Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

4540758268

BIOLOGY **9700/21**

Paper 2 Structured Questions AS **May/June 2015**

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 at the top of the page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **16** printed pages.

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CAMBRIDGE International Examinations

Answer **all** the questions.

1 A student investigated growth in the roots of broad bean, *Vicia faba*. The student cut sections of the root tip of this plant and viewed them with a light microscope.

Fig. 1.1 is a photomicrograph of one of the sections. The cell labelled **D** is in interphase.

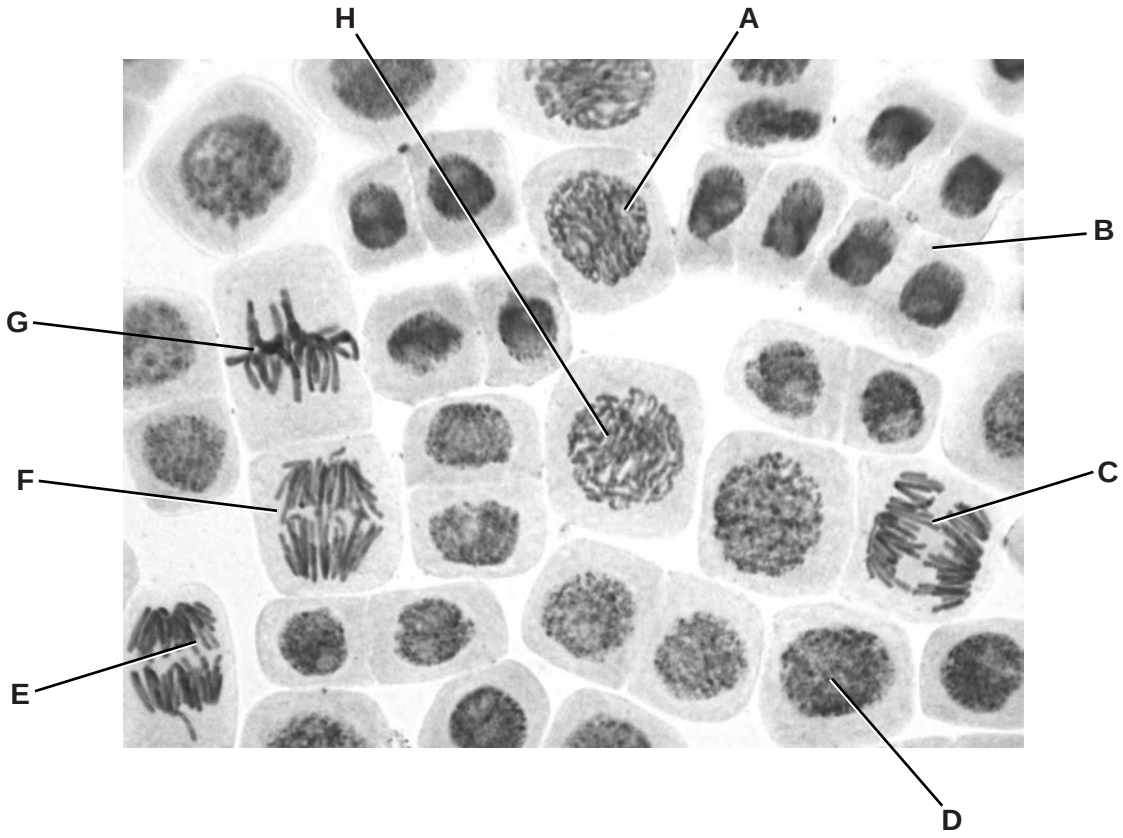


Fig. 1.1

(a) Complete the table below by:

- naming the stages of mitosis in the correct sequence following interphase
- identifying **one** example from the cells labelled **A** to **H** that is in each stage of mitosis that you have named.

stage of mitosis	label from Fig. 1.1

[5]

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(b) In animal cells, centrioles are responsible for assembling microtubules to make the spindle at the beginning of mitosis.

Describe the role of the spindle during mitosis.

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.....

.....

.....[2]

(c) State two roles of mitosis in plants and animals **other than growth**.

1 .....

2 .....[2]

(d) *V. faba* is a legume. Roots of legumes often have swellings at intervals known as nodules. Cells within the nodules contain nitrogen-fixing bacteria.

(i) Explain the role of nitrogen fixation in the nitrogen cycle.

