Cambridge Assessment International Education

Cambridge International AS & A Level

CANDIDATE NAME

CENTRE NUMBER | | | | | |

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1627253449

BIOLOGY **9700/22**

Paper 2 AS Level Structured Questions **October/November 2021**

1 hour 15 minutes

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.
- You should show all your working and use appropriate units.

INFORMATION

- The total mark for this paper is 60.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Any blank pages are indicated.

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Answer **all** questions.

1 There are two types of cell, prokaryotic and eukaryotic. Bacterial cells are prokaryotic and plant cells are eukaryotic.

(a) There are differences in the structural features that are common to bacterial cells and plant cells. For example, the cell surface membrane in a plant cell contains cholesterol, but in a bacterial cell the membrane contains molecules known as hopanoids. Cholesterol and hopanoids have the same function.

Some of the main structural features common to both types of cell are shown in Table 1.1.

Complete Table 1.1 by giving **one** difference between a bacterial cell and a plant cell for each structural feature listed.

The difference between the cell surface membranes of the two types of cell has been completed for you.

Table 1.1

feature common to bacterial and plant cells	bacterial cell	plant cell
cell surface membrane	contains hopanoids	contains cholesterol
ribosome		
DNA		
cell wall		

[3]

(b) One role of the cell surface membrane of bacterial cells and plant cells is the transport of substances into and out of cells.

Explain how membrane carrier proteins and membrane channel proteins are involved in the transport of substances into and out of cells.

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..... [3]

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(c) Fig. 1.1 is a photomicrograph showing chloroplasts in plant leaf cells.

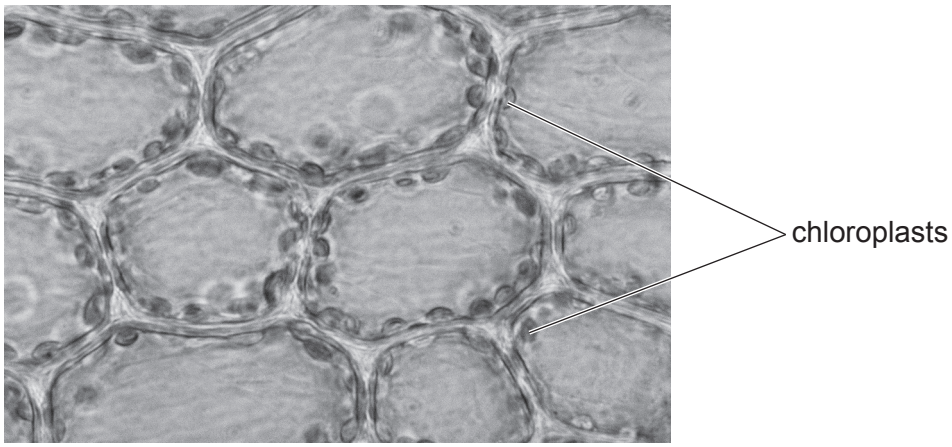


Fig. 1.1

Explain why the chloroplasts are seen only around the periphery (edge) of each plant cell.

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..... [1]

(d) Fig. 1.2 shows plant cells in a root tip where cell division by mitosis is taking place.

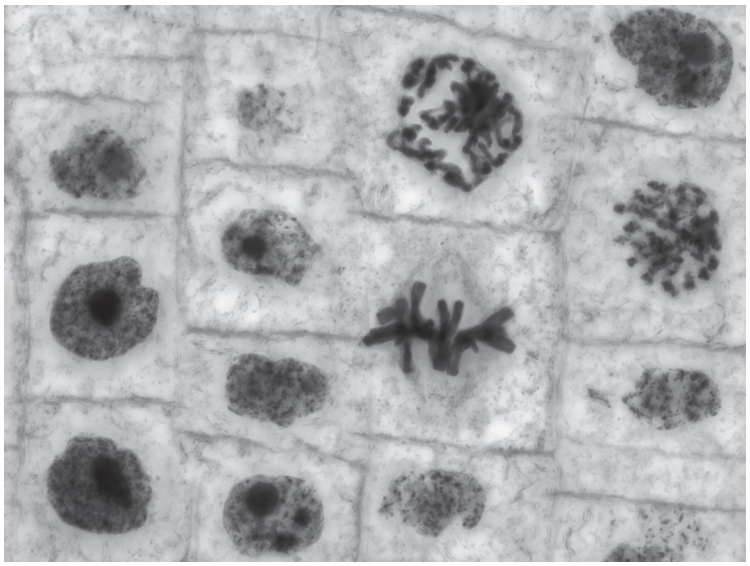


Fig. 1.2

Identify **two** cells in Fig. 1.2 that are in different stages of mitosis.

