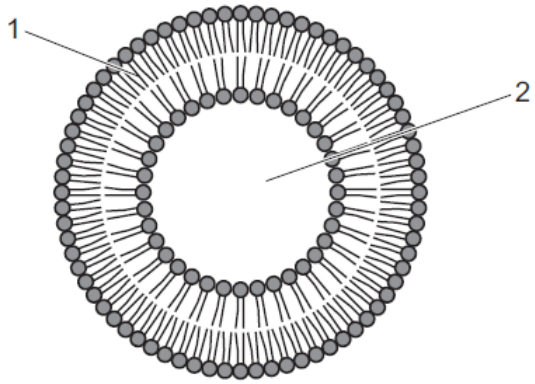
Cell membranes and transport – AS 9700 Biology June 2022

1. June/2022/Paper_11/No.14

The diagram shows a liposome.



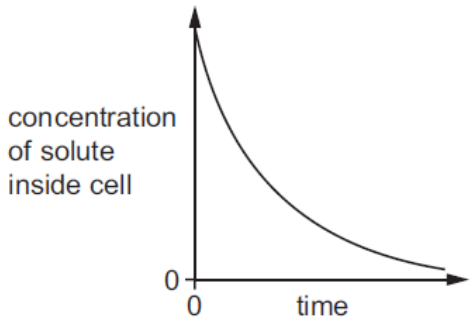
Liposomes can be used to move therapeutic drugs into cells of the body to treat conditions such as cancer.

Which row shows the property of a drug that could be transported in the sections of the liposome labelled 1 and 2?

	property of drug transported in location 1	property of drug transported in location 2
A	hydrophilic	hydrophilic
B	hydrophilic	hydrophobic
C	hydrophobic	hydrophilic
D	hydrophobic	hydrophobic

2. June/2022/Paper_11/No.16

The graph shows changes in the concentration of a solute inside a cell.



What explains this change in concentration?

1 diffusion

2 endocytosis

3 exocytosis

4 osmosis

A 1, 2 and 3 **B** 1, 3 and 4 **C** 1 and 4 only **D** 2 and 4

3. June/2022/Paper_11/No.17

The indicator cresol red, changes from red to yellow when put into acid.

Four blocks of agar containing cresol red were cut to different sizes measured in millimetres. The blocks were submerged in acid. All other variables were kept constant. The time taken for each of the blocks to completely turn yellow was recorded.

Which of the four blocks became completely yellow most quickly?

A 3 × 30 × 30 **B** 6 × 6 × 6 **C** 6 × 12 × 12 **D** 12 × 12 × 12

4. June/2022/Paper_12/No.13

Long chain, saturated fatty acids change from solid to liquid at higher temperatures compared with short chain, unsaturated fatty acids.

Which fatty acids would be more likely to form triglycerides in mammals that live in cold climates?

A long chain saturated

B long chain unsaturated

C short chain saturated

D short chain unsaturated

5. June/2022/Paper_12/No.14

When animal cells are cultured, salt solution is added to keep the cells alive.

What is the purpose of the salt solution?

A to allow facilitated diffusion of salts into the cells

B to prevent diffusion of other ions in or out of the cells

C to prevent net movement of water into or out of the cells

D to provide a source of energy for active transport

6. June/2022/Paper_12/No.15

The following are all processes that allow movement into cells.

1 phagocytosis

2 active transport

3 facilitated diffusion

Which processes require ATP?

A 1 and 2 **B** 2 and 3 **C** 1 only **D** 2 only

7. June/2022/Paper_12/No.16

Which features are required to allow for efficient diffusion?

1 a large surface area

2 a short diffusion pathway

3 maintenance of a constant diffusion gradient

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

8. June/2022/Paper_13/No.14

Batrachotoxin is a poison found in frogs in the Colombian jungle. The poison is used to produce poison darts.

The poison works by increasing the permeability of the cell surface membrane of nerve and muscle cells to sodium ions, which move out of the cells.

Four students made statements about how the poison affects the cells.

1 Water leaves the cells by osmosis, causing the cells to shrink.

2 Water enters the cells by osmosis, causing the cells to burst.

3 When the sodium ions move out of the cells the intracellular fluid has a more positive water potential than the extracellular fluid.