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.....[2]

(ii) Farmers in some parts of the world grow legume crops together with cereal crops in the same field. This is known as intercropping.

Explain how intercropping results in an increase in the yield of the cereals when the legumes die.

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.....[3]

[Total: 14]

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2 Pathogens enter the body in a variety of ways, including through the gas exchange system. The body has several defence mechanisms against the entry of pathogens and their spread throughout the body.

Fig. 2.1 is an electron micrograph of a cross section of the lining of a bronchiole.

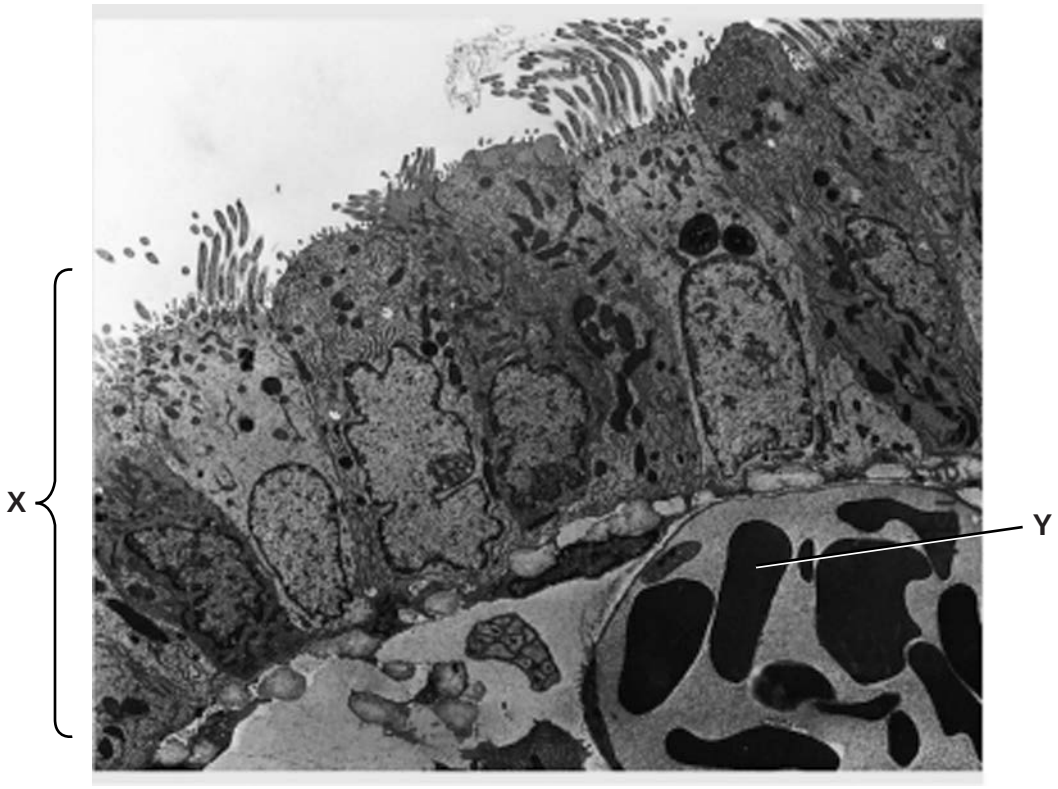


Fig. 2.1

(a) (i) Name tissue **X** and cell **Y**.

X .....

Y .....[2]

(ii) With reference to the structures visible in Fig. 2.1, state three ways in which the lining of the trachea, bronchus and bronchioles provides protection against the entry of bacterial pathogens.

1 .....

.....

2 .....

.....

3 .....

.....[3]

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Fig. 2.2 shows part of the immune response to the first infection by a bacterial pathogen that has entered the body through the lining of a bronchiole. **J** and **K** are stages in the immune response.