Draw a label line to each cell and add the name of the stage of **mitosis** that is shown by the cell. [2]

[Total: 9]

2 The high blood pressure at the arterial end of a capillary network results in some components of blood leaving the capillaries and forming tissue fluid. At the venous end, the presence of plasma proteins allows movement of water by osmosis back into the capillaries.

Fig. 2.1 is a diagram showing a capillary network. The lymph vessels and the blood vessels at the arterial and venous ends of the network are also shown.

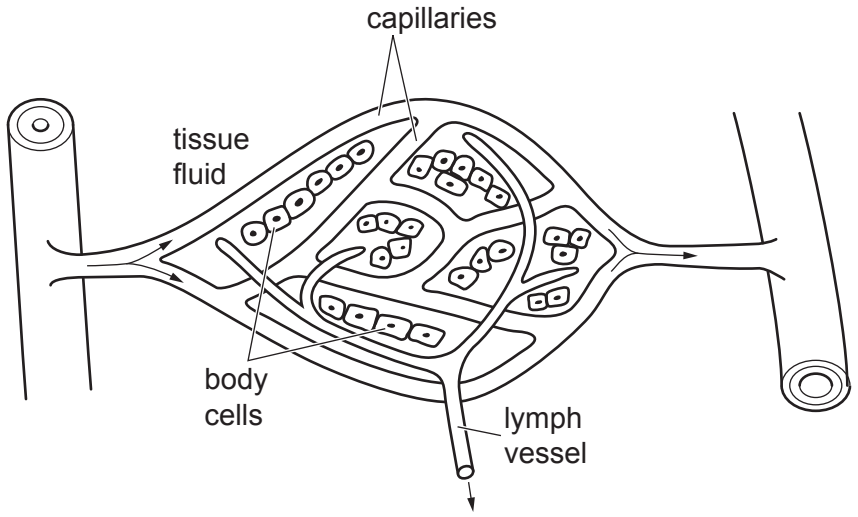


Fig. 2.1

(a) Red blood cells and plasma proteins, such as albumin, remain in the capillaries and are not found in tissue fluid.

Explain why red blood cells and albumin do not leave the capillary.

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..... [2]

(b) Name the chemical reagent or reagents used to test for proteins in a sample of blood plasma **and** state the colour change that will be seen if protein is present.

reagent or reagents .....

.....

colour change .....

.....

[2]

(c) When a person moves from sea level and stays at high altitude for a few months, there is an increase in the number of red blood cells per mm^3 of blood.

Explain why this increase occurs.

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..... [3]

(d) A low blood albumin concentration can lead to a condition known as oedema.

Oedema is a swelling of tissues caused by the accumulation of tissue fluid surrounding the body cells in the capillary network.

Suggest **and** explain how a low blood albumin concentration can lead to oedema.

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..... [3]

(e) Albumin transports some cell signalling molecules from the cells where they are synthesised to their target cells. The cell signalling molecules bind to specific cell surface membrane proteins on the target cells.

Name the type of membrane protein to which the cell signalling molecules bind.

..... [1]

[Total: 11]

3 Baculovirus is a virus that kills some of the insect pests of major crops. When the virus is released to the outside of the insect body, it is contained within stable, protective structures known as polyhedrons.

The main component of the polyhedron is a protein molecule, polyhedrin.

Polyhedrons can be sprayed onto plants as a bioinsecticide. They are ingested by feeding insect larvae and once inside the insect gut they break down to release the virus.

(a) Explain why the term infectious disease can be used to describe the effect of baculovirus on insects.