4 When the sodium ions move out of the cells the extracellular fluid has a more positive water potential than the intracellular fluid.

Which statements are correct for the cells affected by batrachotoxin?

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

9. June/2022/Paper_13/No.15

Which processes use energy in the form of ATP?

1 endocytosis

2 exocytosis

3 facilitated diffusion

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

10. June/2022/Paper_13/No.16

An indicator is colourless in acid and pink in alkali.

In an experiment a petri dish of agar was prepared using an acidic solution of this indicator.

A disc of agar 1 cm in diameter was removed from the centre to create a well.

A white card showing circular marker lines 1 cm apart was placed underneath the petri dish.

1 cm^3 alkali solution was put into the well in the agar and a stop-watch was started.

A circular disc of pink colour appeared and spread through the agar. It reached the first marker line in a short time but took longer to reach the second marker line and a very long time to reach the third marker line.

What explains these observations?

A facilitated diffusion of alkali solution

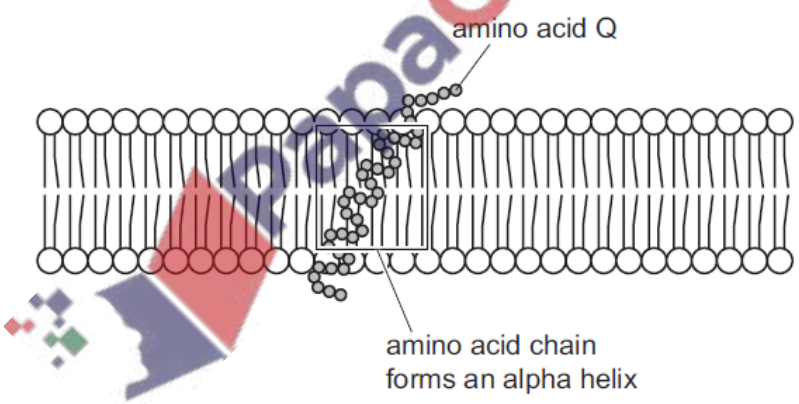
B facilitated diffusion of the indicator

C simple diffusion of alkali solution

D simple diffusion of the indicator

11. June/2022/Paper_13/No.17

The diagram shows a section of a glycoprotein molecule found embedded in a cell surface membrane. Each of the amino acids is represented by a small shaded circle.



Which row shows a property of the amino acids found in the alpha helix and a property of amino acid Q?

	property of amino acids found in the alpha helix	property of amino acid Q
A	non-polar	polar
B	non-polar	non-polar
C	polar	polar
D	polar	non-polar

12. June/2022/Paper_21/No.3

A tyrosine kinase receptor (TKR) is a protein complex found in the cell surface membrane of mammalian cells.

TKR has two components involved in the process of cell signalling:

- a receptor for the signalling molecule (ligand)
- an enzyme that catalyses the transfer of a phosphate group from ATP to an intracellular protein.

Fig. 3.1 is a diagram to show how TKR is involved in cell signalling.

