Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education
Advanced Subsidiary Level and Advanced Level

BIOLOGY **9700/02**

Paper 2 Structured Questions AS

October/November 2005

1 hour 15 minutes

Candidates answer on the Question Paper.
No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces provided at the top of this page.
Write in dark blue or black pen in the spaces provided on the Question Paper.
You may use a soft pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.

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

If you have been given a label, look at the details. If any details are incorrect or missing, please fill in your correct details in the space given at the top of this page.

Stick your personal label here, if provided.

FOR EXAMINER'S USE	
1	
2	
3	
4	
5	
6	
TOTAL	

This document consists of **15** printed pages and **1** blank page.

Answer **all** the questions.

1 Fig. 1.1 is a drawing made from an electron micrograph of a goblet cell from the epithelium of the gas exchange system.

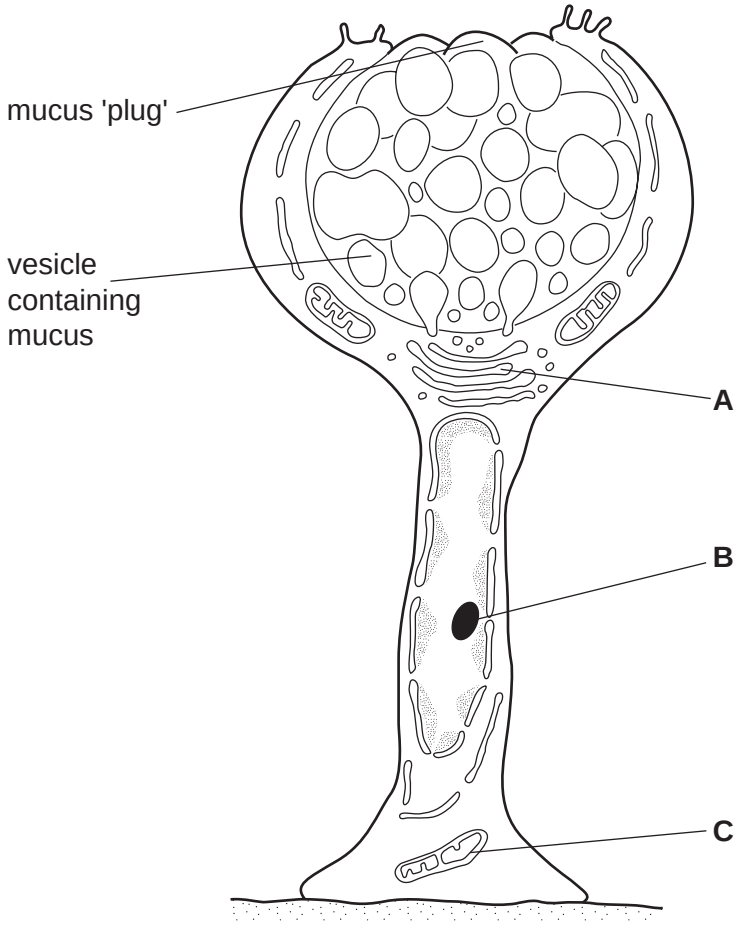

Fig. 1.1

(a) Name **A** to **C**.

A .....

B .....

C .....[3]

(b) State two places in the gas exchange system where goblet cells are found.

1. .....

2. .....[1]

Mucus contains a number of different glycoproteins, called mucins. These have a protein 'core' that is formed by repeated sequences of amino acids, some of which have carbohydrates attached to their side chains (R groups). A part of one of these repeated units is shown diagrammatically in Fig. 1.2.

