Cambridge International AS & A Level

Cambridge International Examinations
Cambridge International Advanced Subsidiary and Advanced Level

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

BIOLOGY **9700/21**

Paper 2 Structured Questions AS **May/June 2016**

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 on all the work you hand in.
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 **13** printed pages and **3** blank pages.

CAMBRIDGE International Examinations

[Turn over

Answer **all** the questions.

1 Table 1.1 shows features of three infectious diseases: malaria, tuberculosis (TB) and cholera.

Complete Table 1.1.

Table 1.1

feature	malaria	tuberculosis	cholera
name of pathogen	……..… *falciparum*	*Mycobacterium tuberculosis*	……..… ……..…
type of organism	……..…	bacterium	……..…
method of transmission	……..… ……..… ……..…	……..… ……..… ……..…	drinking water and food contaminated with human faeces

[6]

[Total: 6]

2 Macrophages synthesise intracellular enzymes.

Fig. 2.1 is a summary diagram of events that occur in a macrophage.

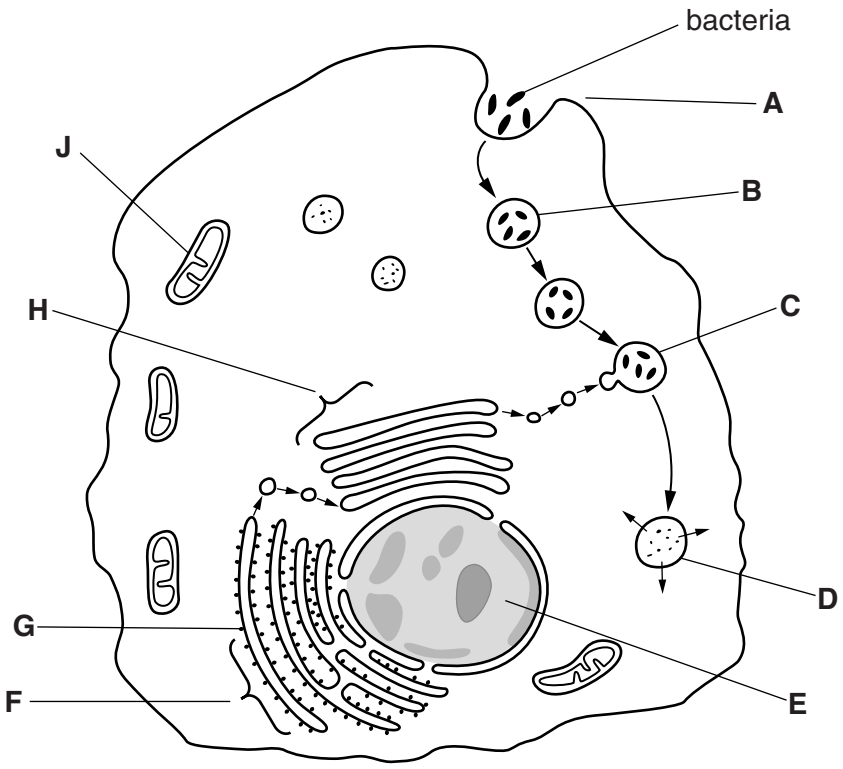

Fig. 2.1

(a) (i) Name the process at **A**.

.....[1]

(ii) Name the stages of protein synthesis that occur at **E** and at **F**.

E .....

F .....[2]

(iii) Name organelles **B**, **G**, **H** and **J**.

B .....

G .....

H .....

J .....[4]

(b) Describe what happens to the bacteria between **C** and **D**.

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(c) Macrophages are antigen presenting cells (APCs). Antigens from pathogens such as the bacteria shown in Fig. 2.1 are presented to helper T-lymphocytes as shown in Fig. 2.2.

