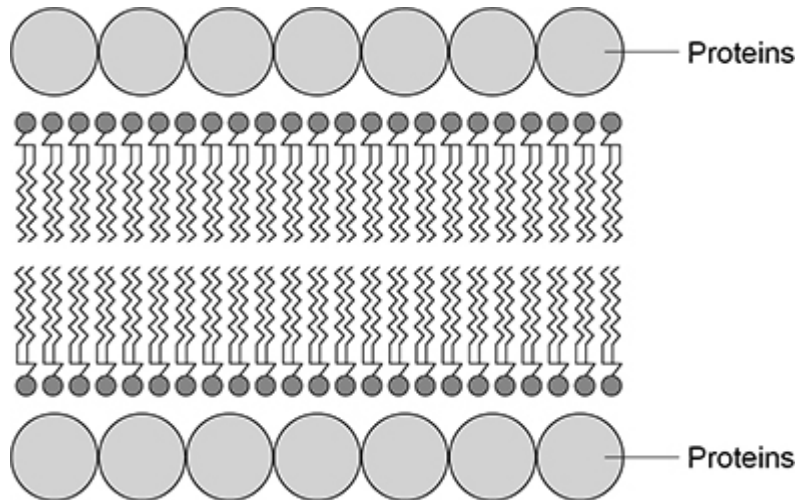


Q1.

In 1935, scientists suggested a model for the chemical structure of a cell-surface membrane. **Figure 2** shows the membrane structure the scientists suggested.

Figure 2



- (d) Give **one** similarity and **two** differences between the membrane structure shown in **Figure 2** and the fluid-mosaic model of membrane structure.

Similarity _____

Difference

1 _____

Difference

2 _____

(3)

Q2.

(b) Name **and** describe **five** ways substances can move across the cell-surface membrane into a cell.

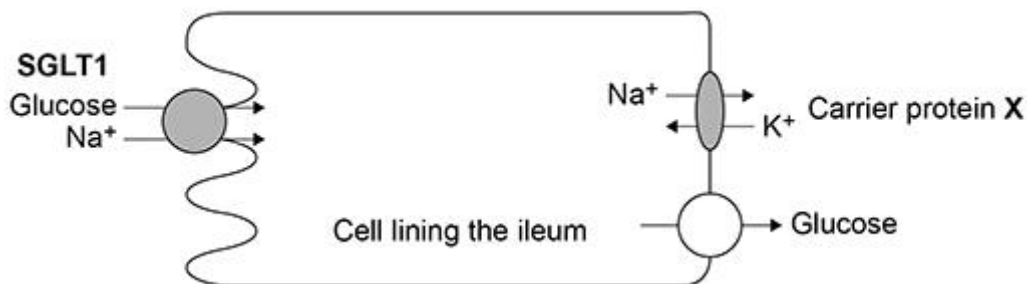
(5)

Q3.

Figure 1 shows a cell from the lining of the ileum specialised for absorption of products of digestion.

SGLT1 is a carrier protein found in the cell-surface membrane of this cell, it transports glucose and sodium ions (Na^+) into the cell.

Figure 1



- (a) The action of the carrier protein **X** in **Figure 1** is linked to a membrane-bound ATP hydrolase enzyme.

Explain the function of this ATP hydrolase.

(2)

- (b) The movement of Na^+ **out** of the cell allows the absorption of glucose **into** the cell lining the ileum.

Explain how.