.....

.....

..... [2]

(b) Suggest **and** explain the conditions present in the insect gut that can cause the breakdown of polyhedrons.

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.....

..... [2]

(c) A polyhedrin molecule is composed of three identical polypeptides. Each polypeptide is 245 amino acids long. The first 10 amino acids of the polypeptide are shown in Fig. 3.1.

1	2	3	4	5	6	7	8	9	10
met —	**pro —**	**asp —**	**tyr —**	**ser —**	**tyr —**	**arg —**	**pro —**	**thr —**	**ile —**

Fig. 3.1

Fig. 3.2 **A** is a ribbon diagram of a single polypeptide. Fig. 3.2 **B** shows a polyhedrin molecule composed of 3 polypeptides.

The two diagrams are not to the same scale.

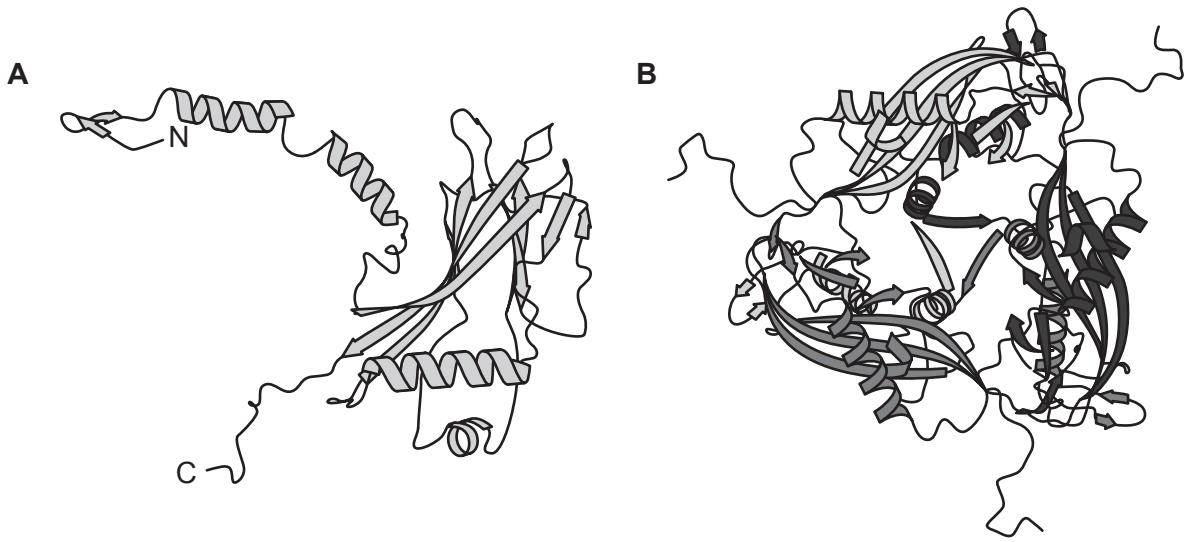


Fig. 3.2

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With reference to Fig. 3.1 and Fig. 3.2, describe the structure of a polyhedrin molecule.

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..... [4]

(d) The sequence of DNA nucleotides for the gene in baculovirus that codes for the polyhedrin polypeptide has been determined.

Explain why the amino acid sequence of the polypeptide **cannot** be used to deduce this sequence of nucleotides in the gene that codes for the polyhedrin polypeptide.

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..... [3]

[Total: 11]

4 Barlinka is a variety of the common grapevine, *Vitis vinifera*. Barlinka grapes are used for making wine and are sold as fruit. There are economic and ecological benefits from using less water to irrigate grapevine plants, while still producing a high crop yield.

The rate of flow of sap within xylem vessels from roots to leaves can be used as an estimate of the rate of transpiration. This also indicates water uptake.

(a) The hydrogen bonding of water molecules is important in the transport of sap within xylem vessels.

State the terms used to describe:

- water molecules sticking together within the xylem vessel

.....

- water molecules sticking to the cellulose molecules in the lining of the xylem vessel

.....
[2]

(b) An experiment was carried out to investigate the effect of leaf area on the rate of flow of the xylem sap during fruit development.

