Sri Lankan Biology Olympiad 2017

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 60.
Mark Answers in the Answer Sheet for Part A and B

Answer All Questions **Time: 2 hours**

Part A – Multiple Choice Questions

Mark the correct answer with an '×' on the answer sheet provided

1. What is the predominant protein in human body?
   (1) Actin (2) Tubulin (3) Collagen (4) Elastin (5) Myosin

2. Which one of the following probably evolved first?
   (1) Krebs cycle (2) Oxidative phophorylation (3) Glycolysis
   (4) Electron transport chain (5) Calvin cycle

3. The rate of photosynthesis of a fresh water plant is measured using four special colours. Which sequence of colours would give an increasing photosynthetic response?

   Smallest ——————————> Largest

   (1) Blue, Green, White, Red
   (2) Green, Red, Blue, White
   (3) Red, White, Green, Blue
   (4) White, Green, Blue, Red
   (5) Red, Blue, White Green

4. The structure of the cell organelles is adopted to function within the cell. Which one is correct regarding glandular cell which involve in the secretion of insulin?
   (1) It contains large amount of DNA.
   (2) It contains many rough endoplasmic reticulum.
   (3) It contains many lysosomes.
   (4) It contains many mitochondria.
   (5) It contains many smooth endoplasmic reticulum.

5. After vigorous exercise, changes occur in muscle tissue. Compared with 'at rest' conditions what will the change be?

	Glycogen	ATP	Lactate	PH
(1)	Decreased	decreased	increased	decreased
(2)	Decreased	increased	increased	increased
(3)	Decreased	decreased	decreased	decreased
(4)	Decreased	increased	increased	decreased
(5)	Increased	increased	increased	decreased

6. What is the effect of increasing substrate concentration on the degree of inhibition of an enzyme controlled reactions?

	Competitive inhibition	Non-competitive inhibition
(1)	Decreased	Increased
(2)	Decreased	No change
(3)	Increased	Decreased
(4)	No change	Increased
(5)	No change	No change

7. Select incorrect statement regarding three Domains.

	Feature	Bacteria	Archaea	Eukarya
(1)	RNA Polymerase	One kind	Several kinds	Several kinds
(2)	Membrane lipids	Branched	Branched	Unbranched
(3)	Growth at temperatures > 100^{o}C	No	Some species	No
(4)	Response to streptomycin	Growth inhibited inhibited	Growth not inhibited	Growth not
(5)	Circular chromosome	Present	Present	Absent

8. Which of the following statements regarding the features of protists is incorrect?
   (1) *Amoeba* – heterotrophic, no cell wall
   (2) *Ulva* – reproductive cells flagellate, thalloid plant body
   (3) *Gelidium* – starch as storage food, used in production of Agar
   (4) *Sargassam* – reproductive cells flagellate, alginic acid in cell wall
   (5) Diatoms – unicellular planktons, vegetative cells non flagellate

9. Select correct statement.
All Arthropods contain
(1) cuticle, abdomen without legs, bilateral symmetry
(2) double nerve cord, gonads and ducts, haemocoel
(3) triploblastic body, malphigian tubules, mouth parts
(4) complete alimentary canal, dorsal ganglia, trachea
(5) larval stages, unisexual animals, cilia

10. Some chordate classes and the features shown by each of those classes are given below. Select the **incorrect** "class- features" combination.
(1) Chondrichthyes – two chambered heart, external fertilization
(2) Reptilia - three chambered heart, ossified exoskeleton
(3) Aves – four chambered heart, no larval stage
(4) Mammals – four chambered heart, viviparous or oviparous
(5) Amphibia – three chambered heart, external ear absent

11. Which of the following statements regarding the human digestive system is **incorrect**?
(1) The most posterior salivary gland is the parotid gland.
(2) Oesophagus of a normal healthy man is about 25 cm long.
(3) Pharyngeal cavity is lined by stratified squamous epithelium.
(4) Pyloric sphincter controls the opening between oesophagus and stomach.
(5) Stomach cavity is lined by simple columnar epithelium.