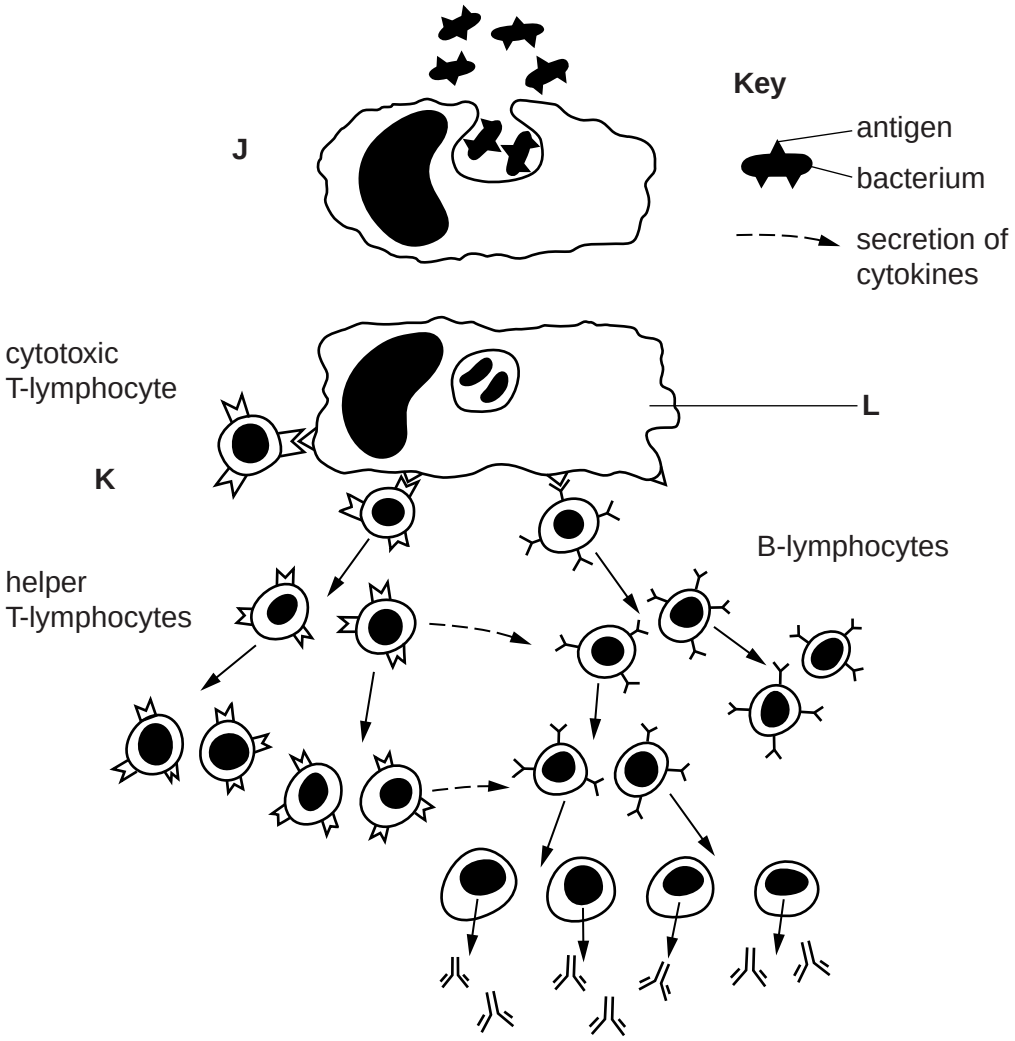


Fig. 2.2

(b) (i) State what is happening at stage **J**.

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.....[1]

(ii) Explain the role of cell **L** at stage **K** in the immune response.

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.....[2]

(c) With reference to Fig. 2.2, explain how the response to a second infection by this bacterial pathogen differs from the first.

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.....[3]

(d) There are various ways in which the effectiveness of immune responses can be reduced.

Suggest how each of the following reduces the effectiveness of an immune response.

(i) The number of T-lymphocytes is reduced in a person with HIV/AIDS.

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.....[1]

(ii) Some pathogens are covered in cell surface membranes from their host.

.....

.....[1]

(iii) B-lymphocytes do not mature properly and do not recognise any antigens.

.....

.....[1]

[Total: 14]

3 When a leaf is first formed it is described as a sink for carbohydrate. As the leaf continues to grow, it starts to photosynthesise and becomes a source of carbohydrates and other assimilates.

Fig. 3.1 shows the changes that occur to the structure of plasmodesmata in the leaf as it grows.

