Sri Lankan Biology Olympiad 2018

Instructions:

This paper contains two parts, **A** and **B**.
Part A: 40 multiple choice questions; Total Marks 40.
Part B: 20 short answer questions; Total Marks 100.

Answer All Questions **Time: 2 hours**

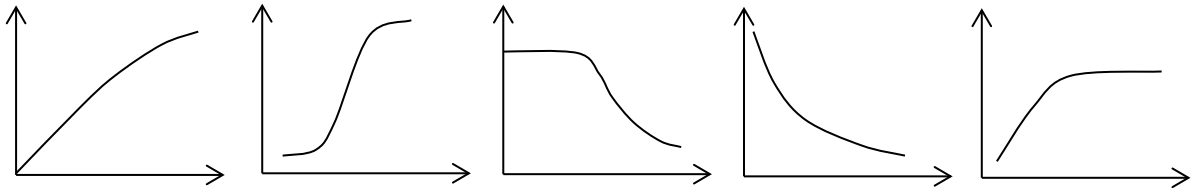
Part A – Multiple Choice Questions

Mark the correct answer with an X on the answer sheet provided

1. Which of the following contain N and P as component elements in addition to C, H and O?
   (1) Haemoglobin and chitin (2) Phopholipids and DNA
   (3) Albumin and inulin (4) Phopholipids and chitin
   (5) RNA and collagen

2. Which of the following is **incorrect** regarding plasma membrane?
   (1) Proteins determine most of its functions.
   (2) Both the phopholipid and protein molecules have hydrophilic and hydrophobic parts.
   (3) Cholesterol molecules are present only in the outer phospholipid layer of the membrane.
   (4) Carbohydrates are involved in the identification of antigens by cells.
   (5) More glycoproteins are present than glycolipids in the membrane.

3. Which of the following graphs represents the changes in substrate concentration with time in a reaction catalyzed by an enzyme?
   (X axis - Time; Y axis – Substrate concentration)



(1) (2) (3) (4) (5)

4. In the prophase of mitosis, a eukaryotic chromosome consists of two chromatids. What is the structure of a single chromatid?

(1) One molecule of single-stranded DNA coiled around protein molecules.
(2) Two molecules of single-stranded DNA coiled around protein molecules.
(3) One double helix of DNA coiled around protein molecules.
(4) Two double helixes of DNA coiled around protein molecules.
(5) Only one DNA molecule.

5. Which of the following statements regarding photosynthesis is correct?

(1) The yield of C4 plants is equal to that of C3 plants.
(2) O_2 is a substrate for PEP carboxylase in C4 plants.
(3) Six cycles are needed for the synthesis of one glucose molecule in Calvin cycle.
(4) Phosphoglycolate formed in photorespiration does not produce PGA.
(5) The number of PGA molecules and the number of PGAL molecules produced in the Calvin cycle are equal to each other.

6. This question is based on the following equation.

$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6H_2O + 6CO_2 + 38\ ATP$$

The process shown by the above equation is

(1) reduction and is endergonic.
(2) reduction and is exergonic.
(3) oxidation and is endergonic.
(4) oxidation and is exergonic.
(5) neither oxidation or nor reduction but is essentially endergonic.

7. Motile gametes are present in

(1) *Allomyces* and *Pogonatum*.
(2) *Nephrolepis* and *Aspergillus.*
(3) *Selaginella* and *Agaricus.*
(4) *Mucor* and *Oryza*.
(5) *Cycas* and Rose.

8. Select the incorrect statement regarding pigments found in organisms.

(1) Phycocyanin is found in Rhodophyta.
(2) Haemocyanin is found in annelids.
(3) Phycoerythrin is found in cyanobacteria.
(4) Haemoerythrin is found in annelids.
(5) Haemoglobin is found in annelids.

9. Which one of the following responses includes only the animals that have internal fertilization?

(1) Liver fluke, centipede, *Hydra*, leech
(2) Tapeworm, *Necator*, shark, crow
(3) Butterfly, prawn, starfish, earthworm
(4) Jellyfish, cockroach, crab, mussel
(5) Spider, *Nereis*, sea urchin, sea anemone

10. Animals with skeletons made up of calcium carbonate are found in which of the following groups?

(1) Reptilia and Polyplacophora
(2) Bivalvia and Hydrozoa
(3) Gastropoda and Ophiuroidea
(4) Crustacea and Scyphozoa
(5) Insecta and Holothuroidea