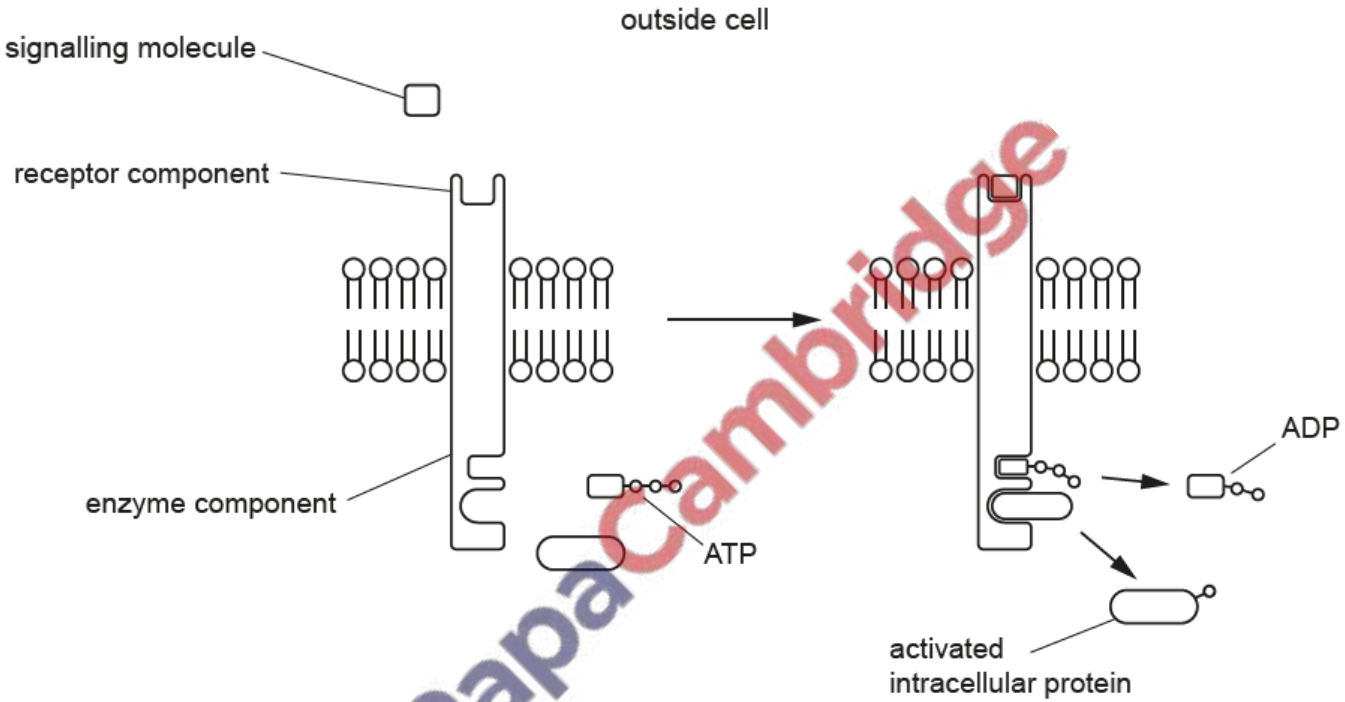


Fig. 3.1

(a) Most enzymes are specific to one reaction.

With reference to Fig. 3.1, explain how the structure of an enzyme provides its specificity.

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The drug GNF-5 is used in the treatment of some cancers. GNF-5 affects the activity of TKR by binding to the enzyme component of the complex.

Researchers investigated the effect of GNF-5 on the activity of TKR using different concentrations of ATP solution. In an experiment the activity of TKR was measured with no GNF-5 **and** with GNF-5.

The results are shown in Fig. 3.2.

