



**BIOLOGY – FORM 4**  
**TIME: 1H 30MIN**

NAME: \_\_\_\_\_

CLASS: \_\_\_\_\_

Question No.	Section A							Section B					
	1	2	3	4	5	6	7	1	2	3	4	5	
<b>Max mark</b>	6	7	6	9	7	11	9	15	15	15	15	15	
<b>Actual mark</b>													<b>TOTAL MARK</b>

<b>85% Theory Paper</b>	<b>15% Practical</b>	<b>100% Final Score</b>

**Section A**

**Answer ALL questions in this section.**

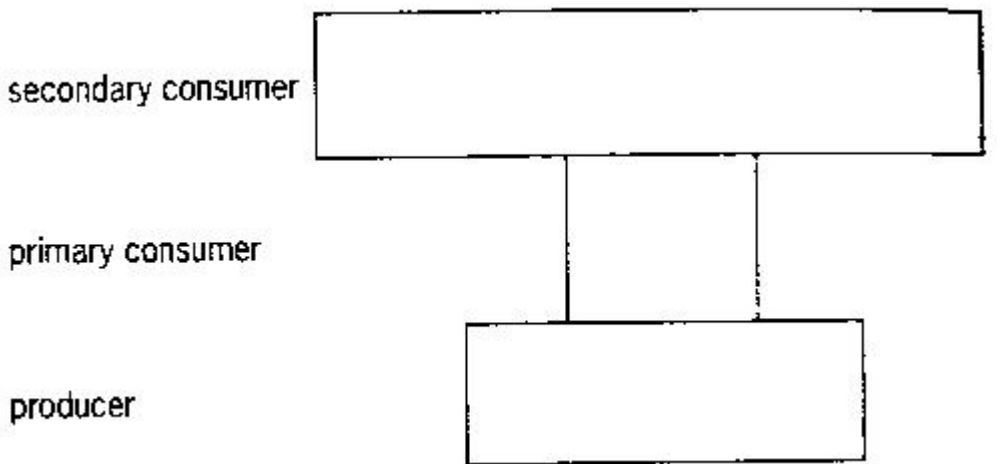
1. The steps in the following table describe the method used to show that a green leaf contains starch. The steps are not in the correct order. In the right hand column write numbers **1 to 6** to show the correct sequence of the steps.

Add Iodine solution	
Immerse leaf in boiling water for 1 minute	
Heat leaf in boiling ethanol	
Place plant in bright sunshine for 12 hours	
Place plant in darkness for 24 hours	
Remove leaf from plant	

(6 marks)

**Total: 6 marks**

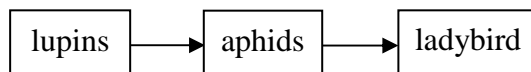
2. The following diagram shows the pyramid of numbers for a food chain.



- a. Give ONE reason why there are more secondary consumers than primary consumers in the pyramid.

\_\_\_\_\_ (1 mark)

- b. A group of biology students were studying the following food chain

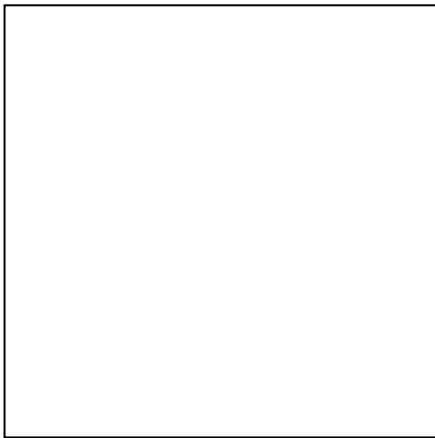


The students collected data showing the masses of the organisms concerned and the mean number of organisms. The data collected is shown in the table below.

