S6 BIOLOGY ACTIVITIES
Class: S6 MCB and PCB

Q1. (a) Photosynthesis occurs in two stages, light dependent stage (light reaction) and light independent stage (dark stage). **2mks**

i. Where precisely in the plant cell does, each stage occur? **2mks**
ii. Which two compounds produced in the light dependent stage are subsequently used in the light independent stage? **2mks**
iii. How are these two compounds produced? **2mks**
iv. Which compound in **C_3** and **C_4** plants acts as the acceptor of carbondioxide. **2mks**

(b) Which one of the following compounds is produced by the reaction between carbondioxide and phosphoenol pyruvate (**PEP**) in tropical plants, such as sugar cane?

A. Malic acid.
B. Oxaloacetic acid
C. Phosphoglyceric acid. **1mk**
D. Ribulose bisphosphate.
E. Triose phosphate.

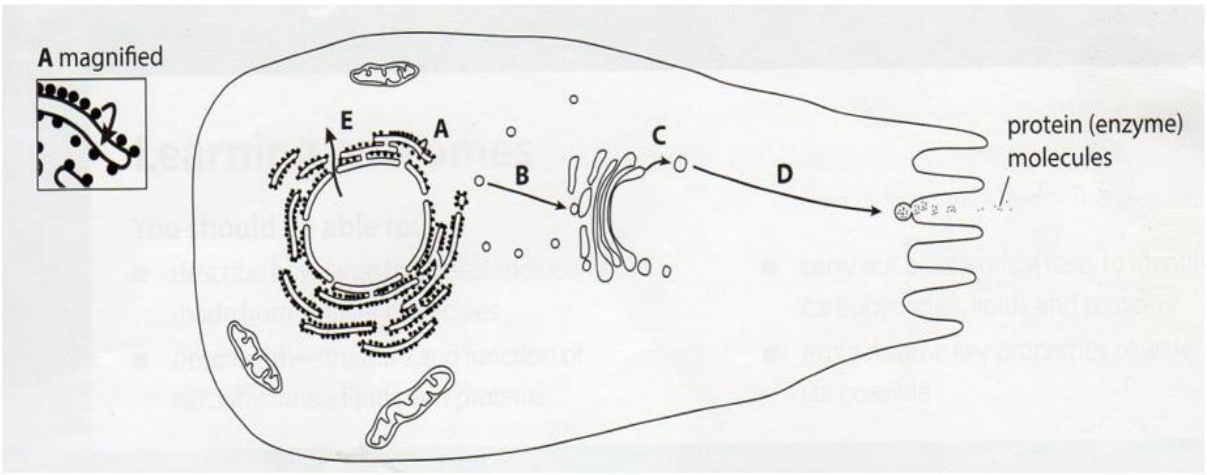
(c) Define the following terms in relation to plant physiology.

i. Compensation point. **1mk**
ii. Limiting factor. **1mk**

Q2. From your knowledge of photosynthetic pathways, explain precisely how three named factors can be limiting factors in photosynthesis.

a. Temperature. **2mks**
b. Light intensity. **2mks**
c. Carbondioxide concentration. **2mks**

Q3. The figure below shows a diagram based on an electron micrograph of a secretory cell from the pancreas. This type of cell is specialized for secreting (exporting) proteins. Some of the proteins are digestive enzymes of the pancreatic juice. The cell is very active, requiring a lot of energy. The arrows show the route taken by the protein molecules.



i. Describe what is happening at each of the stages **A, B, C and D. 4pts**

ii. Name one molecule or structure which leaves the nucleus by route **E**. **1pt**
iii. Through which structure must the molecule or structure you named in **(ii)** pass to get through the nuclear envelope? **1pt**
iv. Name the molecule which leaves the mitochondrion in order to provide energy for this cell. **1pt**

Q4. (a) Explain what is meant by the term homeostasis? **1pt**

(b) Explain how the following adaptations might assist in homeostasis.
i. An elongated loop of Henle. **1pt**
ii. The thick fur pelt in an artic mammal. **1pt**
iii. The subcutaneous fat in a marine mammal. **1pt**

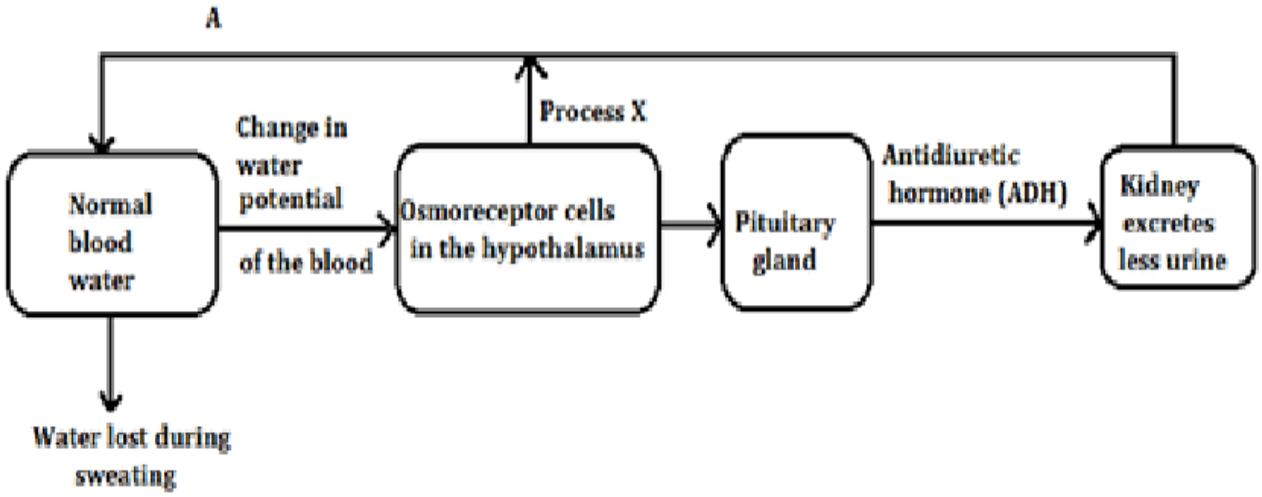
Q5. (a) using suitable examples, distinguish between negative feedback mechanism and positive mechanism. **4pts**
(b) Insulin and glucagon hormones are said to act antagonistically in the blood glucose level regulation. Account for the effects of insulin and glucagon by negative feedback mechanism. **5pts**
(c) What is the role of vasa recta? **2pts**
(d) What are the adaptations of the kidney for the conservation of water? **2pts**

Q6. Table**1** shows the concentration of some compounds in the fluids of a glomerulus, a renal capsule and a collecting duct of the kidney.

