

Quiz 4: Fundamentals of Biology II by Dr. Gaurav Ahuja Date: 26/11/2025

Max Marks = 36 (16 + 20)

Multiple Choice Questions (2 x 8 = 16 marks, 0.5 marks negative)

MCQ 1: Which region of an antibody primarily determines its antigen-binding specificity?

- A. Fc region
- B. Heavy chain constant region
- C. Variable regions of light and heavy chains
- D. Hinge region

MCQ 2: Which hormone is directly released by the anterior pituitary to stimulate the adrenal cortex?

- A. Vasopressin
- B. ACTH
- C. Epinephrine
- D. Thyroxine

MCQ 3: Opening of which channels is mainly responsible for the repolarization phase of an action potential?

- A. Voltage-gated sodium channels
- B. Ligand-gated chloride channels
- C. Voltage-gated potassium channels
- D. Calcium-activated potassium channels

MCQ 4: A sudden reduction in population size due to a natural disaster most directly leads to:

- A. Founder effect
- B. Bottleneck effect
- C. Stabilizing selection
- D. Increased gene flow

MCQ 5: In a phylogenetic tree, what does a node typically represent?

- A. A contemporary species only
- B. A hypothetical common ancestor
- C. A mutation event
- D. A geographic separation

MCQ 6: Which immunoglobulin class is most abundant in blood plasma and provides long-term immunity?

- A. IgA
- B. IgE
- C. IgG
- D. IgD

MCQ 7: Which structure releases CRH (corticotropin-releasing hormone) to initiate the HPA axis response?

- A. Adrenal medulla
- B. Posterior pituitary
- C. Hypothalamus
- D. Pineal gland

MCQ 8: Saltatory conduction occurs specifically in:

- A. Unmyelinated axons
- B. Myelinated axons
- C. Dendrites only
- D. Synaptic terminals

Subjective Questions: Attempt any 4 Questions (5 marks each)

Ques 1: What structural features allow an antibody to specifically recognize an antigen? How do affinity maturation and class switching enhance the precision and strength of the adaptive immune response?

Ques 2: How does the hypothalamus–pituitary–adrenal (HPA) axis coordinate the body's response to stress? What mechanisms ensure feedback regulation of hormone release across these three endocrine tiers?

Ques 3: What molecular events initiate the rapid depolarization during an action potential? How do absolute and relative refractory periods guarantee unidirectional signal propagation along the axon?

Ques 4: What conditions must be met for a population to remain in Hardy–Weinberg equilibrium? How do evolutionary forces such as genetic drift and gene flow alter allele frequencies over generations?

Ques 5: What defines a clade in a phylogenetic tree, and how does it differ from more general branching patterns? How do branch lengths and topology together provide insight into evolutionary relationships and divergence times?