Index Number :

Sri Lankan Biology Olympaid 2013

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. Marks for each question is given with the question.

Answer All Questions in the ANSWER SHEET]
Time: 2 hours

Part A – Multiple Choice Questions

1. In G2 phase of the cell cycle.
   1. The homologous chromosomes are lined up on the equator.
   2. The homologous chromosomes have been pulled to their respective poles by the spindle apparatus.
   3. The homologous chromosomes have not been replicated yet.
   4. The homologous chromosomes are now in the haploid or n condition.
   5. 92 chromatin threads can be seen in the human somatic cell.

2. Select the correct statement about photosynthesis.
   1. Photophosphorylation occurs only in Photosystem II
   2. The essential initial role of light in initiating the light reaction of photosynthesis is to produce free oxygen.
   3. In a plant cell, the ATP synthase complexes are only located in the thylakoid membrane.
   4. Photosystem II is required for cyclic photophosphorylation.
   5. Photolysis of water is required for Photoreduction.

3. Select the correct statement regarding the cell membrane of animal cells
   1. Hydrophilic ails are oriented towards the interior of the cell membrane.
   2. Fatty acids present in the membrane do not have double bonds.
   3. Once phospholipids are incorporated they remain in the cell membrane permanently.
   4. Proteins are randomly distributed inside the bilayer.
   5. Phosholipids are not branched.

4. NADP, NAD, ATP and coenzyme A contain,
   1. A pyrimidine ring
   2. A three ring structure
   3. ADP
   4. Deoxyribose
   5. A triphosphate group

5. Which of the following is **incorrect** regarding the metabolic role of tricarboxylic acid (TCA) cycle?
   1. Completes carbohydrate oxidation in aerobic respiration
   2. Supplies metabolic precursors for biosynthesis of some amino acids
   3. Supplies NADH for the respiratory chain
   4. Liberates CO_2 from organic compounds
   5. Production of ATP

6. Fibre types forming the cytoskeleton can be correctly named as.
   1. tubuline, lignin, actin
   2. microtubules, myosin, microfilaments
   3. keratin, myosin, actin
   4. microfilaments, intermediate filaments, microtubules
   5. actin, myosin, intermediate filaments

7. B-lymphocytes in human blood produces and secretes antibodies. Which structures of its protoplast should therefore be very well developed?
   1. Only the smooth endoplasmic reticulum
   2. Only the smooth endoplasmic reticulum and the Golgi apparatus
   3. Only the rough endoplasmic reticulum and the lysosomes
   4. Only the rough endoplasmic reticulum and the Golgi apparatus
   5. Rough endoplasmic reticulum, the Golgi apparatus and the lysosomes

8. Archaea (Archaebacteria) is closer to the eukaryotes in the classification. What is the most reasonable explanation for this statement?
   Archaebacteria
   1. have single-stranded DNA
   2. have introns
   3. do not have cell walls
   4. have chromosomes with no protein binding
   5. have one type of RNA polymerase

9. Cyanobacteria can be found as small rocks in shallow waters of some parts of the world. These fossilised cyanobacteria are thought to be important because they are suggestive of:
   1. the origin of earth.
   2. the origin of photo-autotrophy.
   3. oxidation of iron in oceans.
   4. the appearance of the ozone layer in the atmosphere.
   5. the origin of life.

10. Which of the following animals would have the largest value for "length of loop of Henle/ length of nephron"?
    1. Elephant
    2. Otter
    3. Rat
    4. Tilapia
    5. Camel

11. This question is based on the following structures.
    A: Ear B: Ruffini corpuscles C: Statocysts D: Meisner's corpuscles
    Which of the above structures carry out similar functions?
    1. A and B
    2. A and C
    3. B and C
    4. B and D
    5. C and D