Compound	**Concentration/g100cm³**		
	Blood plasma entering glomerulus	**Filtrate in renal capsule**	**Urine in collecting duct**
Water	90	90	96
Proteins	8.0	0.0	0.0
Glucose	0.1	0.1	0.0
Urea	0.03	0.03	2

With reference to table **1** above,
i. Explain why proteins occur in the blood entering the glomerulus but not in the filtrate in the renal capsule. **2pts**
ii. Explain why there is glucose present in the filtrate but not in the urine. **2pts**
iii. Explain the difference in the concentration of urea between the filtrate and the urine. **2pts**

Q7. The figure below shows some of the homeostatic changes that occur as a result of water being lost from the blood due to sweating.



(a) Describe the changes in water potential that occurs in the blood as a result of sweating. **2pts**

(b) Which of the structures shown acts as?

i. A receptor. **1pt**
ii. An effector. **1pt**

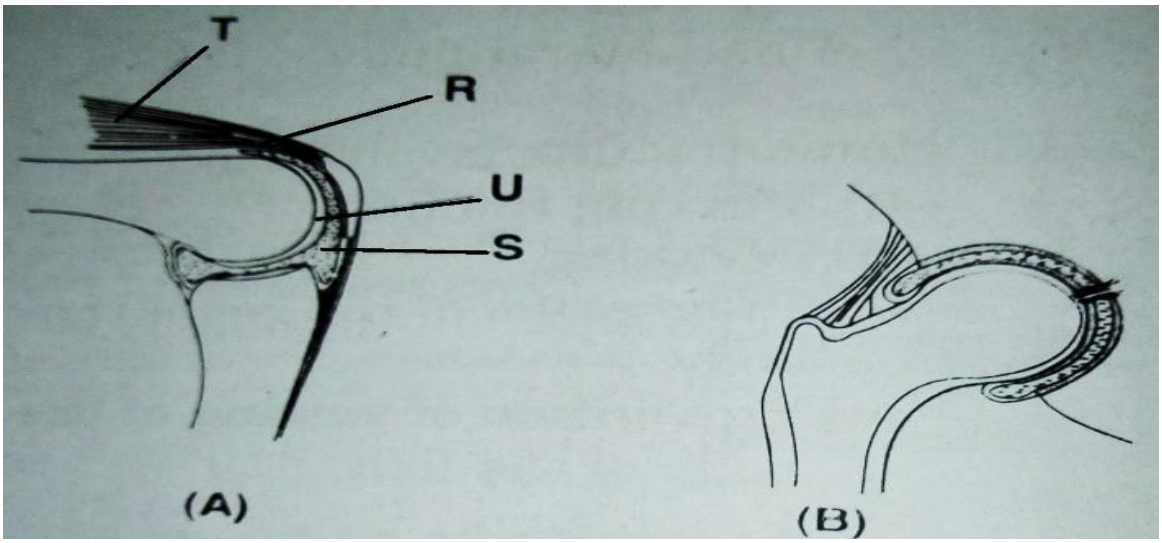
(c) Describe how **ADH** gets from the pituitary gland to the kidney. **1pt**

(d) The kidney conserves the water that is already in the blood. Given that the water potential of the blood remains in its normal level prior to sweating, suggest what is happening in process **X. 3pts**

(e) State as precisely as possible what mechanism is shown by the line labelled **A. 1pt**

(f) Explain why drinking alcohol causes a sensation of thirst. **3pts**

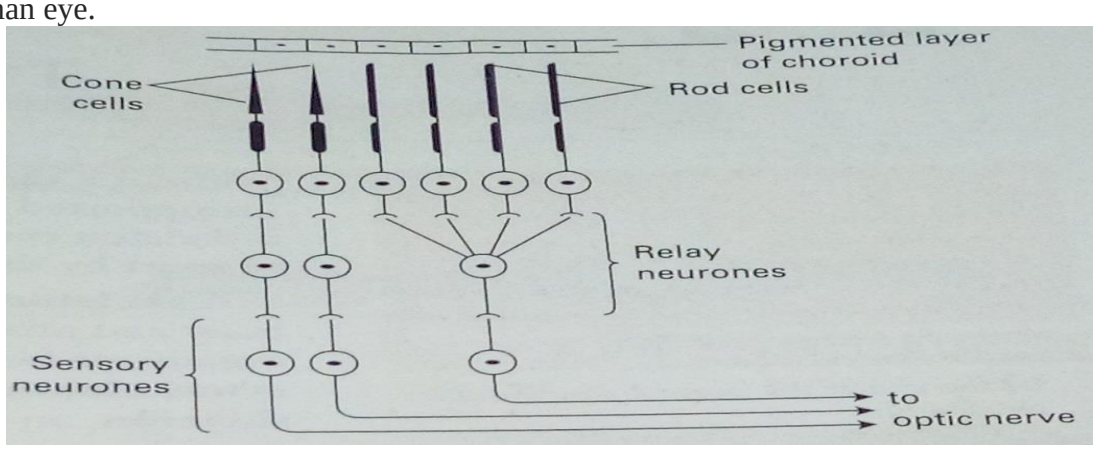
Q8. The diagram below illustrates two types of joints



i. Identify the joints shown on the diagram **A** and **B** above. **2pts**
ii. Name **U, T, R** and **S. 2pts**
iii. State the functions of **U** and **S. 2pts**
iv. What name is given to joints containing **S**? **1pt**

