TAMPINES SECONDARY SCHOOL

Secondary Three Express
MID YEAR EXAMINATION 2019

NAME

CLASS REGISTER NUMBER

SCIENCE (BIOLOGY) **5078**

13 May 2019

1 hour 30 minutes

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name, class and register number on all the work you hand in.
You may use an HB pencil for any diagrams, graphs, tables or rough working.
Write in dark blue or black pen.
Do not use staples, paper clips, glue or correction fluid.

Section A

There are **twenty** questions in this section. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the Multiple Choice Answer Sheet.

Section B

Answer **all** questions.
Write your answers in the spaces provided on the question paper.

Section C

Answer **all** questions.
Write your answers in the spaces provided on the question paper.

The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
SECTION A (20 marks)	
SECTION B (30 marks)	
SECTION C (20 marks)	
TOTAL (70 marks)	

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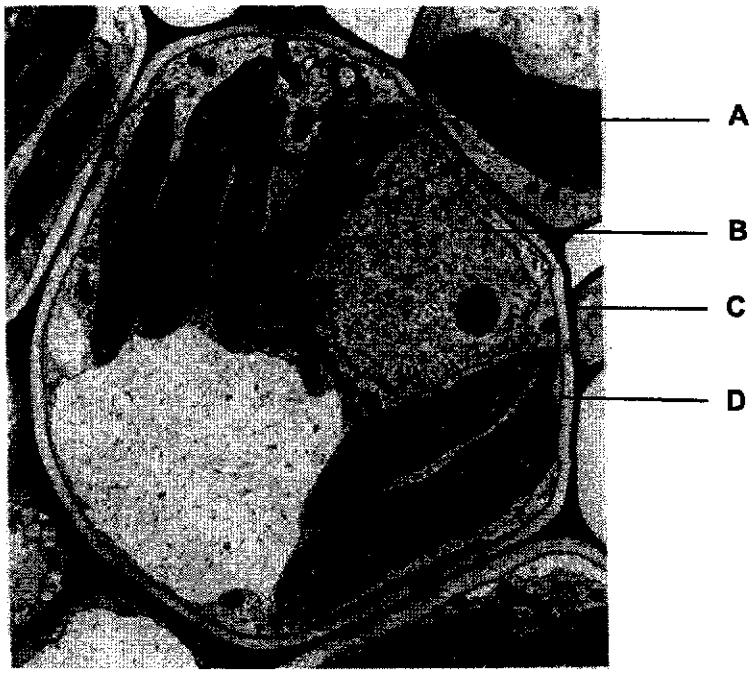
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Section A

1 Which of the following structures are found in both the animal and plant cells?

A cell membrane and chloroplast
B cell membrane and nucleus
C cell wall and chloroplast
D cell wall and nucleus

2 The electron micrograph below shows part of a plant tissue.



Which structure is partially permeable?

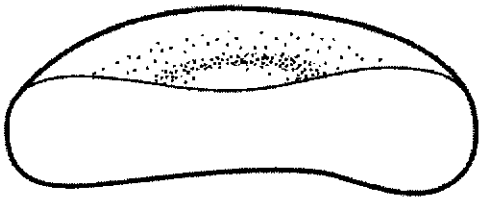
3 The table below shows the main functions of a red blood cell and a root hair cell. Which of the following shows the **correct** identification of the functions of the two cells?

	red blood cell	root hair cell
A	absorption	absorption
B	transport	transport
C	absorption	transport
D	transport	absorption

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4 The diagram shows a specialised cell cut in half.



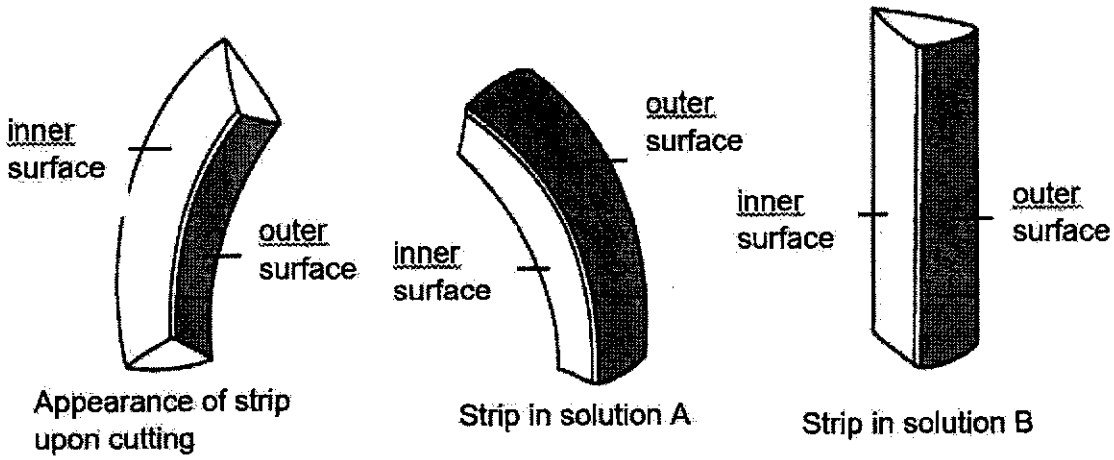
What does this diagram indicate about the structure of this cell?