12. Which of the following statements regarding the human respiratory system is correct?
(1) Tracheal cavity is lined by squamous epithelial cells.
(2) Pseudo-stratified columnar epithelium lines the cavity of the bronchus.
(3) Humidity of inspiratory air is increased when passing through the nose and trachea.
(4) Cartilaginous rings are present in trachea.
(5) The air entering the nose passes through the larynx, pharynx, trachea, trachioles, bronchus, and bronchioles respectively.

13. In the human blood circulatory system,
(1) right pulmonary artery transports blood from right ventricle to left lung.
(2) superior vena cava and pulmonary veins contain oxygen poor blood.
(3) the highest blood pressure during systole is in the left auricle.
(4) tricuspid valve is bathed in oxygen poor blood.
(5) Mitral valve is located in the right side of the heart.

14. The amount of urine produced by a healthy adult man may increase when
(1) exercise in outdoor on a dry day.
(2) relative humidity of the atmosphere is low.
(3) a drug which inhibits ADH is taken.
(4) a sedative is taken.
(5) hydrostatic pressure in the Bowman capsule is increased.

15. When a man with the normal vision wears spectacles with concave lenses,
    (1) image is focused in the vitreous humor.
    (2) image is focused on retina.
    (3) image is focused behind the retina.
    (4) image is never focused.
    (5) image is focused in aquous humor.

16. Which one of the following structures may be seen in a cross section of the human brain taken through hypothalamus perpendicular to the vertical axis of the body?
    (1) Corpus callosum (2) Pituitary (3) Cerebellum
    (4) Thalamus (5) Pons Varolii

17. A tumor in the left frontal lobe of the human brain may adversely affect
    (1) memory. (2) speech. (3) hearing. (4) vision. (5) learning.

18. When the blood glucose level In a normal healthy man is 180 mg / 100 ml,
    (1) secretion of cortisol from adrenal cortex is stimulated.
    (2) secretion of glucagon from β cells of pancreas is inhibited.
    (3) secretion of thyroxin from thyroid gland is stimulated.
    (4) secretion of adrenalin from adrenal medulla is stimulated.
    (5) reabsorption of glucose does not take place in the nephron.

19. In the human vertebral column,
    (1) there are 26 vertebrae superior to the sacrum.
    (2) there are eight fused vertebrae.
    (3) inferior end is bent backward.
    (4) the vertebrae that bear the most of the body weight are lumbar vertebrae
    (5) cervical vertebrae have extra articular facets.

20. Select the correct statement regarding bone tissue.
    (1) Its main organic compound is hydroxyapatite.
    (2) Osteoblast contains large number of lysosomes.
    (3) Blood vessels and lymph vessels are present in the Haversian canals found in spongy bone tissue.
    (4) Spongy bone tissue is present in the distal end of humerus.
    (5) White blood cells are mainly produced in yellow bone marrow of long bones.

21. Pelvis of a woman
    (1) is deeper than the pelvis of a man.
    (2) has anterior, posterior and lateral articular surfaces.
    (3) has a pubic angle less than 90^{o}.
    (4) articulates with the 4th lumbar vertebrae.
    (5) is heavier than the pelvis of a man to facilitate the bearing of fetus during pregnancy.

22. Which of the following statements regarding early embryonic development of man is correct?
    (1) Formation of morula starts as soon as the fertilized egg reaches the uterus.
    (2) Morula increases in size with cell division.
    (3) Blastocyst is formed usually during the 4th day after fertilization.
    (4) Implantation takes place during the morula stage.
    (5) Implantation usually takes about one week to complete.

23. Which of the following 'type of reproduction – example' combination is incorrect?
    (1) Binary fission - *Paramecium*
    (2) Multiple fission - *Plasmodium*
    (3) Budding - *Hydra*
    (4) Fragmentation - *Necator*
    (5) Parthenogenesis – Honey bee

24. In one of the following groups, none of the cells undergo meiotic division. Select that group.
    (1) Oogonia, primary spermatocytes, Sertoli cells
    (2) Secondary spermatocytes, follicle cells, Leydig cells
    (3) Primary oocytes, interstitial cells, first polar body
    (4) Germinal epithelial cells, secondary oocyte, oogonia
    (5) Spermatids, spermatogonia, ovum

