1 A student carried out an investigation involving uptake of the stain methylene blue by yeast cells.

The investigation involved adding methylene blue to a suspension of yeast cells. Samples of the stained yeast cells were heated to different temperatures.

The student then observed the cells at high power under a light microscope.

The results are shown in Table 3.1.

Table 3.1

temperature (°C)	cells observed stained blue (%)	colour of solution surrounding cells
10	98	colourless
20	96	colourless
30	97	colourless
40	96	colourless
50	73	colourless
60	12	light blue
70	2	blue
80	0	blue

(a) (i) Yeast cells take up methylene blue by active transport.

Using **only** the information provided in Table 3.1, outline the evidence that supports this statement.

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..... **[2]**

(ii) Suggest why some cells did **not** stain blue at 20 °C.

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..... **[1]**

(b) (i) Suggest **one** change that occurred to the plasma (cell surface) membranes of the yeast cells at temperatures above 60 °C.

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(ii) Explain why the stained yeast cells lost their colour at higher temperatures.

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(c) The student concluded that yeast cells are killed between 50 °C and 70 °C.

Suggest **one** way in which the student could have improved the **accuracy** of this experiment and **one** way in which he could have improved the **reliability**.

accuracy .....

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reliability .....

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..... **[2]**

(d) The student placed a small sample of the yeast suspension on a microscope slide and observed it under high power.

Fig. 3.1 shows what the student observed.

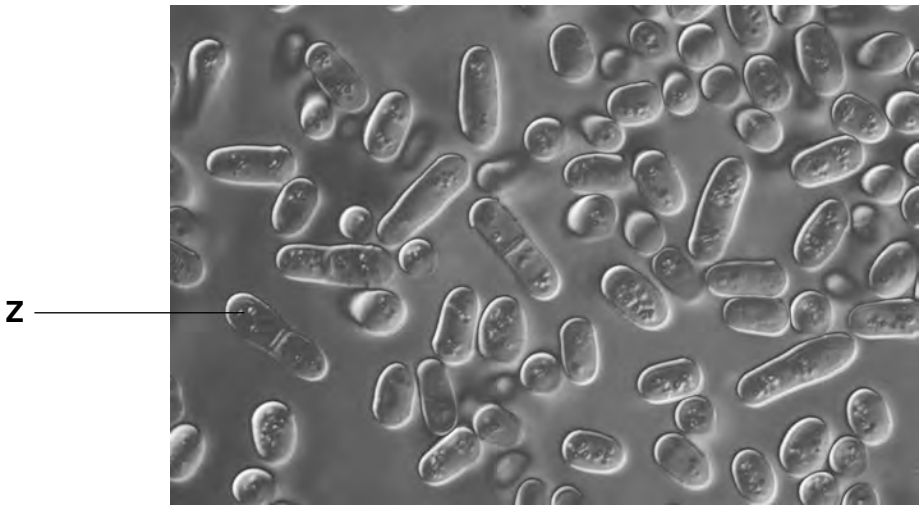

Fig. 3.1

Cell **Z** is undergoing a process called *budding*.

Outline the process of budding in yeast.

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..... **[2]**

[Total: 10]

2 **(a)** Complete the passage below.

Membranes have a variety of functions in cells. All membranes are ..... permeable. This means that they allow the passage of certain substances by processes such as active transport or ..... through the membrane. The cell surface membrane, also known as the ..... membrane, surrounds the cytoplasm. The cell surface membrane consists of a bilayer of ..... . To stabilise the structure of the membrane and keep it fluid, molecules of ..... are also found in this bilayer. **[5]**

(b) Membranes contain a variety of proteins. Some of these proteins are combined with carbohydrates to form glycoproteins.

Describe the functions of glycoproteins in the cell surface membrane.

In your answer you should use appropriate technical terms, spelt correctly.

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..... **[5]**

[Total: 10]