A The cell does not have a membrane.
B The cell is concave on each side.
C The cell contains haemoglobin.
D The cell carries oxygen.

5 A piece of Chinese leek stem was cut lengthwise into four equal strips, three of which were used in an experiment as follows:

1 strip was left as a control
1 strip was placed in solution A for 20 minutes
1 strip was placed in solution B for 20 minutes

The following observations were made.



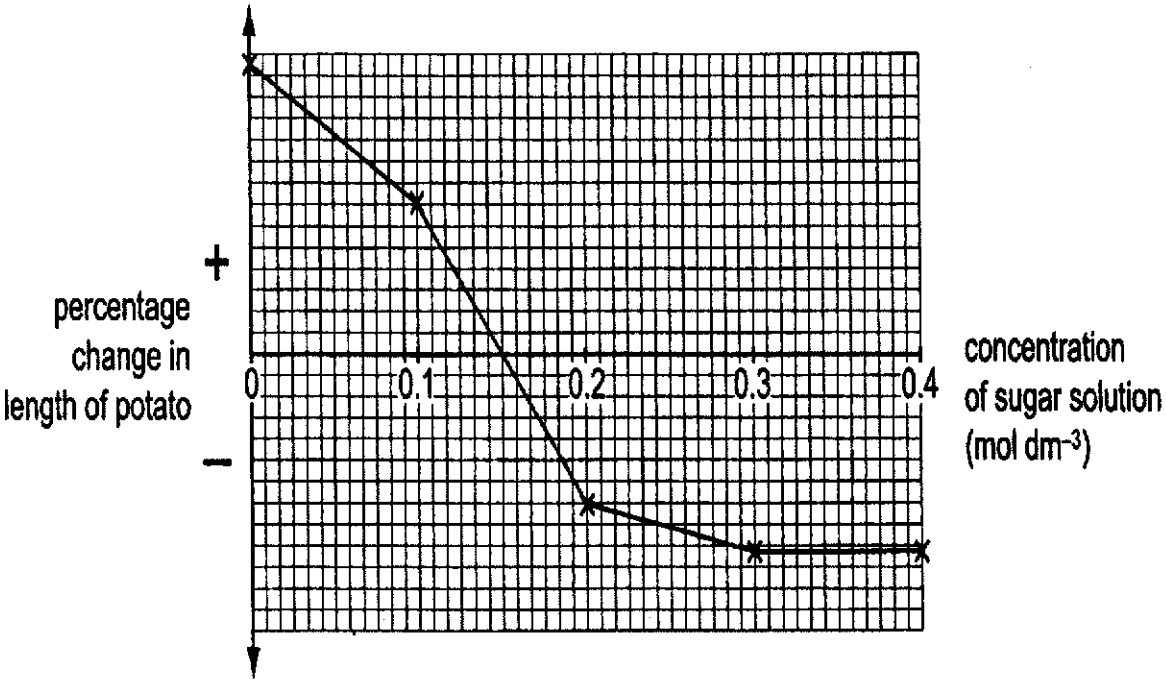
Which of the following statements best describes the observation above?

A Solution A has a lower water potential than solution B.
B Solution A has a higher water potential than that of the Chinese leek cells.
C Solution B has the same water potential as that of the Chinese leek cells.
D Solution B is of a higher concentration than solution A.

[Turn over]

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6 Five pieces are cut from a potato, all of equal size and shape. The pieces are then placed in sugar solutions of different concentrations. After four hours, the change in length of each potato piece is measured.



The results are shown in the graph below.

Which concentration of sugar solution has approximately the same water concentration as the potato?

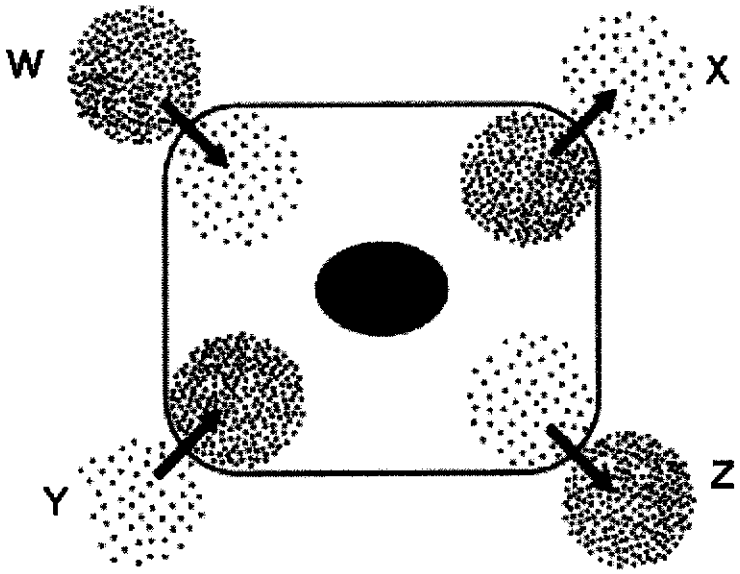
A 0.00 mol dm^{-3}
B 0.15 mol dm^{-3}
C 0.30 mol dm^{-3}
D 0.40 mol dm^{-3}