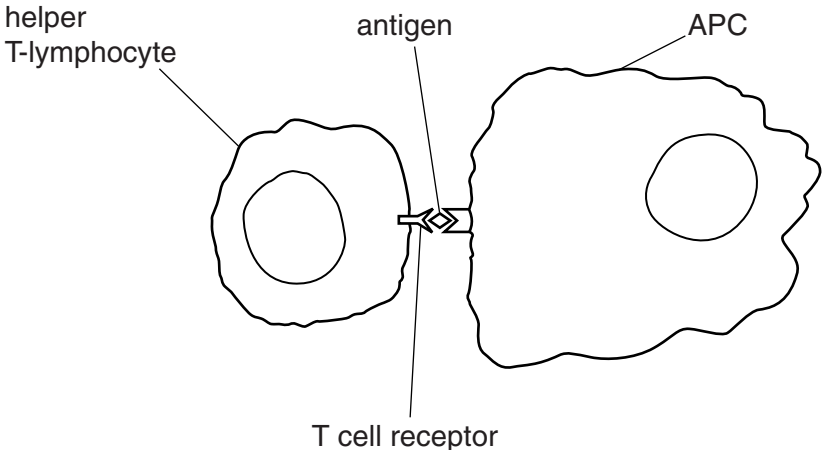

Fig. 2.2

Very few helper T-lymphocytes respond to the presence of APCs by binding in the way shown in Fig. 2.2.

Suggest why this is so.

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.....[2]

[Total: 12]

3 A student studied a transverse section of the trachea of a small mammal. The student drew a plan diagram of the section as shown in Fig. 3.1.

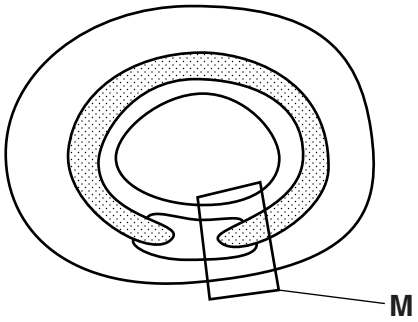

Fig. 3.1

Fig. 3.2 is a photomicrograph of the area labelled **M** in Fig. 3.1.

Fig. 3.2

(a) Name:

(i) the type of epithelium at **N**

.....[1]

(ii) the structures at **O**

.....[1]

(iii) the tissue at **P**.

.....[1]

(b) Smooth muscle in the trachea and in the bronchi relaxes during strenuous exercise.

Suggest the advantages of relaxing this smooth muscle during periods of strenuous exercise.

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.....[2]

(c) The walls of the trachea and bronchi contain elastic fibres.

Elastic fibres are made of bundles of the fibrous protein elastin.

- Each molecule of elastin is a single polypeptide.
- The primary structure contains a large proportion of the amino acid glycine.
- Glycine has a hydrophobic R group.
- Glycine does not occur at regular intervals in the polypeptide.
- The polypeptide forms random coils that change shape as the elastic fibres are stretched and recoil.
- Elastin molecules are joined to each other by many covalent bonds to form a cross-linked network.

Describe two ways in which the structure of a collagen molecule **differs** from the structure of an elastin molecule described above.

1 .....

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2 .....

.....[2]

[Total: 7]

4 **(a)** Transpiration is often described as 'an inevitable consequence of gas exchange in leaves'.

Explain what is meant by this description.

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(b) Explain how hydrogen bonding is involved in the movement of water in the xylem.

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Southern beech trees of the genus *Nothofagus* grow in forests in the South Island of New Zealand. Fig. 4.1 shows a small part of a forest.

Most of the trees in the forests form a thick canopy of leaves. These are known as canopy trees. The tallest trees are known as emergent trees. Some trees do not reach the canopy and are known as suppressed trees.