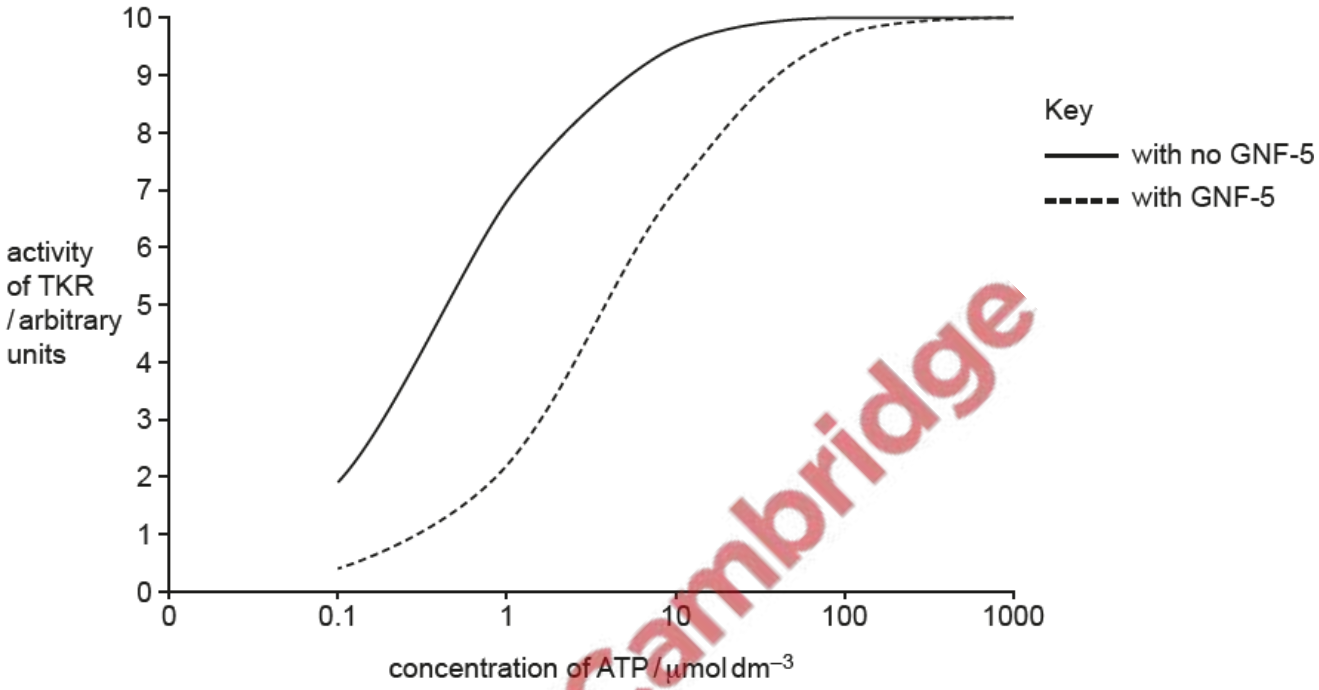

Fig. 3.2

(b) The researchers concluded that GNF-5 acts as an inhibitor of the enzyme component of TKR **and** that it is a competitive inhibitor.

Use Fig. 3.2 to provide evidence for these conclusions.

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(c) A mutation of the gene coding for TKR results in changes to the enzyme component of TKR. This altered form of TKR is known as T315L.

The effect of GNF-5 on the activity of T315L was also investigated.

The results of this investigation are shown in Fig. 3.3.

