answer:** Increasing cranial capacity is the hallmark of the *Homo* genus evolution.

**Answer: (C)**



Q27.

**Solution**

**Concept:** Double fertilization involves two separate fusion events occurring within the embryo sac of a flower.

**Solution:** 1. **Process:** One male gamete fuses with the egg cell (Syngamy) to form a zygote ( $2n$ ). The second male gamete fuses with the two polar nuclei (Triple Fusion) to form the Primary Endosperm Nucleus ( $3n$ ). 2. This ensures that the nutrient-rich endosperm only develops if fertilization of the egg is successful, saving energy. 3. This process is strictly unique to **Angiosperms** (flowering plants).

**Final Answer:** Only Angiosperms exhibit the phenomenon of double fertilization.

Answer: (D)

Q28.

**Solution**

**Concept:** In ecology, competition occurs when two species strive for the same limiting resource.

**Solution:** 1. **Gause's Principle:** G.F. Gause stated that two species competing for the same limiting resources cannot coexist indefinitely; the competitively inferior one will eventually be eliminated. 2. **Other Ecologists:** Robert May estimated global species diversity; Connell performed field experiments on barnacles (Competitive Release); Humboldt described the Species-Area relationship.

**Final Answer:** The principle of competitive exclusion is attributed to G.F. Gause.

Answer: (A)

Q29.

**Solution**

**Concept:** A nucleosome is the basic unit of DNA packaging in eukaryotes, consisting of DNA wrapped around a histone core.

**Solution:** 1. **The Core:** The histone octamer consists of two copies each of H2A, H2B, H3, and H4. Approximately 200 bp of DNA wrap around this core. 2. **H1 Histone:** This is the "linker histone." It binds to the site where DNA enters and exits the nucleosome, "sealing" the DNA in place and connecting one nucleosome to the next via linker DNA.

**Final Answer:** H1 is the histone associated with the linker DNA outside the core octamer.

Answer: (D)



Q30.

**Solution**

**Concept:** Primary productivity is the rate at which solar energy is captured by autotrophs to synthesize organic compounds.

**Solution:** 1. **GPP (Gross Primary Productivity):** This is the total rate of photosynthesis, including the organic matter used up in respiration. 2. **NPP (Net Primary Productivity):** This is GPP minus the energy lost during respiration ( $GPP - R = NPP$ ). NPP is the biomass available for consumption by heterotrophs. 3. **Secondary Productivity:** The rate of formation of new organic matter by consumers.

**Final Answer:** The total rate of organic matter production is GPP.

Answer: (B)

Q31.

**Solution**

**Concept:** The adrenal cortex is the outer layer of the adrenal gland and is histologically organized into three distinct concentric zones. Each zone is responsible for secreting specific steroid hormones.

**Solution:** From the outermost layer (beneath the capsule) to the innermost layer (adjacent to the medulla), the order is:

- **Zona glomerulosa:** Outermost layer, secretes mineralocorticoids (e.g., aldosterone).
- **Zona fasciculata:** Middle and thickest layer, secretes glucocorticoids (e.g., cortisol).
- **Zona reticularis:** Innermost layer, secretes gonadocorticoids (androgens).

A common mnemonic is **GFR** (Glomerulosa, Fasciculata, Reticularis).

**Final Answer:** Zona glomerulosa → Zona fasciculata → Zona reticularis

Answer: (B)

Q32.

**Solution**

**Concept:** Pulmonary volumes represent the amount of air the lungs can hold or move during different phases of respiration.

**Solution:** Even after the most forceful expiration (Expiratory Reserve Volume), the lungs are never completely empty. The volume of air that remains trapped in the alveoli and air passages to prevent lung collapse is the **Residual Volume (RV)**. It averages about 1100 mL to 1200 mL in a healthy adult and cannot be measured directly by spirometry.

**Final Answer:** Residual Volume

Answer: (B)



Q33.

**Solution**

**Concept:** Oogenesis is the process of formation of a mature female gamete. It involves unequal meiotic divisions to ensure the resulting ovum retains maximum cytoplasm.

**Solution:** The primary oocyte (diploid) completes its first meiotic division (Meiosis I) just prior to ovulation. This division is unequal and results in a large haploid **secondary oocyte** and a tiny haploid **first polar body**. Therefore, the first polar body is formed during the transition of the primary oocyte to the secondary oocyte.

**Final Answer:** During the transition of primary oocyte to secondary oocyte

**Answer: (B)**

Q34.

**Solution**

**Concept:** Biocontrol refers to the use of biological methods for controlling plant diseases and pests, reducing the reliance on toxic chemicals.

**Solution:** *Bacillus thuringiensis* (Bt) is a bacterium used to control butterfly caterpillars. It is available in sachets as dried spores which are mixed with water and sprayed onto vulnerable plants. When the larvae eat the leaves, the Bt toxin is released in their gut (activated by alkaline pH), killing the caterpillar while leaving other insects unharmed.

**Final Answer:** *Bacillus thuringiensis*

**Answer: (C)**

Q35.

**Solution**

**Concept:** Reproduction in plants involves various specialized processes and terms that must be distinguished correctly.