11. Deficiency of some vitamins contribute to anemia. Select the response which contains three of such vitamins?

(1) Vitamin B_6, Vitamin B_{12}, Folic acid, Vitamin A
(2) Vitamin K, Vitamin E, Riboflavin, Vitamin D
(3) Vitamin B_3, Vitamin B_5, Biotin, Vitamin C
(4) Vitamin B_1, Folic acid, Pyridoxine, Pantothenic acid
(5) Vitamin A, Vitamin D, Vitamin K, Tocopherol

12. If blood progesterone level is very low, which of the following will **not** occur?

(1) Ovulation
(2) Maintenance of thickened endometrium during pregnancy
(3) Contraction of myometrium at child birth
(4) Production of milk
(5) Menstruation

13 Which of the following is **not** found in blood plasma of a normal healthy person?

(1) Dissolved N_2 (2) Haemoglobin (3) Heparin
(4) Histamine (5) Chromium

14. Which of the following is destroyed by HIV?

(1) Lymphocytes (2) Neurons (3) Epithelial cells in vagina
(4) Endometrium (5) Germinal epithelia

15. Which of the following best illustrates the movement of a flagellum?

(1) Bending (2) Undulation (3) Swing
(4) Contraction (5) Streaming of cytoplasm

16. When an arteriole of a person was blocked by a blood clot, a drug was injected. The active substance in this drug is secreted by some cells in the human body. These cells are

(1) red blood cells. (2) macrophages. (3) basophils.
(4) fibroblasts. (5) eosinophils.

17. Due to a tumour, the pancreas of a person was removed. Which of the following he should limit in his diet?

(1) Rice (2) Leafy vegetables (3) Chicken
(4) Fish (5) Curd

18. If the left leg of man was amputated from the hip joint due to an accident, how many bone he has now in his skeleton?

(1) 146 (2) 148 (3) 176
(4) 177 (5) 178

19. Which of the following is **not** a function of cranial bones of man?

(1) Formation of secondary palate (2) Formation of orbit
(3) Protection of middle ear (4) Movement of head
(5) Protection of pituitary

20. A blood clot in the frontal lobe of the human brain will affect

(1) speech. (2) hearing. (3) vision.
(4) memory. (5) homeostasis.

21. In the proximal and distal convoluted tubules of the human nephron

(1) K^+ ions are passively reabsorbed. (2) Cl^- ions are actively reabsorbed.
(3) HCO_3^- ions are actively reabsorbed. (4) Na^+ ions are actively reabsorbed.
(5) amino acids are actively reabsorbed.

22. In the ventral view of the human skull, which one of the following bones **cannot** be seen?

(1) Occipital bone (2) Parietal bone (3) Maxillary bone
(4) Temporal bone (5) nasal bone

23. Which of the following structures is **not** involved in maintaining balance in man?

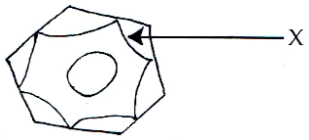
(1) Otoliths (2) Auditory nerve (3) Macula
(4) Cochlea (5) Utricle

24. Two hormones produced by hypothalamus are

(1) LH and FSH. (2) ADH and oxytocin. (3) ACTH and TSH.
(4) Cortisol and GH. (5) Oxytocin and prolactin.

25. Which one of the following is correct regarding the flaccid cell shown in the diagram?

(1) Water potential of X = Water potential of cell
(2) Solute potential of X < Water potential of cell
(3) Solute potential of X > Pressure potential of cell
(4) Water potential of X = Pressure potential of cell
(5) Water potential of X > Pressure potential of cell



26. Which one of the following is **incorrec**t regarding water movement in apoplast pathway in a plant?

(1) Water can enter to apoplast pathway after passing the endodermal cell in root.
(2) Water moves in apoplast pathway through spaces in primary and secondary cell walls and intercellular spaces.
(3) Water movement through the lumen of xylem is considered as a movement through the apoplast pathway.
(4) Rate of water movement in apoplast pathway is greater than that in vacuolar pathway.
(5) Water moves in apoplast pathway as bulk flow and diffusion.

27. Which of the following is **incorrect** regarding phloem tissue?

(1) Companion cells have dense cytoplasm and prominent nucleus at the center.
(2) Between the sieve tube cell and companion cell there are many plasmodesmata.
(3) Sieve tube cell and companion cell are derived from one parent cell.
(4) Phloem tissue is always present outside of the xylem.
(5) Companion cells do not conduct water.

28. Some characteristics of the kingdom Plantae are given below.

A - Monecious gametophyte B – Dominant Sporophyte C - Presence of cuticle

D – Germination of spores before dispersal E – Internal fertilization

Which of the above characteristics could be seen in both *Nephrolepis* and *Selaginella*?