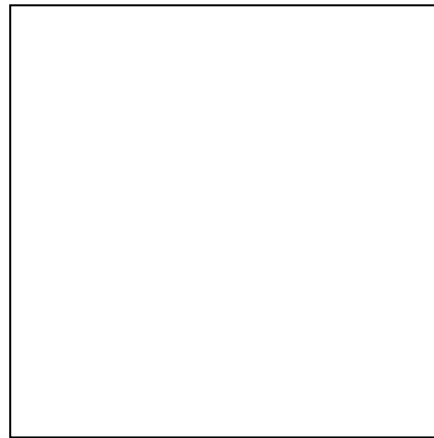
Organism	Mean mass of organism (g)	Number of organisms (m <sup>-2</sup> )
Lupin	52	16
Aphid	0.002	5000
Ladybird	0.03	19

Use the data in the table to draw the

i. pyramid of numbers

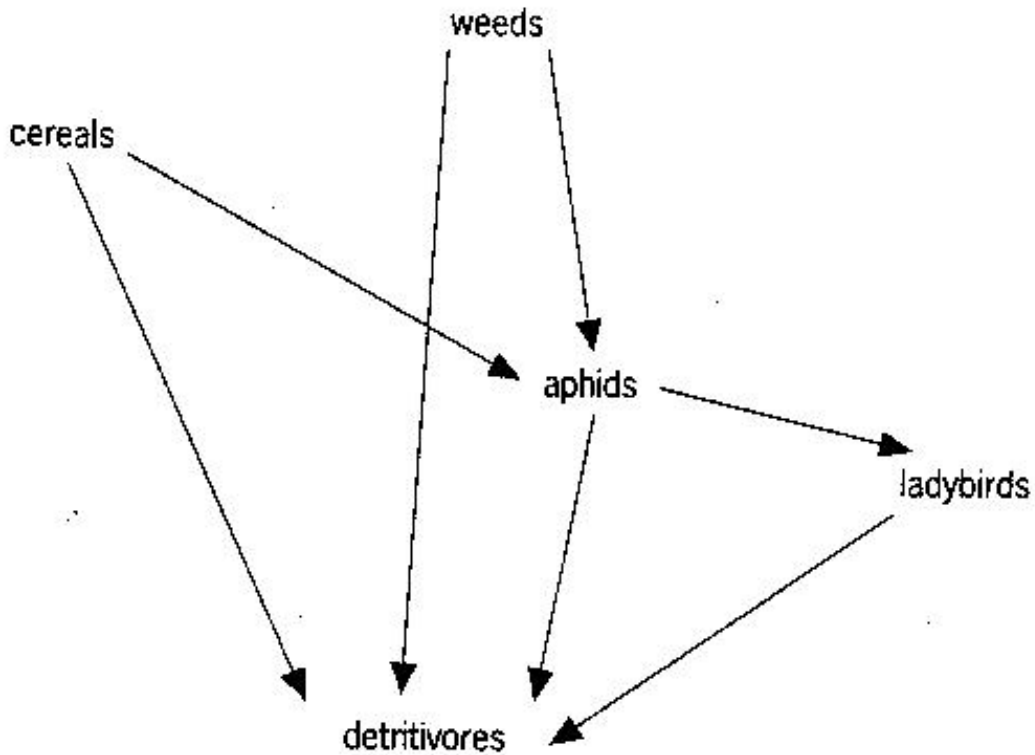


ii. pyramid of biomass for this food chain.



(1, 1 mark)

c. The biology students also studied the following food web.



i. List TWO organisms from the food web whose population would increase when an insecticide is used in the area.

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ii. What happens to the number of cereals in the food web if a selective herbicide (specific for weeds) is used? Give a reason for your answer.

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(2, 2 marks)

**Total: 7 marks**

3. The following table gives the contents of four test-tubes (A, B, C and D) that were used to investigate the effect of bile salts and boiling on the activity of the enzyme lipase. In this experiment the lipid substrate used was full cream milk. The ✓ sign indicates the presence of the contents in the relevant test tube.

Contents	Test tube			
	A	B	C	D
Water	✓		✓	
Bile salts		✓		✓
Lipase	✓	✓		
Boiled lipase			✓	✓
Full cream milk	✓	✓	✓	✓
Universal indicator	✓	✓	✓	✓
Initial colour	green	green	green	green
Initial pH	7	7	7	7

- a. Explain why after 30 minutes the contents of tubes A and B show a drop in pH indicating the presence of acidic conditions. \_\_\_\_\_ (1 mark)

- b. Which TWO test tubes should be compared to draw a conclusion about:

i. the effect of boiling on the activity of lipase \_\_\_\_\_

ii. the effect of bile salts on the activity of lipase? \_\_\_\_\_

(1, 1 mark)

- c. No change in pH occurred in tube D. What conclusion can be drawn from this result?

\_\_\_\_\_ (1 mark)

- d. Where is lipase produced and where is it active?