**Solution:**

- **Parthenocarpy:** The development of fruit without fertilization (correctly matched).
- **Apomixis:** The development of seeds *without* fertilization, not with it.
- **Polyembryony:** The presence of *more than one* embryo in a seed.
- **Somatic hybridization:** The fusion of protoplasts from two *somatic cells*, not gametes.

**Final Answer:** Parthenocarpy — Formation of fruit without fertilization

**Answer: (A)**



Q36.

**Solution**

**Concept:** The Montreal Protocol is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion.

**Solution:** Signed in 1987 (effective in 1989) at Montreal, Canada, this protocol specifically targets **Ozone Depleting Substances (ODS)** like chlorofluorocarbons (CFCs). It was a response to the discovery of the "ozone hole" and aims to reduce the emission of chemicals that break down  $O_3$  molecules in the stratosphere.

**Final Answer:** Ozone depleting substances

**Answer: (B)**

Q37.

**Solution**

**Concept:** Semi-conservative replication means that during DNA duplication, each daughter DNA molecule contains one parental strand and one newly synthesized strand.

**Solution:** In 1958, **Matthew Meselson and Franklin Stahl** performed an experiment using *Escherichia coli* and heavy isotopes of nitrogen ( $^{15}N$  and  $^{14}N$ ). By using equilibrium density gradient centrifugation, they proved that DNA replicates semi-conservatively. Note: Taylor et al. later proved the same in *Vicia faba* using radioactive thymidine.

**Final Answer:** Meselson and Stahl

**Answer: (B)**

Q38.

**Solution**

**Concept:** During translation (protein synthesis), stop codons are specific nucleotide triplets within messenger RNA (mRNA) that signal the termination of the polypeptide chain.

**Solution:** There are three standard stop codons in the genetic code:

- **UAA** (Ochre)
- **UAG** (Amber)
- **UGA** (Opal)

These codons do not code for any amino acid and do not have corresponding tRNA molecules. **AUG** is an initiation (start) codon, while **UGG** codes for Tryptophan.

**Final Answer:** UAA

**Answer: (C)**





Q41.

**Solution**

**Concept:** Lactation involves two distinct processes: milk production (synthesis) and milk ejection (let-down). Different hormones regulate these two stages.

**Solution:** **Oxytocin** is the hormone responsible for the milk ejection reflex. When a baby suckles, sensory impulses trigger the posterior pituitary to release oxytocin, which causes the contraction of myoepithelial cells surrounding the alveoli of the mammary glands. In contrast, *Prolactin* is responsible for the actual production and secretion of milk.

**Final Answer:** Oxytocin

**Answer: (B)**

Q42.

**Solution**

**Concept:** The kidney is composed of millions of complex tubular structures that perform the primary functions of filtration, reabsorption, and secretion.

**Solution:** The **Nephron** is the structural and functional unit of the human kidney. Each kidney contains approximately one million nephrons.

- *Nephridia* are excretory organs in earthworms and other invertebrates.
- *Neuron* is the functional unit of the nervous system.
- *Henle's loop* is only a specific part of the nephron, not the entire functional unit.

**Final Answer:** Nephron

**Answer: (C)**



Q43.

**Solution**

**Concept:** Metabolic pathways in plants and animals occur in specific cellular compartments to ensure efficiency and regulation.

**Solution:** Matching the processes to their primary locations:

- **$C_3$  cycle (Calvin Cycle):** Occurs in the **Mesophyll** cells of most plants (R).
- **$C_4$  cycle (Hatch-Slack Pathway):** The final  $CO_2$  fixation occurs in the **Bundle sheath** cells (Q).
- **Glycolysis:** Occurs in the **Cytoplasm** of the cell (P).
- **Krebs cycle:** Occurs in the **Mitochondrial matrix** (S).

Thus, the correct match is 1-R, 2-Q, 3-P, 4-S.

**Final Answer:** 1-R, 2-Q, 3-P, 4-S

**Answer:** (A)

Q44.

**Solution**

**Concept:** Plants living in swampy or saline areas (mangroves) face difficulty in obtaining oxygen for roots due to waterlogged soil.

**Solution:** **Pneumatophores** (respiratory roots) are a characteristic of **Halophytes**. These roots grow vertically upwards from the soil into the air and contain small pores called lenticels to facilitate gas exchange in anaerobic swampy conditions. A well-known example is *Rhizophora*.

**Final Answer:** Halophytes

**Answer:** (C)

Q45.

**Solution**

**Concept:** Double fertilization is a unique feature of angiosperms involving two types of fusion: syngamy and triple fusion.

**Solution:** The endosperm is formed as a result of **triple fusion**, where one male gamete ( $n$ ) fuses with the two polar nuclei or the secondary nucleus ( $2n$ ) located in the central cell of the embryo sac. This fusion of three haploid nuclei results in a triploid ( $3n$ ) primary endosperm nucleus (PEN), which subsequently develops into the endosperm tissue.

**Final Answer:**  $3n$

**Answer:** (C)



Q46.