(2)

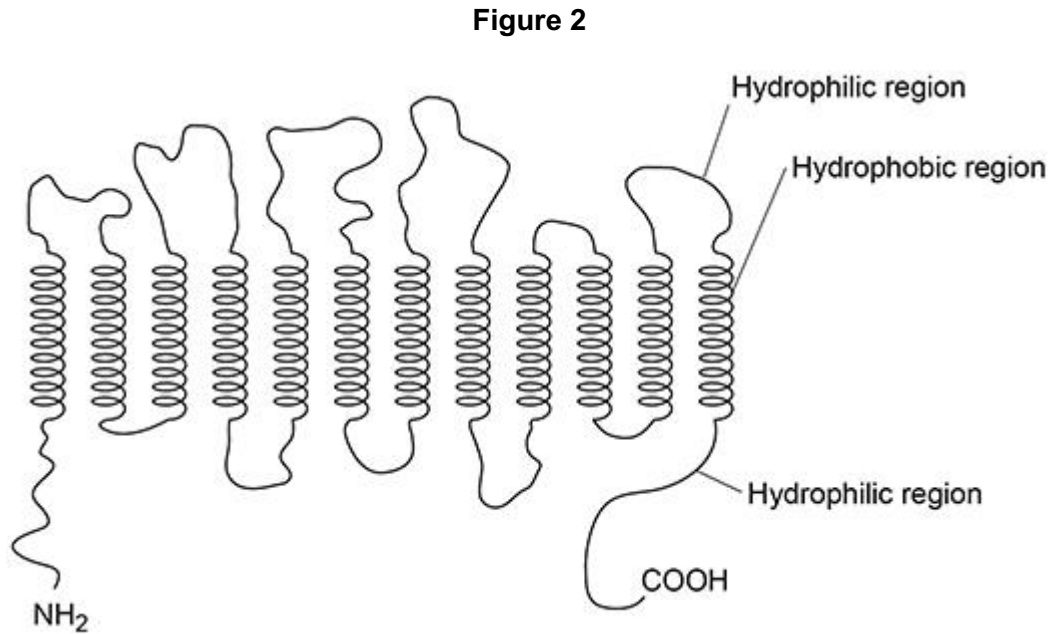
- (c) Describe and explain **two** features you would expect to find in a cell specialised for absorption.

1

2

(2)

Figure 2 is a diagram of one SGLT1 carrier protein.



- (d) Draw phospholipids on **Figure 2** to show how the carrier protein, SGLT1, would fit into the cell-surface membrane.

Do **not** draw more than eight phospholipids.

(2)

Q4.

- (b) The movement of substances across cell membranes is affected by membrane structure. Describe how.

(5)

Q5.

- (a) Give **two** similarities in the movement of substances by diffusion and by osmosis.

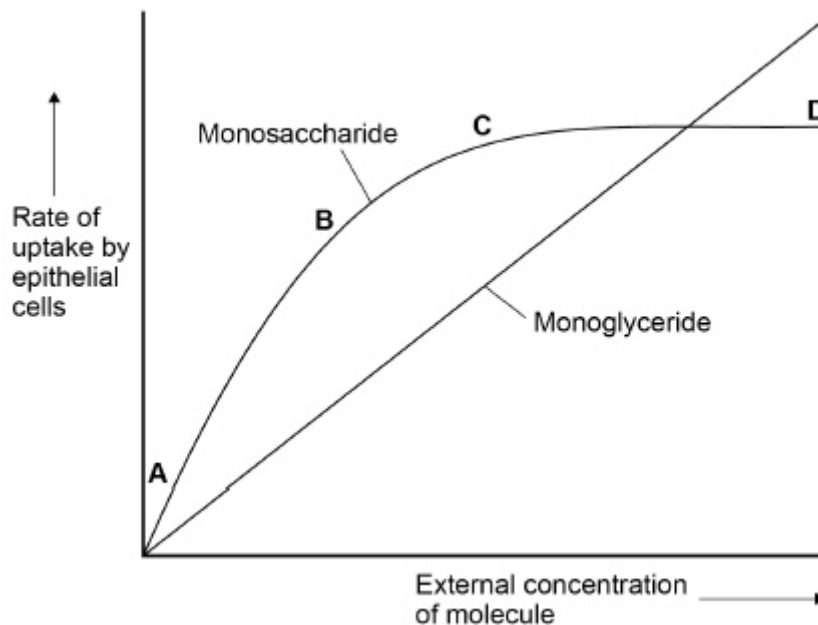
1. _____

2. _____

(2)

A scientist measured the rate of uptake of a monoglyceride and a monosaccharide by epithelial cells of the small intestine of mice. A monoglyceride is a molecule of glycerol with one fatty acid attached. She did this for different concentrations of monoglyceride and monosaccharide.