25. Which of the following plant movements is different from others in terms of their mechanism of movement.
    (1) Growth of rice roots towards the gravity
    (2) Movement of tendrils of cucumber along trellis
    (3) Closure of soyabean leaves during night time
    (4) Growth of shoot apex of bean seedlings towards light
    (5) Movement of pollen tube in the style towards the ovule

26. Which of the following statements regarding plant growth substances is incorrect?
    (1) Effect of gibberellin is antagonistic to the effect of ABA in inducing dormancy
    (2) Auxins promote shoot growth in plant tissue culture
    (3) ABA and cytokinin are transported through xylem
    (4) Ethelene induce flowering and auxins induce fruit growth
    (5) IBA induce roots in stem cuttings while gibberellins elongate stems

27. Select the incorrect statement regarding roots of angiosperm plants.
    (1) Suberin in endodermis cells prevent apoplast movement of water.
    (2) Water moves through pericycle by apoplast and symplast pathways
    (3) Dicot stems have more protoxylem regions in the vascular tissues compared with monocotroots
    (4) In dicot stems, lateral roots are initiated from a tissue layer located inner to endodermis.
    (5) In dicot roots protoxylem vessels are located close to pericycle while metaxylem vessels are located towards the center

28. Which of the following plants have most differentiated archegonium?
(1) *Pogonatum* (2) *Nephrolepis* (3) *Selaginella* (4) *Pinus* (5) *Mangifera*

29. A mutation involving the substitution of one nitrogenous base for another has altered the base sequence of a DNA molecule, coding for amino acids, as shown below
normal A-G-C-A-T-G-G-A-T-C-C-T
mutant A-G-C-A-T-G-C-A-T-C-C-T
The table shows six codons and the corresponding amino acids into which is translated.

mRNA codon	amino acid
AAG	lycine
CUA	leucine
GGA	glycine
GUA	valine
UAC	tyrosine
UCG	serine

The mutation has changed the amino acids
(1) leucine to valine
(2) lysine to glycine
(3) serine to leucine
(4) tyrosine to lysine
(5) valine to serine

30. Heterozygous yellow and round seeded pea plant was intercrossed. In the F1 generation 15 out of 251 pea seed were green and wrinkled. Other seeds were:
yellow and round
green and round
yellow and wrinkled
Which one of the following is correct?
(1) Crossing over has occurred.
(2) Green and winkled seeds are both recessive characters.
(3) The allele for green and wrinkled are linked.
(4) The allele for green is recessive but not the allele for wrinkled.
(5) The allele for wrinkled is recessive but not the allele for green.

31. High number of Thalassemia was recorded in certain area of the country. After 25-30 years later, it was found that the decline of Thalassemia in that area. Which one of the following is the most influence in this decline?
(1) New mutations occur to the Thalassemia allele.
(2) Outbreeding with other non Thalassemia population.
(3) Inbreeding within their community.
(4) Better drugs to combat Thalassemia
(5) Natural selection operates to Thalassemia gene

32. Several methods are needed to identify the desired gene from an organism. Some of the methods are listed below.
a. DNA probes
b. Transfer of DNA to nitrocellulose paper
c. DNA extraction
d. making recombinant plasmids
e. Restriction enzyme digestion

Which one of the following is the most suitable sequence of methods adopted here?

(1) c-d-e –b-a (2) c-e-b-d-a (3) c-e-d-b-a
(4) c-b-d-e-a (5) c-b-a-d-e

33. This diagram illustrates a profile diagram of a particular natural forest in Sri Lanka. The responses indicate some features of forest ecosystems in Sri Lanka. Select the response that does not contain at least one of the features that is not present in the ecosystem shown in the diagram.

(1) Continuous canopy, Stratification, poor undergrowth
(2) Emergents, Sub canopy layer, Buttress roots
(3) Cauliflory, twisted trunks, leaves with drip tips
(4) Lianas, high endemism, leaf litter on the forest floor
(5) Acidic soil, heavy leaching, closed nutrient recycling

34. Which one of the following is not a direct effect of Global warming?

(1) Alter limits of forest and grasslands
(2) Reduce soil organisms responsible for N_2 fixation
(3) Change in rainfall patterns and increase in floods
(4) Increase irrigation demand due to droughts
(5) Increase of forest fires