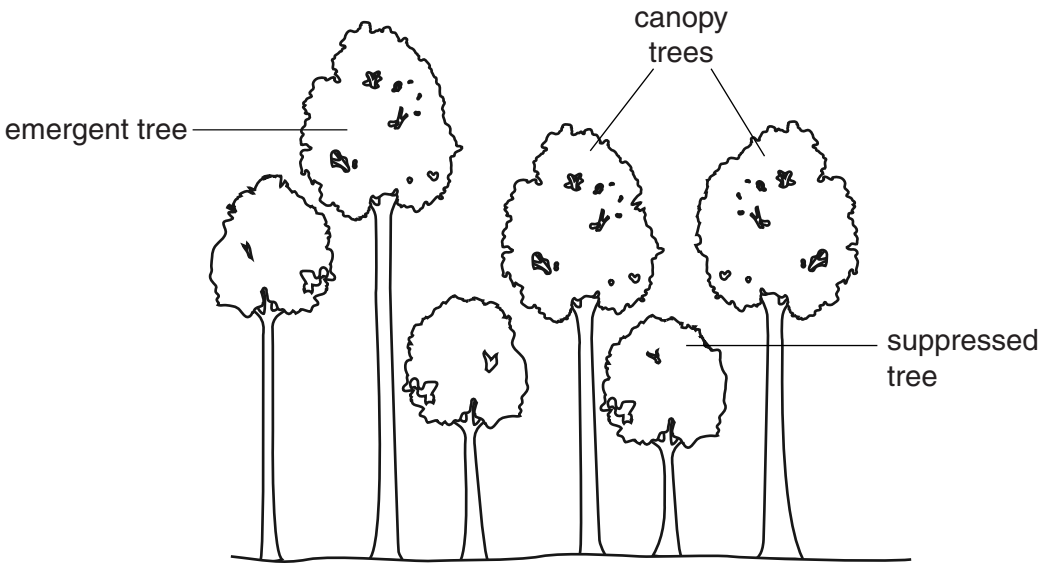
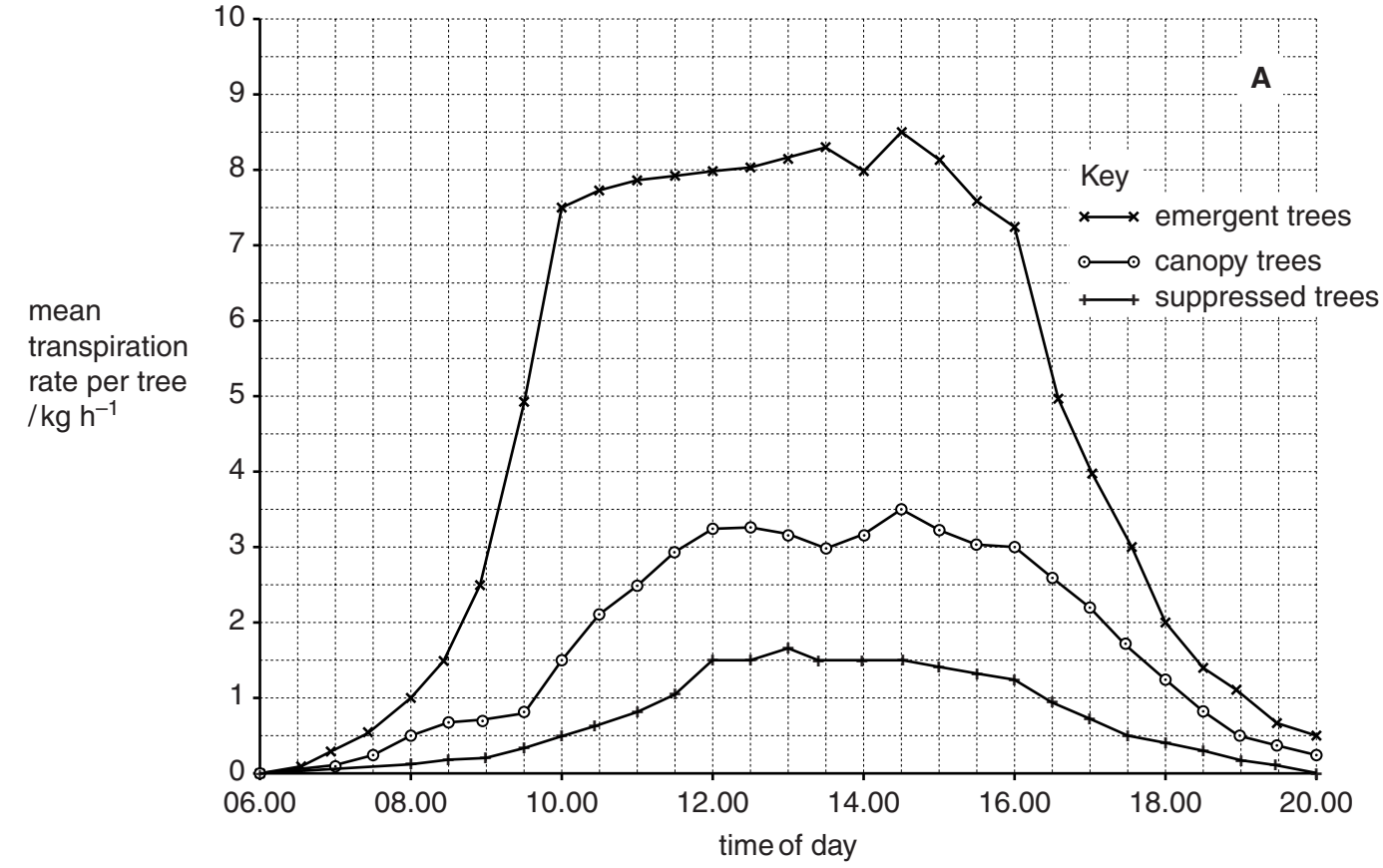


