

## M: Zoology

Q. 1 – Q. 6 carry one mark each.

- Q.1 Which one of the following statements about amino acids is true?
- (A) All amino acids can form hydrogen bonds
  - (B) Only hydrophilic amino acids can form hydrogen bonds
  - (C) Hydrophobic amino acids cannot form hydrogen bonds
  - (D) Amino acids in general do not participate in hydrogen bonds
- Q.2 Biological membranes control flow of information between cells and their environment. Which of the following attributes is true for biological membranes?
- (A) Symmetric
  - (B) Covalent assemblies
  - (C) Fluid structures
  - (D) Electrically depolarized
- Q.3 A “leader sequence” in an mRNA of eukaryotes can be found
- (A) after the “stop” codon
  - (B) between transcriptional start site and translational start site
  - (C) within the first exon
  - (D) in the exon-intron boundaries
- Q.4 Most cells are so small and the constraint in the size could be
- (A) due to the surface-to-volume ratio
  - (B) that the flow of nutrients in larger cells will be much faster and therefore can not be controlled
  - (C) that larger cells might move materials too fast through cytoplasm, leading to inefficient functioning
  - (D) to prevent contacting other cells
- Q.5 Which of the following is a population?
- (A) A spider and flies trapped in its web
  - (B) All the plants that live near each other in a forest
  - (C) The earthworms that live in a grassland plus the earthworm that live in a forest
  - (D) All the sandalwood trees in a forest
- Q.6 Which of the following cells are part of the nonspecific, second line of defense?
- (A) Cytotoxic T cells
  - (B) B cells
  - (C) Prostaglandins
  - (D) Macrophages

**Q. 7 – Q. 24 carry two marks each.**

- Q.7 Mammalian hair evolved from the scales of reptiles. On the other hand, the "hair" on many insects, such as bees, has a completely different origin. These facts mean that the hair of mammals and the hair of insects are
- (A) congruent structures (B) homologous structures  
(C) heterologous structures (D) analogous structures
- Q.8 Rhodopsin is a transmembrane protein belonging to the large family of G Protein-coupled receptors. It is found in the discs of rod cells of human retina. Activation of rhodopsin is due to
- (A) phosphorylation of its extracellular tyrosine residue  
(B) binding of external ligands to its extracellular loops  
(C) photoisomerization of its prosthetic group  
(D) binding of calcium ions to its transmembrane aspartic groups
- Q.9 In an equilibrium population, thousands of eggs and hundreds of tadpoles are produced by single pair of frogs. On average, about how many offspring per pair will live to reproduce in the next season?
- (A) 0 (B) 2 (C) 10 to 20 (D) above 100
- Q.10 A man is admitted to the hospital suffering from an abnormally low body temperature, loss of appetite, and extreme thirst. A brain scan shows a tumor located in the
- (A) hypothalamus (B) cerebellum  
(C) pons (D) right cerebral hemisphere
- Q.11 The British geneticist, J.B.S. Haldane, once jokingly said that he would lay down his life for two brothers or eight cousins. In terms of altruistic behavior, Haldane would do this because
- (A) either two brothers or eight cousins would result in as much representation of Haldane's genes as would two of his own offsprings  
(B) Haldane's death would enhance the fitness of his brothers and cousins  
(C) Haldane loved his brothers and cousins  
(D) none of the above mentioned statements reflect altruistic behavior
- Q.12 An unwound DNA and a supercoiled DNA with the same linking number are
- (A) topologically and geometrically identical  
(B) topologically and geometrically different  
(C) topologically identical but geometrically different  
(D) topologically different but geometrically identical