35. Which of the following statements regarding evolution of and extinction of biodiversity is **incorrect**?

(1) Amphibians, reptiles and conifer trees were present in Carboniferous forests
(2) Vertebrates originated from lobed finned fishes
(3) Dinosaurs and Ammonites became extinct during same period
(4) Dinosaurs appeared in Triassic period
(5) Origin of placental mammals and dominance of flowering plants occur during cretaceous

36. Which one of the following is not a characteristic feature in mangrove tree community.

(1) Thick succulent leaves
(2) Roots with high solute potential
(3) Slit roots with lenticels
(4) Show viviparous for survival
(5) Show adaptations to reduce transpiration

37. Which one of the following the bacteria is not involved in the reactions of N_2 cycle

(1) *Thiobacillus* (2) *Rhizobium* (3) *Nitrococcus*
(4) *Acetobacter* (5) *Clostridium*

38. Which of the following is not an anti microbial substances?

(1) Bile salts (2) Lysozymes (3) Salivary amylase
(4) HCl (5) Lactoferin

39. Which one of the following is **incorrect**?

(1) Only archebacteria can survive in adverse environments.
(2) Nitrogen fixation occurs in anaerobic conditions.
(3) Cyanobacteria use chlorophyll a and chlorophyll b for photosynthesis.
(4) Heterocysts are present in only certain cyanobacteria.
(5) Endospores are present only in certain bacteria.

40. Various steps are used in the waste water treatment plant. The steps given below are in incorrect sequence.

A – Coliform Testing
B – Disinfection
C – Sedimentation
D – Removing sludge
E – Appling activated sludge method

Which of the following represents the correct order of the steps followed in waste water treatment plant?

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

Part B – Short Answer Questions

Indicate whether each of the following statements is correct (✓) or incorrect (×) in the Answer Sheet

1. Indicate whether each of the following statements is correct (✓) or incorrect (×).
   (1) Actin is a globular protein
   (2) Cellulose molecule consists of 1-4 and 1-6 glycosidic links
   (3) There are branched polypeptide chains
   (4) Phospholipid molecule consists of two fatty acid chains.
   (5) The width of the DNA molecule is always 20Å.

2. Indicate whether each of the following statement is correct (✓) or incorrect (×).
   (1) Synaptonemal complex is formed in prophase of meiosis II
   (2) Centrosomes move to opposite poles even in the metaphase
   (3) DNA content of a cell in the G2 phase is 4n
   (4) Mitosis and meiosis take place in gametogenesis in humans
   (5) Reappearance of plasma membrane takes place only in Telophase

3. Indicate whether each of the following statements based on respiration and photosynthesis is correct (✓) or incorrect (×).
   (1) Substrate phosphorylation takes place only in Glycolysis and Kreb's cycle.
   (2) Highest number of ATP is produced in inner membrane of mitochondria.
   (3) Oxidative phospholylation takes place in both respiration and photosynthesis.
   (4) NAD is reduced to NADH only in aerobic respiration.
   (5) Some ATP needed for photosynthesis is taken from cellular respiration.

4. Indicate whether each of the following statements regarding animal phyla is correct (✓) or incorrect (×).

	Platyhelminthes	Annelida	Echinodermata
(1)	Excretion by flame cells and ducts	Excretion by Nephridia	Excretion by Nephridia
(2)	Bisexual	Unisexual or Bisexual	Unisexual
(3)	Internal fertilization	Internal fertilization	External fertilization
(4)	Some have eye spots	Simple eyes	Simple eyes
(5)	No respiratory organs	Some have external gills	Some have external gills

5. Indicate whether each of the following statements regarding plant reproduction is correct (✓) or incorrect (×).
   (1) All seed plants do not have flagellated sperms
   (2) All seed plants do not require external water for fertilization
   (3) All Lycophytes are heterosporous
   (4) In Pterophyta both sporophyte and gametophyte are photosynthetic
   (5) Pterophyta are better adapted to land life compared with Lycophyta

6. Indicate whether each of the following statements regarding the nutrition of man is correct (✓) or incorrect (×).
   (1) When carbohydrates are eaten in excess, glucose is stored mainly in the liver.
   (2) Fats have a supportive function.
   (3) Lysine is an example for a nonessential amino acid.
   (4) One usage of amino acids is forming antibodies.
   (5) During metabolism, highest amount of energy per unit weight is produced by carbohy drates.