7 Five drops of red dye were added to a beaker of water. Which of the following **correctly** describes how the dye "spreads"?

A Osmosis occurs as water molecules are moving around.
B Osmosis occurs as the red dye molecules are moving in between water molecules.
C Diffusion occurs as the red dye molecules move into regions of lower concentration.
D Diffusion occurs as water molecules are moving across a membrane.

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8 The diagram shows four ways in which molecules may move into and out of a cell. The dots show the concentration of molecules. The cell is respiring aerobically.

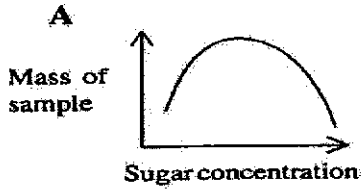


Which of the following represents the movement of oxygen and carbon dioxide molecules respectively?

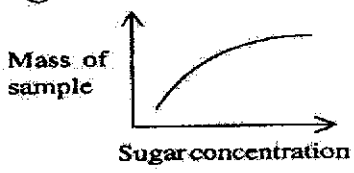
	movement of oxygen molecules	movement of carbon dioxide molecules
A	W	X
B	X	Y
C	Y	Z
D	Z	W

9 Samples of potato tuber were placed in sugar solution of different concentrations. Any changes of the mass of the samples were noted.
Which graph represents the result of this experiment

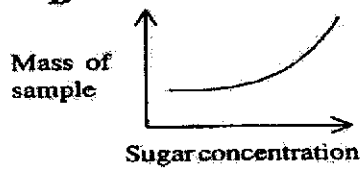
A



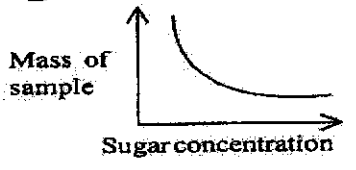
C



B



D



[Turn over]

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10 Which element in a molecule of urea shows that it is formed from amino acids and not from glucose?

A carbon
B hydrogen
C nitrogen
D oxygen

11 Which chemical test shows the presence of enzymes in a biological washing powder?

A Benedict's test
B Biuret test
C Ethanol emulsion test
D Iodine test

12 The table shows the protein, fat and starch content in 10 g of rice and white fish.

food	protein / g	fat / g	starch / g
rice	0.6	0.1	8.7
white fish	2.8	0.05	0.0

What would be the main end-products of digestion of a meal of rice and white fish?

A amino acids and fatty acids
B amino acids and glucose
C fatty acids and glucose
D glucose and glycerol

13 A sample of food mixed with water was tested to find out its contents. The results are shown in the table.

test	result
iodine solution added	blue black colour
Benedict's solution added and mixture heated	blue solution
Biuret's solution added	blue solution
shaken with ethanol	cloudy white emulsion

Which nutrient(s) were present in the food?

A fats only
B proteins and fats
C reducing sugar and fats
D starch and fats

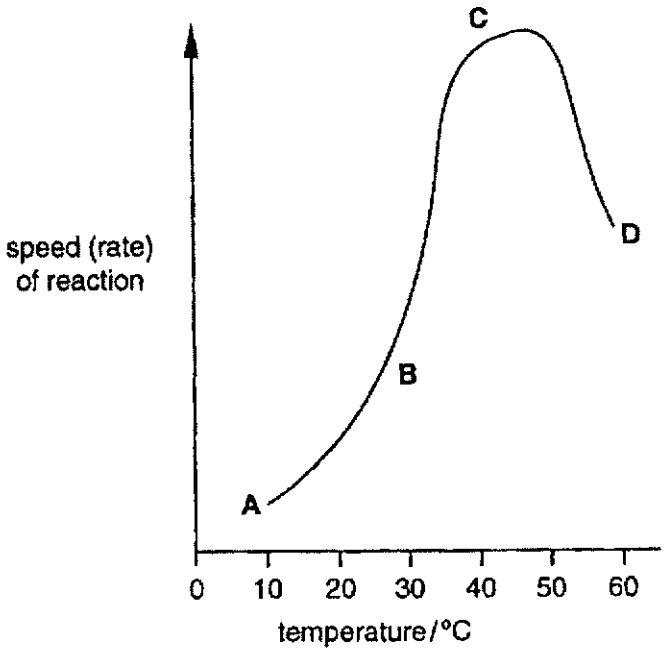
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14 A substance found in banana causes them to turn brown when exposed to air. How would you determine that the substance is an enzyme?