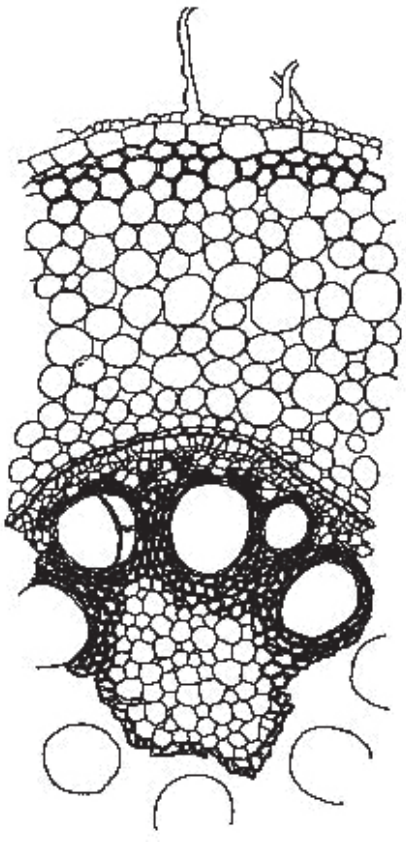
12. From a shop which sells fossils, a student bought the following.
    A: Fossilized tooth of a Dinosaur B: Fossilized scale of *Latimeria*
    C. Fossilized shell of a lamp shell D: Fossilized Ammonite
    E: Fossilized Trilobite
    Which one of the above could be the oldest?
    1.A 2. B 3. C 4. D 5. E

13. Which of the following are found in the cell wall of flowering plants?

I. apoplast	IV microtubules	VII lignin
II. mircofilaments	V keratin	VIII protein
III. microfibrils	VI chitin	IX suberin

    1. I, III, VII, IX,
    2. II, V, VII, VIII,
    3. III, IV, V, VIII
    4. II, VI, IX
    5. I, III, V, VI

14. The figure shows the cross-section of a plant structure. Select the correct morphological, anatomical, systematical and ecological features associated with this structure.

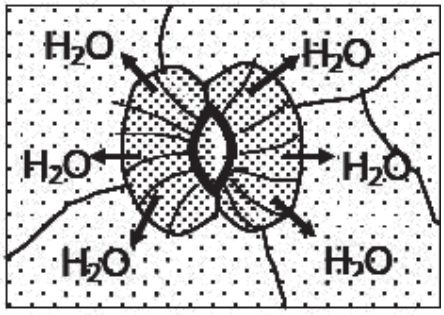


    I. stem
    II. root
    III. leaf stalk
    IV. dicotyledon
    V. monocotyledon
    VI. swamp or water plant
    VII. terrestrial plant

    1. I, IV, VI 2. II, V, VI
    3. II, V, VII 4. II, IV, VII
    5. III, IV, VII

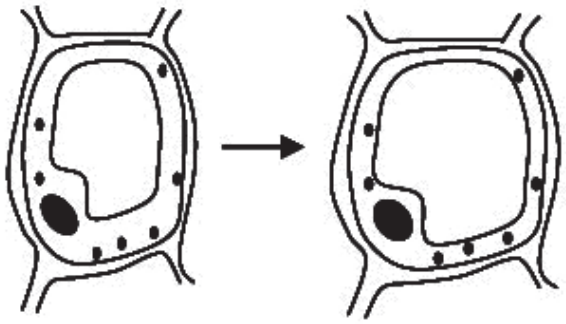
15. Meiosis occurs in
    1. formation of spores in *Mucor*
    2. division of zygote in *Nephrolepis*
    3. formation of male nuclei in *Oryza*
    4. formation of Embryo sac in Oryza
    5. formation of male gametes in *Pogonaturm*

16. The diagram illustrates closing of stomata. Dots represent K^+ ions.
    Select the mistake in this diagram.



    1. Water should move into the cell
    2. Outer wall of the guard cells should be thick
    3. Microfibrils should be located parallel to the long axis of the cells
    4. K^+ concentration should be higher outside the cell.
    5. Subsidiary cells should be present

17. Morphology of a plant cell after immersing in a solution named "A" is shown below. Select the correct statement regarding the cell and the solution.



    1. Water potential of solution A is lower than that of the cell
    2. Solution A cannot be water
    3. Pressure potential of solution A is lower than that of the cell
    4. Pressure potential of the cell has decreased after immersion in the solution
    5. Water potential of the cell is equal to solute potential

18. *Selaginella* is better adapted to land life compared to *Pogonatum*. What is the most accurate explanation for this?
    1. *Selaginella* has well developed xylem tissue
    2. *Selaginella* shows heterospory
    3. Sporophyte is dominant in *Selaginella* whereas gametophyte is dominant in Pogonatum
    4. External water is required for fertilization of *Pogonatum*
    5. *Seleginella* spores are dispersed by air under dry conditions

19. Which of the following statements regarding the nutritional needs of plants is **incorrect**?
    1. Phosphorous is absorbed in the form of $H_2PO_4^-$.
    2. Sulphur is important because it is an element constitutive of coenzyme A.
    3. Molibdinum is important for Nitrogen fixation.
    4. Potassium is important for stomatal opening.
    5. Plants have no need of trace elements such as Manganese and Zinc.