7. Indicate whether each of the following statements regarding the blood circulatory system of man is correct (✓) or incorrect (×).
   (1) The first two arteries that arise from the aorta are innominate artery and the left carotid artery.
   (2) A block in the right iliac artery will reduce the blood flow to right kidney.
   (3) Blood from the liver flows to inferior vena cava through hepatic portal vein.
   (4) Blood from aorta to liver and duodenum flows through celiac artery.
   (5) Hepatic portal artery supplies blood to liver.

8. Indicate whether each of the following statements regarding the nervous system of man is correct (✓) or incorrect (×).
   (1) Reflex actions are voluntary actions that are responsible for maintaining homeostasis.
   (2) Some spinal nerves are sensory nerves.
   (3) In man, there are 12 cranial nerves and 31 spinal nerves.
   (4) Cranial nerves, spinal nerves and ganglia form the sympathetic nervous system.
   (5) Some spinal nerves have one root each.

9. Indicate whether each of the following statements regarding human hormones is correct (✓) or incorrect (×).
   (1) Erythropoietin is secreted by bone tissue.
   (2) Biological clock is regulated by the hormones secreted by the pineal body.
   (3) Growth of mammary glands is stimulated by three hormones secreted by placenta.
   (4) Emptying of the stomach is stimulated by hormones secreted by duodenum.
   (5) Secretion of gastric juice is stimulated by secretin.

10. Indicate whether each of the following statements regarding human skull is correct (✓) or incorrect (×).
   (1) There are no movable bones in the skull of an adult man.
   (2) Foramen magnum is surrounded by temporal bones and occipital bone.
   (3) In the front view of the skull, parietal bones are not visible.
   (4) In the lateral view of the skull, external auditory meatus is visible above the zygomatic arch.
   (5) Nasal bones surround the nasal cavity.

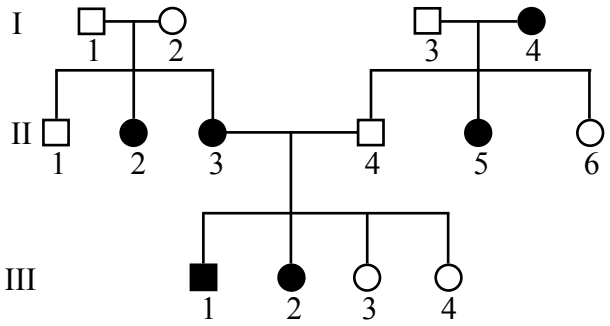
11. Indicate whether each of the following statements regarding human skeleton is correct (✓) or incorrect (×).
   (1) The longest bone in the upper limb is ulna.
   (2) There are eight carpels in the wrist.
   (3) In each upper limb, there are 30 bones.
   (4) In each lower limb, there are 29 bones.
   (5) U shaped dental curve is a human feature.

12. Indicate whether each of the following statements regarding the reproductive system of man is correct (✓) or incorrect (×).
    (1) Testosterone is secreted by the cells located in seminiferous tubules.
    (2) Spermatogenesis of man stops at the age of around 70 years.
    (3) The most amount of semen is produced by the prostate and Cowper glands
    (4) Inhibin produced by testes inhibits the secretion of LH.
    (5) Vas deference stores sperms.

13. Indicate whether each of the following statements regarding photosynthesis of rice and maize plants is correct (✓) or incorrect (×).
    During hot arid conditions,
    (1) CO_2 is fixed only by RuBP carboxylase in rice
    (2) CO_2 is fixed only by PEP carboxylase in maize
    (3) RuBP combines with O_2 in both rice and maize
    (4) oxaloacetic acid is produced in maize
    (5) photohydrolysis of water occurs in both rice and maize

14. Indicate whether each of the following statements regarding plant meristems is correct (✓) or incorrect (×).
    (1) Primary meristems involve in height growth
    (2) Secondary meristems involve in height growth
    (3) Stem vascular cambium is a secondary meristems
    (4) Cork cambium is located in the bark whereas vascular cambium is located between wood and the bark
    (5) Shoot procambium produces exarch collateral xylem bundles.