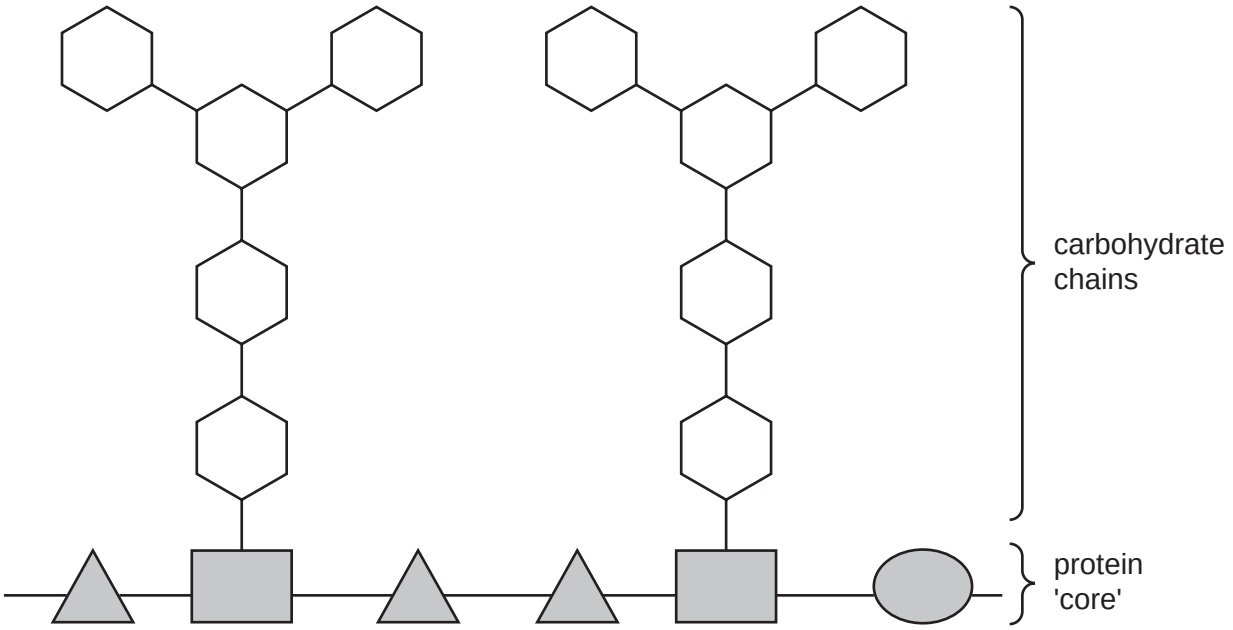

Fig. 1.2

(c) Use label lines and the letters **P** and **G** to indicate on Fig. 1.2 the positions of:
P – a peptide bond;
G – a glycosidic bond. [2]

(d) Describe the role of mucus in the gas exchange system.

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.....[3]

(e) Glycoproteins are found in cell surface membranes.

State **one** function of these glycoproteins.

.....

.....[1]

[Total: 10]

2 Phospholipids are components of cell surface membranes.

(a) Describe how phospholipid molecules are arranged in a cell surface membrane.

You may use the space below for a **simple annotated** diagram if you wish.

.....

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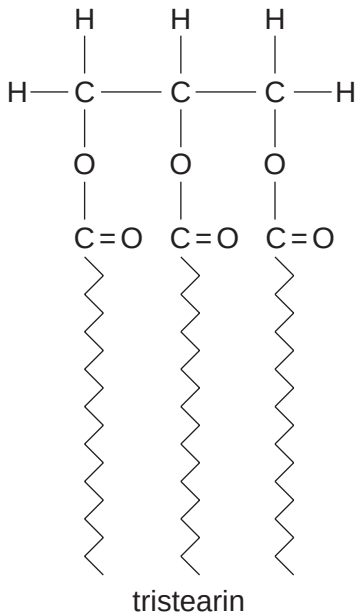
.....

.....