20. Which of the following descriptions are correct regarding plant cork layer?
    A. This is present in stems and roots of angiosperms and gymnosperms
    B. This is formed by vascular cambium
    C. This is located outside primary and secondary phloem in stems and roots
    D. Cork cells contain storage starch
    E. Mature cork cells are dead cells

    Correct statements are

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

21. If person got a severe blow on the left side of forehead in an accident, which one of the following activities would have been severely affected?

    1.Balance 2. Speech 3. Vision 4. Hearing 5. Memory

22. This question is based on the following vitamins.

    P. Vitamin K Q. Folic acid R. Vitamin E S. Biotin T. Thiamine

    Which of the above vitamins are produced by the mutualistic bacteria in the human intestine?

    1. P and Q only 2. P and T only 3. P, Q and S only
    4. Q, R and S only 5. R and T only

Question Nos 23 and 24 are based on the following groups of elements required by man.

A. Mg, Cu, Cl, Zn
B. Ca, P, Na, Fe
C. Fe, N, S, Se
D. Cr, Zn, Mn, I
E. F, Ca, Na, S

23. Which of the above groups contain only the trace elements required by man?

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

24. Which of the above groups contain only the elements required for enzyme activation?

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

Question **Nos. 25 and 26** are based on the diet of five species of fish given below.

Species	**Diet**
A	Zooplankton
B	Phytoplankton
C	Submerged aquatic plants
D	Fish
E	Crustaceans

25. Which of the above species has the highest gut length/body length ratio?
    1. Species A 2. Species B 3. Species C 4. Species D 5. Species E

26. Which of the above species is most likely to have canine like teeth?
    1. Species A 2. Species B 3. Species C 4. Species D 5. Species E

27. The actions of five drugs are as follows.

Drug	**Action**
A	Inhibits the production of renin
B	Inhibits the re-absorption of sodium ions in the kidneys
C	Inhibits the production of aldosterone
D	Inhibits the production of angiotensin II
E	Inhibits the secretion of ADH

    Which of the above drugs may reduce hypertension?
    1. A only 2. A and B only 3. A, B, C and E only
    4. A, B, C, and D only 5. B, C and D only

28. Select **incorrect** statement regarding Rhizobacteria.
    1. They live on root secretions
    2. They form a commensalistic association with plant roots
    3. They produce Gibberelic acid
    4. They produce chemicals that inhibit growth of plant pathogens
    5. They are not plant pathogens

29. Select **incorrect** statement regarding the comparison of endotoxins and exotoxins

	Exotoxins	Endotoxins
1.	Heat unstable	Heat stable
2.	Proteins	Lipopolysaccharide
3.	Not a component of the cell	Components of the cell wall
4.	Affect activity of host cells	Affect activity of host cells
5.	Causes tetanus	Causes diphtheria

30. What is a prion?
    1. A protein
    2. Infectious RNA without a protein envelope
    3. DNA sequence which serves as a template for primer RNA
    4. An early eukaryote free of mitochondria
    5. Infectious agent of some plant diseases.

31. Select correct statement regarding fungi.
    1. All fungi are terrestrial organisms
    2. Fungi do not contain motile spores
    3. Meiosis occurs immediately after nuclear fusion
    4. Sexual and asexual spores of asocmycota fungi are formed inside sporangium
    5. Basidiomycota fungi have branched, dikaryotic, septate hyphae throught their life cycle

32. Which of the following shows the highest genetic variation in a population

(1) Cystic fibrosis (2) Polydactyly (3) Colour of iris
(4) Sickle cell anemia (5) Albinism

33. The following events occur in the replication of DNA

A – Bonds between complementary bases break
B – Bonds between complementary bases form
C – DNA molecule uncoils
D – Opposite strands separate
E – Sugar-phosphate bonds form
F – Free nucleotides align with complementary nucleotides on each strand

In which order do these events take place?