3 Fig. 2.1 shows the structure of a plasma (cell surface) membrane.

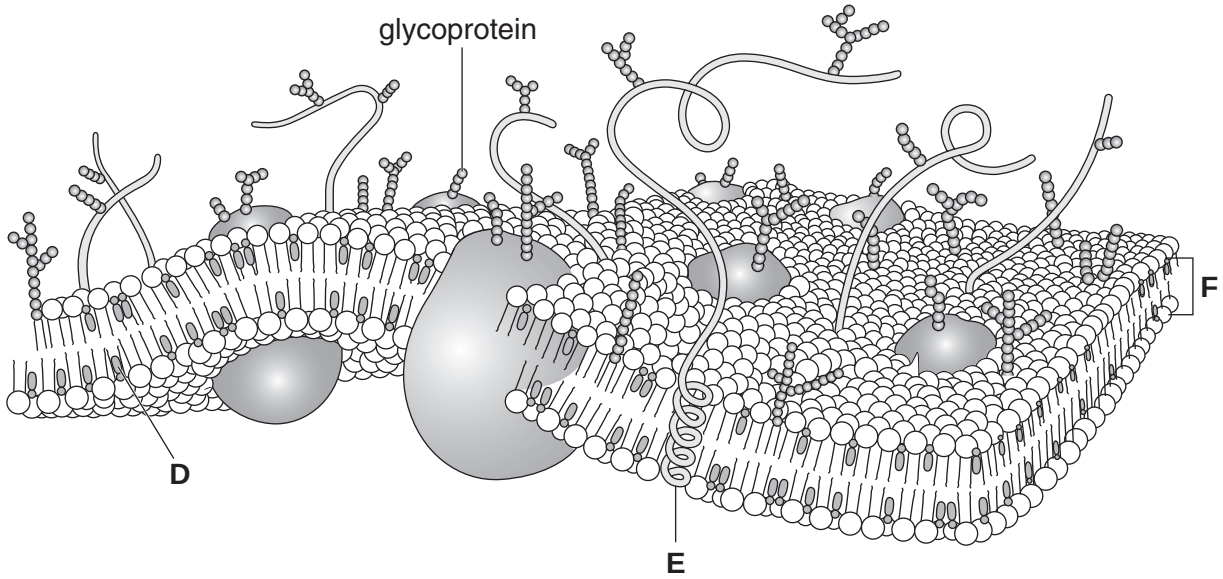

Fig. 2.1

(a) (Name the components of the plasma (cell surface) membrane labelled **D**, **E** and **F**.

D .....

E .....

F ..... **[3]**

(ii) State **one** function for each of the components **D**, **E** and **F**.

D .....

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E .....

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F .....

..... **[3]**

(b) Glycoprotein molecules are positioned in the plasma (cell surface) membrane with the carbohydrate chain outside the cell.

This is to allow the glycoproteins to act as receptors in the process of cell signalling.

(i) Explain what is meant by the term *cell signalling*.

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..... **[2]**

(ii) Explain **how** a glycoprotein can act as a receptor.

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(c) A student investigated the effect of temperature on the release of pigment from pieces of beetroot.

She cut a fresh beetroot into four pieces and placed each piece into water at a different temperature.

After 10 minutes she removed the beetroot and used a colorimeter to test how much pigment had entered the water.

She placed the coloured water into the colorimeter and measured the percentage transmission of light through the water. Her results are shown in Table 2.1.

Table 2.1

temperature of water (°C)	percentage transmission of light
10	85
30	87
50	78
100	0

(i) The results show that below 50 °C little pigment had entered the water.

Explain why there was no transmission of light after the beetroot had been placed in water at 100 °C.

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(ii) Suggest **three** ways in which the student could have improved her investigation.

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..... **[3]**

4 Fig. 2.1 shows diagrams of four cells that have been placed in different solutions.

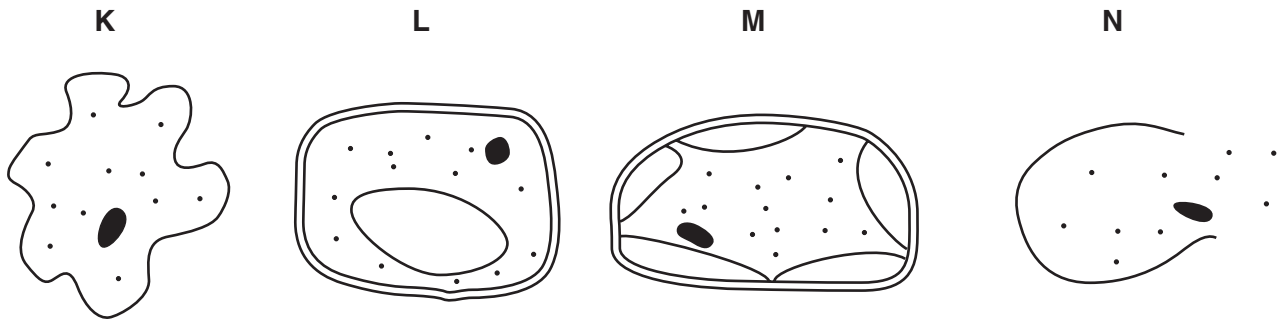

Fig. 2.1

(a) In the table below, write the letter **K**, **L**, **M** or **N** next to the description that best matches the diagram. One has been done for you.

description	letter
an animal cell that has been placed in distilled water	
an animal cell that has been placed in a concentrated sugar solution	
a plant cell that has been placed in distilled water	
a plant cell that has been placed in a concentrated sugar solution	M

[3]

(b) Explain, using the term **water potential**, what has happened to cell **M**.