A Boil the banana and see if it turns brown in the air.
B Deprive the banana of oxygen and see if it turns brown.
C Test whether the unpeel banana turns brown.
D Test whether banana turns brown in an atmosphere of pure carbon dioxide.

15 The graph below shows the effect of temperature on a chemical reaction which is controlled by enzymes.

At which point are most product molecules being released?



16 Fig. 16 below shows the lock and key model of an enzyme-catalysed reaction?

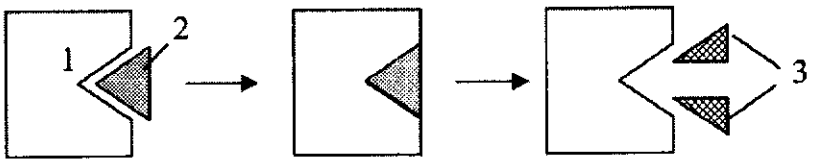


Fig. 16

Which **correctly** identifies the lock and key in Fig. 16?

	lock	key
A	1	2
B	1	3
C	2	1
D	2	3

[Turn over]

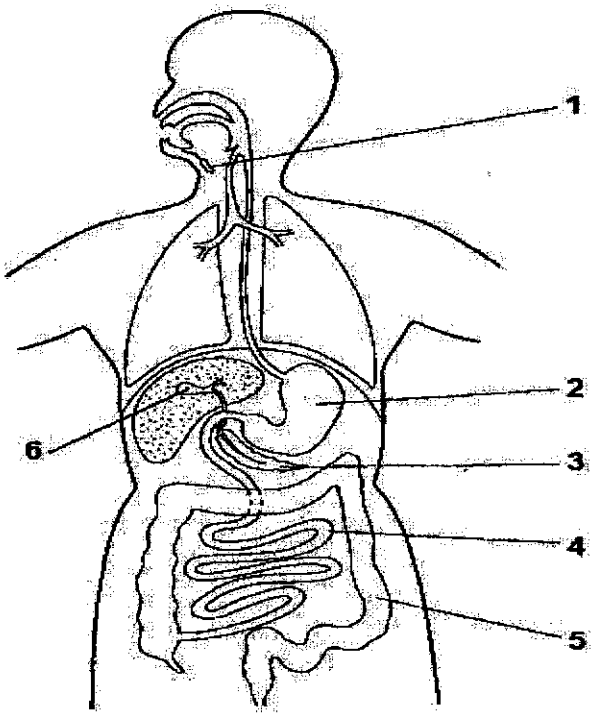
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17 After a student chews on a piece of bread for some time, a sweet taste develops in her mouth.

What is the best explanation for this?

A Bacteria in the mouth feed on starch and produce sugar.
B Enzymes in the saliva digest the starch into maltose, which is a sugar.
C Sugar in the bread diffuses into her mouth.
D There is a greater secretion of saliva into sugar.

18 The diagram shows the human digestive system.

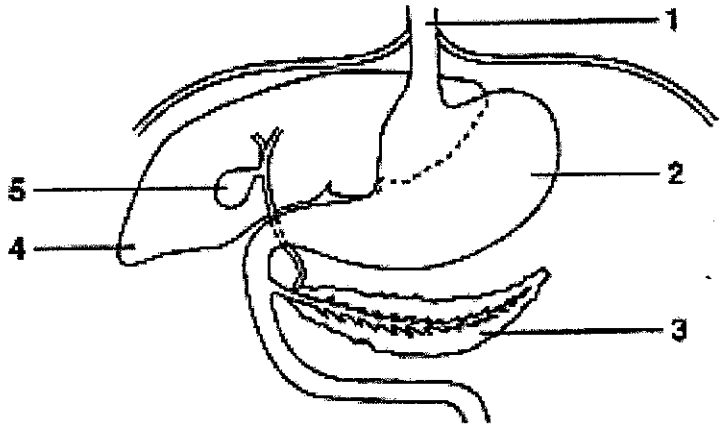


Which structures do not produce enzymes that break down food?