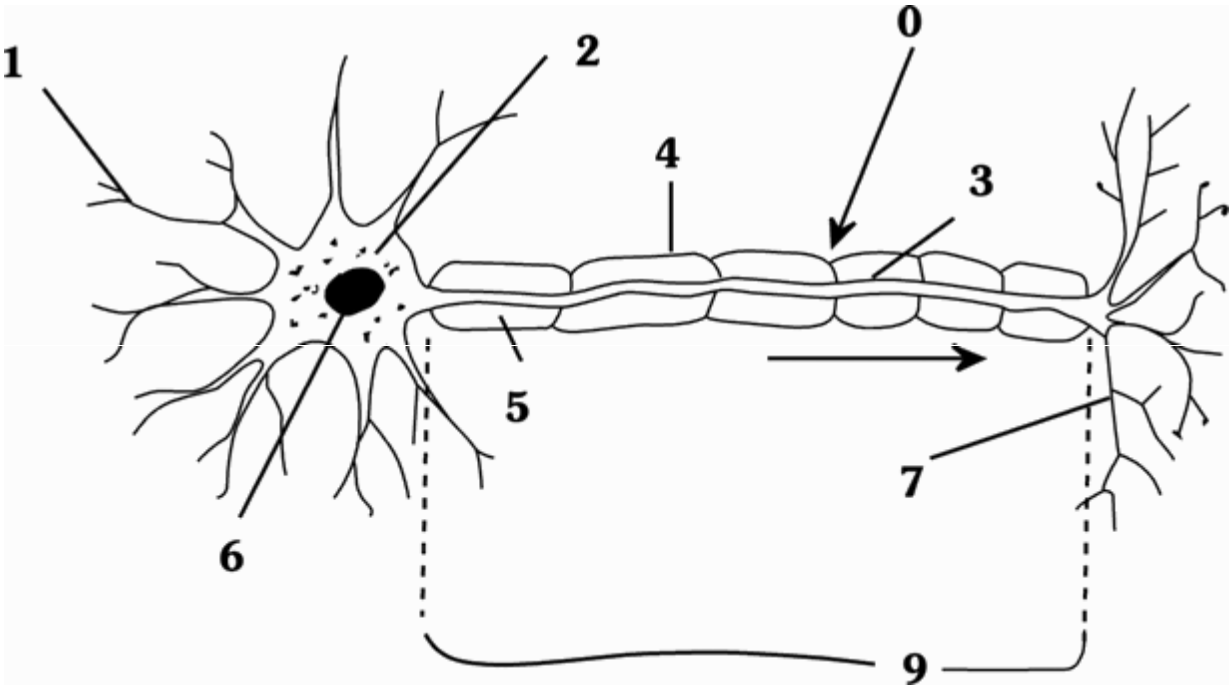
v. Distinguish between the types of movement in joints **A** and **B**. **2pts**

Q9. The diagram represents enlarged section of part of the retina and choroid layer of a human eye.



i. Draw an arrow on a sketch of the diagram to show the direction in which light passes through the retina. **1pt**
ii. Suggest a function of the black pigment which occurs in the choroid layer of the eye. **2pts**
iii. Use information in the diagram to explain how a person is able to:
   a. See light of low intensity. **4pts**
   b. See in great detail in bright light. **3pts**

Q10. Study the diagram of a neuron and answer the question that follow.

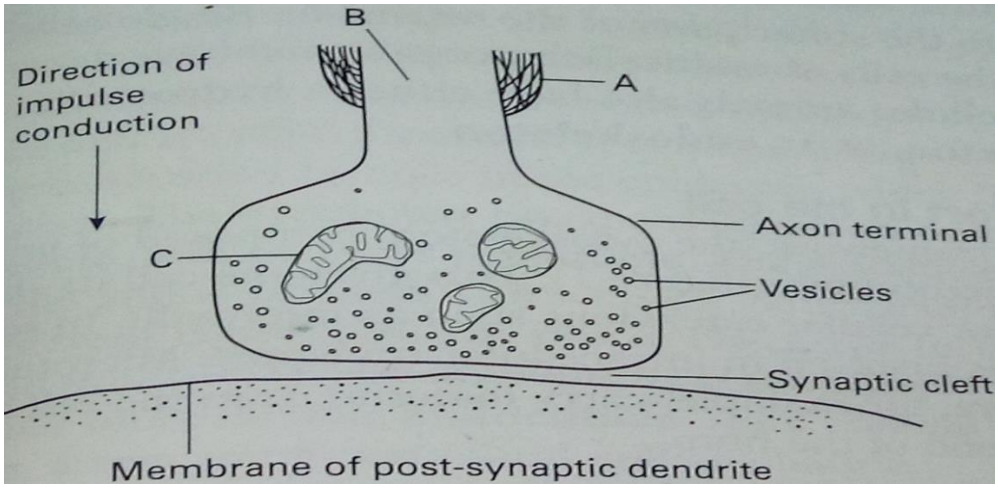


i. Name the type of neuron presented in the diagram. **1pt**
ii. List all the structural details that you can identify in 2. **3pts**
iii. Give the labels for the parts numbered 3, 4, 5, and 7. **2pts**
iv. Give the functions of the parts labelled 1, 5, 7 and 8. **2pts**

v. Which parts are involved in synapses? **1pt**

vi. Explain how drugs affect the transmission of impulses. **1pt**

Q11. The diagram below represents the structures visible at a synapse with the aid of electron microscopy.