Fig. 4.1

Researchers determined the rates of transpiration of emergent, canopy and suppressed trees in a forest over a 14 hour period from 06.00 until 20.00 on one day in the summer. The results are shown in Fig. 4.2A. They also recorded changes in light intensity above the canopy over the same time period as shown in Fig. 4.2B.



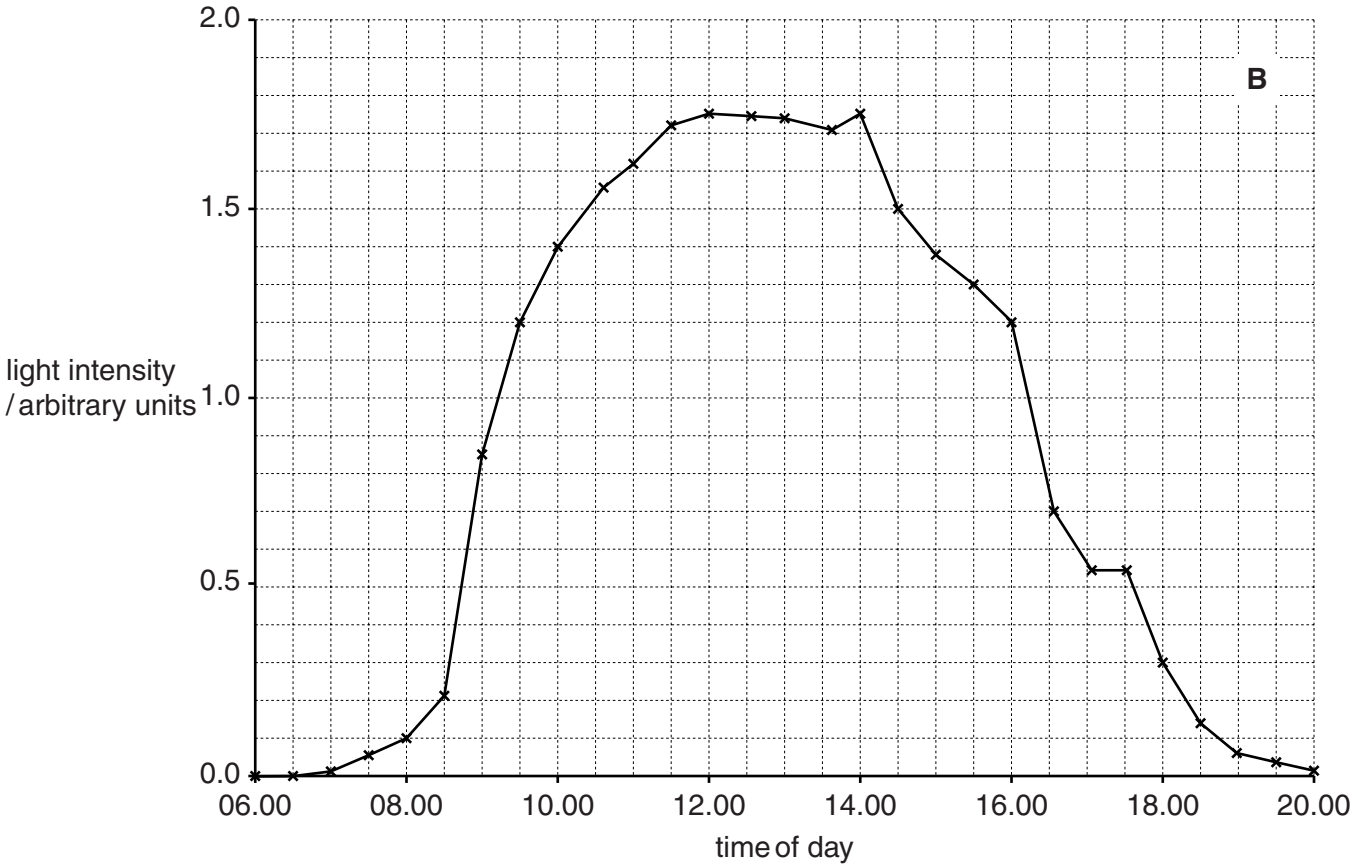


Fig. 4.2

(c) Use Fig. 4.2A to compare the transpiration rates of the emergent, canopy and suppressed trees in the forest over 14 hours.

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(d) The factors that affect transpiration rate vary considerably at different places inside forests.

Use the information in Fig. 4.1 and Fig. 4.2 to suggest reasons for the difference in the transpiration rates of the emergent and suppressed trees.