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

34. Listed below are some amino acids and their corresponding base mRNA triplets

Amino acid	**mRNA base triplet**
Phenylalanine	UUU
Lysine	AAG
Arginine	CGA
Alanine	GCA

Which DNA sequence would be needed to produce the polypeptide sequence alanine-arginine-lycine-phenylalanine?

(1) CGT GCT TTC AAA (2) CGT GCT TTC TTT
(3) CGU GCU UUC AAA (4) CGU GCU UUC TTT
(5) GCT CGT TTC AAA

35. Five stages in the production of human insulin by genetic engineering techniques are given.
(Insulin gene is extracted from mRNA molecules in human pancreas)

A – Plasmid DNA is cut with restriction enzymes
B – DNA copy is made using reverse transcriptase
C – Messenger RNA is extracted from cells.
D – Plasmid DNA is joined to donor DNA using ligase enzymes
E – Recombinant plasmid is inserted into bacteria cell

Which of the following sequences is correct?

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

36. Which of the following is a noninvasive exotic species?

1. *Chitala ornata* 2. *Ophicephalus striatus* 3. *Caryota urens*
4. *Camelia sinensis* 5. *Parthenium hysterophorus*

Question Nos 37 and 38 are based on the following gases.

A: Carbon dioxide B: Methane C: Sulphur dioxide
D: Chlorofluorocarbons E: Oxides of nitrogen F: Carbon monoxide

37. Which of the above contribute most to the greenhouse effect?

1. A and B
2. A and C
3. A, B and C
4. A, B, C and F
5. A, C, D and E

38. Which of the above contributes most to the acid rains?

1. A, B and D
2. B, C and D
3. C, D and E
4. C and E
5. D and F

39. This question is based on the following ecosystems.

A: deserts
B: Montane forests
C: Mangroves
D: Dry mixed forests
E: Thorn forests

Presence of plants with fleshy leaves is a distinctive characteristic of which of the above ecosystems?

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

40. Which of the following is **not** an environmental impact of agricultural activities?

1. Soil erosion
2. Soil salination
3. Loss of habitats
4. Acid rains
5. Global warming

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Answer Sheet

Please handover this part to the Invigilator.
Only Part A is allowed to move out of the examination hall.

Part A - Multiple Choice Questions

Mark the correct response with a cross (x)

1. (1) (2) (3) (4) (5)
2. (1) (2) (3) (4) (5)
3. (1) (2) (3) (4) (5)
4. (1) (2) (3) (4) (5)
5. (1) (2) (3) (4) (5)
6. (1) (2) (3) (4) (5)
7. (1) (2) (3) (4) (5)
8. (1) (2) (3) (4) (5)
9. (1) (2) (3) (4) (5)
10. (1) (2) (3) (4) (5)
11. (1) (2) (3) (4) (5)
12. (1) (2) (3) (4) (5)
13. (1) (2) (3) (4) (5)
14. (1) (2) (3) (4) (5)
15. (1) (2) (3) (4) (5)
16. (1) (2) (3) (4) (5)
17. (1) (2) (3) (4) (5)
18. (1) (2) (3) (4) (5)
19. (1) (2) (3) (4) (5)
20. (1) (2) (3) (4) (5)
21. (1) (2) (3) (4) (5)
22. (1) (2) (3) (4) (5)
23. (1) (2) (3) (4) (5)
24. (1) (2) (3) (4) (5)
25. (1) (2) (3) (4) (5)
26. (1) (2) (3) (4) (5)
27. (1) (2) (3) (4) (5)
28. (1) (2) (3) (4) (5)
29. (1) (2) (3) (4) (5)
30. (1) (2) (3) (4) (5)
31. (1) (2) (3) (4) (5)
32. (1) (2) (3) (4) (5)
33. (1) (2) (3) (4) (5)
34. (1) (2) (3) (4) (5)
35. (1) (2) (3) (4) (5)
36. (1) (2) (3) (4) (5)
37. (1) (2) (3) (4) (5)
38. (1) (2) (3) (4) (5)
39. (1) (2) (3) (4) (5)
40. (1) (2) (3) (4) (5)

Part B – Short Answer Questions

Please answer in the spaces provided. Please use given letters, numbers or symbols only.

1. A cell produces and secretes a certain protein. Select from the list only those structures which are involved in these processes, to our present knowledge. (List the numbers in the correct order of the processes).