- Q.13 Evolution is often referred to as speciation. Which is the most correct statement with respect to speciation?
- (A) Inheritance of the gene pool from one generation to the other
  - (B) Origin of new character in a group of geographically isolated individuals
  - (C) Origin of distinct physical identities amongst races which are located in different geographical locations
  - (D) Origin of reproductive isolation amongst the races of a given species
- Q.14 Modern day giraffes are believed to have descended from predecessors with shorter necks. Darwinian theory of survival of fittest would mean the following (select the most likely explanation)
- (A) Giraffes with longer necks were stronger and therefore they out-populated those with shorter necks
  - (B) Long-necked giraffes foraged better and therefore survived better than those with shorter necks
  - (C) Long-necked giraffes bred more than those with shorter necks
  - (D) During certain physical calamity all the short-necked giraffes perished from the face of the earth
- Q.15 Which one of the following choices does NOT correctly pair a biome with some of its characteristics?
- (A) Temperate deciduous forest: cold winters, moderate to high rainfall
  - (B) Grassland: cool to cold winters, dry summers
  - (C) Taiga: Very cold winters, short growing seasons
  - (D) Savanna: long, cold winters, summer thaws of only the upper layers of soil
- Q.16 Uric acid is the nitrogenous waste by birds, insects, and many reptiles. An advantage of excreting uric acid is that it \_\_\_\_\_, but a disadvantage is that it \_\_\_\_\_
- (A) saves water.....costs energy
  - (B) saves energy.....is highly toxic
  - (C) is not very toxic ..wastes a lot of water
  - (D) saves water..... is highly toxic
- Q.17 In animal behavior, the term "imprinting" implies
- (A) Innate behavior of a given animal which is genetically determined
  - (B) Learned behavior which the animals display during various stages of its life
  - (C) A time-dependent form of learning behavior by exposure to sign stimulus
  - (D) None of the above
- Q.18 In a series of immune system experiments, the thymus glands were removed from new born mice. Which of the following would you predict as a likely result?
- (A) The mice suffered from numerous allergies
  - (B) The mice never developed cancerous tumors
  - (C) The mice suffered from autoimmune diseases
  - (D) The mice readily accepted tissue transplants



- Q.19 After eutrophication due to sewage contamination, a lake often becomes inhospitable to fish. Why?
- (A) Sewage input to a lake reduces the penetration of light into the lake, which results in the death of all the fish
  - (B) Sewage is rich in nutrient and hence results in the explosive growth of algal and cyanobacterial populations. This reduces the penetration of light into the lake, which results in the death of all the fish
  - (C) Sewage input to a lake causes explosive growth of algal and cyanobacterial populations. Bacterial decomposition of dead algae and cyanobacteria results in the depletion of oxygen in the water, which leads to the death of all the fish
  - (D) Sewage input causes the death of algae and cyanobacteria, which eventually reduces the availability of food for fish within the lake
- Q.20 A baby is born with the normal number and distribution of rods, but no cones in his eyes. We would expect that the baby's vision would be
- (A) color-blind, easily blinded by bright light, and capable only of coarse resolving power
  - (B) normal on the left side of the visual field but blurred and gray on the right side
  - (C) normal on the right side of the visual field but totally blind on the left side
  - (D) the baby would be totally blind
- Q.21 When body temperature is too \_\_\_\_\_, \_\_\_\_\_ helps to correct the situation because it \_\_\_\_\_
- (A) high,.....peripheral vasodilation,.....dissipates heat at the surface
  - (B) high,.....sweating,....lowers the metabolic rate by dumping toxic ions
  - (C) low,.....shivering,.....lowers the metabolic rate and conserves blood sugar
  - (D) low,....peripheral vasodilation,.....conserves heat in the inner body
- Q.22 Blastomeres derived from early stages of cleavage divisions (say second cleavage division) of frog embryo, when separated, can give rise to viable tadpoles. The blastomeres derived from late cleavage stages, however, fail to develop into normal tadpoles when separated from each other. Which is the most correct statement that explains the phenomenon?
- (A) Each early blastomere carries the entire genetic information for the development of a tadpole
  - (B) Each early blastomere carries the entire cytoplasmic constituents necessary for development
  - (C) Early blastomeres are mirror images of each other
  - (D) None of the above

### Common Data Questions

#### Common Data for Questions 23, 24:

A major breakthrough in animal science research was achieved when the sheep "Dolly" was born to a foster mother. This represents the first case of cloning in mammals.

