4. Cell Membranes and Transport

4.2 Movement into and out of cells

Paper 1

Question Paper

1 Which statement correctly describes facilitated diffusion?

A The process only occurs using channel proteins that change shape and that use energy provided by the cell.

B The process occurs using channel proteins or carrier proteins that may or may not change shape.

C The process occurs using channel proteins or carrier proteins that use energy provided by the cell.

D The process only occurs using carrier proteins that create a gradient to move ions in opposite directions.

2 Which process always takes place **without** the involvement of energy from ATP?

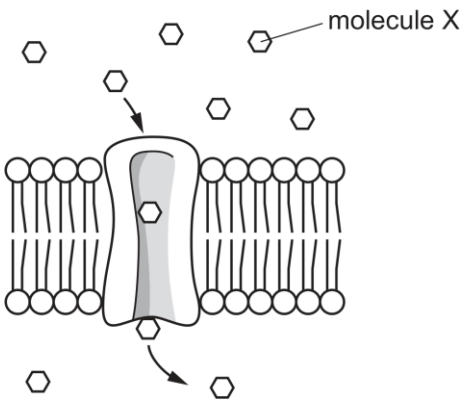
A active transport

B endocytosis

C exocytosis

D facilitated diffusion

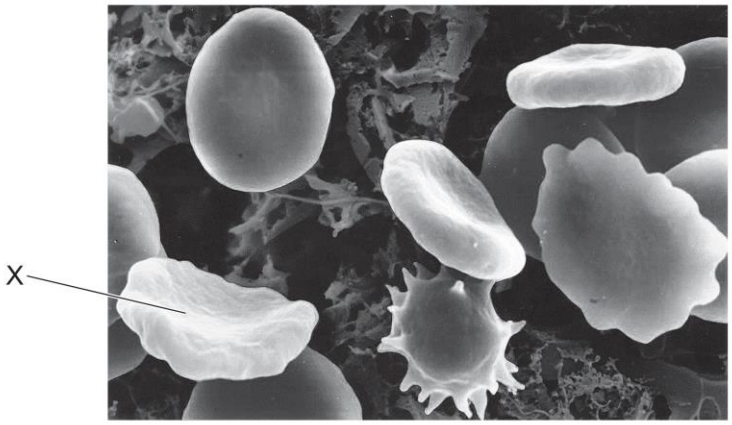
3 The diagram shows the entry of molecule X into a cell.



Which row shows a property of molecule X and the effect of the concentration of ATP in the cytoplasm on the rate of entry of molecule X?

	property of molecule X	concentration of ATP in the cytoplasm
A	non-polar	affects rate of entry of molecule X
B	non-polar	has no effect on rate of entry of molecule X
C	polar	affects rate of entry of molecule X
D	polar	has no effect on rate of entry of molecule X

4 The electron micrograph shows some human blood cells.



Which row correctly shows the net movement of water by osmosis and the water potential of the cytoplasm of cell X compared with the solution surrounding the cells?

	net movement of water by osmosis	water potential of cytoplasm of cell X compared with the solution
A	into the cell	higher
B	into the cell	lower
C	out of the cell	higher
D	out of the cell	lower

5 A red indicator solution was mixed with agar and the resulting solid was cut into small cylindrical blocks. The blocks were placed in an acid which turns the indicator yellow and all other variables were kept constant. The dimensions of the blocks are shown.

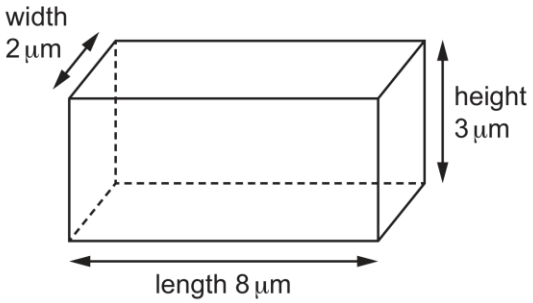
block 1	height 3 mm	diameter 6 mm
block 2	height 6 mm	diameter 12 mm
block 3	height 8 mm	diameter 16 mm

The formula for calculating the surface area of a cylinder is $2\pi rh + 2\pi r^2$. The formula for calculating the volume of a cylinder is $\pi r^2 h$.