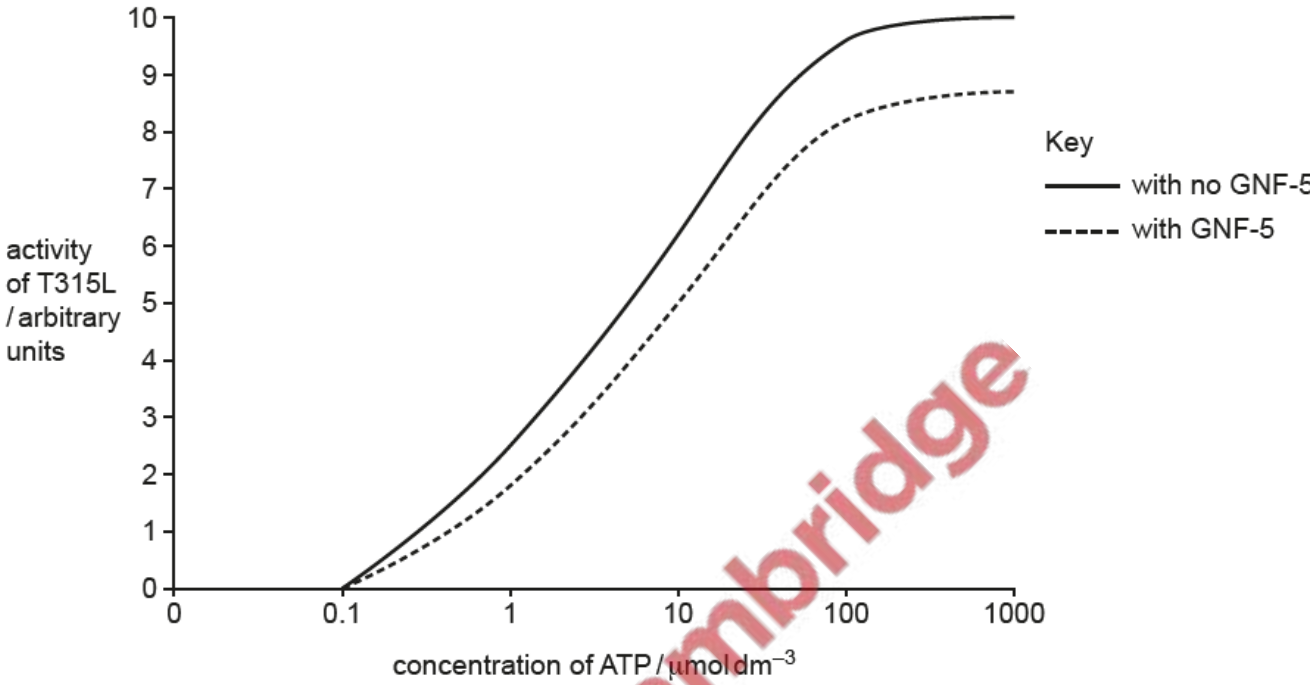

Fig. 3.3

Use Fig. 3.2 **and** Fig. 3.3 to:

(i) State how the activity of T315L differs from TKR when **no** GNF-5 was present.

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(ii) State how the effect of GNF-5 on T315L differs from the effect of GNF-5 on TKR.

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[Total: 8]

13. June/2022/Paper_22/No.1

Epithelial cells in the small intestine have cell structures known as microvilli. The microvilli of these cells are found only on the surface that borders the gut lumen.

Fig. 1.1 shows images of microvilli of intestinal epithelial cells. These images have been obtained using a scanning electron microscope and a transmission electron microscope.

Fig. 1.1**A** is at a different magnification to Fig. 1.1**B**.

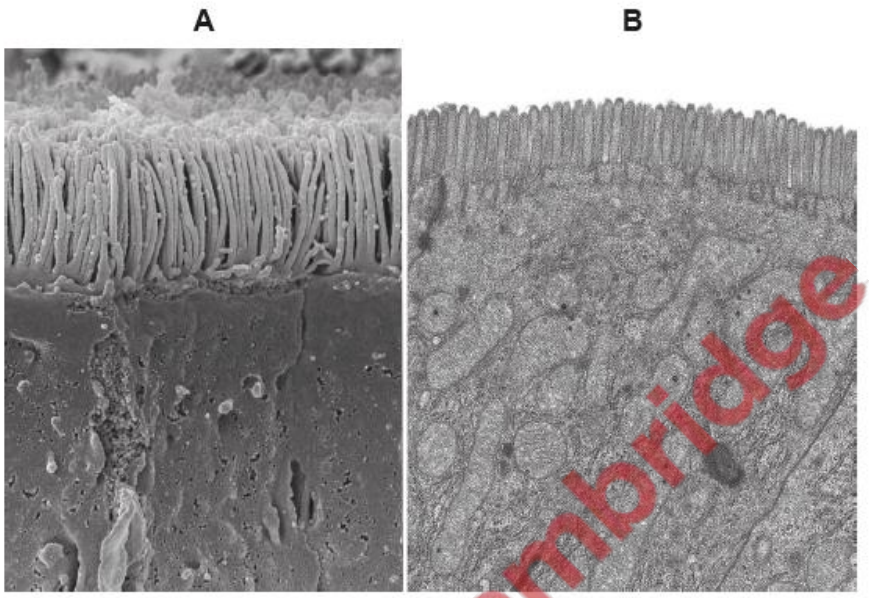

Fig. 1.1

(a) With reference to Fig. 1.1, state how it is possible to distinguish between a scanning electron micrograph and a transmission electron micrograph.

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(b) The approximate length of a microvillus is 1 μm.

Outline the method you would use to estimate the magnifications of the images shown in Fig. 1.1.

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(c) One role of an intestinal epithelial cell is the absorption of glucose from the gut lumen into the circulatory system. This involves different membrane transport proteins.

The events occurring in an intestinal epithelial cell during the absorption of glucose are summarised in Fig. 1.2.