A 1 and 3
B 2 and 5
C 3 and 4
D 5 and 6

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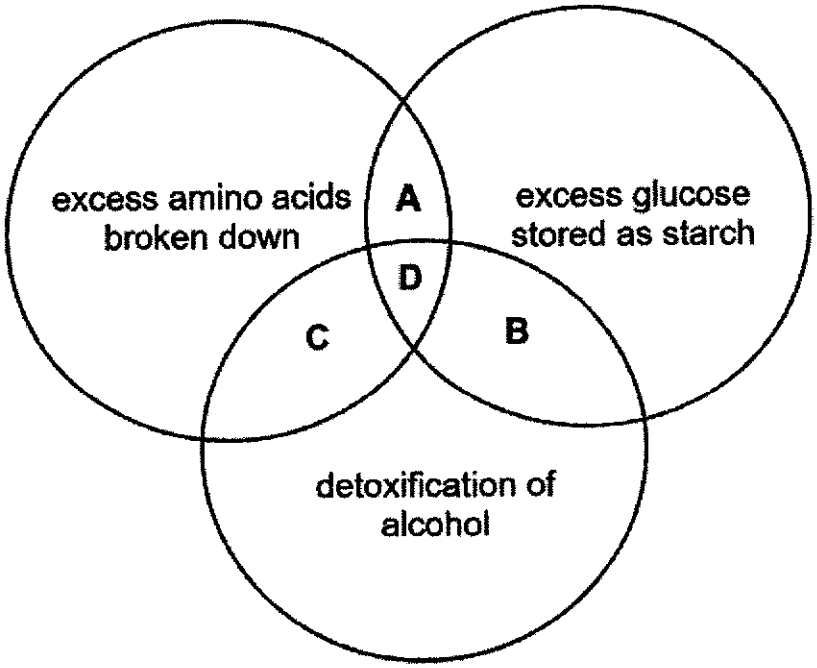
19 The diagram shows part of the human alimentary canal.



Which two structures produce substances involved in the digestion of fat?

A 1 and 5
B 2 and 3
C 3 and 4
D 4 and 5

20 Which section of the diagram represents the functions carried out by the liver?



[Turn over]

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Section B

Answer **all** the questions in the spaces provided.

1 A student observed a cell on a slide, using a microscope. The cell is shown in Fig. 1.1 below.
Parts of the cell are labelled **W**, **X**, **Y** and **Z**.

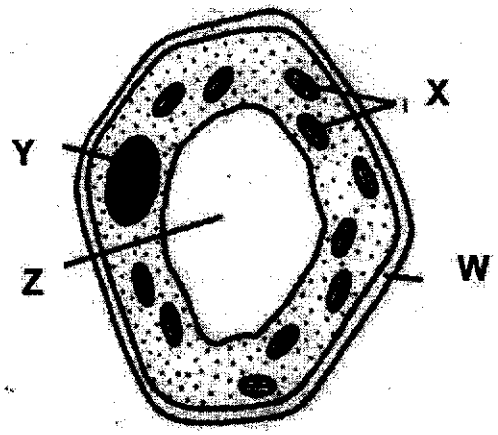


Fig. 1.1

(a) The student identified this cell as a plant cell. State **three** observations that led the student to make this identification.

.....

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..... [3]

(b) State the function of **X** and explain their importance to **all** organisms along a food chain.

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..... [2]

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(c) State one reason why the plant cell in Fig.1.1 cannot be an onion epidermal cell.

.....

..... [1]

(d) Predict and explain what will happen to the cell from Fig.1.1, if it is placed in a concentrated salt solution.

.....

.....

.....

..... [2]

Total [8 marks]

[Turn over]

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2 A student cuts six pieces of potato and weighed each one.
He placed each piece of potato in a different concentration of sugar solution for 60 minutes.
He then re-weighed each piece of potato.
He worked out the change in mass for each piece as a percentage of the original mass.
His results are shown in Table 2.1.

Table 2.1

concentration of sugar solution/ mol per dm^3	mass of potato/g		percentage change in mass/%
	start	finish	
0.20	8.42	9.18	+9.0
0.30	8.15	8.68	+6.5
0.40	8.30	8.48	+2.2
0.50	8.62	8.31	−3.6
0.60	8.38	7.83	−6.6
0.70	8.22	7.53	

(a) Explain why the mass of some potato pieces increased and the mass of other pieces decreased.

.....

.....

.....

.....

.....

..... [3]

(b) Calculate the percentage change in mass for a sugar concentration of 0.70 mol per dm^3.