Which row shows the correct surface area (SA) to volume (V) ratio for each block and the time taken for the block to turn yellow?

	block 1		block 2		block 3	
	SA to V ratio	time to turn yellow / mins	SA to V ratio	time to turn yellow / mins	SA to V ratio	time to turn yellow / mins
A	0.75 : 1.0	4	1.5 : 1.0	5	2.0 : 1.0	11
B	0.75 : 1.0	11	1.5 : 1.0	5	2.0 : 1.0	4
C	1.33 : 1.0	4	0.67 : 1.0	5	0.5 : 1.0	11
D	1.33 : 1.0	11	0.67 : 1.0	5	0.5 : 1.0	4

6 The diagram shows the mean dimensions of an epithelial cell in micrometres (μm).



Which row shows the surface area to volume ratio of the epithelial cell and how the surface area to volume ratio of the cell would change if the cell width doubled?

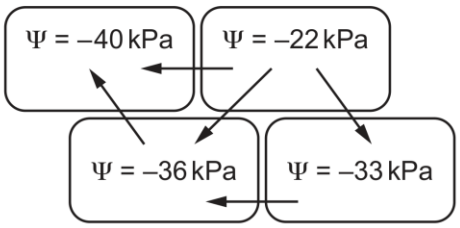
	surface area : volume	how surface area : volume changes if the cell width doubled
A	12 : 23	decreases
B	12 : 23	increases
C	23 : 12	decreases
D	23 : 12	increases

7 Which diagram shows the correct direction of net water movement between the four cells due to osmosis?

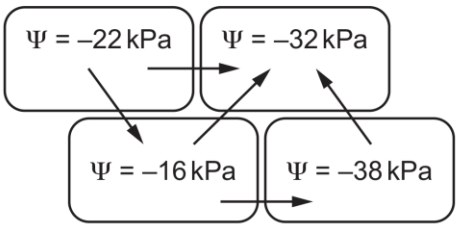
key

Ψ = water potential

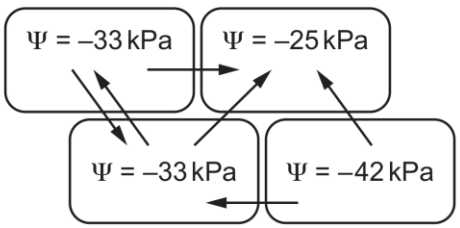
A



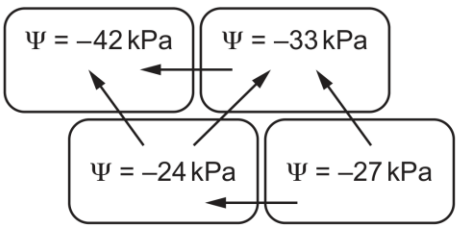
B



C



D



8 A mixture of glucose and starch solutions was placed in a length of dialysis (Visking) tubing and the tubing sealed. The tubing was then placed in a boiling tube containing distilled water. Two samples were immediately removed from this water (time 0 minutes) and tested with either iodine solution or Benedict's solution. This was repeated at 10 minute intervals for 30 minutes.

The iodine solution gave an orange-brown colour each time.

The table shows the results of the Benedict's test.

	time / minutes			
	0	10	20	30
colour produced by Benedict's test	blue	green	yellow	red

What may be concluded from these results?