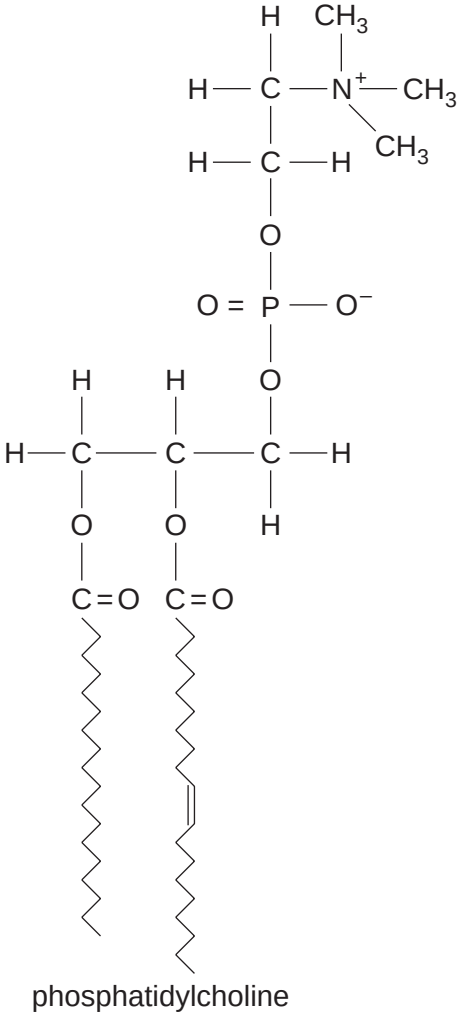
[2]

Fig. 2.1 shows the structure of the lipids:

- tristearin, which is a triglyceride;
- phosphatidylcholine, which is a phospholipid.



tristearin



phosphatidylcholine

(b) State two ways, **visible in Fig. 2.1**, in which phosphatidylcholine differs from tristearin.

1. .....

.....

2. .....

.....[2]

(c) Explain how the structure of triglycerides, such as tristearin, makes them more suitable for energy storage than carbohydrates, such as glycogen.

.....

.....

.....

.....[2]

The enzyme lipase catalyses the hydrolysis of ester bonds in triglycerides. As the reaction proceeds there is a decrease in pH. The progress of the reaction may be followed by using a pH meter.

A solution containing tristearin was placed in a water bath at 25 °C. When the solution had reached this temperature, lipase was added and the mixture stirred. The pH of the reaction mixture was recorded every minute for 20 minutes. The results are shown in Fig. 2.2.

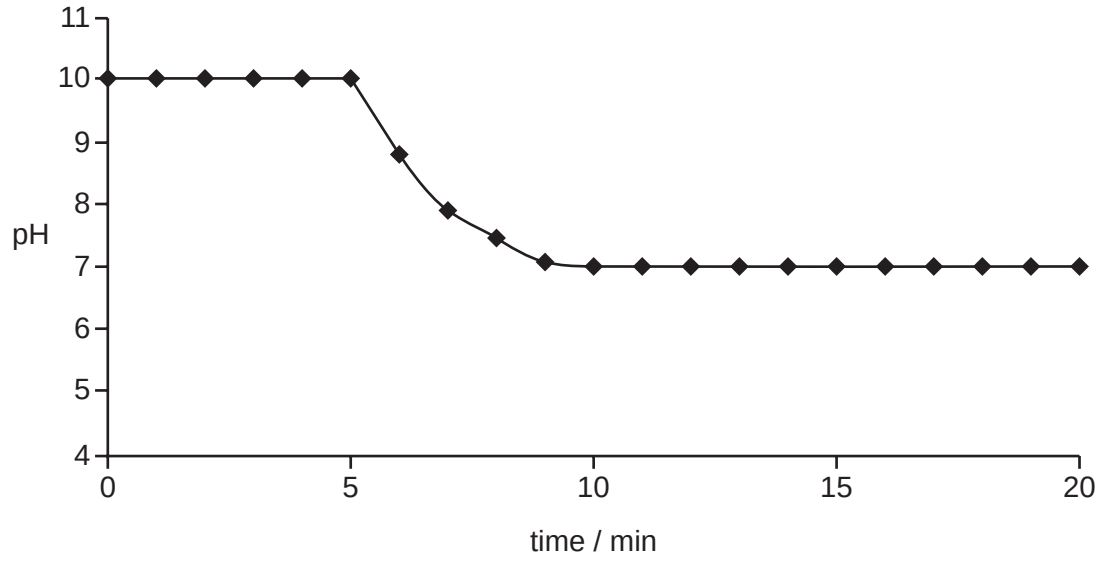


Fig. 2.2

(d) Using the data in Fig. 2.2, state the time when

(i) lipase was added;

.....[1]

(ii) the reaction ended.