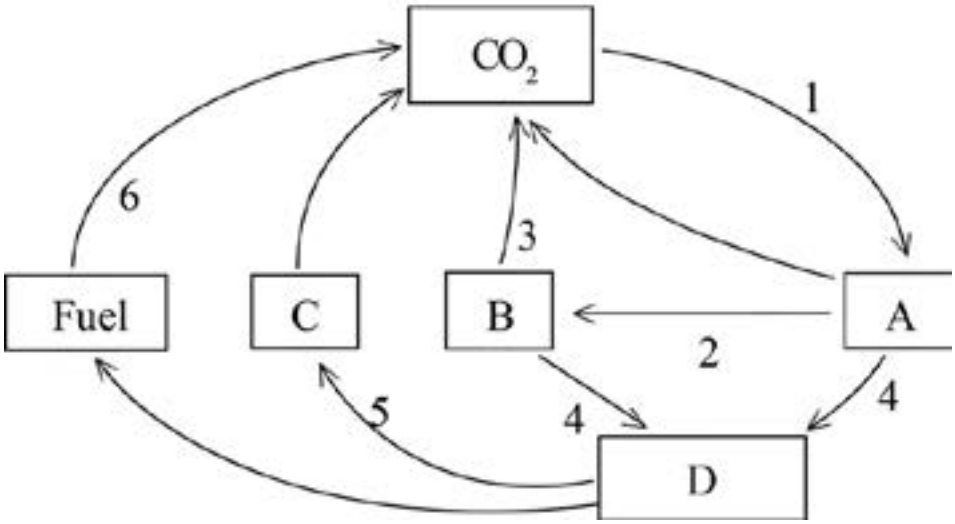
15. The following pedigree shows the inheritance of skin disease.



    Indicate whether each of the following statement is correct (✓) or incorrect (×)
    (1) Both 1 and 2 persons in the first generation are heterozygous.
    (2) 1st person of the second generation is heterozygous.
    (3) This skin disease is due to autosomal dominant.
    (4) 4th person in the second generation is heterozygous.
    (5) 3rd and 4th persons of third generation may be heterozygous or homozygous.

16. Indicate whether each of the following statements regarding protein synthesis is correct (✓) or incorrect (×).
    (1) DNA ligase enzyme is needed for transcription of protein synthesis.
    (2) Transcription takes place in cytoplasm of some cells.
    (3) Transcription of mRNA , tRNA and rRNA from DNA takes place in the nucleus.
    (4) Energy is needed for protein synthesis.
    (5) Many polypeptides can be synthesized using same mRNA molecule.

17. Indicate whether each of the following statements regarding carbon cycle given in the diagram is correct (✓) or incorrect (×).



(1) 2 represents transfer of matter to herbivores and carnivores
(1) 3 and 6 are the contributing factors for Global warming
(1) 4 represents compost production
(1) C contains fungi, bacteria and earthworms
(1) 6 represents inexhaustible, non renewable energy consumption

18. Indicate whether each of the following statements regarding biomes is correct (✓) or incorrect (×).
(1) Taiga – evergreen trees with needle shaped leaves
(2) Tundra - Short season of growth and reproduction
(3) Chaparral – Short deciduous trees with thick bark
(4) Grasslands – Less rainfall compared to forests but higher than deserts
(5) Temperate broadleaved forests – small mammals and birds migrate to warm climatic regions during winter

19. Indicate whether each of the following statement is correct (✓) or incorrect (×) regarding the procedures that are used in destroying microorganisms.
(1) Spore forming bacteria can be destroyed when glass ware are placed in a hot air oven set up at 160^0C.
(2) Certain chemicals act as both anticeptics and disinfectants.
(3) The same anticeptic acts as either bacteriocidal or bacteriostatic depending on the concentration.
(4) Both spore forming and pathogenic bacteria can be destroyed in Pasteurization
(5) Using 0.45μm filters, all microorganisms can be removed.

20. Indicate whether each of the following statements regarding biotechnology is correct (✓) or incorrect (×).
(1) *Agrobacterium* is used to produce single cell proteins.
(2) Innoculating seeds with *Rhizobium* are used in agriculture.
(3) *Glucanobacter* is used in the production of Vinegar.
(4) *Methanococcus* is used for the extraction of metals.
(5) Providing nutrients to target microbes, bioremidation can be done.