1. peroxisome	2. ribosome	3. golgi apparatus
4. secretory vesicle	5. plasma membrane	6. vacuole
7. rough endoplasmic reticulum	8. lysosome	9. transport vesicle

Correct order of Structures:.....

2. Which of the following statements are correct regarding anaphase I of meiosis and anaphase of mitosis? Write the correct numbers from the list below, in the spaces given against the phase. Pay attention to the fact that chromatides are subunits of chromosomes
   1. Chromosomes move to the poles.
   2. Single chromatids move to the poles.
   3. The moving chromosomes consist of two chromatids.
   4. The chromosomes can carry two alleles of a gene.
   5. One haploid set of chromosomes can move to each pole.
   6. There are four spindle poles per cell.

. 1. anaphase I of meiosis: .....
   2. anaphase of mitosis: .....

3. An animal was found to have a protrusible pharynx and two eye spots. Of the following characters indicate which are possessed by this animal by a " ✓ " sign and indicate those which are not possessed by this animal by a "X" sign.

Segmentation	
Fragmentation	
Cephalization	
Hermoproditism	
External fertilization	
Larval stages	

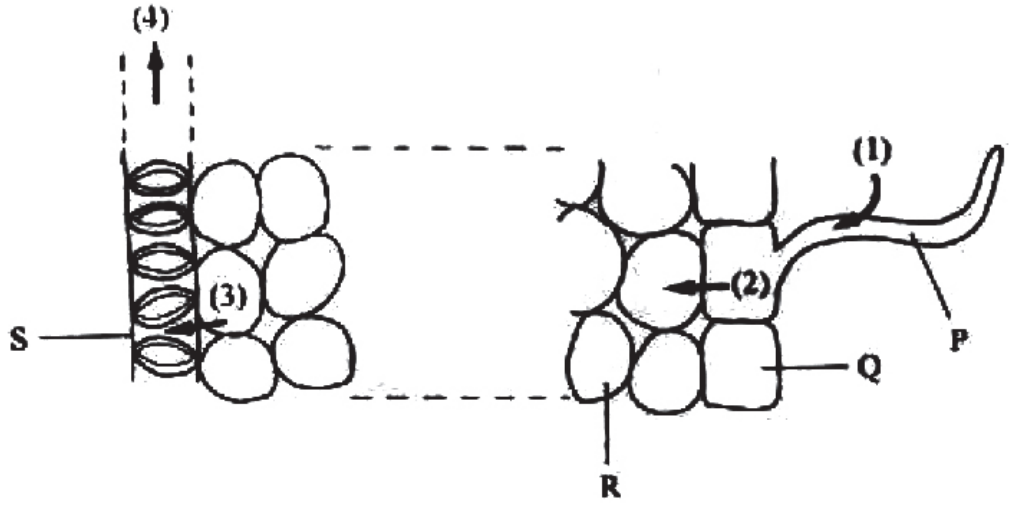
4. Indicate the type of cell division involved in the organ/cell formation and the ploidy of the cells. Use I for mitosis and II for meiosis

Organ / Cell	Type of cell division	Ploidy of cells
Endosperm of angiosperm		
Pollen grain		
Egg of angiosperm		
Spore of moss		
Protonema		
Sperm of moss		
Fern gametophyte		
Spore of fern		
Egg of fern		

5. Match Plant Growth substances with their functions. Indicate the correct answer(s) with a tick (✓) and incorrect answer(s) with a cross (×).

Function	Ethylene	ABA	Auxin
1. promote lateral bud growth			
2. promoting stomatal closure			
3. promote fruit ripening			
4. apical dominance			
5. delay Aging			
6. initiate seed dormancy			
7. promote cell extension			

Question Nos 6 and 7 are based on the following diagram which illustrates the transport of substances from root to leaves.