- Q.23 Dolly was a replica of one of its parents because
- (A) she received mitochondrial DNA from the foster mother
  - (B) she was born out of asexual reproduction
  - (C) she received entire genetic complement from one of her parents
  - (D) she completely resembled one of her parents
- Q.24 Dolly, however, was distinct from her cousin, a transgenic sheep, due to one of the following reasons
- (A) Dolly received stem cells from her parents while her transgenic cousin received only specific gene(s)
  - (B) Dolly was genetically identical to the donor parent while her transgenic cousin was not
  - (C) Dolly phenotypically resembled her donor parent while her transgenic cousin did not.
  - (D) None of the above

**Linked Answer Questions: Q. 25 to Q. 28 carry two marks each.**

#### Statement for Linked Answer Questions 25 & 26:

Hormones coordinate the menstrual and ovarian cycles in human females in such a way that growth of the follicle and ovulation are synchronized with the preparation of the uterine lining for possible implantation of an embryo. Five hormones participate in an elaborate scheme, involving both positive and negative feed-back controls.

- Q.25 The five critical hormones involved in the menstrual and ovarian cycles are
- (A) GnRH, FSH, LH, estrogen and progesterone
  - (B) Prolactin, FSH, LH, MIS and androgen
  - (C) Prolactin, FSH, LH, progesterone and oxytocin
  - (D) GnRH, FSH, LH, estrogen and prolactin

- Q.26 Which one of the following statements is correct in explaining the feed-back control mechanisms regulating the reproductive cycles in human female?
- (A) Whereas a slow rise of progesterone inhibits the secretion of FSH and LH, high concentrations of progesterone have the opposite effect and stimulate the secretion of FSH and LH from the anterior pituitary
  - (B) Whereas a slow rise of estrogen inhibits the secretion of pituitary gonadotropins, high concentrations of estrogen have the opposite effect and stimulates the secretion of gonadotropins by acting on the hypothalamus to increase its output of GnRH
  - (C) Whereas the slow rise of GnRH stimulates the release of LH and FSH, high concentrations of GnRH have the opposite effect and stimulates the secretion of LH and FSH
  - (D) Whereas the lower concentration of prolactin inhibits the secretion of estrogen, higher concentrations of prolactin have opposite effect and stimulates the release of estrogen

**Statement for Linked Answer Questions 27 & 28:**

In the fruit fly, *Drosophila* cinnabar and brown refer to two mutant eye colorations in the adult eye which are otherwise dark brown in the wild type flies. In a genetic cross, mutant male flies with cinnabar eye color were mated with females with brown eye color. Following results were seen in F1 and F2 progeny: all F1 flies displayed wild type eye color while of the 465 F2 progeny derived by intercross of F1 progeny, 274 were wild type, 85 were cinnabar, 95 were brown and finally, 11 flies displayed no eye color (white-eyed).

- Q.27 F1 progeny display wild type eye color due to
- (A) additive effect of two mutations: each mutant version being only part of the wild type eye color
  - (B) complementation between the two mutations since they represent two separate genes
  - (C) lack of complementation between the two mutations since they are on the same eye coloration gene
  - (D) because these mutations represent two different genes which recombine in the progeny
- Q.28 What explains the origin of the new eye phenotype (no eye color – white) in the F2 progeny?
- (A) Genes, mutated in flies showing brown and cinnabar eye colors, are linked
  - (B) These two genes (represented by cinnabar and brown eye colorations) DO NOT display dihybrid ratio
  - (C) The flies displaying no eye color (white) are actually mutant for both cinnabar and brown eye coloration genes
  - (D) Genes mutated for brown and cinnabar eye colorations display segregation distortion

**END OF THE SECTION**