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[Total: 14]

5 **(a)** Fig. 5.1 is a diagram of part of an animal cell in a stage of mitosis.

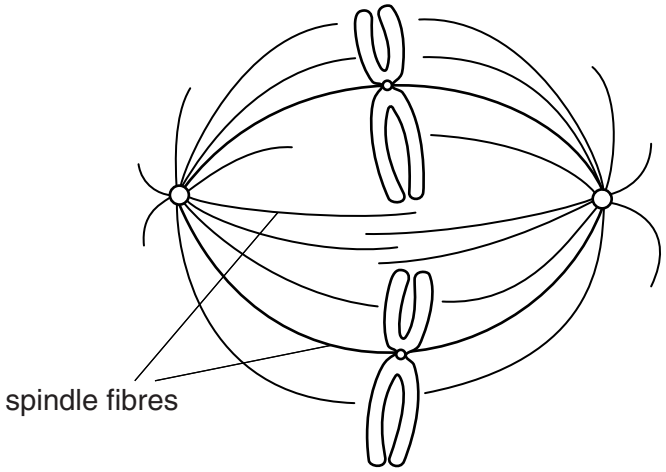

Fig. 5.1

(i) Draw a diagram in the space below to show the stage of mitosis that follows the stage in Fig. 5.1.

[3]

(ii) Describe the roles of the spindle fibres during mitosis.

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Bone marrow contains many stem cells. Some of these stem cells are responsible for the replacement of red blood cells.
During the production of red blood cells a series of changes occur to the cell structure.

Fig. 5.2 shows the production of a red blood cell from one of these stem cells.