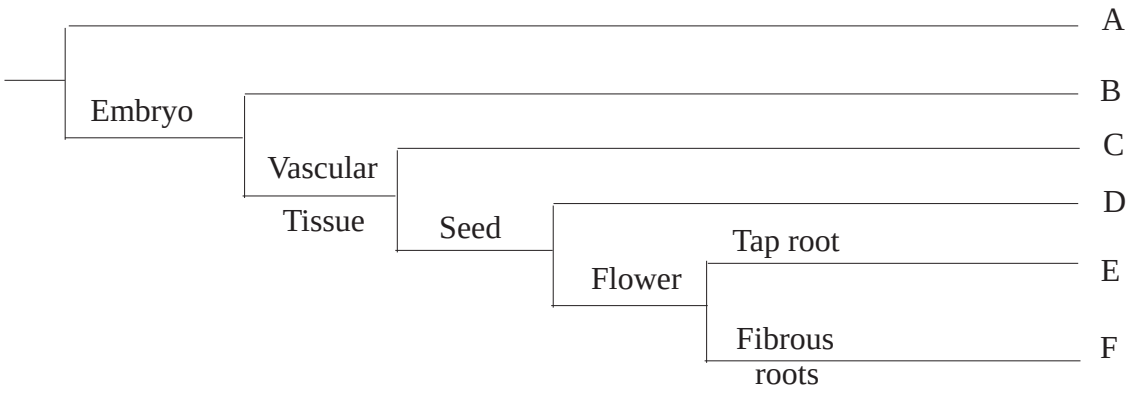
6. Select appropriate transport pathway/ process using a tick (✓) for correct answer and cross (X) for incorrect answer in the following table.

Feature	1	2	3	4
Active transport				
Osmosis				
Symplast pathway				

7. Select cells with following features from among P, Q, R and S. Indicate the correct answer(s) with a tick (✓).

	P	Q	R	S
Highest water potential				
Lowest pressure potential				
Thickest cell wall				
Storage of food				

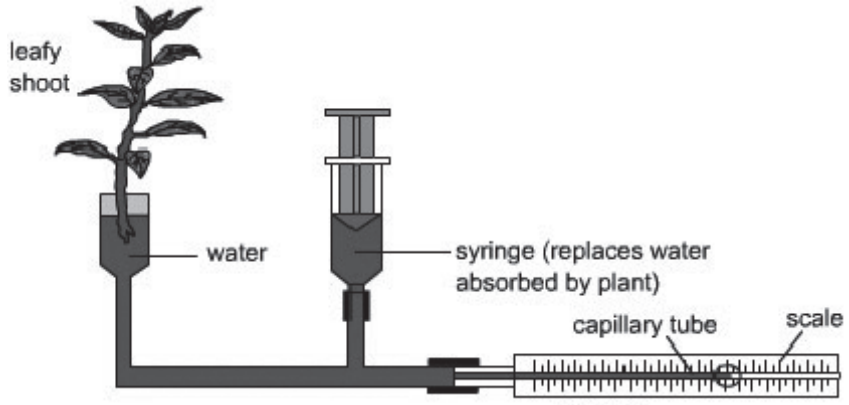
8. Key events in the evolution of plant life cycles are illustrated in this diagram.



In which of the taxons B-F, the following features are present. Indicate the correct answer(s) with a tick (✓) and incorrect answer(s) with a cross (✗).

Feature	B	C	D	E	F
Dioecious sporophyte					
Reduced independent gametophte					
Reduced dependent sporophyte					
Water is required for fertilization					
Species can be dispersed to long distances					
Non motile sperms					
Present in carboniferous forest					

9. The potometer can be used to measure transpiration in a cut shoot such by measuring water uptake.



Indicate which of the following statements are true (✓) and which are incorrect (✗).

A. The potometer is usually assembled under water	
B. The water-filled syringe is used to suck water out of the apparatus when air bubbles appear.	
C. The shoot must be sealed over the cut point with vaseline immediately after it is cut from the plant.	
D. Enclosing the shoot in a black plastic bag will reduce the transpiration	
E. The rate of transpiration will be high in still, humid air.	
F. The rate of transpiration will be highest in warm, dry moving air.	
G. The rate of water uptake and the rate of transpiration are not always equal.	
H. Low cohesive properties between the water molecules create problems for potometer experiments.	
I. Results from potometer experiments can never be quantitative.	

10. Some excretory structures found among animals are given below. Indicate which of those are present in animals that excrete uric acid by a "✓" sign and indicate those which are **not** present in the animals that excrete uric acid by "X" sign.

Malphigian tubules	
Nephridia	
Green glands	
Kidneys	
Gills	

11. Some organs with endocrine function, the hormones secreted by them and the target structures of these hormones are given in the following table.

