

Sri Lankan Biology Olympiad 2015



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.

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 one of the following is **incorrect**?
 1. Triglycerides are non-polar molecules
 2. Glycerol is insoluble in water
 3. Fatty acid is insoluble in water
 4. Glycerol and fatty acids are the products of hydrolysis
 5. Fatty acids are non-polar molecule

2. The following statements describe three orders of structure of the insulin molecule.
 - A. The molecule consists of two polypeptide chains joined and folded around one another
 - B. The sequence and number of amino acids in each polypeptide chain is linear.
 - C. The amino acids in each chain are coiled into a helix and held in position by hydrogen bonds

Which order is described by each statement?

Statement A	Statement B	Statement C
1. Quaternary	Secondary	Tertiary
2. Primary	Tertiary	Secondary
3. Secondary	Tertiary	Primary
4. Quaternary	Primary	Secondary
5. Tertiary	Secondary	Primary

3. Which is the theoretical number of chemically different dipeptides that may be assembled from 12 different amino acids?
 1. 24
 2. 72
 3. 144
 4. 36
 5. 64

4. Five different amino acids (numbered 1-5 below) form the following sequence in part of a polypeptide chain

1 — 2 — 3 — 4 — 2 — 5 — 3

Messenger RNA (m RNA) codons which correspond to these amino acids are

Amino acid 1 UGU

Amino acid 2 GAU

Amino acid 3 CAC

Amino acid 4 UAG

Amino acid 5 AAG

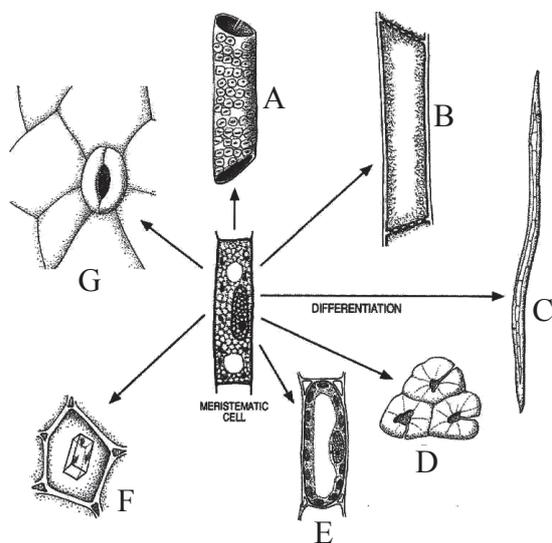
Which one of the following DNA base sequences could provide the code for the given section of polypeptide?

1. A C A C T T G T G A T G C T A T T C G T G
2. A C A C U A G U G A U G C U A U U C G U G
3. A C A C T A G T G A T G C T A A A C G T G
4. A C A C T A G T G A T C C T A T T C G T G
5. C A C A T C U T U C T U A T C T T A U T U

5. Select the mismatched pair

1. SER – Detoxification
2. Lysosomes – Intracellular digestion
3. Mesosomes – Cellular respiration
4. Peroxisomes – Photorespiration
5. Nucleolus – Protein synthesis

6. The following diagram shows representative end products of plant cell differentiation from a meristematic cell



Select **incorrect** statement.

1. B, F, and G are living cells.
2. Differentiation of a meristematic cell into A, B, C and D requires lignin biosynthesis
3. Cell A and B involve in upward movement of materials in plant stem.
4. Cell C, D and E are found as simple tissues.
5. Cell G is present in both terrestrial and aquatic plants

7. Which of the following phyla contains homosporous seedless plants with vascular tissues and photosynthetic gametophytes which are not dependent on the sporophytes?
 (1) Bryophyta (2) Lycophyta (3) Pterophyta
 (4) Cycadophyta (5) Coniferophyta

8. This question is based on the following animals.
 (a) Chiton (b) Squid (c) Snail (d) Mussel

Of the above animals eyes/eye spots and radula are present in

1. (a) and (b) only.
 2. (b) and (c) only.
 3. (a), (b) and (c) only.
 4. (b), (c) and (d) only.
 5. (a), (b), (c) and (d).
9. Central disk, tube feet without suckers and spines are present in which of the following classes of the phylum Echinodermata?
1. Asteroidea
 2. Ophiuroidea
 3. Echinoidea
 4. Holothuroidea
 5. Crinoidea

10. This question is based on the following phyla of the Kingdom Protista.

(a) Chlorophyta (b) Rhodophyta (c) Phaeophyta (d) Chrysophyta

Which of the above phyla has/have Chlorophyll a and c as photosynthetic pigments and cellulose and pectin as components of the cell wall?

1. (a) only
 2. (b) only
 3. (a) and (b) only
 4. (d) only
 5. (a) and (d) only
11. Which of the following enzymes accelerate a reaction where amino acids are **not** produced as an end-product?
1. Chymotrypsin
 2. Aminopeptidase
 3. Dipeptidase
 4. Trypsin
 5. Carboxypeptidase

12. The average values for volume and surface area of the body of fully grown adult animals of five species are given in the following Table.