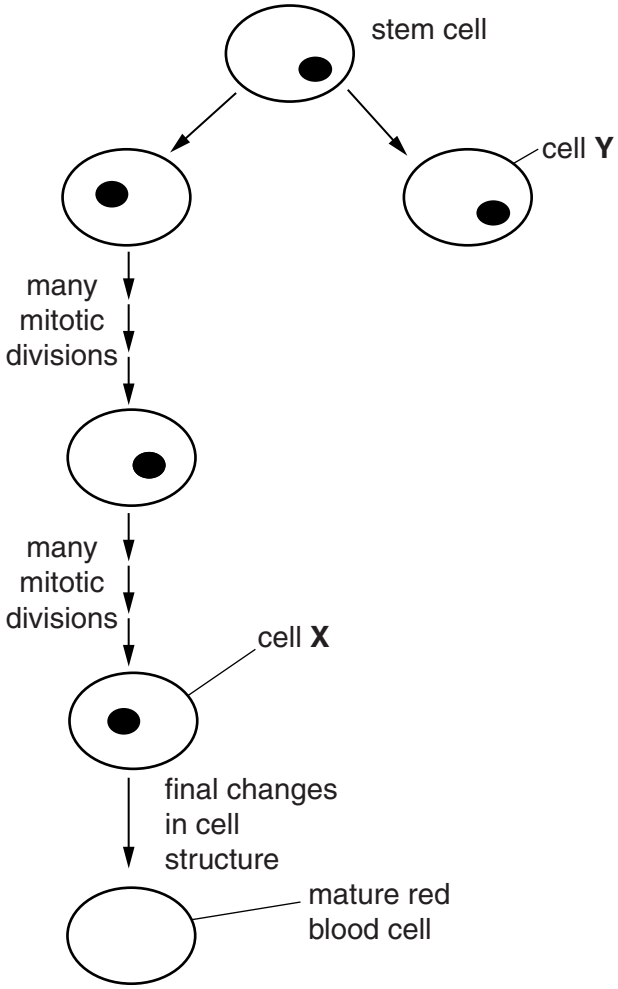

Fig. 5.2

(b) (i) Outline the changes that occur as cell **X** becomes a mature red blood cell.

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.....[3]

(ii) Suggest what may happen to cell **Y**.

.....[1]

(c) People who travel to high altitude become acclimatised to the conditions.

Athletes often train at high altitude before competing at sea level.

A group of male and female athletes who trained at sea level moved to high altitude for further training. Sports scientists analysed blood samples taken from the athletes to measure any changes in the concentration of haemoglobin in the blood and changes in the haematocrit.

Haematocrit is the volume of red blood cells expressed as a percentage of the total volume of a sample of blood.

The results are shown in Table 5.1.

Table 5.1

feature of the blood	at sea level	after 19 days at high altitude	percentage increase
mean concentration of haemoglobin in the blood / g 100 cm^{-3}	13.3	15.1	.....
mean haematocrit	41.0	42.5	3.7

(i) Complete Table 5.1 by calculating the percentage increase in haemoglobin concentration. [1]

(ii) Explain why it is necessary for the athletes to increase the concentration of haemoglobin in their blood when acclimatising to high altitude.

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.....[4]

[Total: 14]

6 Fig. 6.1 shows an incomplete diagram of the fluid mosaic model of membrane structure. The diagram shows the cell surface membrane of a eukaryotic cell.

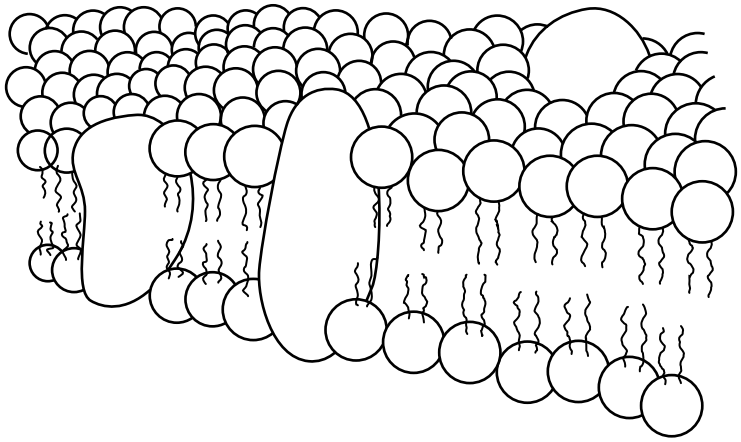

Fig. 6.1

(a) State what is meant by the term fluid mosaic.

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.....[2]

(b) State the thickness of a cell surface membrane.

.....[1]

(c) List four features of cell surface membranes of eukaryotic cells that are **not** visible in Fig. 6.1.

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2 .....

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3 .....

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4 .....

.....[4]

[Total: 7]

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