**Solution**

**Concept:** The Fluid Mosaic Model, proposed in 1972, is the most widely accepted model for the structure of the cell membrane.

**Solution:** According to Singer and Nicolson, the plasma membrane consists of a bilayer of phospholipids with "floating" proteins. The **quasi-fluid nature of lipids** allows for the lateral movement of proteins within the overall bilayer. This ability to move within the membrane is measured as its fluidity, which is essential for functions like cell growth, secretion, and cell division.

- Options (A) and (D) describe older "sandwich" models.
- Option (B) is incorrect as membranes are primarily lipo-proteinaceous and dynamic, not rigid carbohydrate structures.

**Final Answer:** The quasi-fluid nature of lipids enables lateral movement of proteins within the bilayer

**Answer: (C)**

Q47.

**Solution**

**Concept:** In eukaryotes, the primary transcript (hnRNA) contains both functional coding sequences and non-functional non-coding sequences. It must undergo post-transcriptional processing to become mature mRNA.

**Solution:** The process of **Splicing** involves the **removal of introns** (intervening/non-coding sequences) and the **joining of exons** (expressed/coding sequences) in a defined order.

- Option (C) refers to *Capping*.
- Option (D) refers to *Tailing*.
- Mature mRNA consists only of exons, which are then translated into proteins.

**Final Answer:** Removal of introns and joining of exons in a defined order

**Answer: (B)**



Q48.

**Solution**

**Concept:** Plant Growth Regulators (PGRs) can be growth promoters or growth inhibitors. Certain hormones help plants survive adverse environmental conditions.

**Solution:** **Abscisic acid (ABA)** is widely known as the **stress hormone**. It stimulates the closure of stomata in the epidermis and increases the tolerance of plants to various kinds of stresses (such as drought). It also plays a major role in seed dormancy, ensuring that seeds only germinate under favorable conditions.

**Final Answer:** Abscisic acid (ABA)

**Answer:** (C)

Q49.

**Solution**

**Concept:** Photoperiodism is the physiological reaction of organisms (specifically plants) to the length of night or a dark period. It determines when certain plant species will transition from vegetative growth to flowering.

**Solution:** Although the flowering response (the actual floral primordia) happens at the shoot apex, the **leaves** are the actual site of perception of light/dark duration.

It has been hypothesized that a hormonal substance (often called florigen) is synthesized in the leaves when they are exposed to the necessary inductive photoperiod. This substance then migrates from the leaves to the shoot apices to induce flowering. If a plant is completely defoliated, it typically fails to respond to photoperiodic stimuli.

**Final Answer:** Leaves

**Answer:** (C)

Q50.

**Solution**

**Concept:** The Lac Operon is a polycistronic structural gene regulated by a common promoter and regulatory genes. Transcription is controlled by the interaction of proteins with specific DNA sequences.

**Solution:** The repressor protein is synthesized constitutively by the *i* gene. In the absence of an inducer (lactose), the **repressor protein binds to the operator region (*O*)** of the operon. This physical blockage prevents RNA polymerase from transcribing the structural genes (*z*, *y*, *a*), thereby switching off the operon. When an inducer is present, it binds to the repressor, inactivating it and allowing transcription to proceed.

**Final Answer:** Operator (*O*)

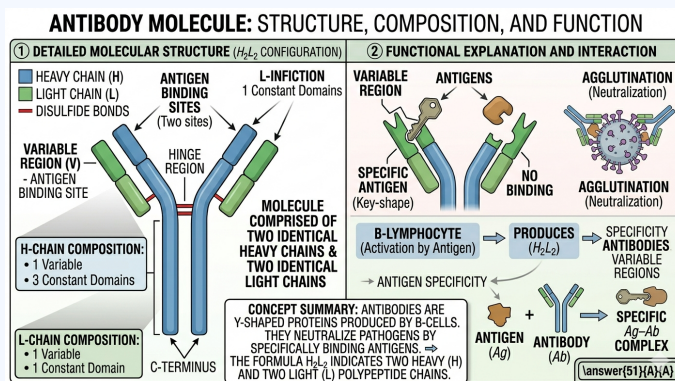
**Answer:** (C)



Q51.

### Solution

**Concept:** Antibodies (Immunoglobulins) are Y-shaped protein molecules produced by B-lymphocytes to identify and neutralize foreign objects like bacteria and viruses.



**Solution:** 1. **Structure:** Each antibody molecule is composed of four peptide chains. 2. **Chains:** There are two small chains called **light (L) chains** and two longer chains called **heavy (H) chains**. 3. **Bonds:** These four chains are held together by disulfide bonds into a  $H_2L_2$  configuration. 4. **Variable Region:** The tips of the "Y" are variable regions that bind to specific antigens.

**Final Answer:** The formula  $H_2L_2$  refers to the count of the two types of polypeptide chains.

Answer: (A)

Q52.

### Solution

**Concept:** Natural selection can lead to different outcomes in a population's phenotype distribution depending on which individuals are favored by the environment.

