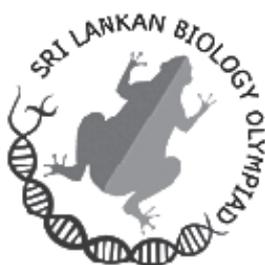


## Sri Lankan Biology Olympiad 2010



### 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.

**Fill all your answers in the answer sheet. Time 2 hours**

### Part A – Multiple Choice Questions

- (1). Lipids are different from carbohydrates because
  1. they have different elemental compositions.
  2. their molecular weights are very different.
  3. their major function in cells are different.
  4. their solubility properties are different.
  5. lipids do not make polymers like carbohydrates.
- (2) Which of the following statements is **incorrect** regarding nucleic acids and proteins?
  1. They have different elemental compositions.
  2. Proteins have a branched chain polymer structure while nucleic acids have straight chain structures.
  3. Denaturation of proteins is usually irreversible while denaturation of nucleic acids is reversible.
  4. Proteins have tertiary and quaternary structures but nucleic acids do not.
  5. Proteins cannot replicate while nucleic acids can.
- (3). Which of the following statements is **incorrect** regarding prokaryotes ?
  1. They do not have organelles bound by membranes.
  2. Their photosynthetic pigments are not bound to membranes.
  3. Their flagella are not covered by membranes.
  4. Their ribosomes are not bound to membranes.
  5. Their DNA are not condensed with histone proteins.

- (4). Which of the following statements is **incorrect** regarding meiosis ?
1. 2<sup>nd</sup> division is similar to a mitosis
  2. Prophase I is longer than prophase II
  3. Homologous chromosomes are joined together by a protein complex
  4. Centioles divide at the end of prophase I
  5. Chiasmata can be seen in metaphase I
- (5) Which of the following statements is **incorrect** regarding enzymes ?
1. All enzymes are made of proteins.
  2. All enzymes need co-enzymes for their function.
  3. Main function of enzymes is to lower the energy of activation.
  4. Enzymes may be inactivated at extreme pH values.
  5. Active site of enzymes may get blocked by inhibitor molecules.
- (6) In the light reactions of photosynthesis
1. ATP accumulates in thylakoid vesicles.
  2. NADPH accumulates in thylakoid vesicles.
  3. electrons are transferred from water molecule into chlorophyll a molecule.
  4. electrons may be transferred from chlorophyll b into electron acceptor molecules.
  5. Some electron acceptors are not bound to thylakoid membrane.
- (7) In respiratory reactions of cells
1. substrates other than glucose can be oxidized to obtain energy.
  2. ATP is formed only inside mitochondria.
  3. CO<sub>2</sub> is formed only inside mitochondria.
  4. pyruvate is oxidized to acetyl Co-A outside mitochondria.
  5. FADH<sub>2</sub> may be formed outside mitochondria.
- (8) A student observed four tissues of the human body which carryout the following functions.  
A. filtering B. Secretion C. Absorption D. Resisting friction
- The tissues he has observed in correct order are
1. Simple cuboidal epithelium, simple columnar epithelium, simple squamosal epithelium, white fibrous tissue.
  2. Simple columnar epithelium, simple cuboidal epithelium, simple squamosal epithelium, stratified squamosal epithelium.
  3. Simple squamosal epithelium, simple cuboidal epithelium, simple columnar epithelium, stratified squamosal epithelium.
  4. Stratified transitional epithelium, simple columnar epithelium, simple squamosal epithelium, while fibrous tissue
  5. Simple columnar epithelium, stratified cuboidal epithelium, simple cuboidal epithelium, stratified transitional epithelium.
- (9) Following are some features that have evolved in organisms and biosphere at different periods of evolution.
- (A) Use of chlorophyll b in photosynthesis
  - (B) Use of bacteriochlorophyll in photosynthesis
  - (C) Opening and closing of stomata
  - (D) Uptake of K<sup>+</sup> through plasma membrane
  - (E) Reduction of impact of UV radiation on organisms
- Which of the following is likely to be the correct sequence of evolution of the above features ?
1. A B D C E
  2. B A D C E
  3. D B E A C
  4. D B A E C
  5. B D A E C