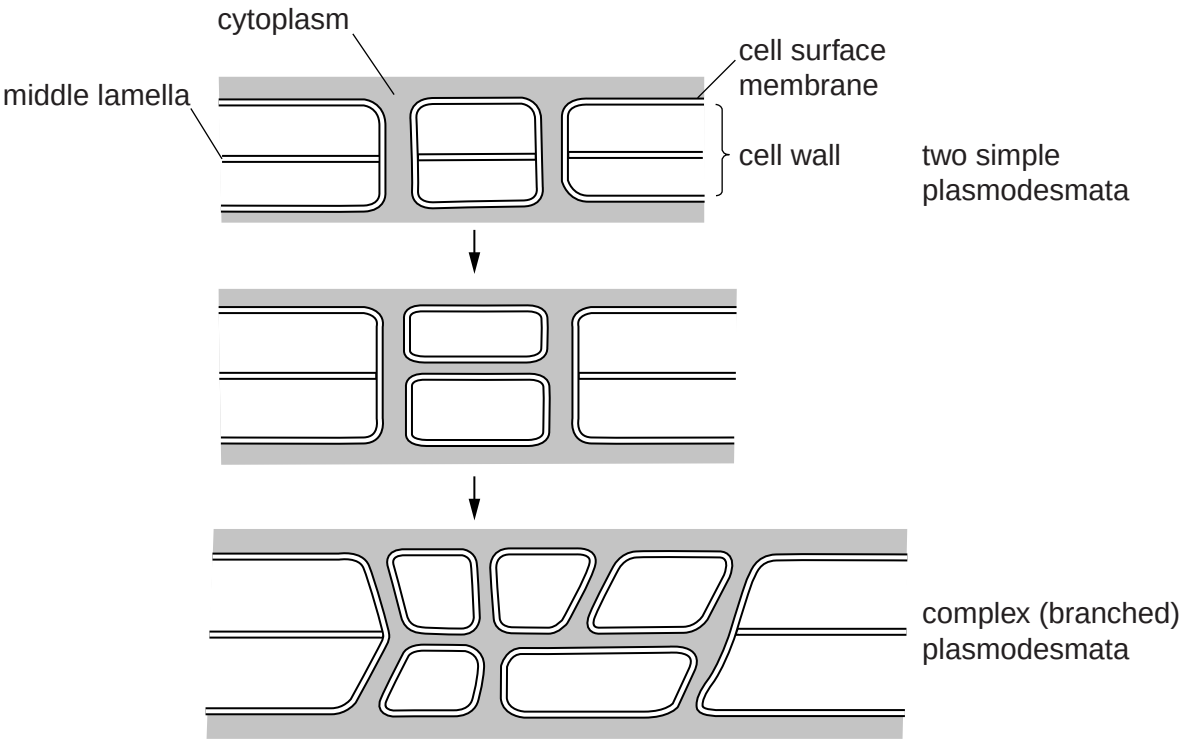


Fig. 3.1

(a) Suggest the advantage of complex plasmodesmata between cells in leaves.

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.....[2]

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(b) Assimilates are transported into phloem sieve tubes.

Explain how assimilates in phloem sieve tubes move from the veins in a mature leaf to sinks, such as flowers and fruits, in the rest of the plant.

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.....[4]

[Total: 6]

4 **(a)** Fig. 4.1 shows two ways in which enzymes interact with their substrates.

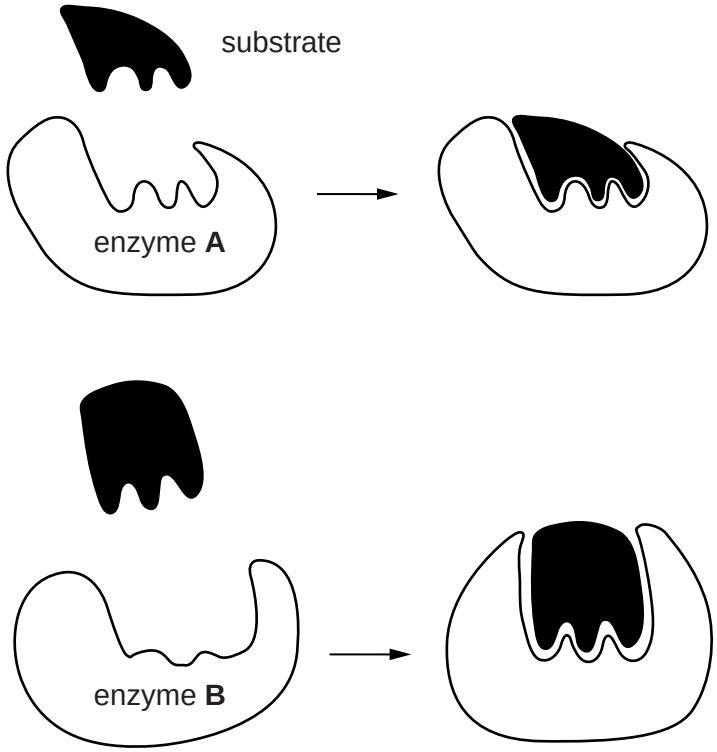


Fig. 4.1

Explain the difference between the two ways in which enzymes interact with their substrates as shown in Fig. 4.1.