.....[1]

(e) Explain why the pH decreases during this reaction.

.....

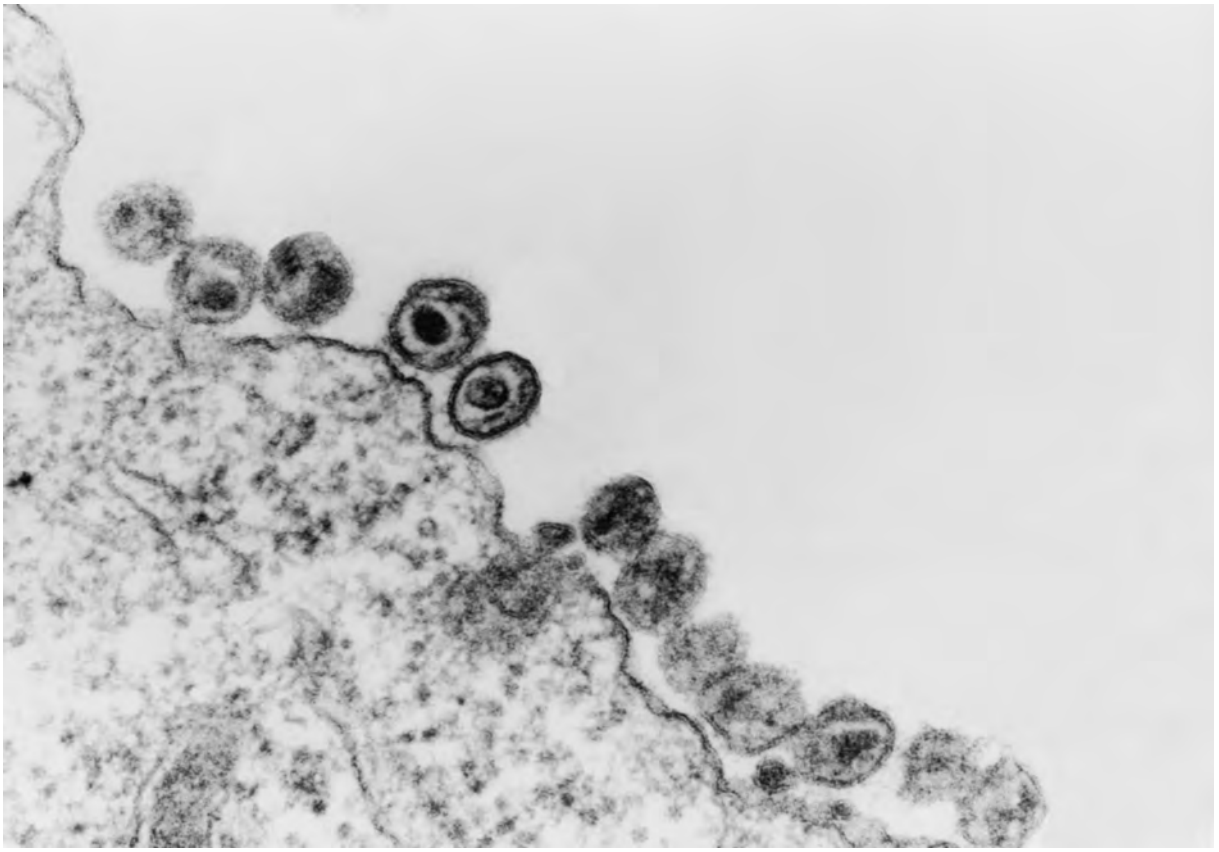
.....[1]

(f) A similar solution was placed in a water bath at 35 °C and left for the same length of time to reach this temperature. Lipase was added as before.

Sketch on Fig. 2.2 the results that you would expect. [2]

[Total: 11]

3 Fig. 3.1 is an electron micrograph of HIV particles leaving a T lymphocyte.



Magnification × 100 000

Fig. 3.1

HIV instructs the cell to reproduce more viruses. During this process the cell makes viral DNA and viral proteins that assemble to make new viral particles. These particles bud away from the cell membrane to infect other T lymphocytes. This process of viral budding kills T lymphocytes. A decrease in the number of T lymphocytes in the blood results in the destruction of a person's immune system and leads to the onset of AIDS.