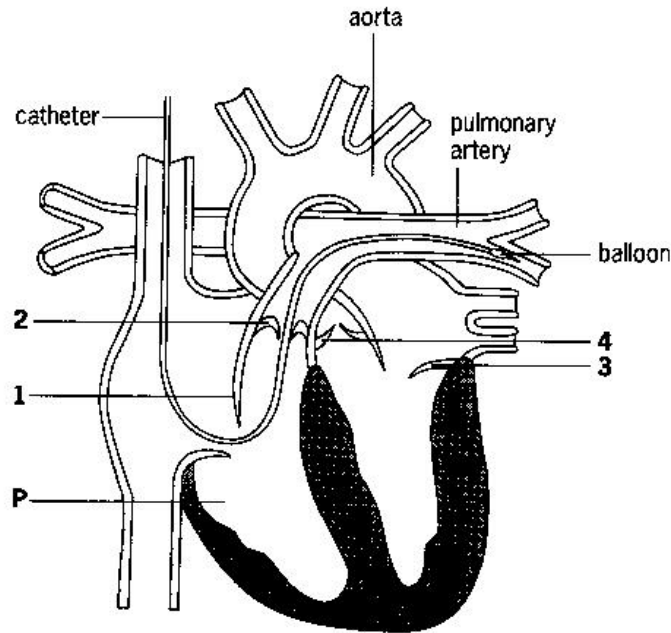
Site of production: \_\_\_\_\_

Site of action: \_\_\_\_\_

(2 marks)

**Total: 6 marks**

4. A small tube called catheter can be inserted into the blood system through a vein. A catheter threaded through the vein and through the heart until its tip is in the pulmonary artery. A balloon at the tip can then be used to measure the pressure changes in the pulmonary artery. The following diagram shows a section through the heart with the catheter in place.



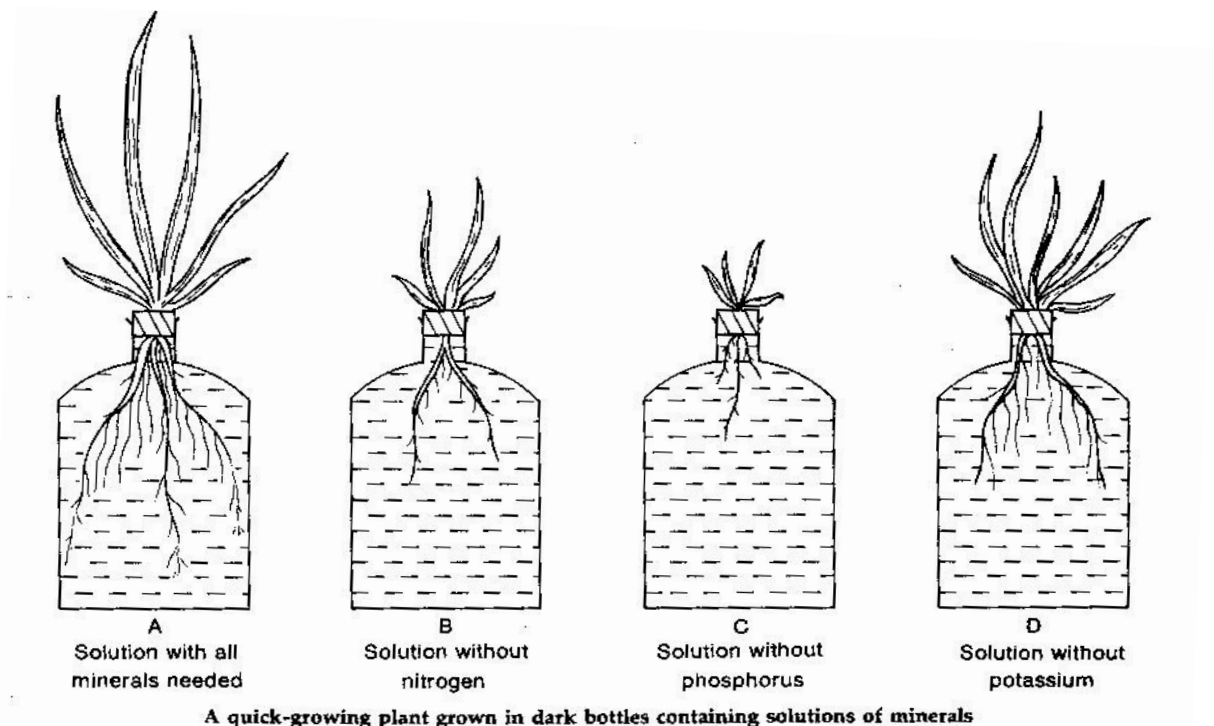
- a. What happens to the blood pressure if the diameter of the arteries narrows?  
 \_\_\_\_\_ (1 mark)
- b. Why is the wall of the part labelled P less muscular?  
 \_\_\_\_\_ (1 mark)
- c. What type of blood flows through the chamber of the heart labelled P?  
 \_\_\_\_\_ (1 mark)
- d. Explain why the strongest pulse is felt in the aorta.  
 \_\_\_\_\_ (1 mark)
- e. The parts numbered 1, 2, 3 and 4 are the heart valves.
- i. Name valves 2 and 4.  
 \_\_\_\_\_
  - ii. Which TWO valves are opened when blood is pumped out of the lower chambers of the heart?  
 \_\_\_\_\_
  - iii. Which TWO valves prevent blood flowing back from the lower chambers of the heart to the upper chambers of the heart during contraction?  
 \_\_\_\_\_
- (1, 1, 1 mark)