- (10) Which of the following groups of animals do **not** have members with external gills?  
1. Polychaetes 2. Vertebrates 3. Molluscs 4. Crustaceans 5. Arachnids
- (11) The gravity receptors among animals have been first developed in the taxon to which the  
1. flat worms belong. 2. round worms belong. 3. segmented worms belong.  
4. sea anemones belong. 5. jelly fish belong.
- (12) Blood vessels are **not** present in  
1. echinoderms. 2. gastropods. 3. polychaetes. 4. insects. 5. tape worms.
- (13) Which of the following is **not** a general feature found plants of Pterophyta?  
1. Circinate vernation of young leaves  
2. Groups of sporangia forming sori  
3. Young parts of stem covered with scales  
4. Sporangia produced on stalks  
5. Development of the gametophyte within walls of spores.
- (14) Which of the following is least likely to have an effect on the mechanism of opening and closing of stomata of a leaf?  
1. Concentration of CO<sub>2</sub>  
2. Availability of water from soil  
3. Rate of photosynthesis of the leaf  
4. Rate of transpiration from the leaf  
5. Humidity of the air
- (15) Which of the following substances is **not** likely to be transported in phloem?  
1. Aminoacids  
2. Abscisic acid  
3. Ethylene  
4. Herbicides  
5 K<sup>+</sup>
- (16) Which of the following is **incorrect** regarding the secondary growth of plants?  
1. All live cells of a stem after secondary growth are present in the bark.  
2. Vascular cambium produces more cells towards center of the stem than towards surface.  
3. Mature part of the secondary xylem is used by plants for storage of secondary metabolic products.  
4. Cork cambium produces two types of cells towards surface of stem.  
5. Secondary cortex, cork cambium and cork together forms periderm of the stem.
- (17). The following experiment was performed to test the effect of auxin on the plant growth. Five plant seedlings, all growing actively, were prepared as below and growth was measured after 10 days.  
Treatments  
Plant A – Tip not removed, nothing applied  
Plant B – Tip removed, nothing applied  
Plant C – Tip removed, gelatin block was placed on cut edge  
Plant D – Tip removed, gelatin block with auxin was placed on cut edge  
Which of the following would be likely to indicate growth rates of plants after treatment?  
1 A>B>C>D 2. D>A>C>B 3. A>D>B>C  
4. D>C>A>B 5. A>C>B>D
- (18) Which of the following is **incorrectly** paired?  
1. Roots of monocotyledonous plants – pith  
2. Stems of dicotyledonous plants – open vascular bundles  
3. Herbaceous annual plants – closed vascular bundles  
4. Monocotyledonous stems-lateral meristems  
5. Coniferous plants – soft wood