The flow rate was measured over a three-day period in three Barlinka grapevine plants with different total leaf area. The plants were growing in the same conditions.

The results are shown in Fig. 4.1.

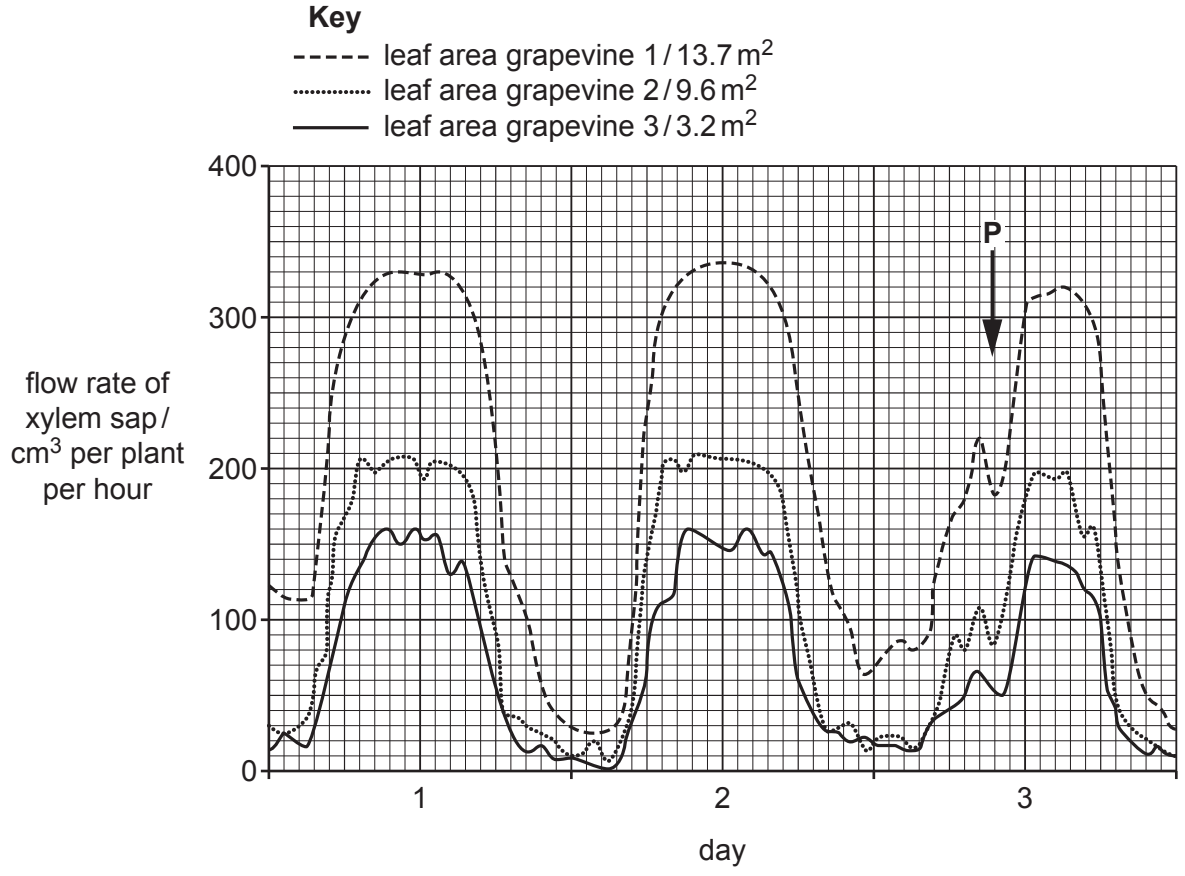


Fig. 4.1

(i) The general pattern of results in Fig. 4.1 is the same for the three Barlinka grapevines.

Explain why the general pattern of results is the same.

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..... [2]

(ii) With reference to Fig. 4.1, explain the differences in the results between the three grapevines, **1**, **2** and **3**.

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..... [2]

(iii) Suggest an explanation for the decrease in flow rate of xylem sap shown at time **P** in Fig. 4.1.