1 The pores in the Visking tubing are too small for a starch molecule to pass through.

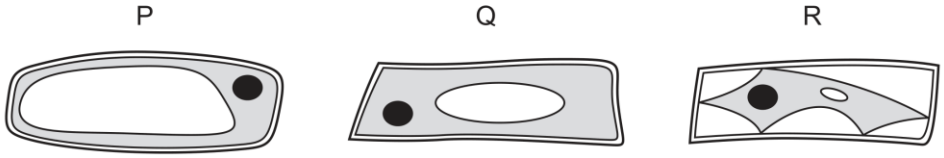
2 Glucose diffuses through the Visking tubing down a diffusion gradient.

3 Water diffuses into the Visking tubing.

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

9 In an experiment, pieces of onion epidermis are put into three different concentrations of sucrose solutions, P, Q and R. The pieces of onion are left for an hour and then examined using the low power of a light microscope.

Each diagram shows one cell from the epidermis that was placed in each of the sucrose concentrations.



What explains the appearance of cells in solution Q?

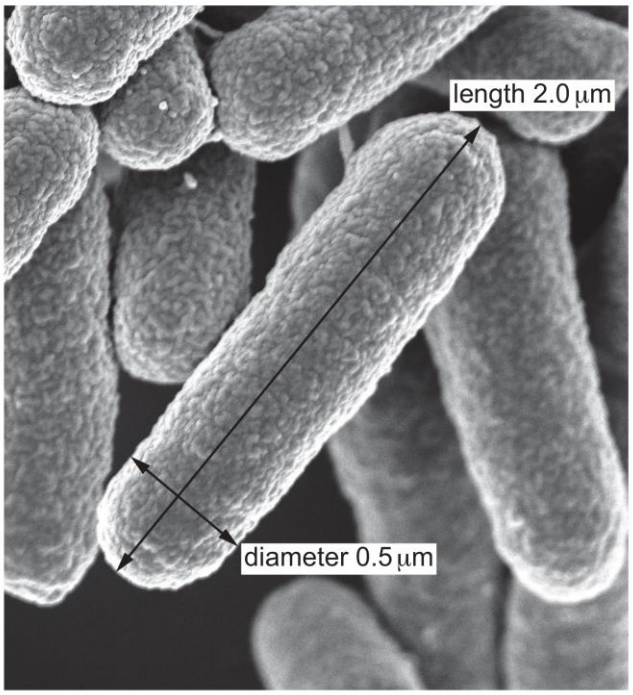
A The concentration of solution Q is equal to the concentration of the solutes in the cell sap.

B The cytoplasm has the same concentration of sucrose as solution Q.

C The water potential of the cytoplasm is equal to the water potential of the vacuole.

D The water potential of the cell sap is equal to the water potential of solution Q.

10 The electron micrograph shows rod-shaped bacteria.



The actual length of the bacterium is 2.0 μm and the diameter is 0.5 μm. Assume that the bacterium is cylinder-shaped.

What is the surface area to volume ratio of the bacterium?

A 3.0 : 1.0 **B** 5.0 : 1.0 **C** 8.0 : 1.0 **D** 9.0 : 1.0

11 Four students, **A**, **B**, **C** and **D**, observed plant epidermal cells that had been placed in a concentrated sucrose solution for 30 minutes. They were asked to identify the partially permeable layer and to explain the appearance of the cells in terms of water potential and movement of water.

Which student is correct?

	partially permeable layer	water potential at start of experiment	movement of water during experiment
A	cell surface membrane	cell contents have a lower water potential than the sucrose solution	water moved out of the cell and no water moved in
B	cell surface membrane	cell contents have a higher water potential than the sucrose solution	more water moved out of the cell than moved in
C	cell wall	cell contents have a lower water potential than the sucrose solution	more water moved out of the cell than moved in
D	cell wall	cell contents have a higher water potential than the sucrose solution	water moved out of the cell and no water moved in

12 The table compares the surface area to volume ratios of five agar blocks that differ in dimensions but which all have the same volume.