(a)Identify the structures labelled in **A** and **B**. **2pts**

(b)Name the chemical found in the numerous vesicles that occur in the synaptic knob. **1pt**

(c)Identify the structure labelled **C** and suggest a reason for its presence in the synaptic knob. **2pts**

(d)A powerful hydrolytic enzyme is found in the synaptic cleft. What is its function in normal synaptic transmission? **1pt**

(e) Copy the list. Using the correct scientific terms, add the words that have been omitted. The list describes the main stages in the process by which information is transmitted across a cholinergic synapse. **4pts**

- An action potential arrives at a synaptic knob of a presynaptic neurone.
- This causes…….ions to enter the synaptic knob.
- Vesicles move to the…….membrane.
- A neurotransmitter called …….is released into the synaptic cleft.
- This moves across the cleft by a process known as……
- The neurotransmitter combines with a……..on the post synaptic membrane.
- The influx of……..ions causes local depolarization and action potential is set up in the post synaptic neurone.

Q12. (a) The amount of urine produced varies according to the amount of water consumed. Make a list of events that may occur in the following cases for the human body:

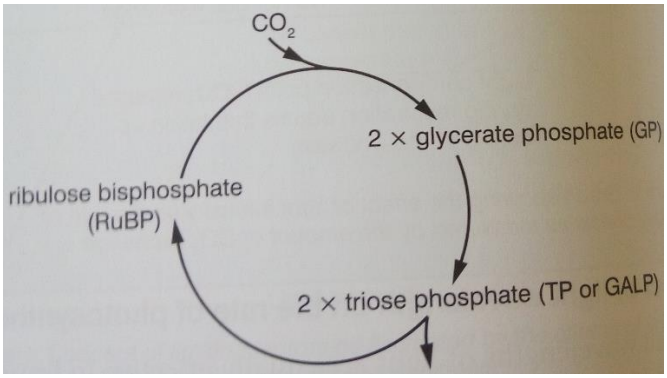
i. Two days without drinking water. **2pts**

ii. When you have drunk 1 liter of water per day. **2pts**

iii. How can you explain the above observations? **2pts**

(b) Make short notes on what happens to your body if the level of sugars decreases in the blood? **4pts**

Q13 a) In the majority of photosynthetic organisms, fixation of carbondioxide occurs in the Calvin cycle. The figure below is an outline of this cycle.



State,

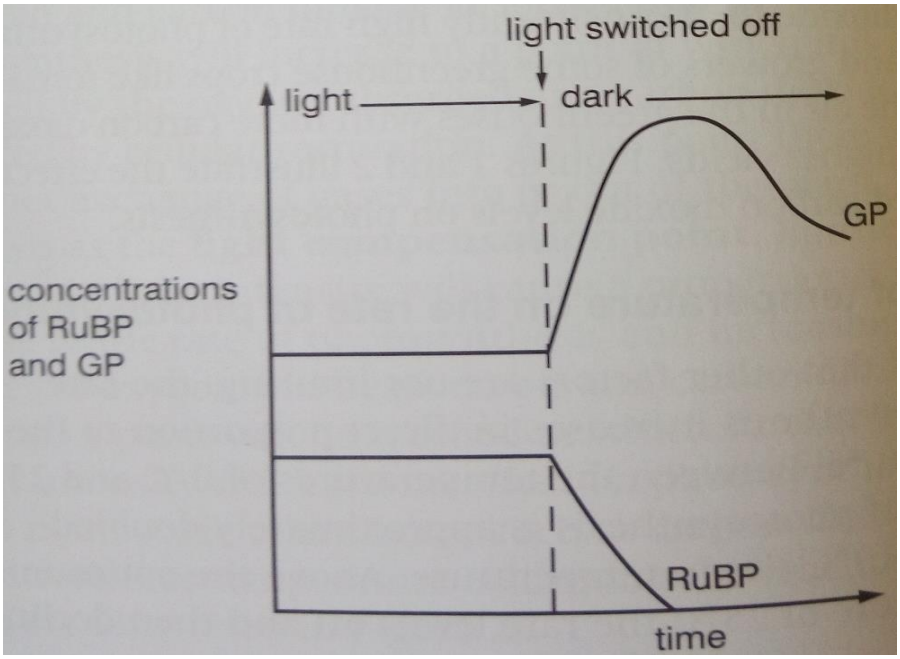
i. The name of the five-carbon sugar in the cycle. **1pt**

ii. The name of the enzyme that fixes carbondioxide. **1pt**

iii. Where in the chloroplast the Calvin cycle occurs? **1pt**

iv. The name of another compound that is produced in the light-independent stage of photosynthesis that is used in the Calvin cycle. **1pt**

(b) The figure below shows the changes in the relative concentrations of **RuBP** and **GP** produced in the Calvin cycle before and after a light source is switched off. All other conditions are constant.



i. Explain the changes in the relative concentrations of **RuBP** and **GP** after the light source is switched off. **6pts**

Other questions

Q1. Fungi were originally classified under the kingdom plantae.

i. Outline the features of the fungi that made it necessary to be placed in their own kingdom.
[**2marks]**

ii. Explain why the fungi are widely spread and in vast numbers.
[1mark]

iii. Giving examples differentiate between photosynthetic and chemosynthetic bacteria.