Her results are shown in the graph.



- (b) Use your knowledge of transport across membranes to explain the shape of the curve in the graph for uptake of monosaccharides between concentrations:

A and B

C and D

(3)

- (c) The graph is evidence for monoglycerides being lipid-soluble molecules.
Suggest how.

(2)

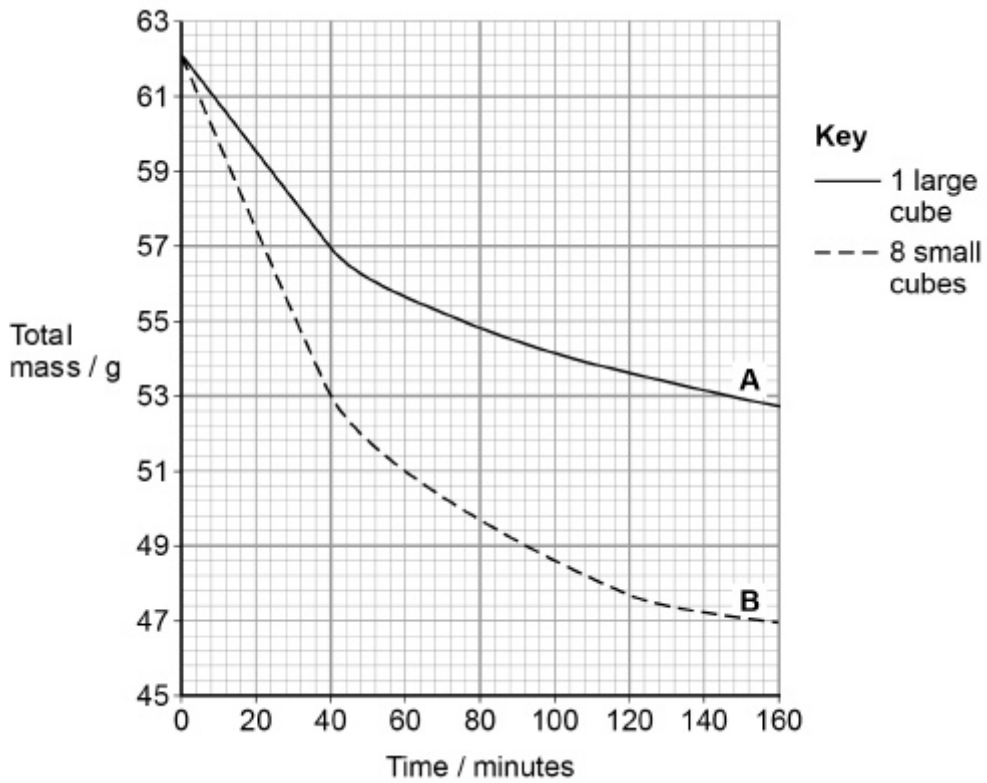
(Total 7 marks)

Q6.

A student investigated the effect of surface area on osmosis in cubes of potato.

- He cut two cubes of potato tissue, each with sides of 35 mm in length.
- He put one cube into a concentrated sucrose solution.
- He cut the other cube into eight equal-sized smaller cubes and put them into a sucrose solution of the same concentration as the solution used for the large cube.
- He recorded the masses of the cubes at intervals.

His results are shown in the graph.



- (a) Describe the method the student would have used to obtain the results in the graph. Start after all of the cubes of potato have been cut. Also consider variables he should have controlled.

(3)

- (b) The loss in mass shown in the graph is due to osmosis. The rate of osmosis between 0 and 40 minutes is faster in **B** (the eight small cubes) than in **A** (single large cube).