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..... [1]

(iv) Outline how you would determine the surface area of one side of a leaf.

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..... [2]

[Total: 9]

5 The causative organism of measles is *Morbillivirus*. Young children who have not been vaccinated for measles are at highest risk of becoming ill and of developing complications associated with the disease.

(a) The genetic material of *Morbillivirus* is a strand of RNA.

Statements **A**, **B** and **C** relate to the structure of RNA.

State the correct term or terms to match each of statements **A** to **C**.

A The names of the two purines and two pyrimidines in RNA.

purines .....

.....

pyrimidines .....

.....

B The type of covalent bond between RNA nucleotides.

.....

C The pentose sugar of the RNA nucleotide.

.....

[4]

(b) Describe how measles is transmitted.

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..... [3]

(c) Young children with measles may develop difficulties with breathing. This is made worse if the child is continually exposed to tobacco smoke. Tobacco smoke contains harmful compounds, such as carbon monoxide.

(i) Inhaled tobacco smoke passes through the larynx (voice box) and other structures in the gas exchange system to reach the alveoli.

Complete Fig. 5.1 to list, in the correct sequence, the main structures of the gas exchange system through which the tobacco smoke passes to reach the alveoli.

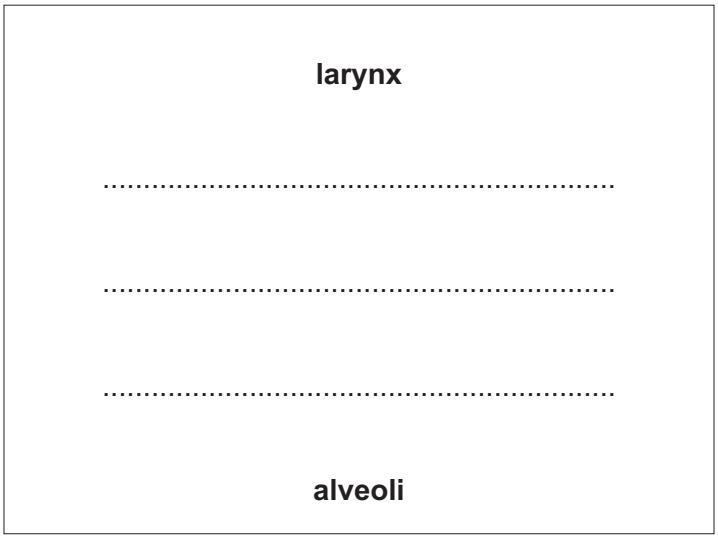


Fig. 5.1

[1]

(ii) State the short-term effects of carbon monoxide on the cardiovascular system.

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..... [2]

(d) Smallpox is a disease that has been eradicated with the help of a global vaccination programme. Measles has not been eradicated, even though there is a global vaccination programme.

Fig. 5.2 is a graph showing the estimates of number of deaths from measles globally, between 2000 and 2017, for people who have **not** been vaccinated.