[**2marks]**

Q2. a) Explain what is meant by term alternation of generations?
[**2marks]**

b) Ferns and mosses show alternation of generations. State the dominant stage in each case.

i. Ferns
[**1mark]**

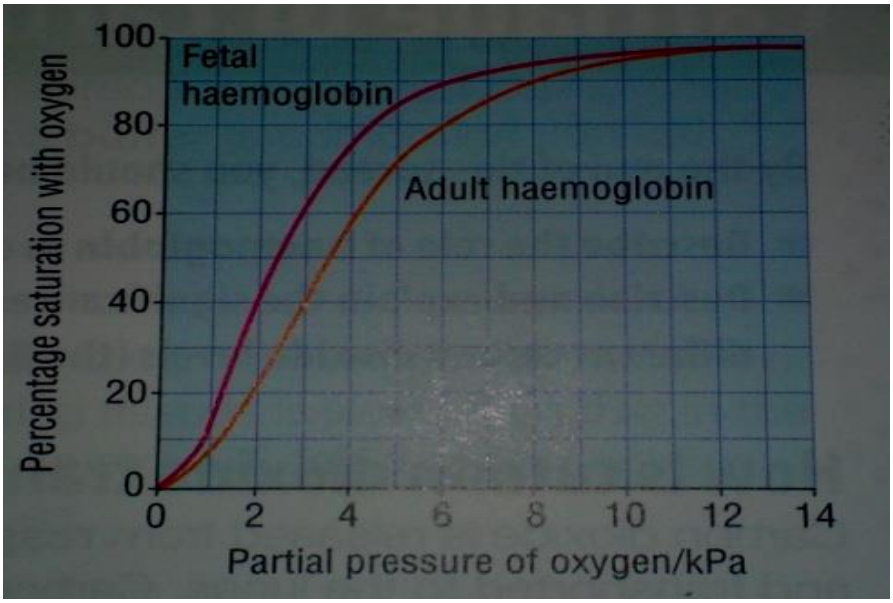
ii. Mosses
[**1mark]**

c) How are ferns better adapted to live on land than mosses? **[2marks]**

Q3. a) Define the term *Bohr effect*.
[**1mark]**

b) What is the physiological importance of *Bohr effect.*
[**2marks]**

c) The figure below represents the oxygen dissociation curves for the foetal and maternal haemoglobin.



What is the biological significance of the two curves?
[**2marks]**

Q4. a) Explain how the following adaptation might assist in homeostasis.

i. An elongated loop of Henle in a desert animal.
[1mark]

ii. A thick fur in arctic mammal.
[**1mark]**

iii. A subcutaneous fat layer in a marine mammal.
[1mark]

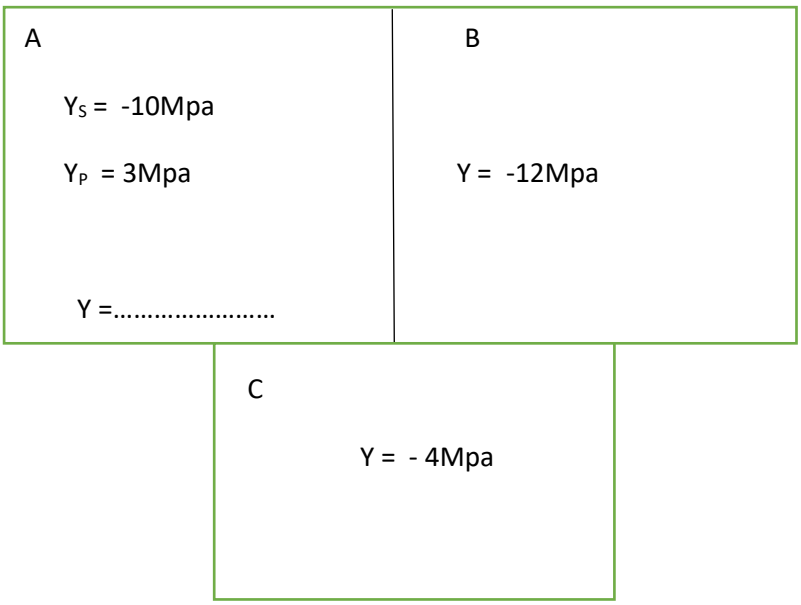
Q5. How is each of the following suited to its function?

i. A red blood cell **(in 4 line**).
[**4marks]**

ii. A xylem vessel (**in 4 line**).
[**4marks]**

iii. Chloroplast. **(in 4 line**)
[**4marks]**

Q6. The diagram below shows three adjacent plant cells.



I. Calculate the water potential of cell A. show your working. **[1mark]**

II. Copy the diagram and show by means of arrows, the direction of water movement between these cells.
[3marks]

III. Explain why water potential of a sucrose solution has a negative value. **[2marks]**

Q7. a) With reasons give examples of animals which produce each of the excretory products.

i. Ammonia. [**1mark]**

ii. Uric acid. [**1mark]**

iii. Urea. **[1mark]**

b) Explain why the pH of the body fluid in human body is kept constants. **[1mark]**

Q8. Autotrophic nutrition known as photosynthesis occurs in two stages.

i. What are they? **[1mark]**

ii. Where precisely in plant cell does each in (i) occur? **[1mark]**

iii. Which two compounds in **C_3** plants act as the acceptor of carbon dioxide in the light independent stage? **[1mark]**

Q9. a) What is meant by the term photophosphorylation? **[1mark]**

b) Where in plants does photophosphorylation occur? [**1mark]**

c) Briefly explain the process of cyclic photophosphorylation. **[2marks]**

d) What is the importance of cyclic photophosphorylation? [**2marks]**

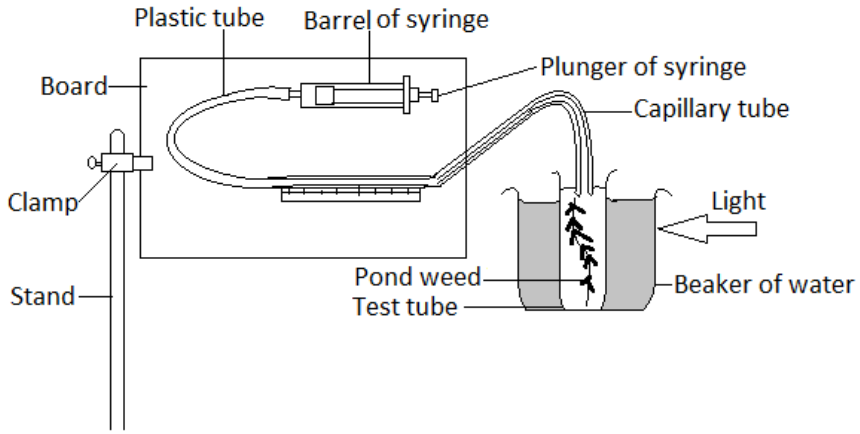
e) Explain the role of water, and light in the process of photosynthesis. **[2marks]**

f) How are leaves modified to perform photosynthesis. **[4marks]**

Q10. a) Explain how this changes in concentration of sodium ions in the renal fluid along the:

i. Descending limb of loop of Henle. **[2marks]**
ii. Ascending loop of Henle. **[2marks]**
iii. Collecting ducts. [**2marks**

Q11. The apparatus in the figure below can be used to investigate the rate of photosynthesis.