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.....[3]

(b) Carbonic anhydrase is an enzyme that is found in blood, liver and kidneys.
Fig. 4.2 shows a molecular model of this enzyme.

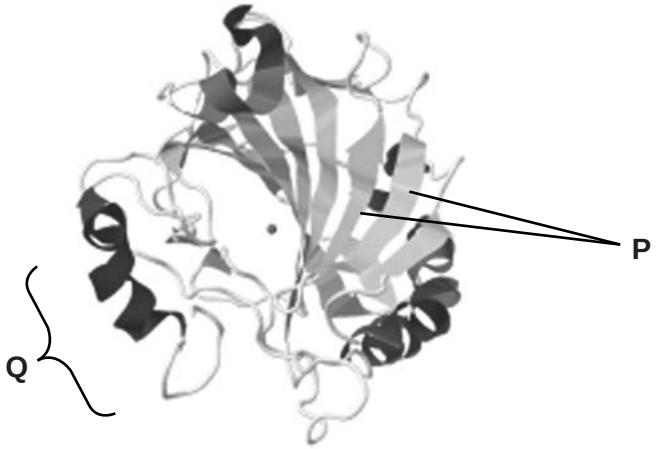


Fig. 4.2

(i) With reference to Fig. 4.2 and the parts labelled **P** and **Q**, explain the term *secondary structure*.

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.....[3]

(ii) Describe the role of carbonic anhydrase in the blood.

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.....[4]

[Total: 10]

5 Fig. 5.1 shows a diagram of the molecular structures of tristearin (a triglyceride) and phosphatidylcholine (a phospholipid).