Organ with endocrine function	**Hormone**	**Target structure**
A: Parathyroid	P: Progesterone	i: Intestine
B: Placenta	Q: Parathormone	ii: Mammary glands
C: Ovary	R: TRH	iii: Kidney
D: Hypothalamus	S: Oestrogen	Iv: Anterior Pituitary

Based on the above table, indicate 10 correct combinations of "Secretory organ – Hormone – Target organ" using the respective letters and the numbers.

1……2…… 3……4…… 5……

6……7…… 8…… 9……10…….

12. Some events that take place during thermoregulation of man are given below. Indicate by a " ✓" sign the events that take place when the heat gain center is stimulated and by a "X" sign the events that **do not** take place when this center is stimulated.

Increase in the activity of sweat glands	
Inhibition of adrenal activity	
Contraction of smooth muscle fibers	
Contraction of skeletal muscle fibers	
Stimulation of Krause's end bulbs	

13. Some of the following have a pH value less than 7. Indicate those with a " ✓" sign. Indicate those with a pH value above 7 with a "X" sign.

Saliva	
Gastric juice	
Vagina	
Seminal vesicle fluid	
Intestinal juice	

14. Microbial industries are based on four principal techniques.

I. Micro-organisms as end product
II. Mircrobial products as end product
III. Microbial processes as end product
IV. Genetically modified organisms to obtain end product.

Select appropriate principal technique involved in the production of following microbial products by putting a (ü) tick mark in the appropriate cage.

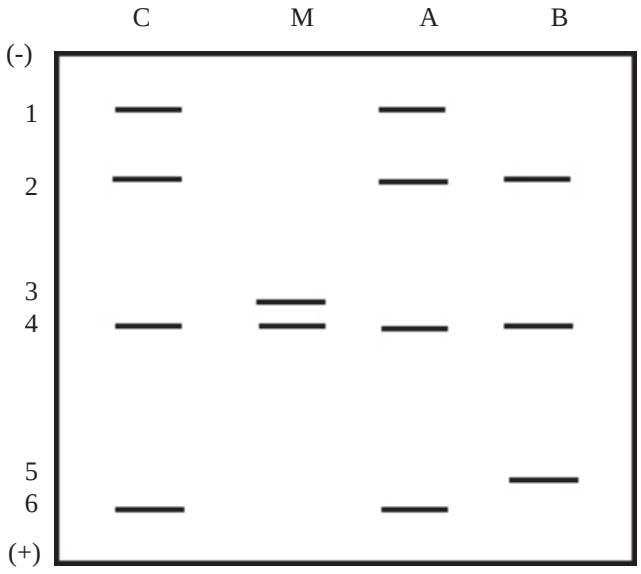
Microbial product	I	II	III	IV
Vinegar				
Penicillin				
Immunization agent against Hepatitis				
Extraction of copper				
Bio-insecticides				
Insulin				
Bio remediation				

15. A paternal chromosome has alleles L, M, and n and the maternal chromosome has alleles l, m, and N. Which of the following chromosomes could possibly be produced as a result of a single crossing over

Indicate the correct answer(s) with a tick (✓) and incorrect answer(s) with a cross (x). (1 point)