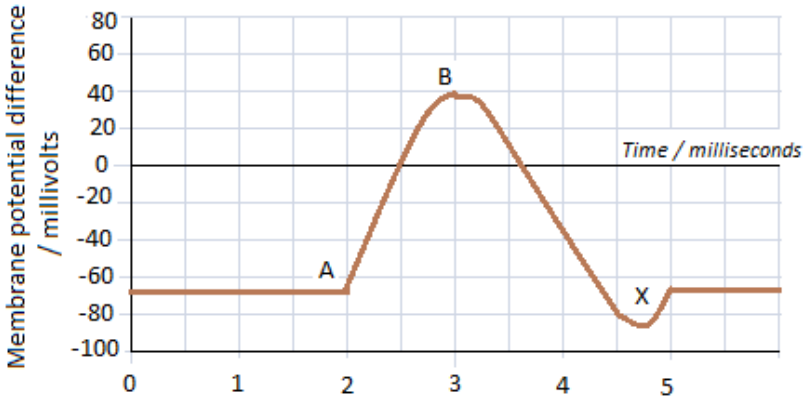


a) Describe how you would set up this apparatus to measure the effect of light intensity on the rate of photosynthesis.
[3mks]

b) Describe three precautions you need to take during this investigation.
[3mks]

c) Describe how you would modify the experiment to determine the effect on photosynthesis of:
(i) Carbon dioxide concentration **[2mks]**
(ii) The wavelength of light.
[2mks]

Q12. The graph below shows the change in membrane potential during the passage of a nerve impulse.



a) What is the resting potential of this neurone? **[1mk]**

b) How is the resting potential maintained in the neurone?

[1mk]

c) Explain how ion movements bring about the change in membrane potential between points A and B on the graph.

[2mks]

d) How is the resting potential restored? **[1mk]**

e) What is the refractory period?

[1mk]

f) How does the length of refractory period limit the number of impulses which can pass along the axon?

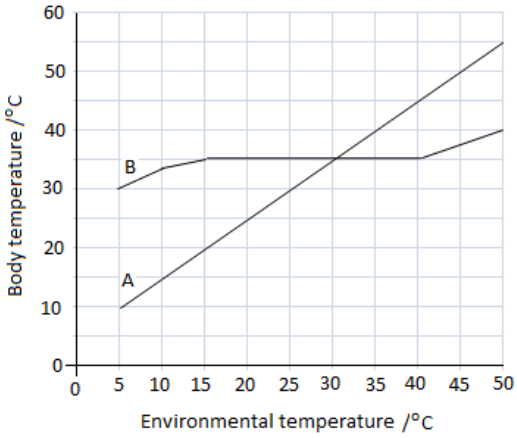
[2mks]

g) Account for the blip at point x on the graph. **[2mks]**

Q13. (a) Distinguish between the terms ectothermy and endothermy.

[4mks]

(b) The figure below shows the change in body temperature with environmental temperature for two animals.

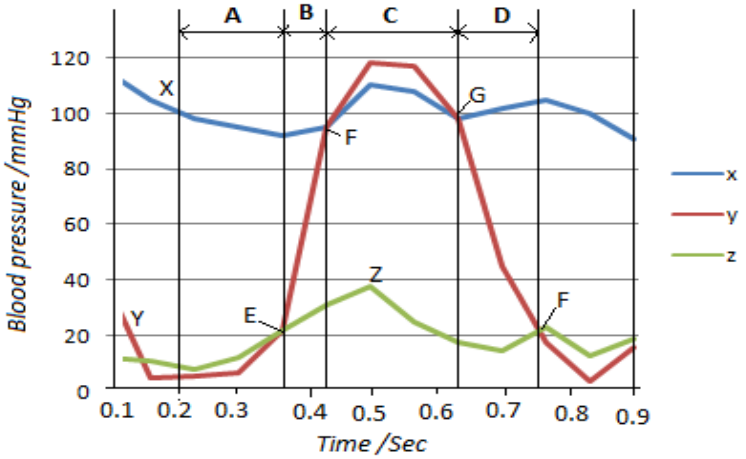


Which of the curves represents an ectotherm? Explain your answer. **[3mks]**

(c) What restrictions does the physiology of ectotherms place on their geographic distribution? **[3mks]**

Q14. Discuss why smoking is hazardous for our life. **[10mks]**

Q15. The diagram bellow shows the blood pressures in three regions of a human heart.



a) Indicate which line (X,Y or Z) you think will represent the left ventricle, the left atrium and the aorta.