(a) (i) Calculate the actual size of a viral particle shown in Fig. 3.1. Show your working and express your answer to the nearest nanometer.

Answer ..... nm [2]

(ii) State the property of the electron microscope that makes it possible to view clearly very small objects, such as viral particles.

.....[1]

(b) Suggest why an infected T lymphocyte that is producing HIV particles has a higher demand for amino acids than an uninfected cell.

.....

.....[1]

(c) State three ways in which HIV is transmitted.

1. .....

.....

2. .....

.....

3. .....

.....[3]

(d) Outline the problems involved in controlling the spread of HIV.

.....

.....

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.....

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.....[3]

[Total: 10]

4 **(a)** Explain why the mammalian circulatory system is described as a closed double circulation.

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.....

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.....[2]

(b) Mature mammalian red blood cells have no nuclei. State **one** advantage and **one** disadvantage of this.

advantage .....

.....

.....

disadvantage .....

.....

.....[2]

(c) Fig. 4.1 shows the origin and development of a B lymphocyte and its subsequent role in an immune response following an infection with the measles virus.

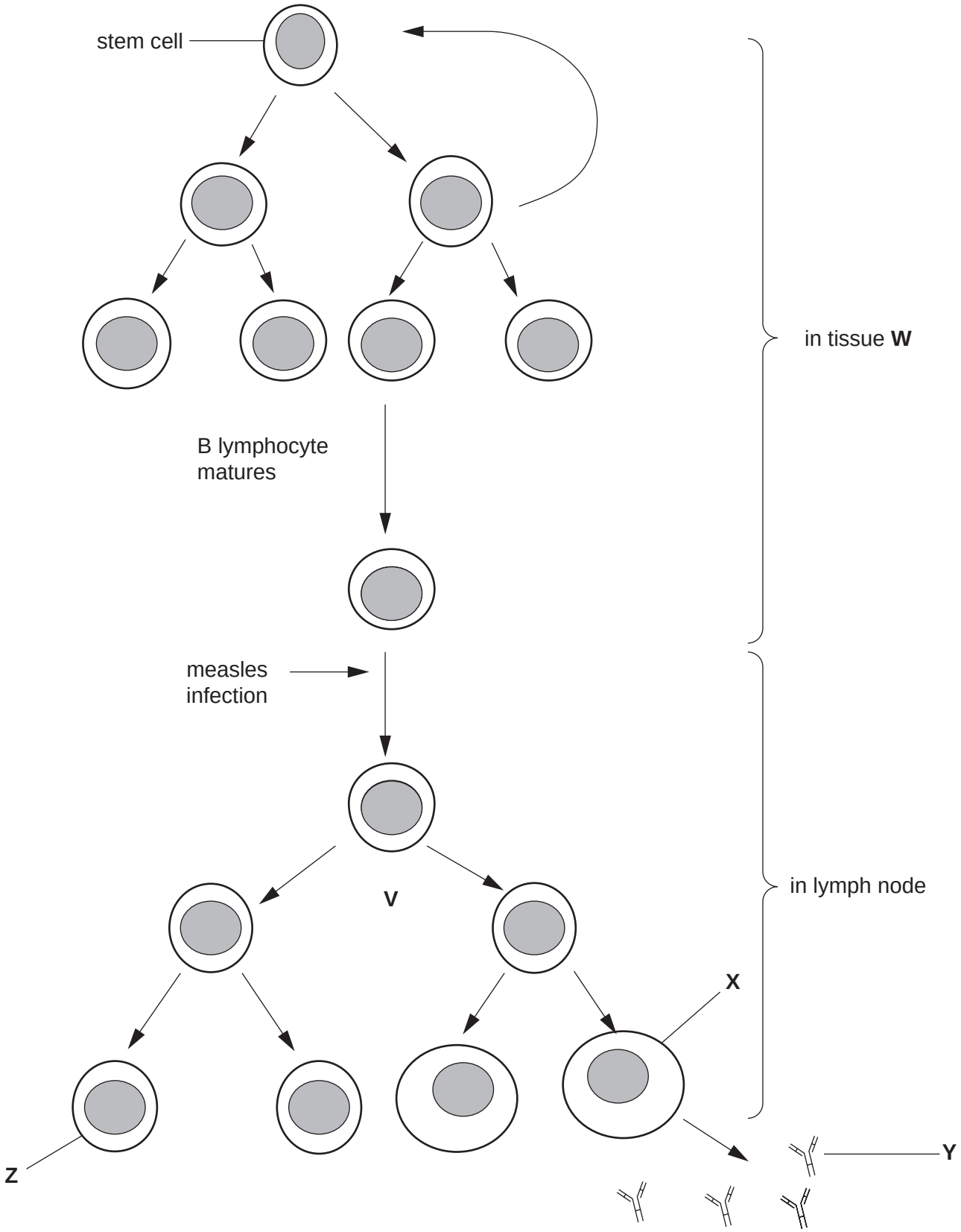


Fig. 4.1