- (19) Which of the following statements of comparison between pollen of *Cycas* with pollen of Angiosperms is **incorrect**?
1. Pollen of *Cycas* have three cells at the time of pollination while pollen of Angiosperms have two nuclei.
  2. Pollen of *Cycas* is transported into the ovule while pollen of Angiosperms remain outside ovules.
  3. Pollen tubes of *Cycas* do not transport gametes while pollen tubes of Angiosperms transport gametes.
  4. Pollen of *Cycas* produces motile gametes while pollen of Angiosperms produces nonmotile gametes.
  5. Pollen of *Cycas* produces two male gametes while pollen of Angiosperms produces one male gamete.
- (20) In man, which one of the following organs is most likely to be located at the same level of the largest vertebra?
1. Pancreas
  2. Kidney
  3. Liver
  4. Urinary bladder
  5. Small intestine
- (21) Which of the following fibres of the autonomic nervous system could be the longest?
1. Sympathetic postganglionic fibers to stomach
  2. Parasympathetic preganglionic fibers to colon
  3. Sympathetic postganglionic fibers to heart
  4. Parasympathetic postganglionic fibers to urinary bladder
  5. Sympathetic postganglionic fibers to colon
- (22) A tumour was detected in the occipital lobe of a person. Which of the following can be most affected due to this tumour?
1. Speech
  2. Memory
  3. Hearing
  4. Vision
  5. Balance
- (23) Which of the following human hormones is secreted by more than one organ?
1. Oestrogen
  2. Secretin
  3. Melatonin
  4. Gastrin
  5. Erythropoitin
- (24) Vitamins are important for normal cell function. They are important because they
1. function as an energy source
  2. act as hormones
  3. directly assist in the normal conduction of impulses
  4. resist pH changes
  5. enable enzymes to function normally
- (25) A person is suffering from frequent muscle cramps due to a deficiency of a vitamin. Which of the following food items contain this vitamin?
1. Peanuts
  2. Tomato
  3. Leafy vegetables
  4. Milk
  5. Cheese
- (26) A person is suffering from a rare disorder where lactose cannot be digested. Which of the following secretions are responsible for this?
1. Saliva
  2. Gastric juice
  3. Pancreatic juice
  4. Intestinal juice
  5. Bile
- (27) A person was asked by a physician to take few deep breaths. Within a minute he took eight deep breaths. During that period, the amount of air flown out of his lung is approximately
1. 20 L.
  2. 16 L.
  3. 12 L.
  4. 8 L.
  5. 4 L.
- (28) Which of the following is **incorrect** regarding the chromosome theory of heredity?
1. Chromosome theory of heredity was presented by Boveri and Sutton
  2. The theory was based on the observation that all cells of an organism has a constant number of chromosomes.
  3. The theory states that genetic factors discovered by Mendel are carried in chromosomes.
  4. Experiments of Morgan confirmed the theory.
  5. The fact chromosomes exist as homologous pairs was discovered before the theory was presented.

- (29) Which of the following is **incorrect** regarding polygenic inheritance?
1. Mutations do not affect polygenic characters
  2. Amount of milk produced by a cow is a polygenic character.
  3. Genes of polygenic character usually segregate independently at meiosis
  4. Most often the number of genes involved cannot be determined easily.
  5. Polygenic characters of crop plants can be improved by breeding programmes.
- (30) Which of the factors given below is **not** likely to change the frequency of alleles in a population?
1. Mutation
  2. Independent segregation of genes
  3. Migration
  4. Small population size
  5. Nonrandom breeding
- (31) Which of the following statements regarding DNA is **incorrect**?
1. The number of purine bases in a molecule of DNA is equal to the number of pyrimidine bases.
  2. DNA molecules of different sizes can be separated by centrifugation
  3. Only one of the two strands of DNA is used for protein synthesis
  4. DNA of different organisms denatures at slightly different temperatures
  5. DNA does not absorb visible light but absorbs UV light.
- (32) Which of the following is **not** a reason for using vectors for cloning genes in bacteria?
1. Vectors are not degraded by bacterial cells
  2. Genes are too small for transformation without vectors
  3. Vectors replicate in bacterial cells
  4. Vectors carry marker genes
  5. Linear molecules of DNA do not survive in bacterial cells
- (33) Two *Paramecium* species, *P. caudatum* and *P. aurelia* were grown in separate culture media in Petri dishes. Both populations grew rapidly and reached carrying capacity. When they were cultured together in one culture medium *P. aurelia* survived, but *P. caudatum* did not. The most likely explanation for the above observation is that
1. *P. caudatum* was attacked by a parasitic organism
  2. *P. caudatum* interbreeds with *P. aurelia*
  3. *P. aurelia* reproduces faster than *P. caudatum*
  4. *P. aurelia* has an advantage for survival in the competition with *P. caudatum*
  5. *P. caudatum* is a prey and *P. aurelia* is a predator
- (34) A soil sample was analyzed a microorganism with following characteristics were found. Rod shaped, aerobic, autotrophic  
This microorganism is likely to be
1. *Bacillus thuringiensis*
  2. *Staphylococcus sp.*
  3. *Nitrosomonas sp.*
  4. *Azotobacter sp.*
  5. *Clostridium sp.*
- (35) Which of the following is **incorrect** regarding fungi of Ascomycota.
1. They can be heterothallic
  2. They have a dicaryotic vegetative mycelium
  3. They reproduce asexually by conidiospores
  4. They have open or closed fruit bodies
  5. They have incomplete septa between cells
- (36) Which of the following can be the order of the biomes met by a person moving from North Pole to the equator?
1. tundra-taiga-temperate deciduous forest-desert-grassland-tropical rain forest
  2. tundra-savanna -desert-temperate deciduous forest-grassland-tropical rain forest
  3. tundra- grass lands- taiga- savanna-temperate deciduous forest-tropical rain forest
  4. tundra-taiga-temperate deciduous forest-desert-savanna-tropical rain forest
  5. tundra-taiga-grassland-savanna-temperate deciduous forest-tropical rain forest