[1.5mks]

b) On the graph, which one of the periods (labeled A-D) or points (labeled E-H), identifies each of the following events? **[2.5mks]**

(i) The atrio-ventricular valves closes (1st heart sound)

(ii) The semi-lunar valve closes (2nd heart sound)

(iii) The ventricle is filling with blood

(iv) The ventricle is emptying

(v) The volume of ventricle is not changing

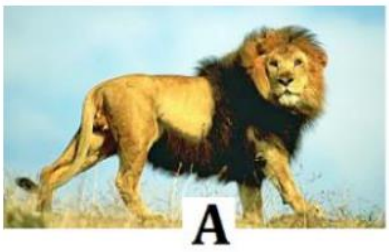
c) With reference to the above diagram:

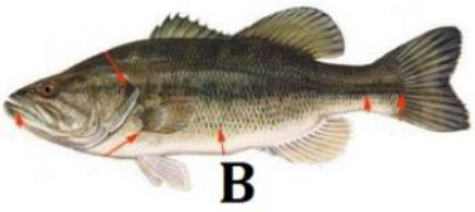
(i) Estimate the diastolic arterial blood pressure that would be measured in this person artery where it branches from the aorta. **[2mks]**

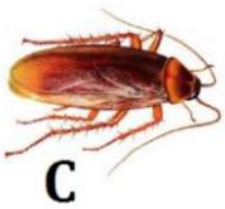
(ii) The total period displayed in the graph is actually slightly more than the duration of a single heartbeat. Calculate the pulse rate in the beats per minute for this person. **[4mks]**

Other activities

1. Look carefully the specimen below

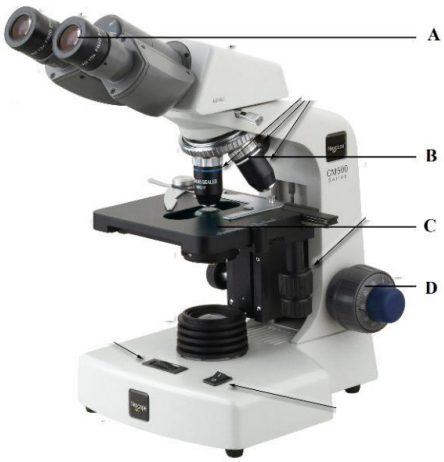






a) To which kingdom do the following organisms belong? **/2mks**
b) Make a dichotomous key for these animal specimens. **/5mks**

2. The photo below shows a light microscope.

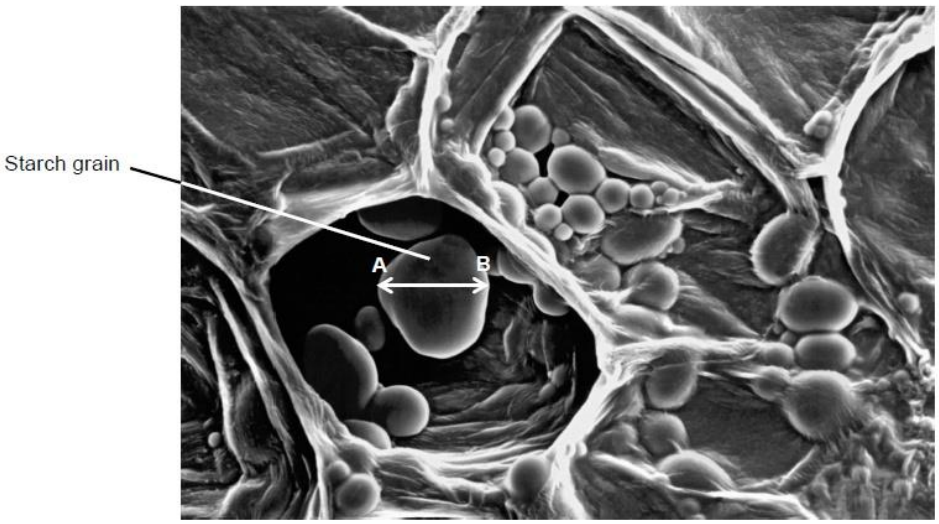


a) Identify the parts represented by the letters A, B, C and D**.(4maks)**
b) What is the difference between magnification and resolution? **(2marks)**

c) State advantages of an electron microscope over a light microscope. **(2maks)**

d) Advantages of a light microscope over an electron microscope. **(2marks)**

3. The figure below shows a section through a plant tissue at a magnification of ×500.



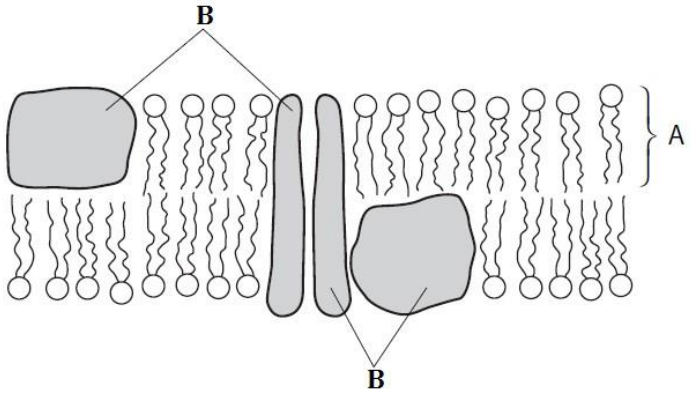
a) Calculate the actual diameter of the starch grain between points A and B. **(2maks)**

b) What type of microscope was used to obtain the image shown in Figure ? Give one piece of evidence to support your answer.