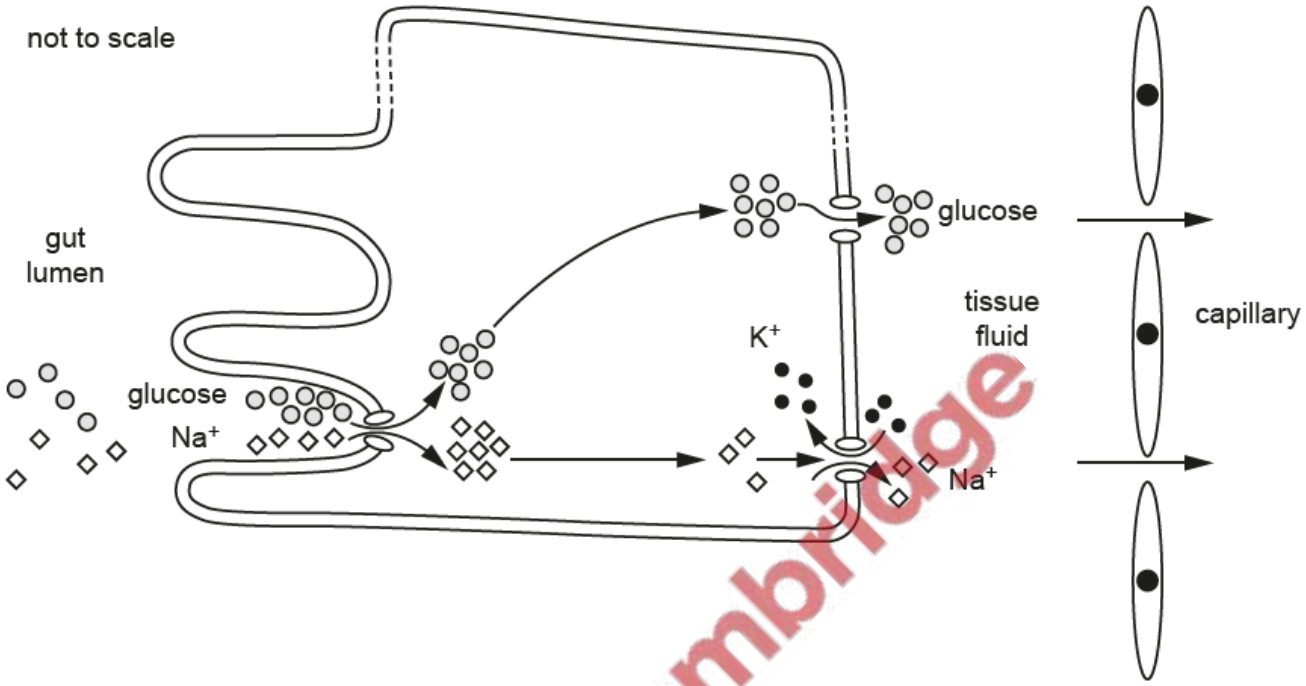

Fig. 1.2

- Sodium ions (Na^+) are removed from the cell by active transport through a transport protein known as a sodium-potassium (Na^+/K^+) pump.
- This decreases the concentration of Na^+ in the cell compared to the gut lumen.
- Glucose molecules are cotransported with Na^+ into the cell from the gut lumen.
- Glucose molecules are transported out of the cell into the tissue fluid down a concentration gradient.

(i) Active transport involves water-soluble substances, such as Na^+ and K^+, and the use of ATP to provide the energy needed for their transport through carrier proteins.

Outline **other** features of active transport.

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(ii) Glucose molecules enter the cell through a membrane protein.

Suggest why glucose molecules need to be cotransported with Na^+ when it enters the cell through the membrane protein.

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(iii) Explain how microvilli increase the uptake of glucose into an intestinal epithelial cell.

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(d) Stem cells are also located in the wall of the small intestine. These cells divide by mitosis continuously.

Suggest **and** explain the importance of mitosis by stem cells in the small intestine.

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[Total: 13]

14. June/2022/Paper_23/No.2

Bacterial cells are prokaryotic. The cells of plants are described as eukaryotic.

(a) Complete the passage comparing a bacterial cell with a plant cell.

A bacterial cell and a plant cell have a cell wall, but the main component of the bacterial cell wall is ..... and not cellulose. The same organelle is used for protein synthesis in both cell types, but a bacterial cell only has smaller, 70S, ... A bacterial cell does not have a large ..... surrounded by a tonoplast.