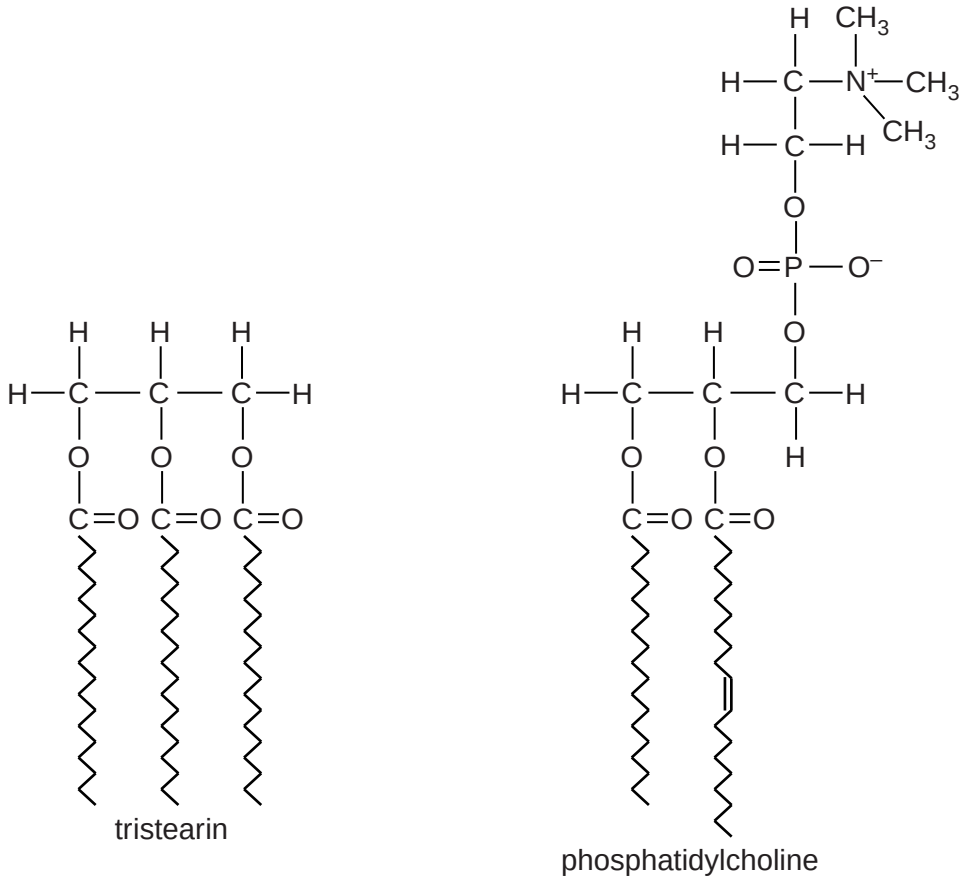


Fig. 5.1

(a) Table 5.1 shows a structural difference between the two molecules shown in Fig. 5.1.

Complete Table 5.1 with two further structural differences **other than** in numbers of different types of atoms.

Table 5.1

structural feature	tristearin	phosphatidylcholine
length of fatty acid chains	all the same length	different lengths

[2]

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(b) Cells in the pancreas secrete enzymes, such as amylase and trypsin, into a duct.

The enzymes are packaged in vesicles so that they can be exported from these cells as shown in Fig. 5.2.

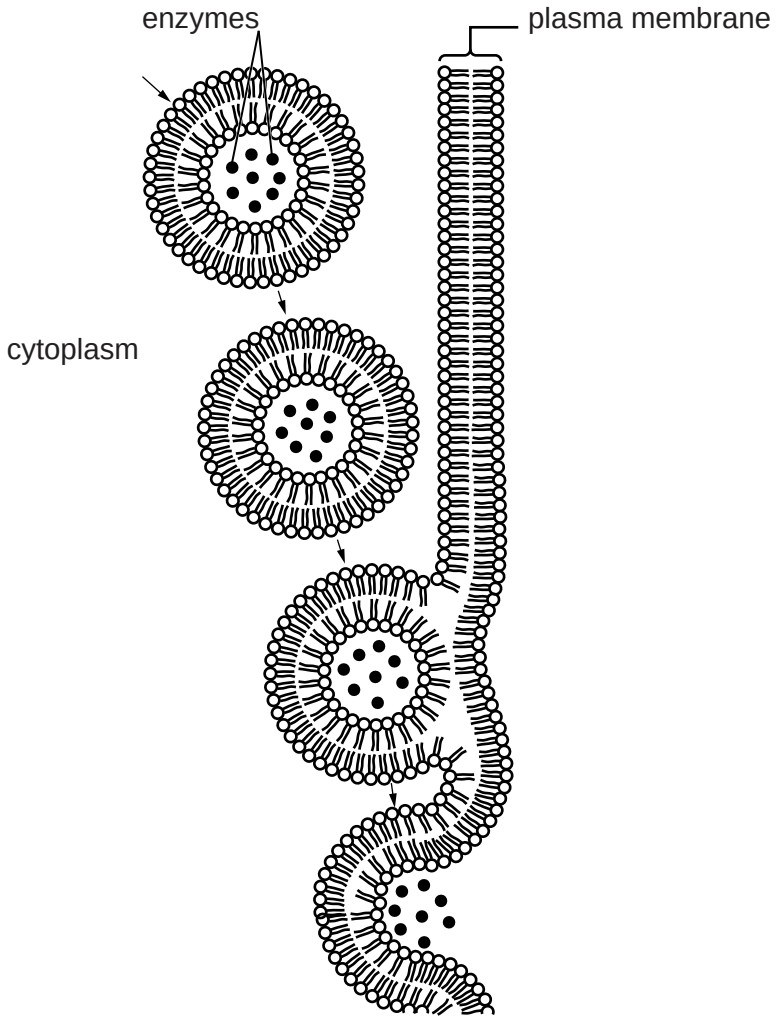


Fig. 5.2

With reference to Fig. 5.2, explain how enzymes that are secreted by cells in the pancreas are packaged into vesicles and exported.

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.....[4]

(c) Water has many significant roles to play in cells and living organisms.

Complete Table 5.2 below by stating the property of water that allows each of the following to take place.

Table 5.2

role of water	property of water
solvent for glucose and ions	
movement in xylem	
helps to decrease body temperature in mammals	

[3]

[Total: 9]

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6 Red blood cells are formed from cells called reticulocytes. Stem cells in the bone marrow produce reticulocytes which differentiate into red blood cells. During differentiation haemoglobin is produced.