- f. The pressure generated by the beating of the heart together with the elastic recoil of the arteries drives the blood out to the tissues. At the capillaries, some of the plasma moves across the capillary walls to form the tissue fluid. List TWO substances that are lacking in tissue fluid.

\_\_\_\_\_ (2 marks)

**Total: 9 marks**

5. A biology student carried out an experiment to investigate the effect of mineral deficiencies on plant growth. Cereal plants of equal age and size were grown in four cultures (A, B, C and D). Solution A contained all known mineral nutrients in the correct proportions while each of the other cultures (B, C and D) lacked one mineral. The following diagram shows the apparatus set up for the experiment.



- a. List TWO conditions (besides plant size and age) that need to be kept constant during this investigation.

\_\_\_\_\_ (2 marks)

- b. Describe TWO differences shown in the diagram between the plant in culture A as compared with the plants in cultures B, C and D.

\_\_\_\_\_ (2 marks)

- c. During the investigation air was bubbled in each of the four cultures. Explain the importance of this.

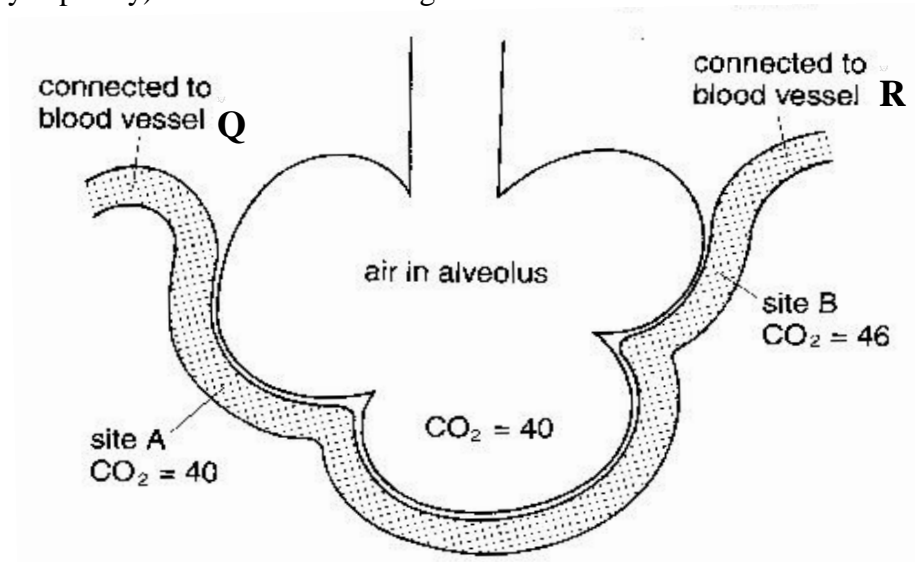
\_\_\_\_\_ (1 mark)

- d. If a cereal plant was grown in a solution without the mineral magnesium, what would happen to the leaves of the plant? Give a reason for your answer.

\_\_\_\_\_ (2 marks)

**Total: 7 marks**

6. The relative concentrations (in units of carbon dioxide in the air in an alveolus and in the blood in a pulmonary capillary) are shown in the diagram below.