The agar blocks can be used to measure the efficiency of diffusion, where efficiency is measured as the time taken for a dye to reach all parts of the block.

	length / mm	width / mm	height / mm	surface area / mm^2	volume / mm^3	surface area : volume ratio
1	8	8	8	384	512	0.75
2	16	16	2	640	512	1.3
3	32	4	4	544	512	1.1
4	32	32	0.5	2112	512	4.1
5	64	4	2	784	512	1.5

Which prediction can be made about the way in which size and dimensions of these blocks affect the efficiency of diffusion?

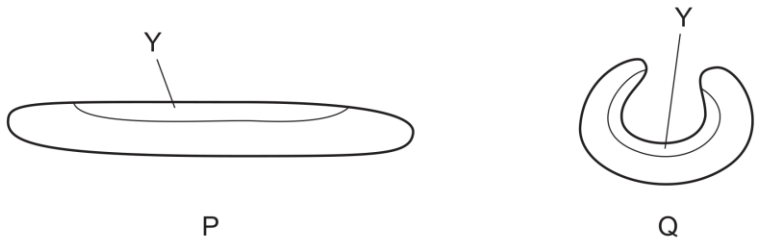
A The efficiency of diffusion will decrease as the width of a block increases.

B The efficiency of diffusion will increase as the height of a block increases.

C The efficiency of diffusion will increase as a block of fixed volume is flattened.

D The efficiency of diffusion will decrease as a block of fixed volume is elongated.

13 The diagram shows the outline of a xerophytic leaf that had been left for 45 minutes in different conditions, P and Q.



Which statements about the cells in layer Y of the leaf in each of the conditions P and Q **after** 45 minutes are correct?

1 There is a less negative water potential in P than in Q.

2 The cells may be turgid in P and plasmolysed in Q.

3 The cells are less turgid in P than in Q.

4 There is no net diffusion of water into Y in either P **or** Q.

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

14 The three main factors that affect the rate of diffusion across a membrane can be expressed by the relationship shown.

$$\text{rate of diffusion is proportional to } \frac{\text{surface area} \times \text{concentration difference}}{\text{thickness of membrane}}$$

Which changes in the factors would result in the rate of diffusion doubling?

1 Surface area has doubled.

2 Concentration difference has halved.

3 Thickness of membrane has doubled.

4 Thickness of membrane has halved.

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

15 A student measured the time taken for complete diffusion of a dye into agar blocks of different sizes which were suspended in the dye.

The results are shown.

size of agar block / mm × mm × mm	time for diffusion / s
5 × 5 × 5	6.2
10 × 10 × 10	16.1
15 × 15 × 15	34.5
5 × 10 × 15	

What is the predicted time for complete diffusion of the dye into the agar block measuring 5 mm × 10 mm × 15 mm?

A 6.2 s

B 16.1 s

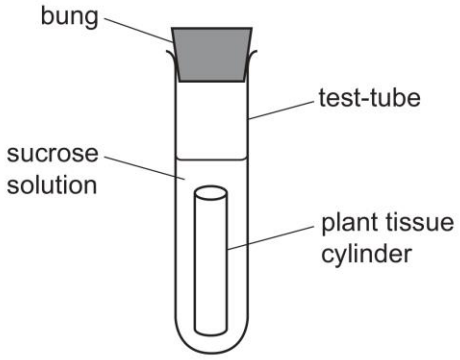
C 34.5 s

D more than 34.5 s

16 An experiment was carried out to investigate the effect of concentration of sucrose solution on cells in a plant tissue.