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..... **[3]**

(c) Small non-polar substances enter cells in different ways to large or polar substances.

Outline the ways in which substances, **other than water**, can enter a cell through the plasma (cell surface) membrane.

In your answer, you should use appropriate technical terms, spelt correctly.

small, non-polar substances .....

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large substances .....

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polar substances .....

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..... **[5]**

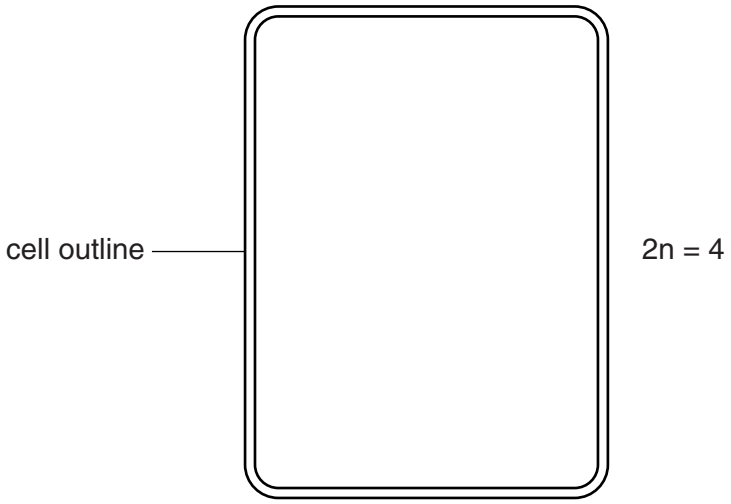
[Total: 11]

5 (a) (i) Name the type of nuclear division that occurs in plant growth.

..... **[1]**

(ii) Draw the **chromosomes** within the cell outline below as they would appear during **metaphase** of nuclear division.

Assume the diploid number of chromosomes is **four**.

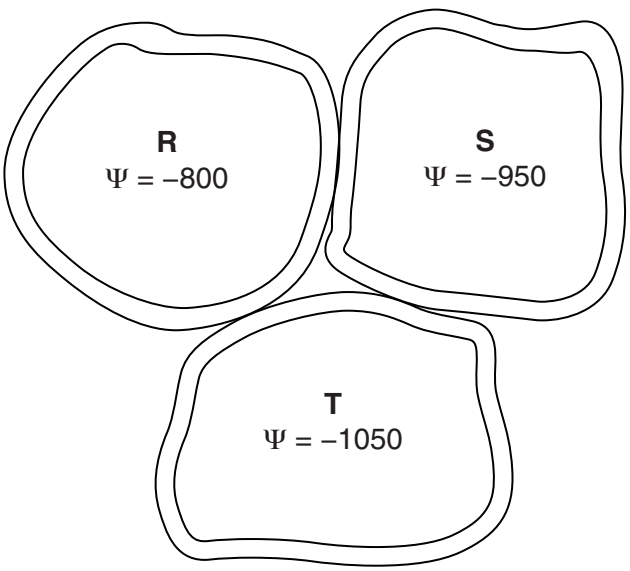


[2]

(iii) Cytokinesis follows nuclear division. After cytokinesis, the cells elongate due to water uptake by osmosis.

Fig. 3.1 shows three plant cells. The value shown in each cell refers to the water potential, Ψ, in kPa.

Draw arrows on Fig. 3.1 below to show the movement of water between cells **R**, **S** and **T**.



[2]

Fig. 3.1

Fig. 3.2

(b) Fig. 3.2, **on the insert**, shows the stump of a tree with new branches growing from the stump.

New growth in a stem or trunk comes from the **cambium**, which is situated between the xylem and phloem tissues.

Explain why the new branches in Fig. 3.2 are seen growing from a position just under the bark of the cut surface.

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..... **[2]**

(c) Name **one** other location where growth occurs in a plant.

..... **[1]**

(d) Look at the areas labelled **L** on Fig. 3.2. These are areas of loosely packed cells in the bark called lenticels. Lenticels allow gases to diffuse into the living tissues of the trunk.

Suggest why lenticels are essential to the survival of large multicellular plants **and** explain why similar structures are not found in large multicellular animals.

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..... **[2]**

[Total: 10]