Fig. 6.1 shows the structure of small sections of DNA and messenger RNA (mRNA) in the nucleus of a reticulocyte during transcription.

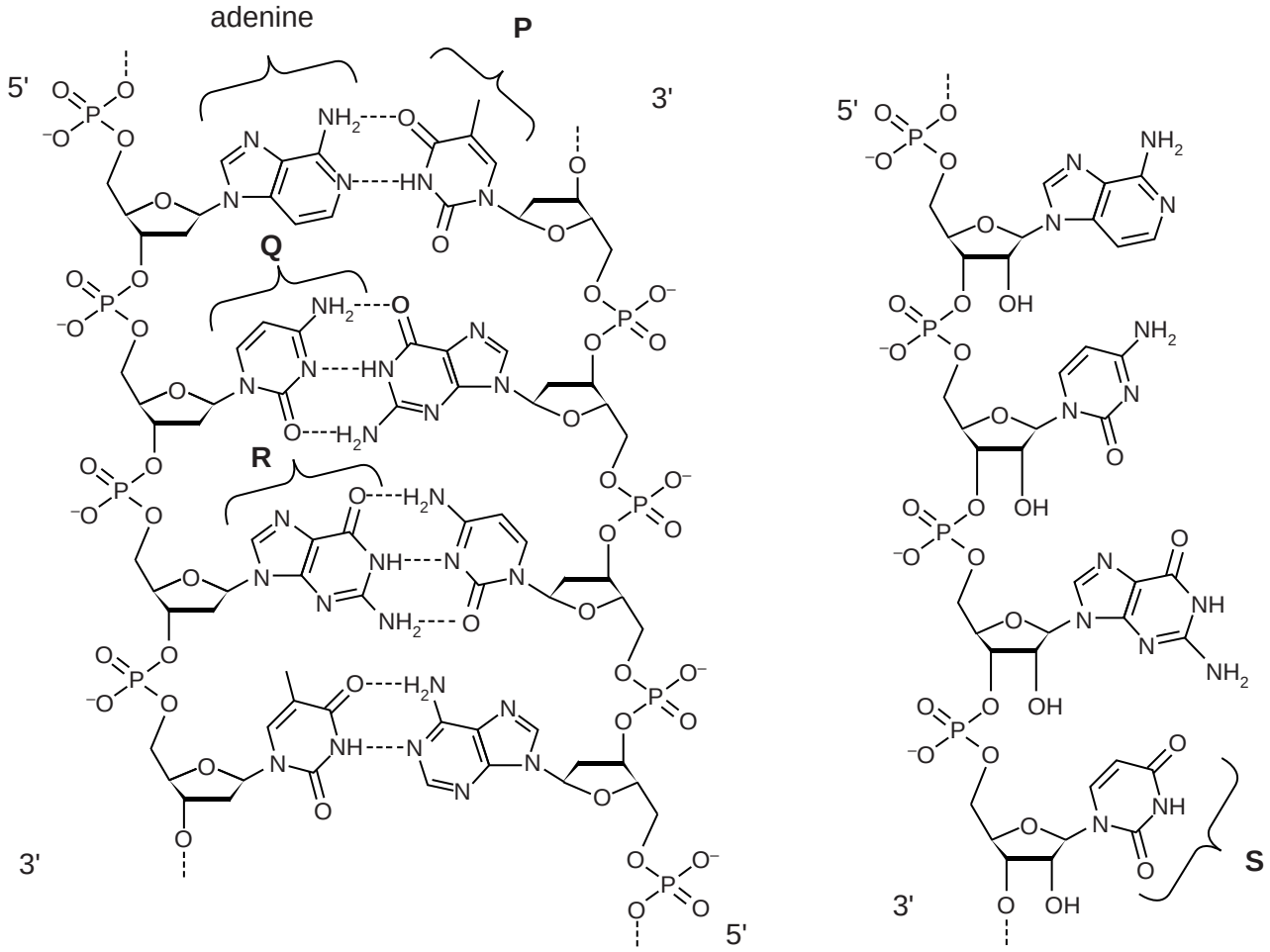


Fig. 6.1

(a) Name the bases **P** to **S**.

P .....

Q .....

R .....

S .....[4]

(b) Describe the role of the mRNA molecule shown in Fig. 6.1.

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.....[3]

[Total: 7]

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