- a. Name the TWO blood vessels Q and R.

**Q:** \_\_\_\_\_ **R:** \_\_\_\_\_ (1, 1 mark)

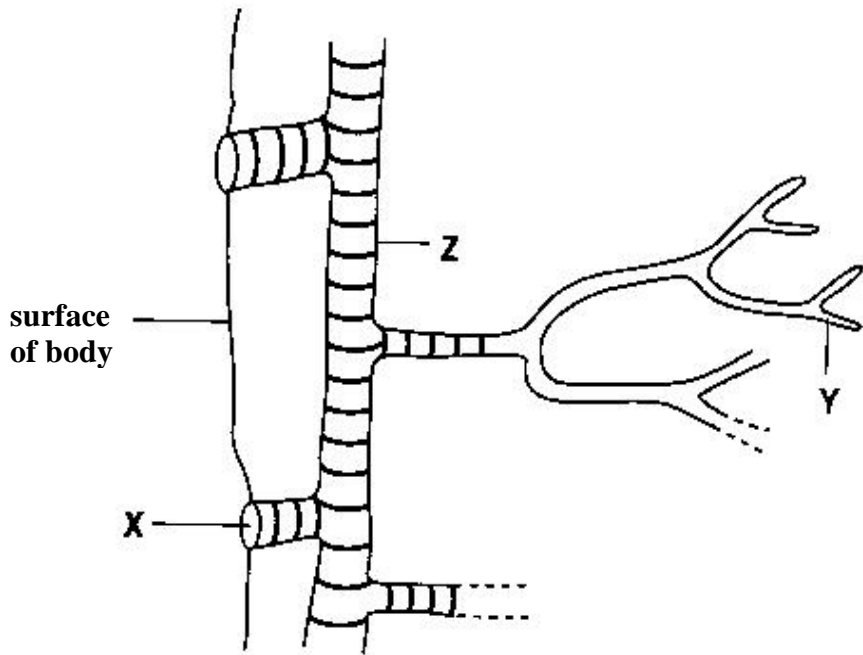
- b. Explain why the rate and depth of breathing increases during exercise.

\_\_\_\_\_  
 \_\_\_\_\_ (2 marks)

- c. What happens to the carbon dioxide concentration of arterial blood if a person holds the breath for a short time?

\_\_\_\_\_ (1 mark)

d. The following diagram shows part of the route taken by air to the cells in an insect.



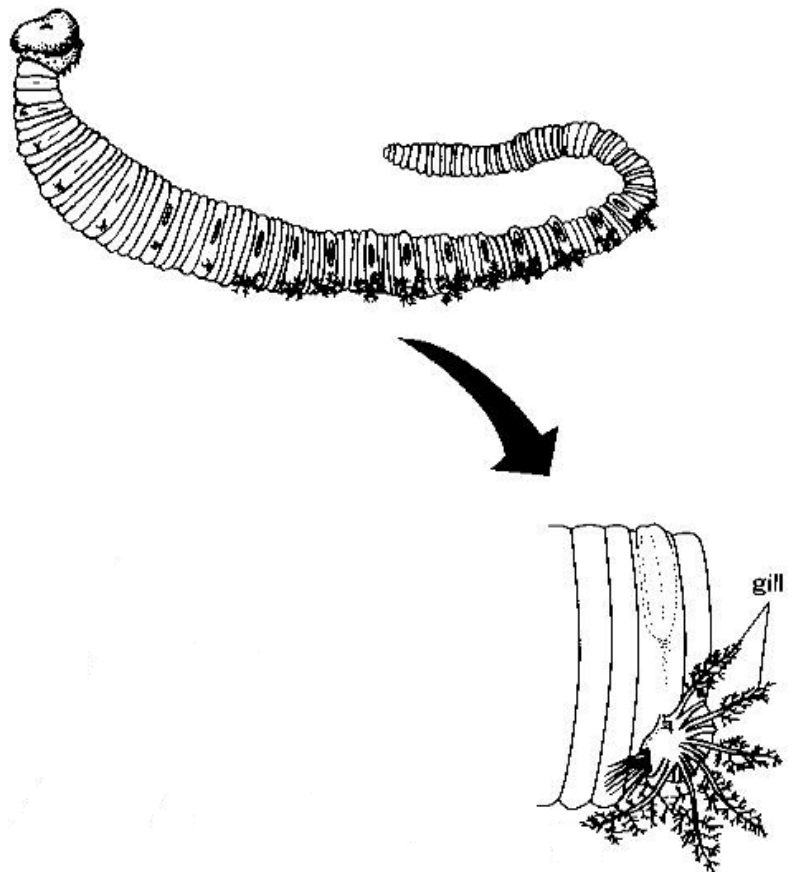
Name the parts labelled X and Y.