- (37) Which of the following is **not** likely to be a feature of troposphere?  
 1. cyclones  
 2. green house effect  
 3. absorption of UV radiation  
 4. air currents  
 5. lightning
- (38) When compared to dry mixed evergreen forests wet evergreen forests of Sri Lanka have  
 1. nutrient rich soils.  
 2. deep soils.  
 3. a well developed ground layer of plants.  
 4. trees with rough barks.  
 5. trees with buttress roots.
- (39) Which of the following bacteria produces enterotoxins?  
 1. *Mycobacterium tuberculosis*      2. *Corynebacterium diphtheriae*      3. *Clostridium tetani*  
 4. *Salmonella typhi*                      5. *Bacillus thuringiensis*
- (40) Which of the following is most likely to cause acid rain?  
 1. Coal power plants                      2. Burning limestone                      3. Diesel power generators  
 4. Use of Petrol in motor vehicles      5. Burning forests

**Part B – Short Answer Questions**

1. (2 points) Names of some substances found in organisms are given below labeled A-H.  
 (A) cutin (B) starch (C) murein (D) collagen (E) albumin (F) cellulose  
 (G) chitin (H) glycogen  
 Select the most appropriate substance which fits the properties given in each row of table given below and write its name, using letters A-H, in the last column

Composition	Structure	Found in	Function	Substance
C, H,O	branched chain	animals microorganisms	food storage	
C, H, O	unbranched chain	animals microorganisms	Protection	
C, H, O, N	unbranched chain	plants	Protection	
C, H, O, N	Globular	animals	Food storage	

2. (2 points) Fill the blanks of the table given below writing + or – sign in each cage to indicate the properties of the cell organelles given.

	Present (+) or absent (-) in Cyanobacteria	Contain (+) or do not contain (-) nucleic acids	Contain (+) or do not contain (-) enzymes	Mainly anabolic (+) or catabolic (-) in function
Ribosomes				
Lysosomes				
Mitochondria				
Chloroplasts				

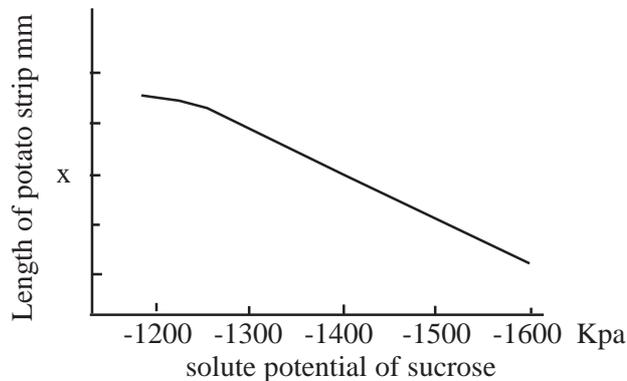
3. (3 points) Fill the table given below by writing + or – sign in each cage to indicate the association (+) or not association (-) of each substance given, in the two types of photosynthesis.

	C3 photosynthesis	C4 photosynthesis
Phosphoglycerate		
phosphoglycolate		
phosphoglyceraldehyde		
Phosphoenol puruvate		
Pyruvate		
Ribulose bisphosphate		

4. (2 points) Out of the substances A-H given below what are involved in the oxidative phosphorylation in the mitochondria?

(A) NADPH (B)  $FADH_2$  (C) Cytochrome (D) NADH (E) Coenzyme A (F) FMN (G)  $O_2$   
 (H) ATP (I)  $CO_2$

5. (2 points) In an experiment to study the solute potential of potato tissues one student cut several strips of exactly equal length of x mm of from a fresh potato. They were immersed separately in a series of sucrose solutions of different solute potentials. After 30 minutes he removed the strips and measured their lengths again. His results, plotted in a curve, are shown below.