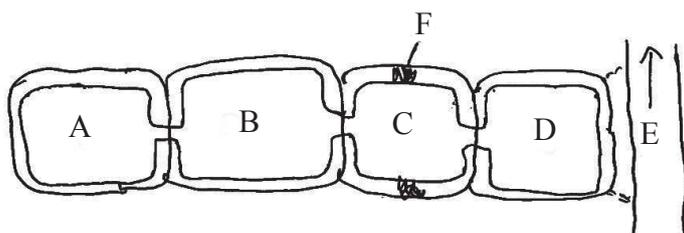
Species	A	B	C	D	E
Average Body volume (m ³)	12	13	8	10	15
Average Surface area of the body (m ²)	28	20	15	19	30

Which of the above animals is most likely to use its body surface for respiratory gas exchange?

1. A
2. B
3. C
4. D
5. E

or cm³?

13. This question is based on the diagram below showing the pathways of water movement from tissue A to E inside the root.



A = Epidermis B = Cortex C = Endodermis D = Pericycle E = Xylem F = Casparian Strip
Select the **incorrect** statement.

- Water movement occurs from tissue D to tissue E through apoplast, symplast and vacuolar pathways.
 - Lowest water potential occurs in tissue A
 - Water and solutes move from tissue C to tissue D
 - Apoplast movement does not occur from tissue C to tissue D
 - Tissue E has a negative pressure potential
14. Sunil's blood group is A⁺. His wife's blood group is B⁻. Their son married a girl with blood group B⁻ and they also have a son. Which of the following could be the blood group of Sunil's grand child?
- A⁺ or O⁻
 - AB⁺ or O⁺
 - B⁻ or A⁻
 - A⁻ or O⁺
 - AB⁻ or B⁻
15. Which of the following hormones helps to maintain Na⁺ and K⁺ balance in the human blood?
- Aldosterone
 - Parathormone
 - Cortisol
 - Adrenaline
 - Thyroxin
16. Which of the following organs secretes hormones that act on skeletal muscles of man?
- Hypothalamus
 - Parathyroid
 - Pancreas
 - Posterior pituitary
 - Adrenal medulla
17. One of the main functions of the thalamus of man is
- controlling body temperature.
 - involving in learning.
 - controlling voluntary muscle movement.
 - controlling blood pressure.
 - integrating sensory information.
18. Which of the following is the correct sequence of transmitting sound waves in air to the Organ of Corti in the human ear?
- Tympanic membrane - Incus - Malleus - Stapes - Oval window - Endolymph - Cochlear membrane
 - Tympanic membrane - Malleus - Incus - Stapes - Round window - Endolymph - Cochlear membrane - Perilymph
 - Round Window - External auditory meatus - Tympanic membrane - Incus - Malleus - Stapes - Endolymph - Cochlear membrane
 - Ear lobe - Temporal bone - Tympanic membrane - Ear ossicles - Round window - Perilymph - Endolymph
 - Tympanic membrane - Malleus - Incus - Stapes - Oval window - Perilymph - Cochlear membrane - Endolymph

19. Which of the following statements regarding the human kidneys is correct?
1. Left kidney is located closer to the anterior body wall than to the posterior body wall.
 2. They are located at the level of the lumbar and sacral vertebrae.
 3. Structural units of the kidneys are Juxta-cortical and medullary nephrons.
 4. Cortical tissue is present among the renal pyramids.
 5. Cortex has a striated appearance due to the presence of renal pyramids.
20. Which of the following processes can be seen most posteriorly in the human skull?
1. Mastoid process
 2. Condylod process
 3. Styloid process
 4. Coronoid process
 5. Zygomatic process
21. In a sarcomere, both actin and myosin filaments can be seen in the
1. H Zone.
 2. I Band.
 3. A Band.
 4. M Line.
 5. Z Line.
22. Which of the following statements regarding the bones associated with the thoracic cage of man is **incorrect**?
1. It has 12 pairs of ribs.
 2. Ribs articulate with the sternum through costal cartilages.
 3. Clavicle articulates with sternum.
 4. Thoracic cage consists of 37 bones.
 5. During inspiration ribs forming the thoracic cage are lifted upwards.
23. Direction of stimulus does not affect the direction of response in,
1. Opening and closing of *Sesbania* leaves
 2. Movement of pollen tube through style
 3. Upward Growth of plant stems
 4. Growth of plant tendrils
 5. Growth of sporangiospores in fungi
24. Which of the following statements regarding the hormones produced during pregnancy is correct?
1. Progesterone is produced from the placenta from the 12th week of gestation.
 2. Progesterone stimulates the formation of oxytocin receptors in the uterus.
 3. Immediately before the birth, there is an acute rise in progesterone level.
 4. Oxytocin stimulates the production prostaglandins from the placenta.
 5. Oxytocin is produced by the placenta stimulates the contractions of myometrium.
25. Which of the following is in the optimum range of temperature for the production of sperms in man?
- (1) 31°C (2) 33°C (3) 35°C (4) 37°C (5) 39°C
26. Presence of which of the following hormones in blood is used in early detection of pregnancy in women?
1. hCG
 2. Oestrogen
 3. Progesterone
 4. LH
 5. FSH