..... [1]

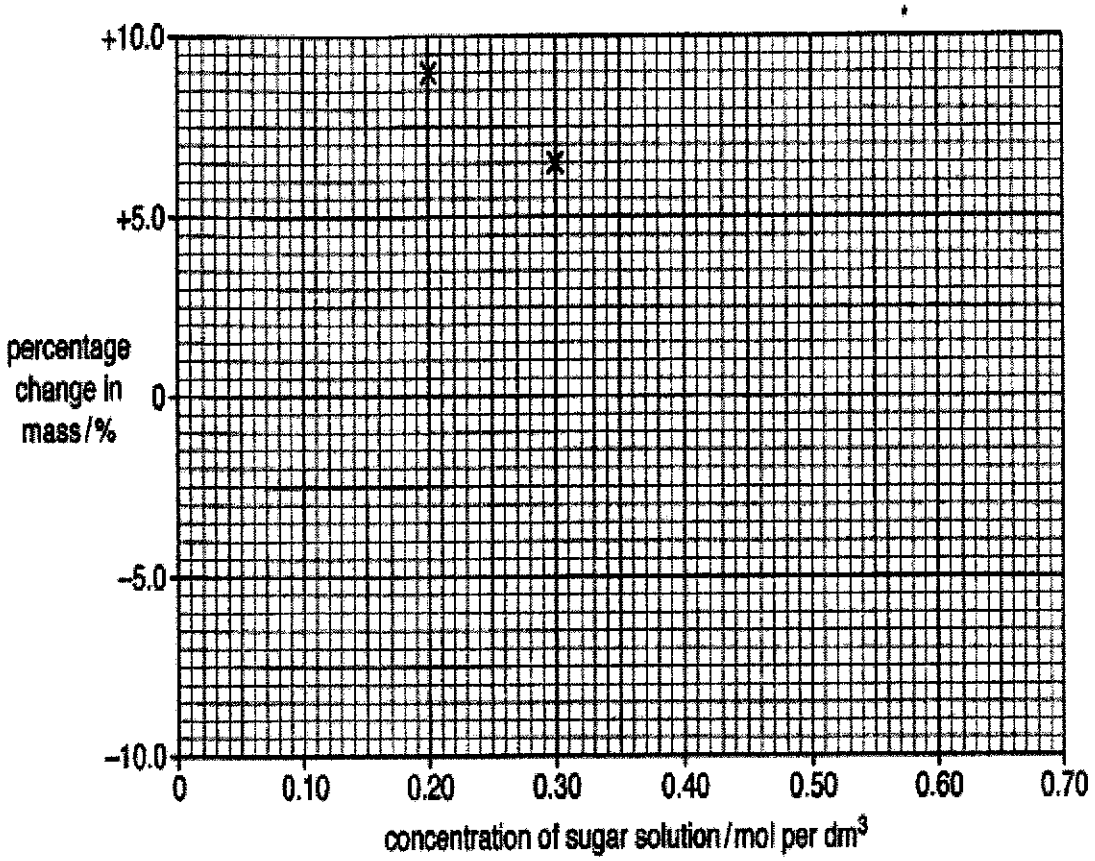
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(c) On the grid two of the points from Table 2.1 have been plotted for you.

(i) Plot the other four points. [2]

(ii) Draw a best-fit curve. [1]



(d) **(i)** Use your graph to suggest a concentration for the cell sap in the potato.

..... mol per dm^3 [1]

(ii) Explain your answer in **(d) (i)**.

.....

..... [1]

Total [9 marks]

[Turn over]

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3 Table 3.1 below shows the nutritional value of a school lunch eaten by a 16 year old girl.

food eaten	protein in g	carbohydrate in g	fat in g	iron in mg	vitamin in mg
sausages	9	5	24	1	0
chips	8	70	20	2	20
baked beans	10	20	1	3	4
apple pie	5	60	25	1	1
ice cream	2	20	12	0	0
fizzy drinks	0	30	0	0	0

Table 3.1

(a) **(i)** In this meal, which food was the greatest source of proteins?

..... [1]

(ii) Explain why proteins are essential to the girl.

.....

..... [1]

(iii) Describe briefly how you would test for the presence of proteins in a food sample.

.....

.....

.....

..... [2]

(b) **(i)** Name the two foods in this meal which provide the highest amounts of energy.

..... [2]

(ii) The girl's daily energy needs is 2200 kJ. This meal supplied her with 6600 kJ of energy. State one effect if she were to continue with this meal for lunch for a period of six months.

.....

..... [1]

Total [7 marks]

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4 Read the passage below and answer the questions that follow.

> *For many years, doctors believed that gastric ulcers (damage and bleeding of the stomach wall) were caused by excessive acid secretion in the stomach, so they used certain chemicals to treat ulcer patients. However, after recovery, many patients might develop gastric ulcer again.*
>
> *In the 1980s, an Australian doctor, Barry Marshall, observed that all his ulcer patients had a type of bacteria called Helicobacter pylori in their stomach. He therefore put forward a new hypothesis about gastric ulcers. Based on this hypothesis, he treated his patients with antibiotics which are chemicals that kill bacteria. Many of his patients recovered rapidly and did not develop gastric ulcers again.*

(a) Many doctors were surprised at Marshall's observation because they thought that bacteria could not survive in the stomach. Explain why.

.....

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..... [2]

(b) Gastric ulcer can sometimes lead to stomach cancer. A patient with stomach cancer will need to have their stomach surgically removed. Discuss the effects on the digestive function and changes to the lifestyle of such a patient.