X: \_\_\_\_\_ Y: \_\_\_\_\_ (1, 1 mark)

e. In some insects the part labelled X may be surrounded by hairs. Suggest a reason for this.

\_\_\_\_\_ (1 mark)

f. There are many species of annelid worm. Some are very small, only a few millimetres in length, while others such as the lugworms are much larger. The following diagram shows a lugworm and part of one of its gills.





i. List ONE way (shown in the diagram) in which the structure of a lugworm gill is adapted for efficient gas exchange.

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ii. Explain why smaller species of annelid worms do not have gills.

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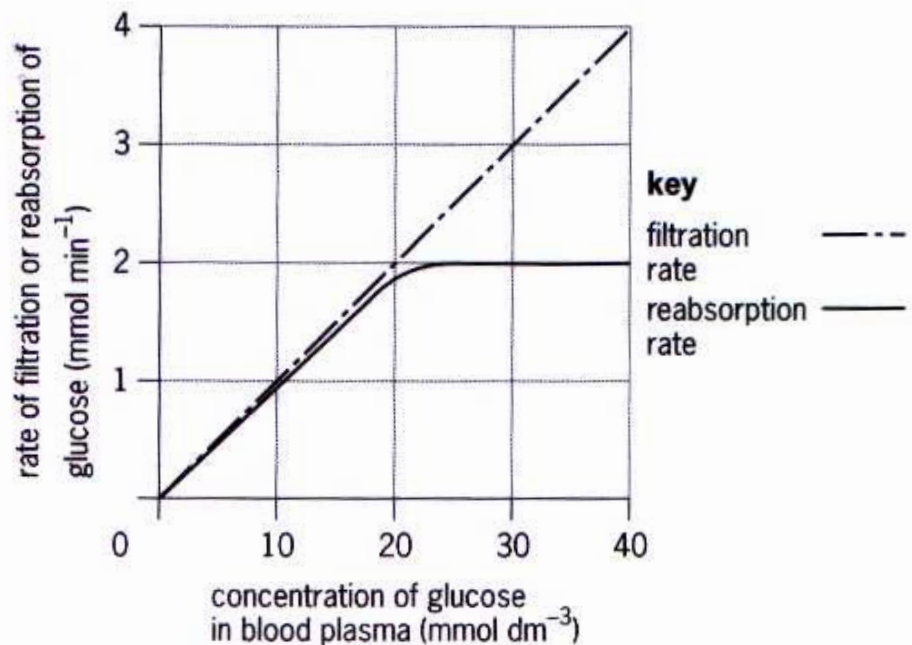


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(1, 2 marks)

**Total: 11 marks**

7. The following graph shows how the filtration rate and the reabsorption rate of glucose in human nephrons vary with the concentration of glucose in the blood plasma.



a. From the graph determine the maximum rate of glucose reabsorption.

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(1 mark)

b. Describe the relationship between the filtration rate and the concentration of glucose in blood plasma.

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(1 mark)

c. Describe the relationship between the reabsorption rate and the concentration of glucose in blood plasma.

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(2 marks)

d. What happens to the glucose in a person where the concentration of glucose in the blood plasma exceeds (is higher) 20mmol/dm<sup>-3</sup>?

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(2 marks)

- e. Explain why eating extra protein may have a greater effect on the urea content of an adult than in a child.

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(3 marks)

**Total: 9 marks**

## Section B

Answer any **THREE** questions from this section.

This section carries **45** marks. Write the answers for section B on a foolscap.

1. Read the following passage and answer the questions that follow.

In 1822 a young man called Alexis St. Martin was accidentally injured by a shotgun. His abdomen and stomach were blasted open. He survived thanks to prompt treatment by a local doctor. His stomach did not fully heal and Alexis was left with an opening to his stomach which the doctor covered with a leather flap. The doctor carried out experiments that investigated digestion in the stomach.