[3]

(b) Protoplasts are plant cells that have had their cell walls removed by treatment with enzymes. Scientists often use protoplasts when researching ways to improve the yield of crop plants.

Fig. 2.1 is a scanning electron micrograph of protoplasts of cells from the tobacco plant, *Nicotiana tabacum*.

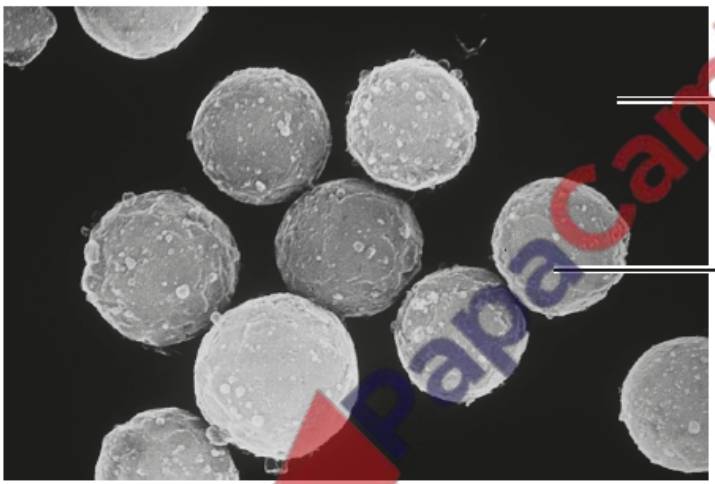

Fig. 2.1

Explain why scientists keep the protoplasts in a solution that has the same water potential as the cell.

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..... [2]

After protoplast treatment, the cells can be stimulated to synthesise new cell wall material.

Fig. 2.2 is at a higher magnification than Fig. 2.1 and shows a scanning electron micrograph of part of a protoplast in an early stage of cell wall synthesis.

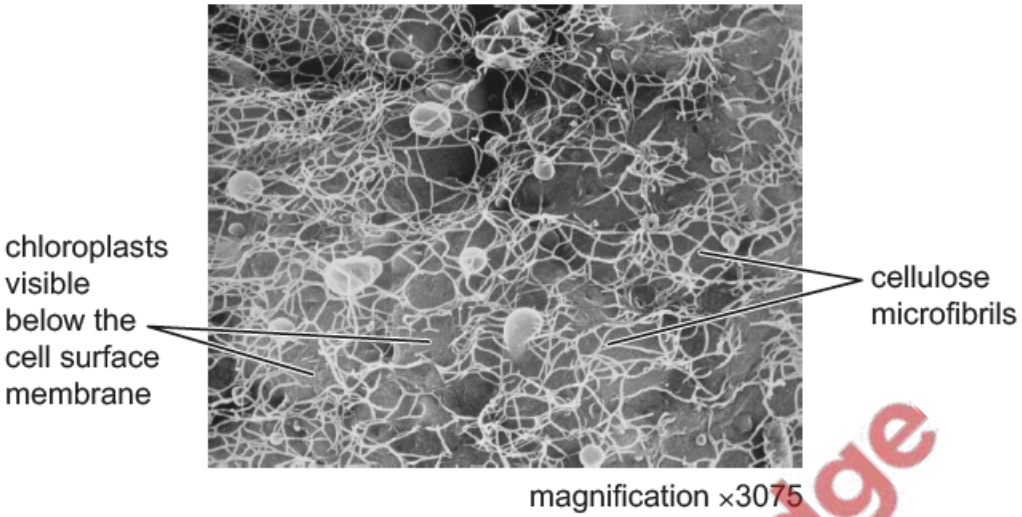

Fig. 2.2

(c) The cellulose microfibrils visible in Fig. 2.2 will form cellulose fibres. Each microfibril is formed from cellulose molecules. Each cellulose molecule is a polymer of β-glucose.

(i) Describe the structure of a cellulose molecule **and** a cellulose microfibril.

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(ii) Name **one** substance that may be added to the network formed by the cellulose microfibrils in the formation of a cell wall.

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(d) Name the type of plant cell that could have been used to produce the protoplast shown in Fig. 2.2.

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[Total: 10]