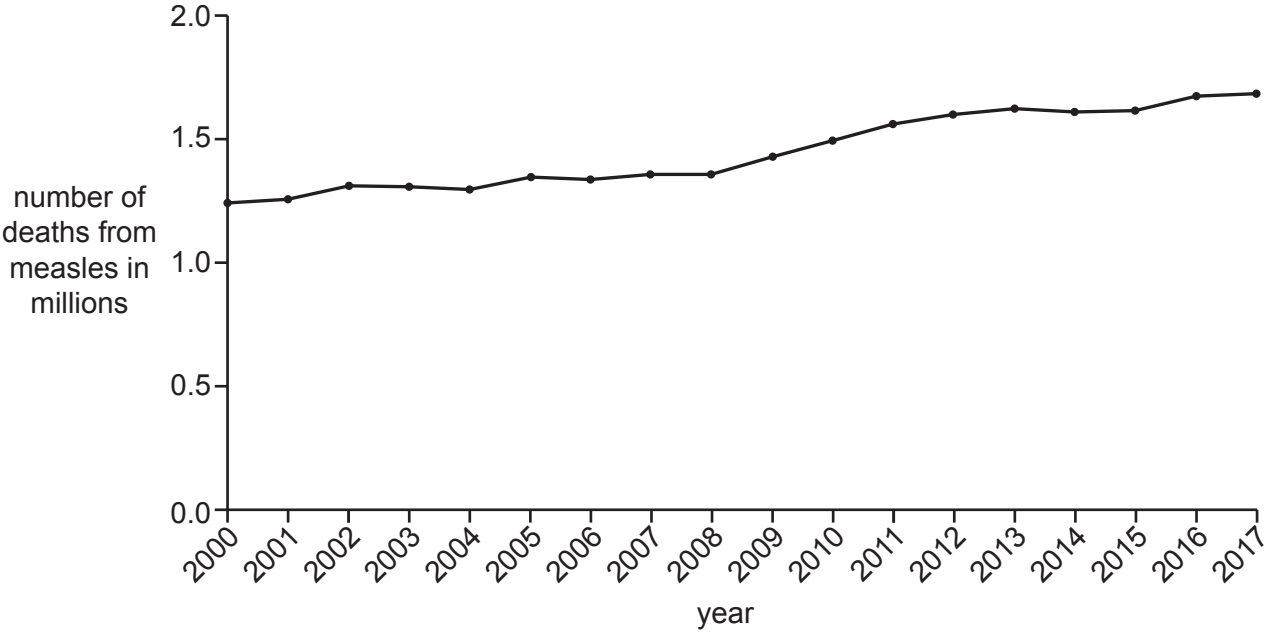


Fig. 5.2

(i) State the trend shown in Fig. 5.2 between 2000 and 2017.

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..... [1]

(ii) Suggest reasons for the trend shown in Fig. 5.2.

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..... [3]

(e) A child with leukaemia is at high risk of developing measles even though the child has a high white blood cell count **and** has been vaccinated against the disease.

Explain why this child is at high risk of developing measles.

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..... [2]

[Total: 16]

6 Amylase is an enzyme that catalyses the hydrolysis of starch into reducing sugars.

A student carried out an experiment to investigate the hydrolysis of starch using immobilised amylase. Fig. 6.1 is a diagram of the apparatus that was used in the investigation.

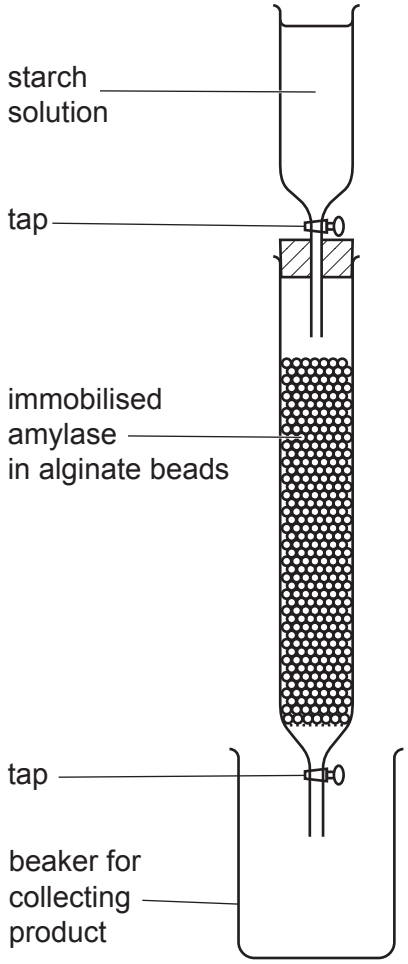


Fig. 6.1

The alginate beads were all the same size.

Both taps were opened to allow the starch solution to flow down the column and for the product to be collected.

The product was tested for the presence of reducing sugar and starch.

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(a) The results of the investigation showed that the product collected in the beaker contained reducing sugar **and** starch.

With reference to Fig. 6.1, describe a method that would allow the student to use the immobilised amylase to collect a product that contains **only** reducing sugar.

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..... [3]

(b) One standardised variable in the investigation is the size of the alginate beads.

Suggest **one** reason why using larger or smaller alginate beads in the column would affect the results obtained.

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..... [1]

[Total: 4]

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