**Solution:** 1. **Stabilizing Selection:** This occurs when the environment favors the average (mean) phenotype and selects against the extreme variations. This results in the peak of the bell curve getting higher and narrower. 2. **Directional Selection:** Individuals at one extreme end of the distribution are favored (the curve shifts in one direction). 3. **Disruptive Selection:** Individuals at both extreme ends are favored over the mean (the curve develops two peaks).

**Final Answer:** Selection for the "mean" is stabilizing selection, which maintains the status quo.

Answer: (C)



Q53.

**Solution**

**Concept:** Auto-immunity is a condition where the body's immune system loses the ability to distinguish between "self" and "non-self," and starts attacking its own cells.

**Solution:** 1. **Rheumatoid Arthritis:** This is a classic example where the immune system attacks the synovial membranes of the joints, leading to inflammation and damage. 2. **Other Options:** *AIDS* is an immunodeficiency (system is destroyed); *Cancer* is uncontrolled cell division; *Malaria* is a protozoan infection. 3. Other examples of auto-immune diseases include Myasthenia gravis and Type 1 Diabetes.

**Final Answer:** Rheumatoid arthritis is caused by the body attacking its own joint tissues.

Answer: (B)

Q54.

**Solution**

**Concept:** Water potential is a measure of the free energy of water in a system, which determines the direction of water movement.

**Solution:** 1. **Pure Water:** By convention, the water potential of pure water at standard temperature and pressure (not under any pressure) is taken to be **zero**. 2. **Effect of Solutes:** If a solute is dissolved in pure water, the concentration of free water molecules decreases, and the water potential becomes **negative** (less than zero). 3. Therefore, zero is the highest possible value for water potential at standard atmospheric pressure.

**Final Answer:** Pure water has a  $\Psi_w = 0$ .

Answer: (C)

Q55.

**Solution**

**Concept:** An Electrocardiogram (ECG) is a graphical representation of the electrical activity of the heart during a cardiac cycle.

**Solution:** 1. **P-wave:** Represents atrial depolarisation (contraction). 2. **QRS complex:** Represents ventricular depolarisation (contraction). 3. **T-wave:** Represents the return of the ventricles from excited to normal state, known as **repolarisation**. 4. The end of the T-wave marks the end of the systole.

**Final Answer:** The T-wave corresponds to ventricular repolarisation.

Answer: (C)



Q56.

**Solution**

**Concept:** The Rivet Popper Hypothesis is an analogy used to illustrate how the loss of species (even "minor" ones) can eventually lead to the collapse of an entire ecosystem.

**Solution:** 1. **Paul Ehrlich:** An ecologist from Stanford, he compared an ecosystem to an airplane and species to the "rivets" holding it together. 2. **The Analogy:** If passengers start popping rivets (causing species extinction), the plane might not crash immediately. However, if "key rivets" (key-stone species) on the wings are removed, the safety of the flight is immediately threatened. 3. **Others:** Edward Wilson popularized the term "Biodiversity." David Tilman showed that plots with more species show less year-to-year variation in total biomass.

**Final Answer:** Paul Ehrlich proposed this hypothesis to highlight the danger of species extinction.

Answer: (A)

Q57.

**Solution**

**Concept:** The human urinary system consists of a pair of kidneys, a pair of ureters, a urinary bladder, and a urethra.

**Solution:** 1. **Kidney:** Urine is formed here through filtration, reabsorption, and secretion. 2. **Ureter:** These are thin muscular tubes that carry urine from the renal pelvis of the kidney to the bladder. 3. **Urinary Bladder:** A muscular sac that stores urine temporarily. 4. **Urethra:** The canal through which urine is finally expelled from the body (micturition).

**Final Answer:** The sequence follows the anatomical flow from production to excretion: Kidney → Ureter → Bladder → Urethra.

Answer: (B)

Q58.

**Solution**

**Concept:** Light enters the eye and must be focused precisely on the retina to form a clear image. This requires the bending (refraction) of light rays.

**Solution:** 1. **Cornea:** While the lens provides the "fine-tuning" for focus (accommodation), the **cornea** (the clear outer layer) provides about 65% to 75% of the eye's total focusing power because of the high difference in refractive index between air and the corneal tissue. 2. **Lens:** It is responsible for adjusting the focus for objects at different distances. 3. **Retina:** The light-sensitive layer where the image is formed.

**Final Answer:** The cornea is the primary refractive surface of the eye.

Answer: (C)



Q59.

**Solution**

**Concept:** Facilitated transport is a type of passive transport that moves substances across the cell membrane through specific protein channels or carriers.

**Solution:** 1. **Passive Nature:** Like simple diffusion, facilitated transport moves substances *along* the concentration gradient (from high to low). Therefore, it **does not** require energy and is not an "uphill" process. 2. **Characteristics:** It requires specific proteins, it can reach saturation (when all transporters are used), and it is sensitive to inhibitors. 3. **Active Transport:** This is the process that performs "uphill" transport using ATP.

**Final Answer:** Uphill transport is a feature of active transport, not facilitated transport.

Answer: (D)

Q60.