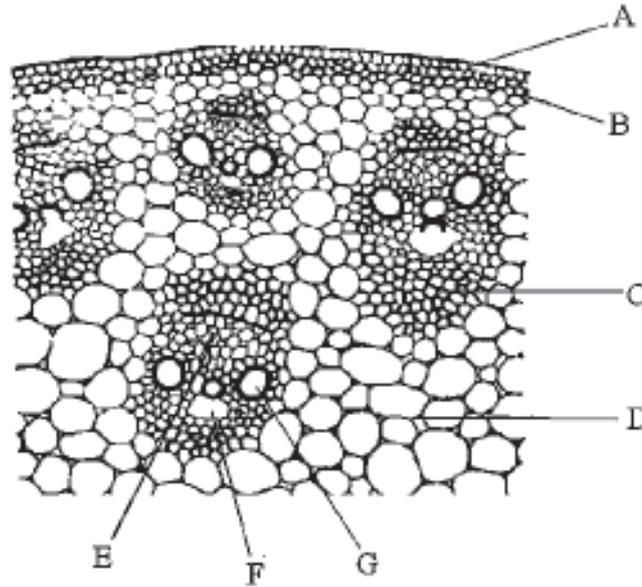


What can you state about the solute potential of potato tissue? Select the correct statement.

- (A) more than -1400 kPa (B) less than -1400 kPa  
 (C) equal to -1400 kPa (D) data insufficient to conclude.
6. (4 points) A mesophyte was planted in soil with high salt concentration and watered. It showed wilting. Fill the table regarding the water potential of different positions indicated, soon after wilting has occurred, by selecting options given below.
- (A) -600 kPa (B) -700 kPa (C) -800 kPa (D) -1000 kPa

Position	Water Potential
Soil solution	
Root hair cell	
Xylem vessel	
Leaf mesophyll cell	

7. (2 points) The diagram given below indicates a transverse section of a monocotyledonous stem. Different tissues have been labeled as A-G.

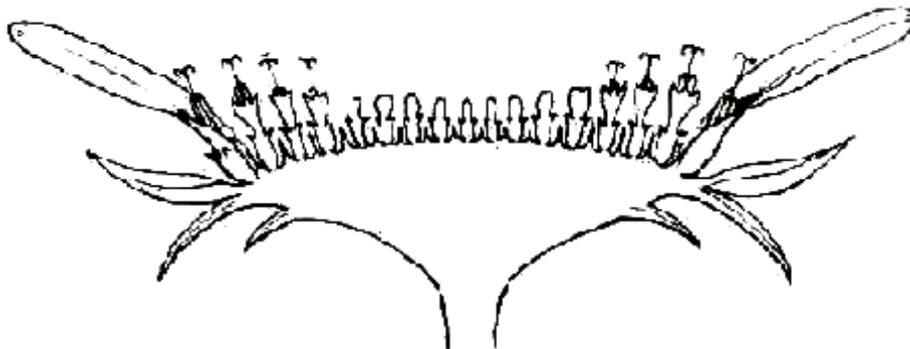


Select the tissues which can have the following functions.

- |                      |                        |
|----------------------|------------------------|
| 1. Solute conduction | 2. Mechanical strength |
| 3. Food storage      | 4. Protection          |
| 5. water conduction  |                        |

8. (2 points) Names of five common plant growth substances are given below.  
 (A) Auxins (B) Cytokinin (C) Gibberellins (D) Abscicic acid (E) Ethelene  
 Select appropriate plant growth substances which give following functions to plants.
- |                                      |                                       |
|--------------------------------------|---------------------------------------|
| 1. Initiation of flowering           | 2. Elongation of stems                |
| 3. Enhancing growth of axillary buds | 4. Inhibiting growth of axillary buds |

9. (4 points) The diagram given below indicates a cross section through the inflorescence of Sunflower.



Out of the terms describing floral characters given below select the terms which describe the features of Sunflower correctly.

