1 **(a)** Describe the structure of a plasma (cell surface) membrane.

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

(b) A student investigated the movement of substances through the cell surface membrane of yeast cells using an indicator.

- The student was supplied with a suspension of yeast cells in a slightly alkaline solution.
- The indicator used is yellow in alkaline conditions but turns red in acidic conditions.

The student mixed the indicator with the yeast suspension and labelled the tube containing this suspension **A**. The suspension was red/pink in colour.

(i) The student took a small sample from tube **A** and centrifuged this sample.

After centrifuging, the student observed that the liquid portion was colourless but the cells at the bottom were red/pink.

Suggest the mechanism by which the indicator enters the cells and suggest the component of the membrane involved.

mechanism .....

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

(ii) The student took a small sample from suspension **A** and added alkaline ammonia solution. There was no colour change.

What could the student conclude about the permeability of the yeast plasma membrane?

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

(iii) The student then took another sample from suspension **A** and boiled it. When this boiled suspension was centrifuged the liquid portion was yellow and the cells at the bottom were red/pink.

The student suggested that the liquid in the suspension was yellow because boiling the yeast had damaged the plasma membrane, allowing the indicator out of the cells.

Describe the effect of high temperature on the structure of the yeast cell membranes.

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

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..... **[4]**

[Total: 10]

2 Membranes are found both at the surface of cells and within cells.

(a) State **two** functions of membranes **within** cells.

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

(b) Describe the arrangement and functions of **two** named components of a cell surface membrane.

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

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

(c) (i) Which component of a cell membrane becomes more fluid as temperature increases?

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

(ii) Which component of a cell membrane denatures as temperature increases?

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

(iii) Liver cells contain membrane-bound organelles called peroxisomes. These organelles contain catalase, an enzyme that breaks down hydrogen peroxide to release oxygen gas.

A student carried out an investigation on catalase using the following procedure:

- two identical sized cubes were cut from a piece of fresh liver
- one cube was frozen overnight and then defrosted
- the other cube was stored in the refrigerator
- both cubes were returned to room temperature and were placed in separate test tubes containing equal volumes of 2% hydrogen peroxide solution.

The student observed that the cube of liver that had been frozen and defrosted, bubbled significantly more than the cube that had been refrigerated.

Suggest an explanation for this result.

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

[Total: 11]

3 **(a)** The structure of cell membranes can be described as 'proteins floating in a sea of lipids'. This membrane structure allows certain substances to pass through freely whereas other substances cannot.

State the term used to describe a membrane through which some substances can pass freely but others cannot.

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

(b) Complete the following paragraph about cell membranes, using the most appropriate terms.

The model of cell membrane structure is called the .... model. Phospholipid bilayers with specific membrane proteins account for the ability of the membrane to allow both passive and ..... transport mechanisms. Ions and most polar molecules are insoluble in the phospholipid bilayer. However, the bilayer allows diffusion of most non-polar molecules such as ..... Protein channels, which may be gated, and ..... proteins enable the cell to control the movement of most polar substances. **[4]**

(c) One function of membranes that is not mentioned in **(b)** is cell signalling.

(i) State what is meant by *cell signalling*.

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

(ii) Explain how cell surface membranes contribute to the process of cell signalling.

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

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..... **[4]**

[Total: 10]

4 Membranes are a fundamental part of the cell. They are found both at the surface of a cell and inside a cell.

(a) State **three** roles of membranes **inside** cells.

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

(b) Cells contain a large number of membrane-bound vesicles. Many of these vesicles transport substances between organelles.

(i) Outline how the vesicles are moved from one organelle to another.

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

(ii) The proteins embedded in the membranes of vesicles have different functions.

- COPI and COPII proteins are known as 'address proteins'.
- Vesicles that transport materials from the Golgi to the rough endoplasmic reticulum (RER) are coated in COPI proteins.
- Vesicles that transport materials to the Golgi from the RER are coated in COPII proteins.

Suggest how these proteins ensure that a vesicle is transported to the correct target organelle.

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

(c) Cells in the pancreas secrete proteins such as the enzymes pancreatic amylase and protease.

Describe how these extracellular enzymes are secreted from the cells.

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

[Total: 9]

5 The cell surface membrane allows different substances to enter and leave the cell.

(a) List **three** components of a cell surface membrane.

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

(b) **(i)** Explain what is meant by the term *active transport*.

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

(ii) State **two** examples of active transport in cells.

For each example, you should name the substance that is transported **and** the cell involved.

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

(c) In addition to active transport, substances can pass through cell surface membranes by:

- diffusion
- facilitated diffusion
- osmosis
- bulk transport (endocytosis / exocytosis)

For each example described in Table 2.1 below, state how the substance crosses the cell surface membrane. The first one has been done for you.

Table 2.1

example	mechanism of movement across cell surface membrane
release of enzymes into the gut	bulk transport
a plant cell taking up water	
calcium ions entering a nerve cell down a concentration gradient	
oxygen entering a red blood cell	

[3]

[Total: 10]

6 **(a)** **(i)** Name the process by which water leaves a cell.

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

(ii) Describe the routes that water molecules take through the **cell surface membrane**.

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

A student carried out an investigation to determine the effects of different sucrose concentrations on cells from pieces of onion epidermis.

- Strips of epidermis were taken from an onion.
- Separate pieces of epidermis were placed into water and a range of sucrose solutions.
- The pieces of epidermis were left for 30 minutes before being removed.
- The pieces of epidermis were then viewed at high power under the microscope.

The student counted 100 cells from each piece of epidermis. The student noted how many cells had become plasmolysed.

The results are shown in Table 6.1.

Table 6.1

concentration of sucrose solution ($mol\,dm^{-3}$)	water potential of sucrose solution (kPa)	percentage of cells plasmolysed (%)
0.0	0	0
0.1	–260	0
0.3	–860	3
0.4	–1120	7
0.5	–1450	39
0.6	–1800	57
0.7	–2180	83
0.8	–2580	94
1.0	–3500	100

(b) None of the onion epidermis cells this student observed had burst when left in pure water.

Explain why plant cells do not burst when they are left in pure water.

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

(c) **(i)** The water potential of the onion epidermis cells can be assumed to be the same as the water potential of a solution that causes 50% plasmolysis.

Use the information in Table 6.1 to **estimate the water potential** inside these onion epidermis cells.

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

(ii) Suggest how the student could construct and use a graph to obtain a better estimate of the water potential.

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

(d) Suggest how the student could modify the procedure to make the results more reliable and accurate.

reliable .....

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accurate .....

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..... **[4]**

[Total: 12]