- a. Define the term digestion. (2 marks)
- b. Name the acid produced in the stomach and list ONE function of it. (2 marks)
- c. Name the tube that carries food from the mouth to the stomach. (1 mark)
- d. How is food prevented from entering the windpipe during swallowing? (2 marks)
- e. In one experiment, pieces of meat were tied to a silk thread and pushed into Alexis' stomach. Meat is mainly protein.
- i. Name the building blocks of protein.
- ii. The digestion of protein starts in the stomach. Name the organ where digestion of proteins is complete.
- iii. Where does the digestion of starch start? (1, 1, 1 mark)
- f. An egg sandwich contains starch, fat and protein.
- i. Which part of the sandwich contains the protein?
- ii. The sight, smell and even the thought of the egg sandwich is enough to start saliva production. Saliva contains mucus. Explain how mucus in saliva facilitates swallowing.
- iii. The wall of the stomach also produces lots of mucus. What is the function of the mucus produced in the stomach? (1, 2, 2 marks)

**Total: 15 marks**

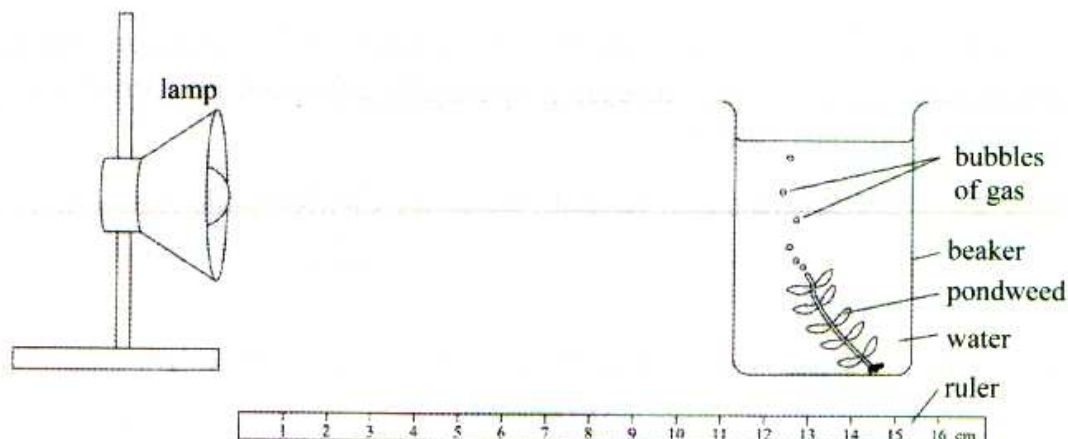
2. List ONE difference and ONE similarity between **each** of the following:

- a. fructose and sucrose
- b. hepatic portal vein and hepatic artery
- c. carbon dioxide and urea
- d. trypsin and pepsin
- e. intercostal muscles and diaphragm muscles.

(3, 3, 3, 3, 3 marks)

**Total: 15 marks**

3. A biology student carried out an investigation about photosynthesis in which the concentration of carbon dioxide available to a water plant (pondweed) was varied by adding different amounts of sodium hydrogen carbonate to the water in the beaker. The following diagram shows the apparatus that was set up for the investigation.



- Name the gas produced in the beaker and explain what test can be carried out for the gas you mention. (3 marks)
- The biology teacher suggested to the student to collect the gas in a measuring cylinder. Give a reason for this. (2 marks)
- As the amount of carbon dioxide increases (with increasing concentration of hydrogencarbonate) the rate of photosynthesis increases. Describe how this would be evident during the experiment. (2 marks)
- At dawn and dusk no gases enter or leave the plant. Explain. (4 marks)
- Explain the importance of
  - the waxy cuticle
  - cells containing many chloroplasts in the palisade mesophyll layer of a leaf. (2, 2 marks)

**Total: 15 marks**

4. Give a biological explanation for **each** of the following statements:

- At the end of a race athletes need to repay the oxygen debt. (4 marks)
- Poorly planned vegetarian diets can be low in some nutrients. (4 marks)
- Yeast respire without the need for oxygen. (3 marks)
- One important function of blood is protection. (4 marks)

**Total: 15 marks**

5. Explain the biological message in **each** of the following posters.

a.



(4 marks)

b.



(3 marks)

c.

How many cigarettes a day  
does your child smoke?



(4 marks)

d.



(4 marks)  
**Total: 15 marks**