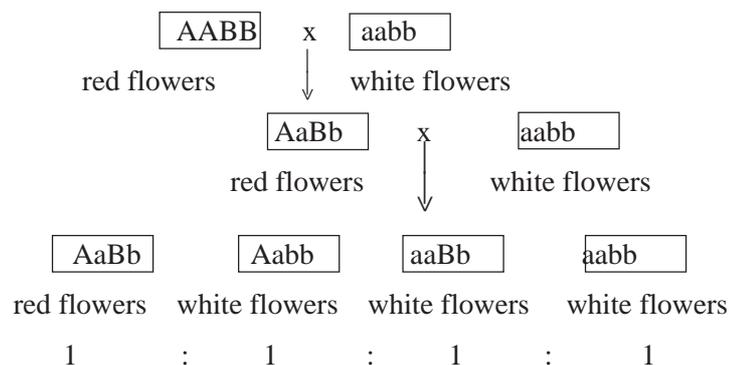
- (A) Simple raceme (B) Polypetalous (C) Epigynous (D) Gamopetalous (E) Multilocular  
 (F) Hypogynous (G) Epiptalous (H) Head

10. ( 3 points) The different types of hearts and the blood circulation patterns seen in the animal kingdom are given in the following table. The animals having a particular type of heart have one or several types of circulations. Place a ✓ mark in the correct cage to indicate the type/types of circulations found in the animal groups having a particular type of heart.

Type of heart.	Type of circulation			
	Open	Closed	Single	double
Several pairs of lateral hearts				
Dorsal tubular heart				
Ventral muscular heart				

11. (5 points) The three types of skeletons found among animals are given below.
- A. Hydrostatic skeleton
  - B. Exoskeleton
  - C. Endoskeleton
- Using the letters A, B and C , indicate the type/types of skeletons found in the following groups of animals.
- Vertebrates
  - Cephalopods
  - Asteroids
  - Polychaetes
  - Crustaceans

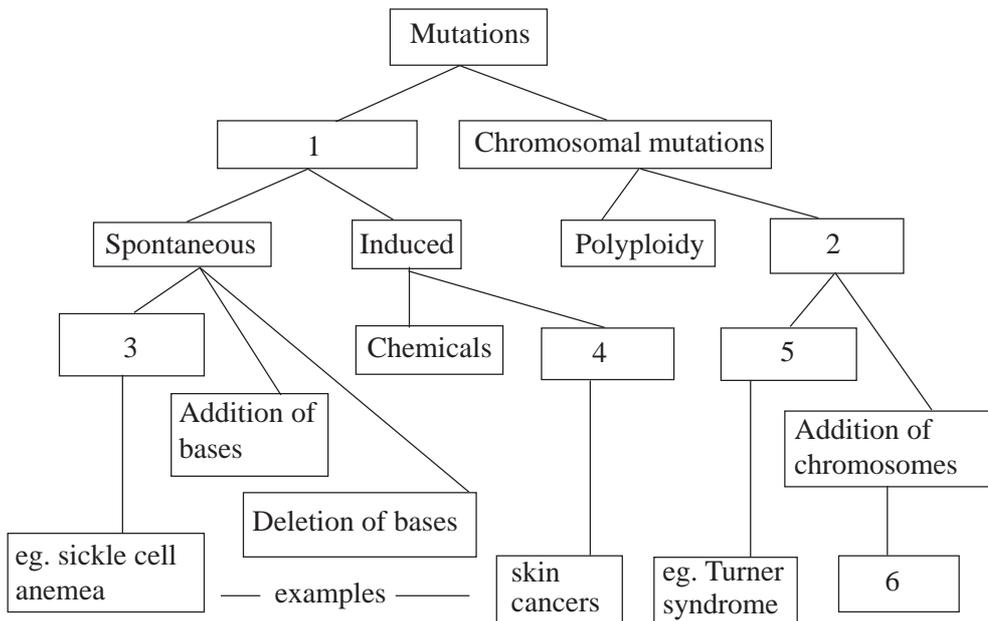
12. (2 points) The diagram given below indicates results of a genetic cross regarding flower colour of a plant species.



Which of the following is a correct name for the pattern of inheritance shown.