Is the rate of osmosis per mm^2 per minute different between **A** and **B** during this time?

Use appropriate calculations to support your answer.

(3)

(Total 6 marks)

Q7.

The cells of beetroot contain a red pigment. A student investigated the effect of temperature on the loss of red pigment from beetroot. He put discs cut from beetroot into tubes containing water. He maintained each tube at a different temperature. After 25 minutes, he measured the percentage of light passing through the water in each tube.

- (a) The student put the same volume of water in each tube.

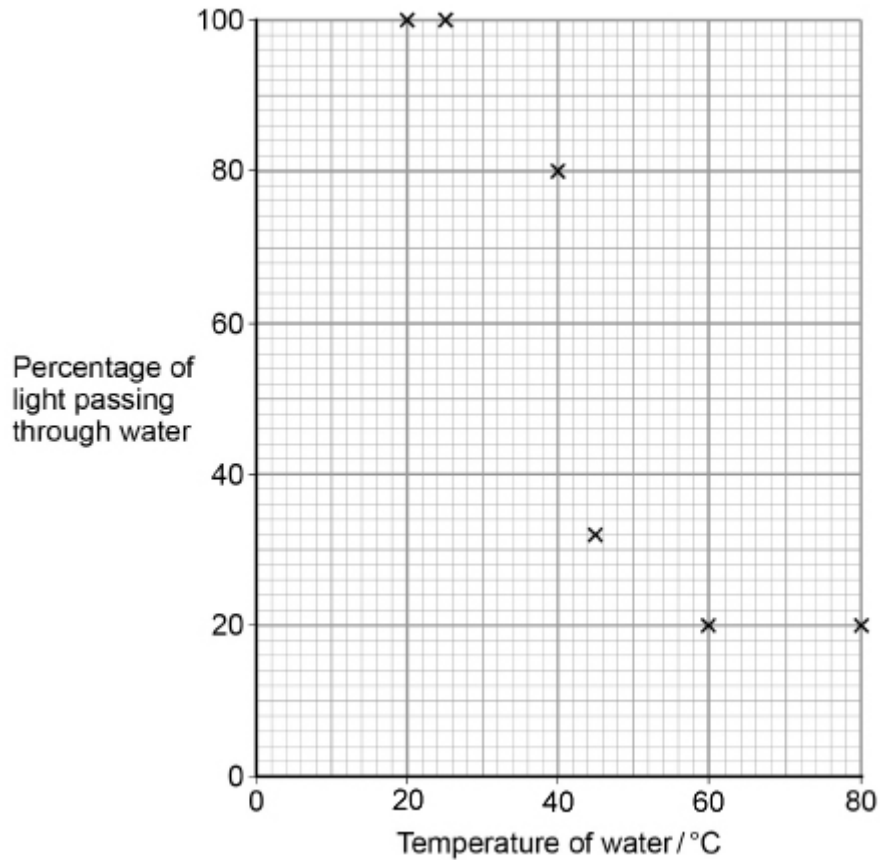
Explain why it was important that he controlled this experimental variable.

(2)

- (b) Describe a method the student could have used to monitor the temperature of the water in each tube.

(1)

The graph shows the student's results.



(c) Draw a suitable curve on the graph above.

(1)

(d) The decrease in the percentage of light passing through the water between 25 °C and 60 °C is caused by the release of the red pigment from cells of the beetroot.

Suggest how the increase in temperature of the water caused the release of the red pigment.

(2)

(Total 6 marks)

Q8.

In mammals, in the early stages of pregnancy, a developing embryo exchanges substances with its mother via cells in the lining of the uterus. At this stage, there is a high concentration of glycogen in cells lining the uterus.

- (c) Suggest and explain **two** ways the cell-surface membranes of the cells lining the uterus may be adapted to allow rapid transport of nutrients.

1. _____

2. _____

(2)

Q9.