(i) Name the type of nuclear division that occurs at **V**.

.....[1]

(ii) Name the tissue **W**.

.....[1]

(iii) State the term given to foreign molecules, such as those on the surface of the measles virus, that stimulate an immune response.

.....[1]

(iv) Name cell **X** and molecule **Y**.

X .....

Y .....[2]

(v) Cell **Z** is responsible for long-term immunity to measles.

Name cell **Z** and outline its role.

name .....

role .....

.....

.....

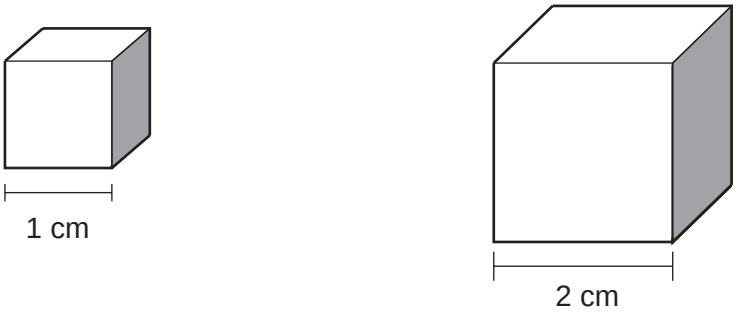
.....[3]

[Total: 12]

5 An experiment was performed to find the effect of surface area:volume ratio on the rate of osmosis.

Pieces of yam were cut into cubes of the following sizes:

- 2 cm × 2 cm × 2 cm (surface area = 24 cm^2, volume = 8 cm^3)
- 1 cm × 1 cm × 1 cm (surface area = 6 cm^2, volume = 1 cm^3)



The cubes were carefully blotted dry, weighed and their fresh masses recorded.

One cube, 2 cm × 2 cm × 2 cm, was put into a beaker and covered with distilled water.

Eight cubes each measuring 1 cm × 1 cm × 1 cm were put into another beaker of distilled water, making sure that they were all covered with distilled water.

At intervals for a period of 45 hours, the cubes were removed from the beakers, blotted dry, reweighed and then replaced into fresh distilled water. The percentage increase in mass was calculated for the eight cubes of side 1 cm and the one cube of side 2 cm. The results are shown in Fig. 5.1.