**Solution**

**Concept:** Hormones are classified based on their chemical nature, which dictates how they interact with target cells.

**Solution:** 1. **Water-Soluble Hormones:** These (like Adrenaline, FSH, LH) cannot pass through the lipid bilayer of the cell membrane. They bind to membrane-bound receptors. 2. **Signal Transduction:** The binding triggers the production of a "second messenger" inside the cell, most commonly cAMP (cyclic Adenosine Monophosphate) or  $Ca^{2+}$ . 3. **Lipid-Soluble Hormones:** (like Steroids) can enter the cell and bind to intracellular receptors to act directly on DNA.

**Final Answer:** cAMP acts as the mediator to relay the signal from the membrane to the cell's interior.

Answer: (A)

Q61.

**Solution**

**Concept:** Bioreactors are large vessels used for the large-scale production of biological products (like enzymes or proteins) using microbial, plant, or animal cells.

**Solution:** 1. **Oxygen Transfer:** Most biological processes are aerobic. A stirred-tank bioreactor is equipped with an impeller (stirrer) and an air sparger. 2. **Stirring:** The stirrer facilitates even mixing of the contents and, crucially, ensures that oxygen is distributed uniformly throughout the medium, making it available to every cell. 3. It also helps in maintaining uniform temperature and pH.

**Final Answer:** The primary design goal of a stirred-tank is efficient oxygenation and mixing.

Answer: (C)



Q62.

**Solution**

**Concept:** Various microorganisms are used in biotechnology to produce organic acids through fermentation.

**Solution:** 1. **Aspergillus niger (Fungus):** Correct. It is used for the production of **Citric acid**. 2.

**Acetobacter aceti (Bacterium):** Produces **Acetic acid** (vinegar), not lactic acid. 3. **Clostridium**

**butylicum (Bacterium):** Produces **Butyric acid**, not acetic acid. 4. **Lactobacillus (Bacterium):**

Produces **Lactic acid**, not butyric acid.

**Final Answer:** Only option A correctly matches the microbe with its product.

**Answer: (A)**

Q63.

**Solution**

**Concept:** Neurons are the structural units of the nervous system. Some axons are wrapped in a protective layer called the myelin sheath.

**Solution:** 1. **Myelin Sheath:** Produced by Schwann cells in the PNS. It acts as an electrical

insulator. 2. **Nodes of Ranvier:** These are the **gaps** in the myelin sheath where the axonal membrane

is exposed to the extracellular fluid. 3. **Function:** They allow for "Saltatory Conduction," where the nerve impulse "jumps" from node to node, significantly increasing the speed of transmission.

**Final Answer:** These nodes are specific to myelinated nerve fibers.

**Answer: (B)**

Q64.

**Solution**

**Concept:** Pulmonary capacities are combinations of two or more pulmonary volumes measured using a spirometer.

**Solution:** 1. **Vital Capacity (VC):** The maximum volume of air a person can breathe in after a forced expiration, or the maximum volume of air a person can breathe out after a forced inspiration.

2. **Formula:** It includes:

- **ERV** (Expiratory Reserve Volume)
- **TV** (Tidal Volume)
- **IRV** (Inspiratory Reserve Volume)

3. It does *not* include Residual Volume (RV).

**Final Answer:**  $VC = ERV + TV + IRV$ .

**Answer: (B)**



Q65.

**Solution**

**Concept:** The Loop of Henle plays a critical role in the concentration of urine through a counter-current mechanism. The two limbs have opposite permeability characteristics.

**Solution:** 1. **Descending Limb:** Permeable to water but almost impermeable to electrolytes. As filtrate moves down, water leaves, making the filtrate hypertonic. 2. **Ascending Limb: Impermeable to water** but allows transport (active or passive) of electrolytes ( $Na^+$ ,  $Cl^-$ ). 3.

**Result:** As electrolytes are removed and water stays inside, the filtrate becomes diluted (hypotonic) as it moves up.

**Final Answer:** The ascending limb is the water-impermeable segment.

Answer: (B)

Q66.

**Solution**

**Concept:** The water vascular system is a unique and defining physiological feature of phylum Echinodermata (e.g., Starfish).

**Solution:** 1. **Function:** It is a network of hydraulic canals extending into "tube feet." It helps in locomotion, capture and transport of food, and respiration. 2. **Distinction:** Do not confuse this with the *Water Canal System* found in Porifera (Sponges), which is used for circulating water through the body for feeding and waste removal. 3. **Components:** It includes the madreporite, ring canal, and radial canals.

**Final Answer:** The water vascular system is the hallmark of Echinoderms.

Answer: (C)

Q67.

**Solution**

**Concept:** Chromosomal disorders are caused by the absence, excess, or abnormal arrangement of one or more chromosomes.

**Solution:** 1. **Turner's Syndrome:** Caused due to the absence of one of the X chromosomes in females, resulting in a karyotype of **45 with XO**. 2. **Symptoms:** Such females are sterile as ovaries are rudimentary; they also lack other secondary sexual characters. 3. **Others:** Trisomy 21 is Down's Syndrome; XXY is Klinefelter's Syndrome.

**Final Answer:** Turner's syndrome is a monosomy of the sex chromosome.

Answer: (B)



Q68.