- (a) Sodium ions from salt (sodium chloride) are absorbed by cells lining the gut. Some of these cells have membranes with a carrier protein called NHE3.

NHE3 actively transports one sodium ion into the cell in exchange for one proton (hydrogen ion) out of the cell.

Use your knowledge of transport across cell membranes to suggest how NHE3 does this.

(3)

- (b) Scientists investigated the use of a drug called Tenapanor to reduce salt absorption in the gut. Tenapanor inhibits the carrier protein, NHE3.

The scientists fed a diet containing a high concentration of salt to two groups of rats, **A** and **B**.

- The rats in Group **A** were **not** given Tenapanor (0 mg kg^{-1}).
- The rats in Group **B** were given 3 mg kg^{-1} Tenapanor.

One hour after treatment, the scientists removed the gut contents of the rats and immediately weighed them.

Their results are shown in the table.

Concentration of Tenapanor / mg kg^{-1}	Mean mass of contents of the gut / g
0	2.0
3	4.1

The scientists carried out a statistical test to see whether the difference in the means was significant. They calculated a P value of less than 0.05.

They concluded that Tenapanor did reduce salt absorption in the gut.

Use all the information provided and your knowledge of water potential to explain how they reached this conclusion.

(4)

- (c) High absorption of salt from the diet can result in a higher than normal concentration of salt in the blood plasma entering capillaries. This can lead to a build-up of tissue fluid.

Explain how.

(2)

(Total 9 marks)

Q10.

Write an essay on the importance of diffusion in organisms.

(Total 25 marks)

Q11.

Water and inorganic ions have important biological functions within cells.

- (c) Compare and contrast the processes by which water and inorganic ions enter cells.

(3)

Q12.

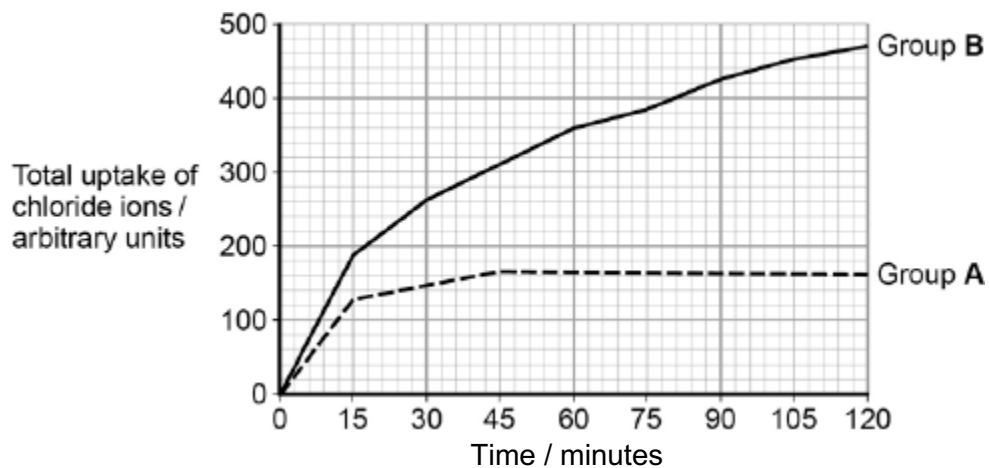
(a) Contrast the processes of facilitated diffusion and active transport.

(3)

Students investigated the uptake of chloride ions in barley plants. They divided the plants into two groups and placed their roots in solutions containing radioactive chloride ions.

- Group **A** plants had a substance that inhibited respiration added to the solution.
- Group **B** plants did not have the substance added to the solution.

The students calculated the total amount of chloride ions absorbed by the plants every 15 minutes. Their results are shown in the figure below.



(b) Calculate the ratio of the mean **rate** of uptake of chloride ions in the first hour to the **rate** of uptake of chloride ions in the second hour for group **B** plants.

Ratio = _____ :1

(2)

(c) Explain the results shown in the figure above.

(4)

(Total 9 marks)