i) Type of microscope: ----------**(1mark)**

ii) Evidence : ----------**(2marks)**

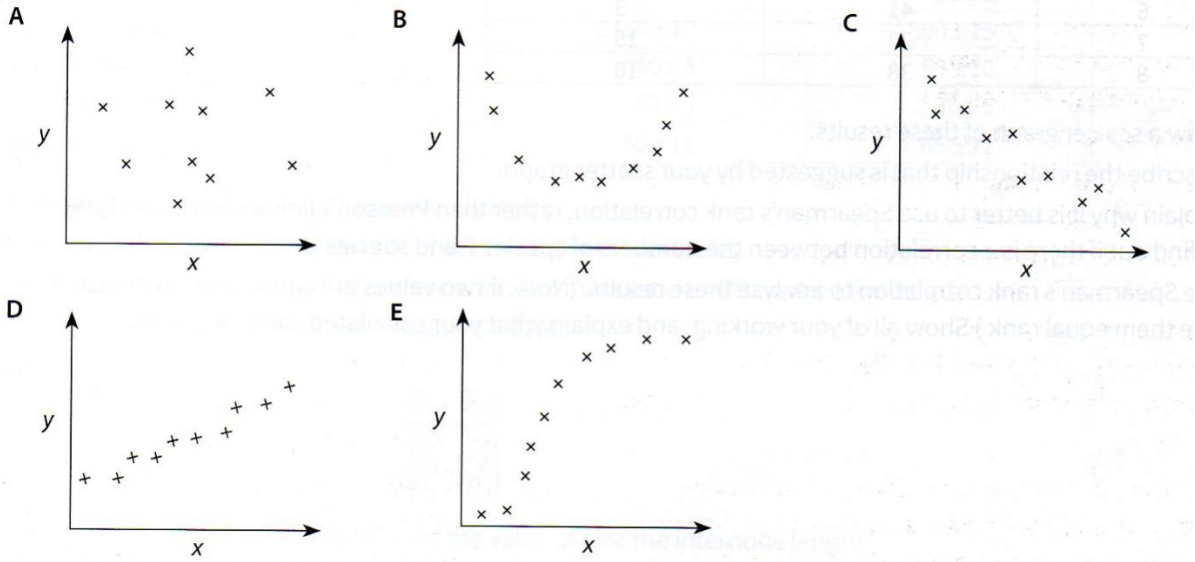
4. The fluid mosaic model describes the structure and properties of cell membranes. The diagram below shows the structure of a cell membrane based on this model.



a. Name the molecule labelled A and describe its structure. **(2 marks)**

b. Name the molecule labelled B and state its function. **(2 marks)**

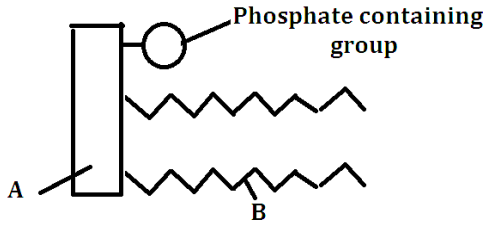
5. The scatter graphs show values for x plotted against values for y.



State the letter of any graph or graphs that: **(5 marks)**

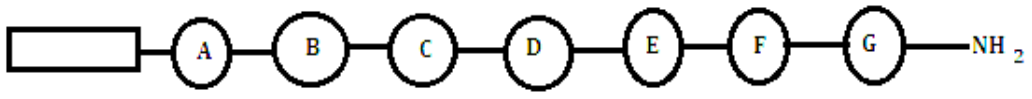
a) Indicate there could be a positive correlation.
b) Indicate that there is probably no correlation.
c) Indicate there is a linear correlation.
d) Indicate that Spearman's rank correlation could be used.
e) Indicate that Pearson's linear correlation could be used.

6. The figure below represents a phospholipid molecule:



a) Give the structure labelled A and B. **(2 marks)**
b) State how the structures A and B differ in the way they react to water. **(2 marks)**
c) Which chemical elements are found in fats? **(1 mark)**
d) What is meant by a saturated fatty acid? **(1 mark)**

7. The figure below represents a polypeptide made up of seven amino acids, A-G.



a) What is the chemical formula of the group represented by the box? **(1mark)**

b) How many molecules of water would be produced in forming this polypeptide? **(1mark)**

c) Give the difference between globular and fibrous proteins. **(2marks)**

d) Protein molecules are held together by a combination of the following: Peptide bonds, hydrogen bonds, ionic bonds, disulfide bridges, hydrophobic interactions. Which one or more of these bonds:

i. Maintain the primary structure of a protein. **(1mark)**

ii. Maintain the secondary structure of a protein. **(1mark)**

iii. Maintain the tertiary structure of a protein. **(1marks)**

8. Two proteins have the same number and type of amino acids but different tertiary structures. Explain why? **(2maks)**

9. The table below shows the composition of five foods A, B, C, D and E. Study it and answer the following questions

Composition per kg							
Food	**KJ/100mg**	**Proteins**	**Fats**	**Carbohydrates**	**Vit C**	**Vit D**	**Iron**
A	3800	0.4g	8.6g	0	0	40g	0
B	130	1.2g	0	8g	220g	0	0
C	1150	8.8g	1.5g	60g	0	0	0
D	400	2.0g	0.1g	25g	10g	0	6mg
E	1650	0	0	100g	0	0	0

From the table, which food among A, B, C, D and E would: **(8 marks)**

a) Help prevent anemia and why?

b) Help prevent scurvy and why?

c) Help prevent rickets and why?

d) Provide most energy and why?

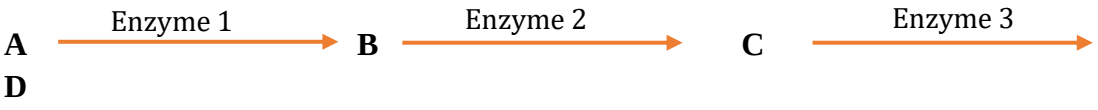
10. a) During the laboratory test of non – reducing sugars, explain why the following procedures are performed.

I) Addition of dilute hydrochloric acid **[2 marks]**

II) Addition of Benedict's solution **[2 marks]**

c) Examine structural features that make carbohydrates have a wide variety of polysaccharides? **(2maks)**

11. The diagram shows a metabolic pathway in which substrate A is converted, with the aid of enzymes, to the end – product **D**.



a) Giving an explanation for your answer, suggest what would happen to rate of production of the end protein **D** if;

i. The production of substrate were reduced **[1 mark]**

ii. The concentration of enzyme 1 were increased but the concentration of the other enzymes remained constant. **[1 mark]**

iii. The temperature rose from 15^{o}C to 25^{o}C. **[1 mark]**

b) Suggest how molecule **D** could act as an end product inhibitor. **[1 mark]**

12. a. Why are enzymes effective in small quantities? **(2maks)**

b.Explain why changing an amino acid that makes up the active site could prevent the enzyme from functioning. **(2maks)**

C. Why might changing certain amino acids that are not part of the active site also prevent the enzyme from functioning? **(2maks)**

Good luck!