**Solution**

**Concept:** The seminiferous tubules are lined on their inside by two types of cells: male germ cells (spermatogonia) and Sertoli cells.

**Solution:** 1. **Sertoli Cells:** Often called "nurse cells." They provide nourishment to the developing spermatozoa. 2. **Blood-Testis Barrier:** They also form a barrier to protect the developing sperm from the immune system. 3. **Leydig Cells:** These are located *outside* the tubules in the interstitial spaces and secrete Testosterone.

**Final Answer:** Sertoli cells serve a nutritive and supportive role during spermatogenesis.

Answer: (B)

Q69.

**Solution**

**Concept:** Analogous organs are those that have different anatomical structures and origins but perform similar functions. This is a result of **Convergent Evolution**.

**Solution:** 1. **Flippers of Penguin and Dolphin:** Penguins are birds (forelimbs modified) and Dolphins are mammals (forelimbs modified). Their anatomical structures are different, but both have evolved flippers for swimming in a similar aquatic environment. 2. **Homologous Organs:** The other options (A, C, D) are examples of homologous organs, which have the same structural origin but different functions (**Divergent Evolution**).

**Final Answer:** Penguin and dolphin flippers are analogous because they evolved independently for the same purpose.

Answer: (B)

Q70.

**Solution**

**Concept:** The menstrual cycle involves significant changes in the ovary and the uterus, mediated by hormones.

**Solution:** 1. **Luteal Phase:** After ovulation, the remains of the Graafian follicle transform into a yellow endocrine structure called the **Corpus luteum**. 2. **Function:** The corpus luteum secretes large amounts of **Progesterone**, which is essential for the maintenance of the endometrium (the uterine lining) for possible pregnancy. 3. If fertilization does not occur, the corpus luteum degenerates, leading to a drop in progesterone and the start of menstruation.

**Final Answer:** Progesterone is the "pregnancy hormone" primarily produced by the corpus luteum.

Answer: (B)



Q71.

**Solution**

**Concept:** Ecological pyramids represent the relationship between different trophic levels. However, the pyramid of energy follows the thermodynamic laws of energy flow.

**Solution:** 1. **The 10% Law:** Only about 10% of the energy available at a lower trophic level is transferred to the next higher level. The rest is lost as heat during respiration and other processes. 2.

**Directionality:** Energy always flows from producers to consumers and can never be recycled back or increased at higher levels. 3. Therefore, the energy at the producer level is always maximum, making the pyramid **always upright**.

**Final Answer:** Due to the unidirectional flow of energy and loss at each level, the pyramid of energy can never be inverted.

**Answer: (A)**

Q72.

**Solution**

**Concept:** The Respiratory Quotient (RQ) is the ratio of the volume of  $CO_2$  evolved to the volume of  $O_2$  consumed during respiration.  $RQ = \frac{\text{Volume of } CO_2 \text{ evolved}}{\text{Volume of } O_2 \text{ consumed}}$

**Solution:** 1. **Carbohydrates:**  $RQ = 1.0$  (equal  $CO_2$  and  $O_2$ ). 2. **Fats (e.g., Tripalmitin):** Fats are oxygen-poor compared to carbohydrates, so they require more external  $O_2$  for oxidation. For Tripalmitin, the balanced equation shows  $102 CO_2/145 O_2$ . 3. **Calculation:**  $102/145 \approx 0.7$ . 4. **Proteins:**  $RQ$  is approximately 0.9.

**Final Answer:** The RQ for fats like tripalmitin is always less than 1, specifically 0.7.

**Answer: (C)**

Q73.

**Solution**

**Concept:** Emphysema is a major obstructive lung disease, often associated with long-term smoking.

**Solution:** 1. **Structural Damage:** Chronic exposure to cigarette smoke or pollutants leads to the **breakdown of the alveolar walls**. 2. **Surface Area:** When the walls of the alveoli break, the many small "bubbles" merge into fewer, larger sacs. This drastically reduces the total surface area available for the exchange of  $O_2$  and  $CO_2$ . 3. **Result:** Breathlessness and reduced oxygenation of blood.

**Final Answer:** The hallmark of emphysema is the irreversible damage to alveolar partitions.

**Answer: (C)**

Q74.

**Solution**

**Concept:** Some plants do not flower unless they are exposed to a specific period of cold temperatures. This prevents them from flowering during the winter and ensures flowering occurs in the favorable spring.

**Solution:** 1. **Vernalisation:** This is the qualitative or quantitative dependence of plants on exposure to **low temperature** for flowering. 2. **Example:** Winter varieties of wheat and rye are planted in autumn; they undergo a cold period in winter and flower in summer. Biennial plants like carrots and cabbage also require this cold treatment. 3. **Site of Perception:** Unlike photoperiodism (leaves), the site of vernalisation is the **shoot apex** or the embryo of the seed.

**Final Answer:** Vernalisation is a cold-mediated induction of flowering.

Answer: (B)

Q75.

**Solution**

**Concept:** While the bone marrow is the site where RBCs are produced (erythropoiesis), the chemical signal to start this process comes from elsewhere.