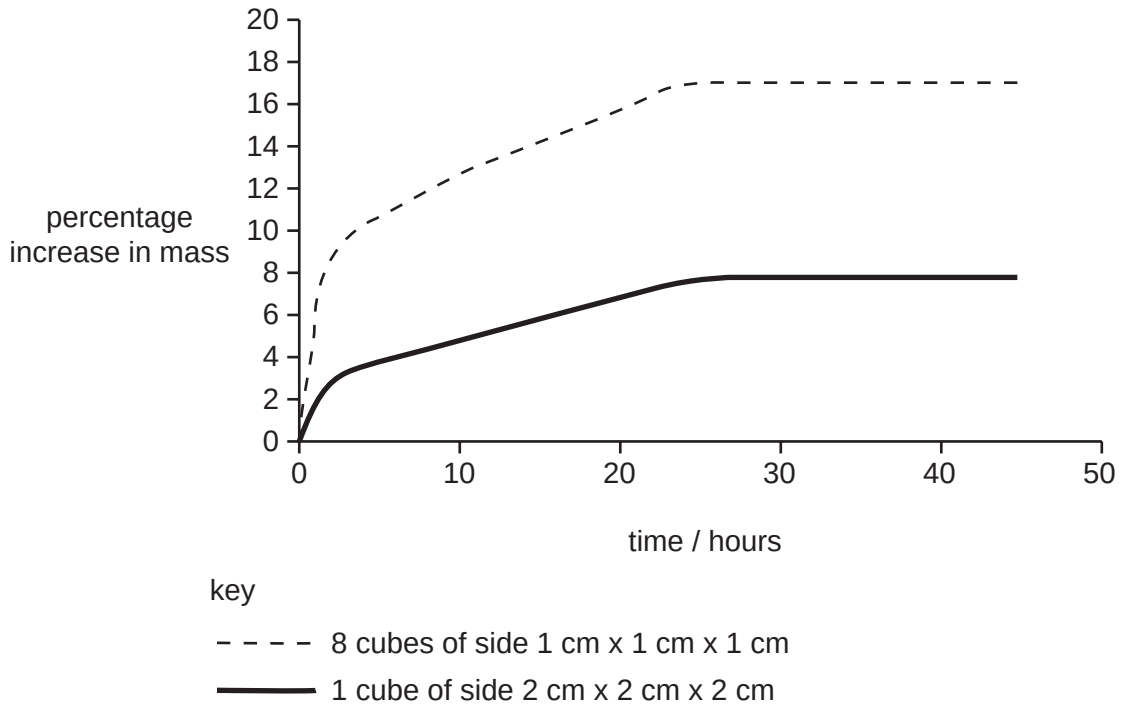


Fig. 5.1

(a) Explain why **eight** cubes of side 1 cm × 1 cm × 1 cm were used in this experiment.

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.....[1]

(b) Describe the results shown in Fig. 5.1.

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.....[3]

(c) Explain, **in terms of water potential**, why all the cubes of yam gained in mass.

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.....[3]

(d) Explain why the percentage increase in mass for the eight cubes of side 1 cm was faster than that of the cube of sides 2 cm.

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.....[2]

[Total: 9]

6 Haemoglobin is a globular protein that shows quaternary structure. It is composed of two types of polypeptide, known as α and β globin.

(a) Explain how a globular protein differs from a fibrous protein, such as collagen.

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.....

.....

.....[2]

Fig. 6.1 shows part of the base sequence of the mRNA that codes for the first ten amino acids of β globin. Table 6.1 shows some of the codons and the amino acids for which they code.

GUG	CAC	CUG	ACU	CCU	GAG	GAG	AAG	UCU	GCC

Fig. 6.1

Table 6.1

amino acid	abbreviation	codons					
alanine	ala	GCA	GCC	GCG	GCU		
glutamic acid	glu	GAA	GAG				
histidine	his	CAC	CAU				
leucine	leu	UUA	UUG	CUA	CUC	CUG	CUU
lysine	lys	AAA	AAG				
proline	pro	CCA	CCC	CCG	CCU		
serine	ser	UCA	UCC	UCG	UCU	AGC	AGU
threonine	thr	ACA	ACC	ACG	ACU		
valine	val	GUA	GUC	GUG	GUU		

(b) Use the information in Table 6.1 to complete the sequence of amino acids at the beginning of β globin using the first three letters of each amino acid. Some of them have been done for you.

val	his				glu				ala

[2]

(c) β globin has a tertiary structure that consists of eight helices arranged to give a precise three-dimensional shape.

Describe how the precise three-dimensional shape of a polypeptide is maintained.

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.....[4]

[Total: 8]

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