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..... [4]

Total [6 marks]

[Turn over]

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Section C

Answer **all** the questions in this section.

Write your answers in the spaces provided.

5 (a) List **two** functions of the xylem cell.

.....

.....

..... [2]

(b) Describe **two** ways in which a xylem cell is different from a typical plant cell. Explain how these two ways help the xylem to carry out its functions.

.....

.....

.....

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.....

.....

..... [4]

(c) Describe **two** ways in which a red blood cell is different from a typical animal cell. Explain how these two ways help the red blood cell carry out its function.

.....

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.....

.....

..... [4]

Total [10 marks]

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6 **Fig. 6.1** below shows, in order, four stages in which an enzyme-controlled chemical reaction may occur.

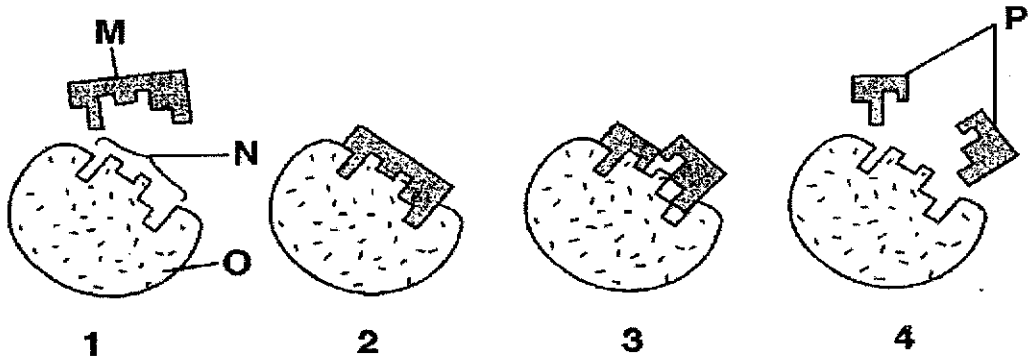


Fig 6.1

(a) Using the following terms: **active site, enzyme, product, substrate**, identify substances **M, N, O** and **P**.

M: .....

N: .....

O: .....

P: ..... [2]

(b) By referring to **Fig 6.1**, explain why only a small amount of enzyme is needed to catalyse a reaction involving many molecules.

.....

..... [1]

(c) In the **small intestines**, digestion of **fat** and **carbohydrate** occurs. Describe how this occurs in terms of the enzymes, substrates and final products.

.....

.....

.....

.....

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.....

.....

..... [4]

[Turn over]

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(d) Food absorption takes place in the small intestines. Name the blood vessel through which absorbed food molecules are transported to the liver for processing.

..... [1]

(e) The liver processes the absorbed food molecules. State **two** other functions of the liver.

.....

.....

.....

..... [2]

Total [10 marks]

---------- End of paper ----------

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1.B	2. D	3. D	4. B	5. A	6. B	7. C	8.A	9. D	10.C
11.B	12.B	13.D	14.A	15.C	16.A	17.B	18.D	19.C	20.C

Section B

1 (a) presence of cell wall [1]

presence of large central vacuole [1]

presence of chloroplast [1]

(b) X is chloroplast, absorbs light for photosynthesis [1]

Chloroplast helps to make food, which in turn feeds all organisms along a food chain. [1]

(c) Because it has a chloroplast. [1]

(d) The cell would decrease in size and become flaccid/ plasmolysed. [1]
as water moves out from a region of higher water potential (cell sap) into the concentrated salt solution (region lower water potential) by osmosis. [1]

2 (a) The sugar solutions with concentrations of 0.20, 0.30 and 0.40 mol per dm^3 all had higher water potentials as compared to the cell sap of the potato. [1]

In these solutions, water moved into the potato pieces via osmosis, causing the mass of the potato pieces to increase. [1]

The sugar solutions with concentrations of 0.50, 0.60 and 0.70 mol per dm^3 had lower water potentials as compared to the cell sap of the potato. [1]