**Solution:** 1. **The Kidney:** The **Juxtaglomerular (JG) cells** of the kidney are sensitive to low oxygen levels in the blood (hypoxia). 2. **Erythropoietin (EPO):** In response to hypoxia, the JG cells secrete the peptide hormone erythropoietin. 3. **Action:** EPO travels via the blood to the bone marrow, where it stimulates the proerythroblasts to mature into red blood cells.

**Final Answer:** The kidney acts as the primary oxygen sensor and EPO producer in the body.

Answer: (B)

Q76.

**Solution**

**Concept:** Microbes are used to produce bioactive molecules which have significant medicinal value.

**Solution:** 1. **Monascus purpureus:** This is a yeast used for the commercial production of **Statins**. Statins act by competitively inhibiting the enzyme responsible for the synthesis of cholesterol. 2. **Trichoderma polysporum:** Produces **Cyclosporin A**, an immunosuppressive agent. 3. **Saccharomyces cerevisiae:** Common brewer's yeast used for ethanol production. 4. **Propionibacterium sharmanii:** Used to produce Swiss cheese (large holes due to  $CO_2$ ).

**Final Answer:** Statins are yeast-derived molecules used to manage blood cholesterol.

Answer: (A)



Q77.

**Solution**

**Concept:** During secondary growth in dicot stems, the cork cambium (phellogen) develops to replace the broken outer cortical and epidermal layers.

**Solution:** 1. **Phellogen:** The cork cambium itself. It cuts off cells on both sides. 2. **Phellem (Cork):** Formed on the outer side of the phellogen. These cells are suberized and dead. 3. **Phelloderm (Secondary Cortex):** Formed on the inner side of the phellogen. 4. **Sequence (Out to In):** Phellem (outermost) → Phellogen (middle) → Phelloderm (innermost). Together, these three are called the **Periderm**.

**Final Answer:** The phellogen acts as the generative layer between the cork and the secondary cortex.

Answer: (A)

Q78.

**Solution**

**Concept:** Plant Growth Regulators (PGRs) are small, simple molecules of diverse chemical composition.

**Solution:** 1. **Ethylene ( $C_2H_4$ ):** It is the only PGR that exists in a gaseous state at standard temperatures. 2. **Functions:** It is highly effective in fruit ripening and promotes horizontal growth of seedlings. 3. **Others:** IAA (Auxin),  $GA_3$  (Gibberellic acid), and ABA (Abscisic acid) are all non-gaseous chemical compounds.

**Final Answer:** Ethylene is unique due to its gaseous nature, allowing it to diffuse easily through plant tissues.

Answer: (C)

Q79.

**Solution**

**Concept:** Glucocorticoids (mainly Cortisol) are secreted by the adrenal cortex and are involved in carbohydrate, lipid, and protein metabolism.

**Solution:** 1. **Catabolic Effects:** They stimulate gluconeogenesis (formation of glucose from non-carbs), lipolysis (breakdown of fats), and proteolysis (breakdown of proteins). 2. **Inhibition:** Crucially, they **inhibit** the cellular uptake and utilization of amino acids by peripheral tissues to keep them available for glucose production in the liver. 3. Therefore, Option D is the exception because they decrease uptake rather than stimulate it.

**Final Answer:** Cortisol increases blood sugar levels by promoting catabolism and inhibiting cellular amino acid uptake.

Answer: (D)



Q80.

**Solution**

**Concept:** The process of formation of the female gametophyte is called megagametogenesis.

**Solution:** 1. **Megasporogenesis:** A diploid megaspore mother cell undergoes meiosis to form four haploid megaspores. 2. **Degeneration:** In most angiosperms, three megaspores degenerate and only one remains functional. 3. **Development:** The functional megaspore undergoes three sequential mitotic divisions (without immediate cytokinesis) to form the 7-celled, 8-nucleate Embryo Sac (Female Gametophyte).

**Final Answer:** The embryo sac is the structure derived directly from the functional megaspore.

Answer: (C)

Q81.

**Solution**

**Concept:** The Human Genome Project (1990–2003) was a global effort to sequence the entire human DNA and map all its genes.

**Solution:** 1. **Findings:** Before the project, scientists estimated humans had over 100,000 genes. 2. **The Reality:** The HGP concluded that the human genome contains about **30,000 genes**. 3. **Other stats:** Almost all (99.9%) nucleotide bases are exactly the same in all people. The average gene consists of 3000 bases, but sizes vary greatly (Dystrophin is the largest at 2.4 million bases).

**Final Answer:** The HGP corrected earlier overestimations, placing the gene count at approximately 30,000.

Answer: (B)

Q82.

**Solution**

**Concept:** The human heart is myogenic, meaning the impulse for contraction is generated within the specialized muscular tissue of the heart itself.

**Solution:** 1. **SA Node:** Located in the upper right corner of the right atrium. It generates action potentials at a rate of 70 – 75 per minute without external stimuli. 2. **Function:** It initiates and maintains the rhythmic contractile activity of the heart. This is why it is called the **pacemaker**. 3. **Conductive Pathway:** SA Node → AV Node → Bundle of His → Purkinje fibers.