27. Which of the following is **incorrect**?

Meiosis occurs,

1. inside pollen grains in angiosperm plants
2. inside ovules in gymnosperm plants
3. inside sporangium in mosses
4. in the formation of megaspores in *Selaginella*
5. in the formation of sperms in human male

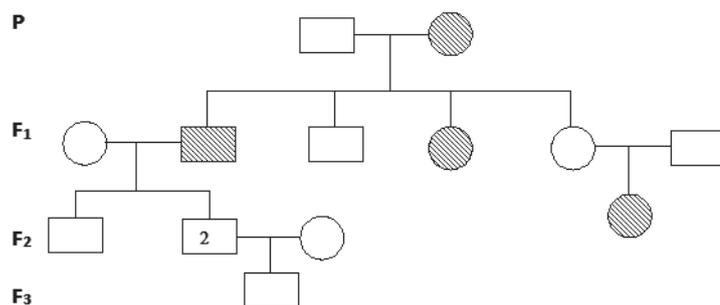
28. Alternation of generations and related structures are homologous across plant taxa. Based on this fact, which of the following structures is homologous to *Cycas* endosperm?

1. Endosperm of Angiosperms
2. Prothallus of *Nephrolepis*
3. Male gametophyte of *Selaginella*
4. *Cycas* embryo
5. *Pogonatum* sporophyte

29. Natural selection acts directly on

1. Phenotype
2. Genotype
3. Allele
4. Entire genome
5. Community

* Answer the 30 and 31 questions based on the pedigree given below for biochemical disorder known as alkaptonuria. Affected individuals are unable to break down a substance called alkapton, which colours the urine black and stains body tissues.



30. What is the pattern of inheritance?

- (1) Sex-linked dominant
- (2) Sex-linked recessive
- (3) Autosomal dominant
- (4) Autosomal recessive
- (5) Holandric

31. What is the genotype for person no.2?

- (1) Aa
- (2) AA
- (3) aa
- (4) X^aY
- (5) X^AY

32. Various steps involved in the DNA finger printing technique are given below in an incorrect sequence.

- | | |
|----------------------------------|--|
| A – Gel electrophoresis | B – DNA extraction |
| C – Hybridization with probes | D – Put on X –ray film on nitrocellulose paper |
| E – Restriction enzyme digestion | |

Which of the following represents the correct order of the steps in DNA finger printing?

1. B A E C D
2. B E C A D
3. B E A C D
4. B C E A D
5. B A C E D

33. Which of the following organisms represent the Not Evaluated, Least Concerned and Data Deficient categories of the IUCN red data book in correct order?
- (1) Tailor ant, *Mystus keletius*, *Melanocheilus trijuga*
 - (2) Rock terrapin, *Chloroxylon swietenia*, *Crocodylus palustris*
 - (3) Satinwood, Marsh crocodile, Yellow catfish
 - (4) Marsh crocodile, Satinwood, Rock terrapin
 - (5) Yellow catfish, *Oecophyla smaragdina*, Satinwood
34. Of the following groups of organisms, which appeared on earth first?
1. Insects 2. Mollusks 3. Crustaceans
 4. Echinoderms 5. Arachnids
35. The largest accumulation of phosphorus in the biosphere is
1. sedimentary rocks. 2. soil. 3. ocean water.
 4. fresh water. 5. organisms.
36. Primordial soup was most probably present
1. 6.5 – 5.5 billion years ago. 2. 5.5 – 4.5 billion years ago.
 3. 4.5 – 3.5 billion years ago. 4. 3.5 – 2.5 billion years ago.
 5. 2.5 – 1.5 billion years ago.
37. Select the **incorrect** statement.
1. *Aspergillus niger* is used in the production of starch digesting enzyme
 2. Production of vinegar from alcohol is caused by *Acetobacter aceti*
 3. *Thiobacillus ferrooxidans* is a chemoautotrophic bacterium
 4. *Bacillus thuringiensis* (Bt) strains have been used for designing Bio-fertilizers
 5. *Agrobacterium tumefaciens* produces weedicide resistant protein.
38. The presence of high coliform counts in water indicate
- a. contamination by human wastes.
 - b. phosphorus contamination.
 - c. decreased biological oxygen demand.
 - d. hydrocarbon contamination.
 - e. possibility of a *Shigella* poisoning
- Select correct statements
1. a only 2. a and e only 3. a, c and e only
 4. e only. 5. a, b, c and e only
39. Select **incorrect** statement
1. *Salmonella* produces enterotoxin and endotoxin
 2. *Salmonella* and *Clostridium* cause food poisoning
 3. Botulism can be prevented by low temperature treatment before canning
 4. Fruits are likely to be spoiled by yeast
 5. Sugary foods are likely to be spoiled by xerophilic yeast
40. Which of the following chemicals are **least likely** to be produced by Soil microorganisms
1. IAA 2. CO₂ 3. Polysaccharides 4. Ammonium 5. ethylene