- (A) Incomplete dominance
- (B) Linkage
- (C) Dominant epistasis
- (D) Recessive epistasis

13. (3 points) The diagram given below indicates a classification of mutations with some examples.



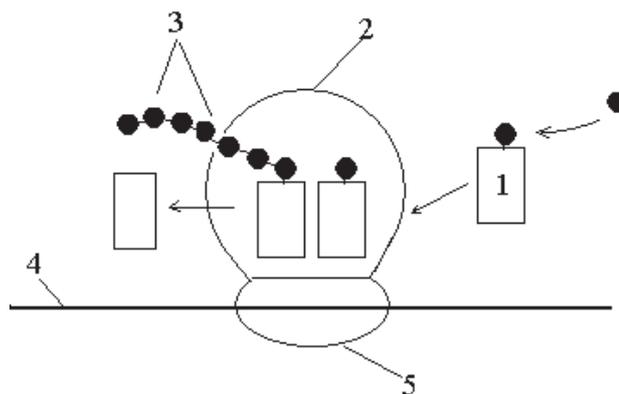
Select appropriate term from the following list to fill the cages labeled 1-6.

- (A) Klinefelter syndrome (B) Albinism (C) Aneupliody (D) Downs syndrome  
 (E) Substitution of bases (F) X-Rays (G) UV radiation (H) Loss of chromosomes  
 (I) Translocation of chromosomes (J) Point mutations

14. (5 points) Following diagram indicates some aspects of the mechanism of protein synthesis in bacteria.

Select the most appropriate terms from the following for correct labeling of parts numbered 1-5.

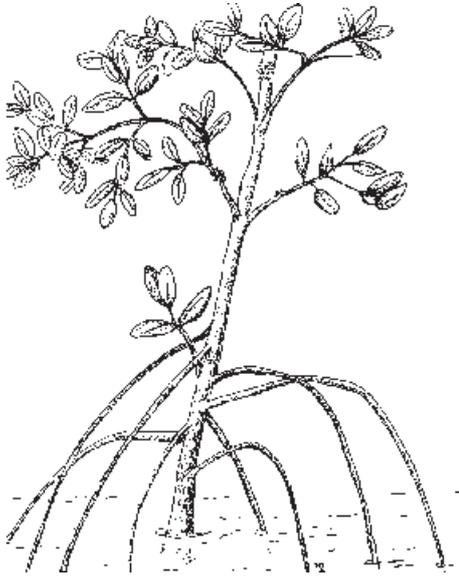
- (A) DNA (B) 60S particle (C) tRNA (D) 30S particle (E) rRNA (F) mRNA (G) 50S particle (H) 40S particle (I) polypeptide (J) aminoacid



15. (5 points) Genes making proteins toxic to insects have been transferred from bacteria into crop plants to obtain insect resistant varieties. Indicate whether each of the following statements are correct or incorrect with ✓ (correct) or ✗ (wrong) sign.

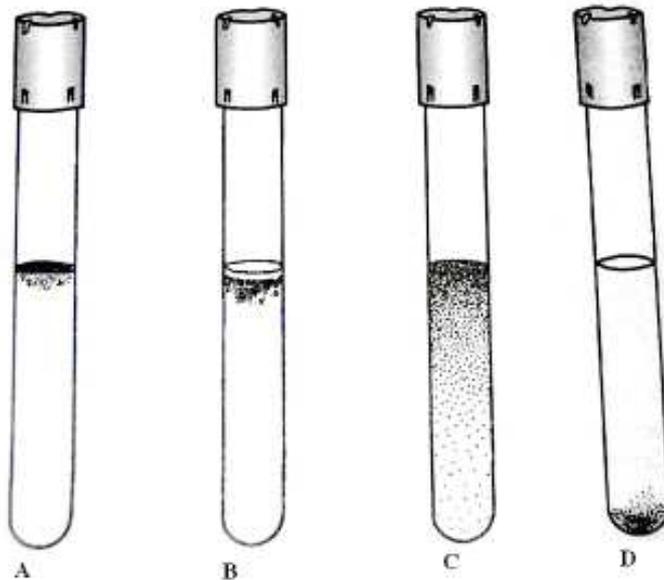
1. Rice is one of the examples for such crops
2. Some people fear that cultivation of such crops may bring environmental problems
3. This is possible because genetic code used by bacteria and plants is similar
4. Genes for this has been taken from the bacterium *Bacillus thuringiensis*
5. Some such crops are cultivated in Sri Lanka

16. (2 points) Answer the questions based on the picture given below.