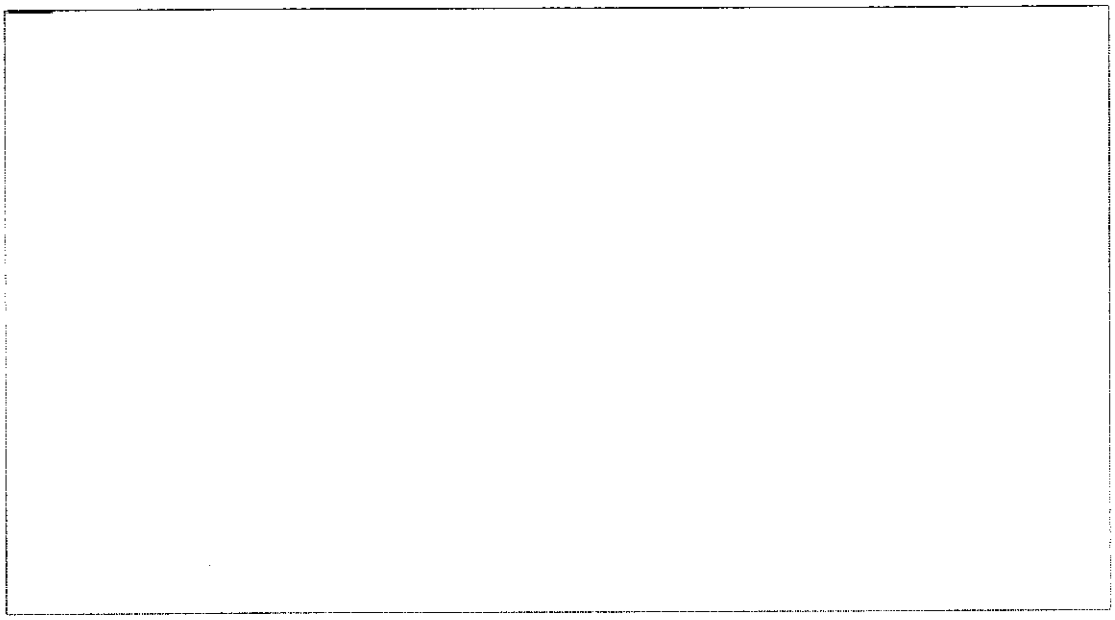
In these solutions, water moved out of the potato pieces via osmosis, hence resulting in a decrease in their mass. [1]

Max 3

(b) Percentage change in mass = $\frac{7.53-8.22}{8.22}$ x 100% = -8.4% (1 dp) [1]

(c) (i) [total 2m for 4 points, every 2 points correctly plotted 1m]
(ii) [total 1m] curve nicely drawn, most points connected correctly

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(d) (i) 0.435 mol per dm^3 [± 0.02] [1]

(ii)
The **concentration of the cell sap in the potato is equal to the concentration of the sugar solution** when the percentage change in mass is at 0%. [1]

This is because when the concentration of the cell sap in the potato is the same as the concentration of the sugar solution, there is **no net movement into or out of the potato via osmosis, and hence there is no change in the mass** of the potato.

3 (a) (i) Baked beans [1]

(ii) For growth + body building / repair of worn-out/damaged tissues / synthesis of enzymes and hormones [1] [1]

(iii) Carry out Biuret Test [1]

Add biuret solution / copper sulphate + sodium hydroxide solution and shake [0.5]

If violet colouration is observed, proteins are present. [0.5]

(b) (i) Apple pie; chips [2]

(ii) She would become obese. [1]

4 (a) stomach produce hydrochloric acid [1m] the low pH of 2-3 which kills bacteria [1]

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(b) Without stomach, a person will be unable to digest protein into polypeptide as efficiently as a normal person [1]
the person will need to change his diet by consuming food with less protein [1m] [1]
the person will need to take more frequent meals and lesser amount of food per meal / chew more [1]
the person will be more prone to infection of the gut as bacteria are not killed by acid in the stomach [1]

Section C

5 (a) Conduct water and mineral salts from the roots up to the stems and leaves [1]

Provide mechanical support to the plant [1]

(b) Continuous and hollow lumen due to absence of cross walls/ no protoplasm [1]

To transport water and dissolved mineral salts from the roots to the leaves [1]

Xylem has lignin deposits + typical plant cell has no lignin [1]

Lignin strengthens the walls of the xylem and prevents the xylem from collapsing [1]

(c) Red blood cell contains haemoglobin + typical animal cell does not contain haemoglobin [1]

Haemoglobin binds with oxygen to enable RBC to transport it. [1]

RBC has no nucleus + typical animal cell has nucleus [1]

Allows more space to carry more haemoglobin, hence more oxygen [1]

RBC has biconcave shape + typical animal cell has spherical shape [1]

Increase surface area: volume ratio, so that oxygen can diffuse into and out of RBC at faster rate [1]

max 4

6 (a) M: substrate [0.5]

N: active site [0.5]

O: enzyme [0.5]

P: product [0.5]

(b) enzyme remains unchanged after the reaction [1]

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(c) **fat:**

enzymes – pancreatic lipase [0.5]

- intestinal lipase [0.5]

fats to fatty acids and glycerol [1]

carbohydrates:

enzyme – pancreatic amylase [0.5]

starch to maltose [0.5]

enzyme – maltase [0.5]

maltose to glucose [0.5]

(d) hepatic portal vein [1]

(e) [A1]x2

- Secretion of bile
- regulation of blood glucose concentration
- Deamination of amino acids
- regulate removal of toxic waste
- Breakdown Hb/ hormones / enzymes
- excretory organ to remove bile pigments

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