(1) A, B, E (2) B, C, E (3) B, C, D (4) B, C, D, E (5) B, D, E

29. One complete turn of the double helix of DNA contains 10 base pairs and is 3.4 nm long. What is the approximate length of the DNA coding sequence of lysozyme, which is a protein of 129 amino acids?

(1) 132 nm (2) 1290 nm (3) 340 nm (4) 113 nm (5) 12.9 nm

30. Different stages of protein synthesis are given below.

A – Movement of mRNA from nucleus to cytoplasm

B – Linking of adjacent amino acid molecules.

C – Transcription of mRNA from a DNA template

D – Formation of polypeptide chain

E – Attachment of mRNA strand to a ribosome

Which of the following is the correct sequence of events in protein synthesis?

(1) A, C, B, E, D (2) A, E, C, D, B (3) C, A, E, B, D

(4) ` C, D, A, B, E (5) E, A, D, C, B

31. Which one of the following combinations is **incorrect** regarding Non-Mendelian inheritance?

(1) Incomplete dominance – Dominant allele suppresses the expression of recessive allele.

(2) Polyallelism – Many dominant and recessive alleles are in the same locus.

(3) Co-dominance – Two different alleles of the same locus are expressed at the same time.

(4) Polygenic inheritance – Many genes are involved in the expression of one character.

(5) Epistasis – Two genes in different loci are involved in the expression of one character.

32. Which one of the following is correct regarding evolution?

(1) Production of transgenic organisms contributes to increase natural selection.

(2) Population acts as the unit of evolution.

(3) The rate of extinction of species is greater than the rate of speciation.

(4) Genetic variation of plants that show polyploidy is higher than that of sexually reproducing plants.

(5) Overproduction of a species is an evolutionary error.

33. Which of the following statements regarding environment related agreements and Acts is correct?

(1) Transport of solid waste from one country to another cannot be done due to Basel convention.

(2) Recycling of plastics is prohibited in Sri Lanka by the National Environmental Act.

(3) Montreal protocol helps in food security.

(4) Kyoto protocol is associated with reduction of the release of CFCs.

(5) United Nations Framework Convention on Climate Change is called Marpol convention.

34. Select the correct statement.

(1) Leopard is a keystone species in Wilpattu national park.

(2) *Ophicephalus striatus* is an endemic species in Sri Lanka.

(3) Tuatara is an endemic species in Australia.

(4) Flagship species are endemic to a particular country.

(5) Barn swallow is an exotic species.

35. Brief descriptions of three species are given below.

Species A: Lives only in few zoos of the world.

Species B: Lives in oceans and contributes greatly to fisheries industry.

Species C: Lives in oceans and its breeding sites are continuously destroyed by man.

Which of the following indicates the above species in increasing risk of extinction?

(1) B, C, A (2) A, C, B (3) B, A, C

(4) C, B, A (5) A, B, C

36. In an ecosystem, species D is eaten by Species B and E. Species A and B are eaten by Species E and C. Species E is eaten by Species C. In this ecosystem, which species is in the highest trophic level?

(1) A (2) B (3) C (4) D (5) E

37. Which one of the following statements is **incorrect** regarding viral genomes?

(1) Few plant viruses have DNA as their genome.
(2) Bacteriophage viruses have either DNA or RNA.
(3) There are single stranded DNA viral genomes.
(4) There are double stranded RNA viral genomes.
(5) Influenza virus has DNA as its genome.

38. Which of the following 'organism – economic value' combination is **incorrect**?

(1) *Pleurotus* – Sexual reproductive structures used as food.
(2) *Spirulina* – Single cell proteins
(3) *Gluconobacter* – Vinegar production
(4) *Aspergillus* – Lipase enzyme production
(5) *Thiobacillus* – Metal extraction

39. Which one of the following statements regarding non-specific defense in human body is **incorrect**?

(1) Lysozymes in saliva and tear break down bacterial cell walls
(2) Lactoferrin in respiratory tract prevents the growth of bacteria.
(3) HCl in the stomach kills many bacteria in food.
(4) Neutrophils engulf pathogens that enter the circulatory system.
(5) Interferons in blood destroy viruses.

40. Which one of the following statements regarding a waste water treatment plant is correct?

(1) Both activated sludge and trickling filter systems are used in one treatment plant.
(2) Anaerobic bacteria are used in activated sludge system.
(3) Primary outflow is taken out from the bottom of the sedimentation tank.
(4) Sometimes chlorination is carried out before the primary discharge enters in to the secondary treatment.
(5) Both primary and secondary sludge outflows are connected to the sludge digester.