I. LMN
II. LMn
III. LmN
IV. Lmn
V. lmn

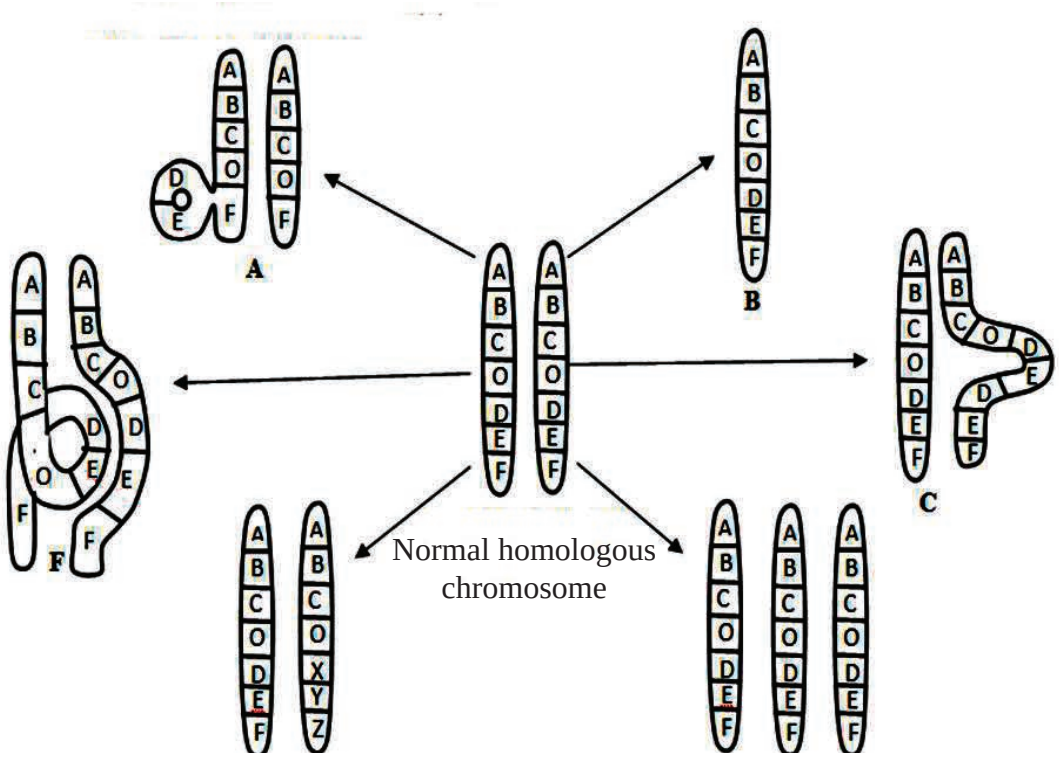
16. This question is regarding a paternal dispute of a child (C), where Mother (M) is known but father can be either A or B male. DNA finger printing is carried out on blood from child (C), the mother (M) and two males A and B using multi-loci DNA probe. The result is shown in the following diagram.



Select the number of the DNA band corresponding to following situations by putting a (✓) tick mark in the appropriate cage.

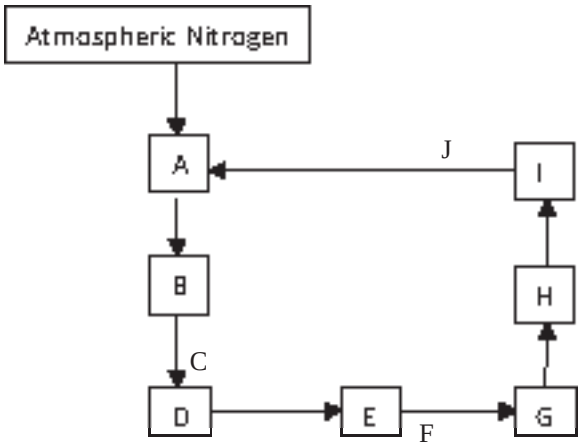
	1	2	3	4	5	6
Shortest band in the DNA profile						
Band common to all males						
Band common to humans						
Band common to all females						
Band(s) common to Biological father and Child						

17. The diagram below shows different forms of chromosomal mutations. Indicate the correct letter for the types of chromosomal mutations.



1. Inversion	
2. Deletion	
3. Monosomic	
4. Duplication	
5. Trisomic	
6. Translocation	

18. Gross diagram of the nitrogen cycle is given below



Select the correct letter from the above diagram which indicates the each of the following processes/substances and write it in the appropriate cage.

Ammonification	
Nitrification	
Plant proteins	
Nitrates	
Organic nitrogen in soil	
Animal protein	
Amino acids	
Ammonium ions	
Nitrites	
Ingestion	

19. Several statements regarding the estuarine ecosystems in Sri Lanka are give below. Indicate the correct statements by a "✓" sign and the **incorrect** statements by a "X" sign.

Salinity is below than that of the sea water	
Nutrient content is higher than that of the ocean	
Biodiversity is in between those of the ocean and freshwater ecosystems	
Primary productivity is in between those of the ocean and freshwater ecosystems	
Connection with the sea is sometimes closed by a sand bar	

20. Some organisms that are found in a home garden ecosystem are as follows.

A: Toad	B: Grasshopper	C: Rat snake	D: Grass
E: Eagle	F: Hare	G: Lizard	

In the food web of this ecosystem given below, indicate the correct position of the above organisms using the appropriate letter.