- a. This picture represents a tree that is a characteristic feature of an ecosystem. In which of the following places you would expect to such a tree?  
(A) Sinharaja (B) Forest in Dambulla (C) Negambo lagoon (D) Sea shore
- b. Which of the following adaptive features you would find in the tree?  
(A) Knee roots (B) Pneumatophores (C) Prop roots (D) Thick cuticle (E) Fleshy leaves

17. (2 points) The diagram illustrates the distribution of microbial colonies in four test tubes.



Select appropriate which would show the growth of each of the microorganism given below.

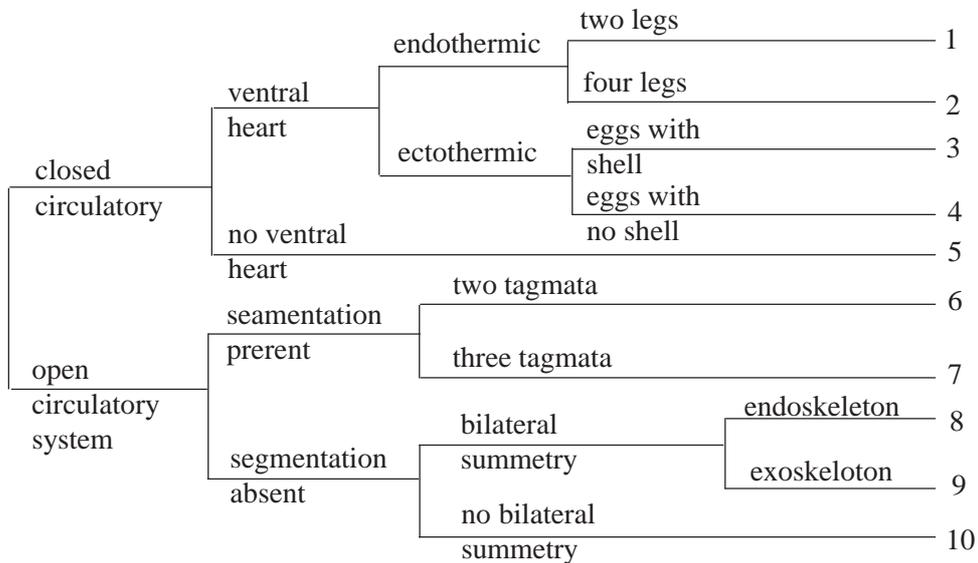
1. *Acetobacter aceti*
2. Purple sulfur bacteria
3. *Clostridium tetani*
4. *Saccharomyces cerevisiae*
5. *Lactobacillus bulgaricus*

18. (4 points) History of the earth is divided into four eras. Mark with a tick (v) to indicate the presence of an organism in each era.

	Proterozoic (Precambrian)	Paleozoic	Mesozoic	Cenozoic
Amphibians				
Algae				
Trilobites				
Dinosaurs				
Mollusks				
Insects				
Apes				

19. (5 points) A dichotomous key for the identification of animal phyla are given below

Fill answers in the answer sheet.



Fill in the appropriate number from the key against respective groups in the table given below:

- |            |                       |
|------------|-----------------------|
| Mammalia   | Insecta               |
| Gastropoda | Bivalvia (Pelycopoda) |
| Cehapapoda | Amphibia              |
| Reptilia   | Annelida              |
| Aves       | Crustacea             |

20. (2 points) A forest in a hillside was deforested for timber and for unsustainable farming. Indicate whether each of the following parameter will increase or decrease by putting a tick (v) in the appropriate cage.

	Increase	Decrease
Evapo-transpiration		
Surface run-off		
Flash floods		
Oxygen released by vegetation		
CO2 absorbed by vegetation		
Landslides		
Leaching of minerals		
Surface temperature		