

**L : Zoology****Q.1 – Q.10 carry one mark each.**

- Q.1. From the perspective of developmental origin, which of the following structures is homologous to a tortoise shell?
- (A) Exoskeleton of a lobster                      (B) Bones of a fish  
(C) Skull of humans                                (D) Feathers of birds
- Q.2. Acoelomates are characterized by
- (A) the absence of cavity surrounding the internal organs  
(B) the presence of huge body cavity, as in case of terrestrial animals  
(C) the presence of air sacs, as in case of birds  
(D) the absence of brain in a group of extinct species
- Q.3. Identify the phylum that is characterized by the animals that have segmented appendages.
- (A) Cnidaria    (B) Porifera  
(C) Arthropoda                                        (D) Mollusca
- Q.4. Which one of the following is the smallest biological unit capable of evolving over time?
- (A) A cell    (B) An individual organism  
(C) A population                                      (D) A species
- Q.5. In case of parasites that require multiple hosts to complete their life cycle, what does definitive host mean?
- (A) It is the host that harbors the sexual stages of the parasite.  
(B) It is the host in which the parasite reproduces asexually.  
(C) It is the host in which the parasite feeds.  
(D) It is the host in which the parasite remains in a dormant stage.
- Q.6. Enzymes catalyze biochemical reactions by
- (A) sequestering the product(s)  
(B) decreasing the  $\Delta G$  of the reaction  
(C) increasing the  $\Delta G$  of the reaction  
(D) stabilizing the transition state of the reaction.
- Q.7. Which one of the following results from Mendel's monohybrid cross is the strongest evidence against the blending theory?
- (A) 3:1 ratio of phenotypes in the F1 generation  
(B) All progeny of the F1 generation exhibited the dominant phenotype  
(C) The recessive phenotype showed up in the F2 progeny  
(D) The observation of incomplete dominance
- Q.8. In the context of cell differentiation, lateral inhibition is referred to as the
- (A) formation of two distinct cell types within a uniform field.  
(B) inhibition of formation of a distinct cell type next to an existing cell type.  
(C) inhibition of stem cells towards self-renewal.  
(D) inhibition of erythropoiesis in the lateral plate mesoderm.

- Q.9. As compared to peptide hormones, steroid hormones take more time to activate a cellular response because
- (A) steroid hormones show non-specific binding with diverse sets of receptors.
  - (B) steroid hormone acts through a receptor which is a transcription factor.
  - (C) cells that respond to steroid hormones are dormant in nature.
  - (D) peptide hormones are not transported through plasma while steroid hormones are.
- Q.10. In allopatric mode of speciation, a new species forms due to
- (A) Geographic isolation
  - (B) Genetic drift
  - (C) Formation of a few fertile individuals that can not mate with other members of the same species living in the same geographical area
  - (D) The formation of allopolyploid condition

**Q.11 - Q.20 carry two marks each.**

- Q.11. Neurogen (Ngn) a newly discovered protein in chicken, is produced by the notochord and the floor plate (FP). Ngn induces cells of the neural tube (NT) to become neurons. It is known that from ventral to dorsal direction cells at different levels give rise to distinct types of neuronal cells. Which of the following observations will cast a doubt in the claim that Ngn is a morphogen?
- (A) Ngn is a cytosolic protein
  - (B) Artificial mis-expression of Ngn at identical level through out NT does not affect the neuronal cell types formed in the NT
  - (C) Ngn is an integral membrane protein
  - (D) All of the above
- Q.12. An alien species has been discovered with very similar genetic makeup as that of the existing species on planet earth with certain differences. The genetic material of this new species is referred to as DNA\*. The building blocks of the genetic material is known as Nucleotide\*. The proteins of the new species (Protein\*) is made up of Amino Acids\*.
- It has also been discovered that the new species has 5 distinct Nucleotide\* as opposed to the four for species on planet earth. The new species has 40 different Amino Acids\* as opposed to the 20 for species on planet earth. What should be the codon length for this new species (the same for species of planet earth is 3)? It may be assumed that the average codon degeneracy of the new species is very similar to that of species of planet earth.
- (A) 2                      (B) 3                      (C) 4                      (D) 5
- Q.13. Which one of the following options is NOT a viable strategy for developing a female contraceptive? The administration of
- (A) a combination of synthetic progesterone and estrogen
  - (B) synthetic progesterone alone
  - (C) ormeloxifene – a selective estrogen receptor modulator
  - (D) a synthetic oxytocin
- Q.14. In the field of community ecology, the term "competitive exclusion" refers to two species that cannot co-exist
- (A) in a community if the niches are identical.
  - (B) in two different communities if the niches are identical.
  - (C) if the ecosystem is imbalanced.
  - (D) in the event of a volcanic eruption.

- Q.15. During immune response, helper T-cell memory against the antigen appears earlier than the B memory cells. Which one of the following is the primary reason for this phenomenon?
- (A) Affinity of antibody molecules produced by B cells is weaker than those of T cells
  - (B) B memory cells proliferate at a rate slower than that of T cells
  - (C) B-cell activation requires helper T cells
  - (D) Thymic selection more rapidly enhances the T cell population than B cell population
- Q.16. Oceans have enormous impact on the biosphere. Identify which one of the following factors is NOT influenced by the marine biome.
- (A) CO<sub>2</sub> level in the atmosphere
  - (B) Climatic change in the terrestrial biome
  - (C) pH of the fresh water bodies
  - (D) Oxygen level in the biosphere
- Q.17. Certain lung fishes that live in small stagnant fresh water pools produce urea as a nitrogenous waste. What is the advantage of this adaptation?
- (A) Urea form precipitates and does not accumulate in the surrounding water.
  - (B) Lung fish do not find enough water for production of ammonia and hence the nitrogenous waste is excreted as urea.
  - (C) The excreted urea makes the pool uninhabitable to the predators of the lung fish.
  - (D) Urea requires much less energy for its synthesis than ammonia.
- Q.18. Hamilton's rule measures the probability of whether or not natural selection would favor an altruistic act. Which one of the following statements best explains Hamilton's rule. Natural selection would favor an altruistic act only when
- (A) the receiver and not the altruist is benefited.
  - (B) the receiver is an offspring and NOT a sibling of the altruist.
  - (C) the benefit to the receiver, reduced by the coefficient of relatedness, exceeds the cost to the altruist act.
  - (D) the altruist survives in an altruist act to save his/her related individuals.
- Q.19. In a cross between plants with purple- and white-colored flowers, the following results were obtained in the F1 generation (assume that both varieties are true breeding): 100 plants with white flowers; 150 straw yellow; 200 yellow; 245 greenish yellow; 500 green; 440 light blue; 400 blue; 300 indigo; 253 purple; and 100 dark purple. These data support which one of the following conclusions?
- (A) Flower color in this species does not follow Mendelian inheritance
  - (B) Law of incomplete dominance
  - (C) Colors are co-dominant in this species
  - (D) Flower color in this species is determined by multiple genes
- Q.20. Which one of the following is most crucial for the success of vaccination?
- (A) Antigen presentation by T helper cells
  - (B) Complement system
  - (C) Presence of long-lived antigen-specific lymphocytes
  - (D) Selection of B cells in the lymphoid tissue

**END OF THE QUESTION PAPER**