**Final Answer:** The SA node sets the pace for the entire heart's rhythm.

Answer: (C)



Q83.

**Solution**

**Concept:** Succession is the gradual and predictable change in the species composition of a given area over time.

**Solution:** 1. **Xerarch Succession:** Takes place in very dry areas, such as bare rocks. It progresses from xeric (dry) conditions to mesic (medium moisture) conditions. 2. **Pioneer Species:** On bare rock, these are usually **lichens**, which secrete acids to dissolve rock and form soil. 3. **Hydrarch Succession:** Starts in water bodies (like ponds) and moves towards mesic conditions.

**Final Answer:** Succession on rocks is termed Xerarch.

**Answer: (B)**

Q84.

**Solution**

**Concept:** DNA replication is a complex process requiring high accuracy and a specific suite of enzymes to handle the tightly coiled double helix.

**Solution:** 1. **Helicase:** This enzyme acts like a zipper. It moves along the DNA, breaking the hydrogen bonds between the nitrogenous bases to separate the two strands. 2. **Topoisomerase:** Relieves the tension (supercoiling) created ahead of the replication fork by the unwinding process. 3. **DNA Polymerase:** Adds new nucleotides to the growing strand.

**Final Answer:** Helicase is the enzyme specifically responsible for "unzipping" the DNA.

**Answer: (C)**

Q85.

**Solution**

**Concept:** Respiratory volumes are standard measurements used to assess pulmonary function.

**Solution:** 1. **Tidal Volume (TV):** The volume of air inspired or expired during a normal, relaxed breath. 2. **Value:** In a healthy adult, this is approximately **500 mL**. 3. **Minute Ventilation:** A healthy man can inspire or expire approximately 6000 to 8000 mL of air per minute ( $500 \text{ mL} \times 12 - 16 \text{ breaths/min}$ ).

**Final Answer:** 500 mL is the standard tidal volume for a normal breath.

**Answer: (A)**



Q86.

**Solution**

**Concept:** Proteins are the most diverse biomolecules. Their abundance varies depending on whether we look at the animal kingdom or the entire planet.

**Solution:** 1. **RuBisCO (Ribulose biphosphate carboxylase-oxygenase):** This enzyme is involved in carbon fixation in the Calvin Cycle. Since all photosynthetic plants and many algae contain it, it is the **most abundant protein in the biosphere**. 2. **Collagen:** This is the most abundant protein in the **animal world**, making up connective tissues. 3. **Hemoglobin:** An iron-containing protein in RBCs. 4. **Insulin:** A peptide hormone.

**Final Answer:** RuBisCO's role in global carbon fixation makes it the planet's most prevalent protein.

Answer: (B)

Q87.

**Solution**

**Concept:** The embryo sac of angiosperms contains an "egg apparatus" at the micropylar end, consisting of two synergids and one egg cell.

**Solution:** 1. **Synergids:** These are specialized cells that have finger-like projections at the micropylar tip called the **filiform apparatus**. 2. **Function:** The filiform apparatus plays a crucial role in **guiding the pollen tube** into the synergid by secreting chemical attractants. 3. Once the pollen tube enters, it releases the two male gametes.

**Final Answer:** The filiform apparatus is a specialized structural component of synergids.

Answer: (A)

Q88.

**Solution**

**Concept:** The Hardy-Weinberg principle states that allele frequencies in a population are stable ( $p + q = 1$ ) unless evolutionary forces act upon them.

**Solution:** 1. The binomial expansion of the allele frequencies is:  $(p + q)^2 = p^2 + 2pq + q^2 = 1$ .  
2.  $p^2$ : Frequency of homozygous dominant individuals (AA). 3.  $q^2$ : Frequency of homozygous recessive individuals (aa). 4.  $2pq$ : Frequency of **heterozygous** individuals (Aa).

**Final Answer:** The term  $2pq$  represents the proportion of carriers/heterozygotes in the population.

Answer: (D)



Q89.

**Solution**

**Concept:** An mRNA molecule has several regions. Not all of them are translated into proteins by the ribosome.

**Solution:** 1. **UTRs:** These are sequences that are not translated but are required for efficient translation and mRNA stability. 2. **Position:** They are located at both ends:

- Before the start codon (at the 5' end).
- After the stop codon (at the 3' end).

3. The ribosome recognizes these regions to dock correctly and terminate properly.

**Final Answer:** UTRs flank the coding region at both the 5' and 3' ends.

**Answer: (C)**

Q90.

**Solution**

**Concept:** Connecting links are organisms that possess characters of two different groups, providing evidence for evolutionary transition.

**Solution:** 1. **Archaeopteryx:** A fossil bird from the Jurassic period.

- **Reptilian characters:** Teeth in jaws, long bony tail, claws on fingers.
- **Avian (Bird) characters:** Presence of feathers, wings, and beak.

2. **Others:** *Platypus* is a link between reptiles and mammals; *Latimeria* (Coelacanth) is a living fossil link for fish and amphibians.

**Final Answer:** *Archaeopteryx* is the most famous example of a transition from reptiles to birds.

**Answer: (A)**



## Answer Key

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