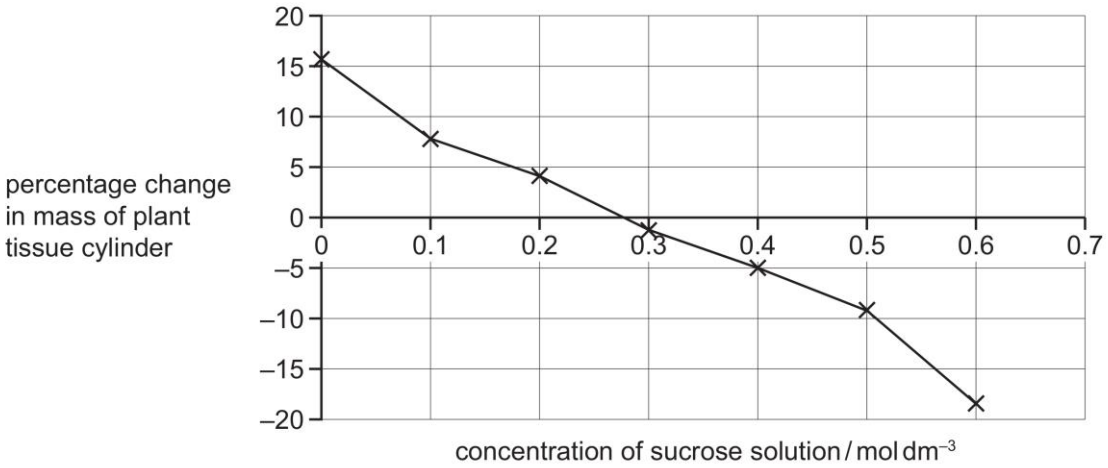
A sample of plant tissue was cut into seven cylinders of equal length and diameter. The mass of each cylinder was recorded.

Each of the seven cylinders was put into a different sucrose solution concentration.



After two hours, the cylinders were removed, blotted dry and reweighed. The percentage change in mass of each cylinder was recorded.

The graph shows the results of this investigation.



Which row explains the results if plant tissue cells were put in a sucrose solution of 0.45 mol dm^{-3}?

	water potential of the cytoplasm of the cells at the start of the experiment compared with the water potential of 0.45 mol dm^{-3} sucrose solution	change in volume of the vacuoles of the cells at the end of the experiment, that were initially placed in 0.45 mol dm^{-3} sucrose solution
A	less negative	decreased
B	less negative	increased
C	more negative	decreased
D	more negative	increased

17 The dimensions of three agar cylinders, X, Y and Z, are summarised in the table.

cylinder	radius / mm	length / mm
X	2	10
Y	1	20
Z	5	5

What is the correct order of surface area : volume ratio for the cylinders, from smallest to largest?

A $X \rightarrow Y \rightarrow Z$ **B** $Y \rightarrow X \rightarrow Z$ **C** $Z \rightarrow X \rightarrow Y$ **D** $Z \rightarrow Y \rightarrow X$

18 Three individual plant leaf cells were each placed in a different solution for 30 minutes. Each solution had a different water potential.

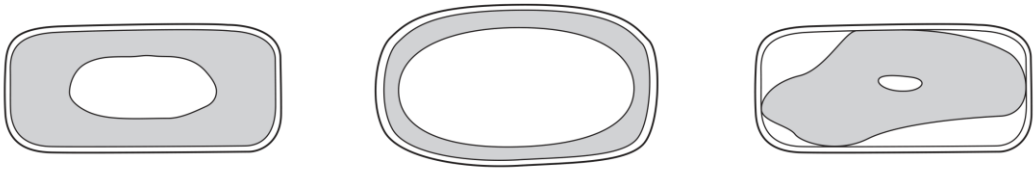
Which row correctly shows the **change in volume** of the three cells after 30 minutes?

	water potential of solution		
	lower than cells	equal to cells	higher than cells
A	decreased	increased	decreased
B	decreased	no change	increased
C	increased	decreased	decreased
D	increased	no change	increased

19 Plant cells were left for 50 minutes in three different sugar solutions, 10%, 5% and 1%. The water potential in the cytoplasm of the three cells was the same at the start of the experiment.

The diagrams show the appearance of the cells after 50 minutes, using a light microscope.

cell P cell Q cell R



Which conclusion is correct?

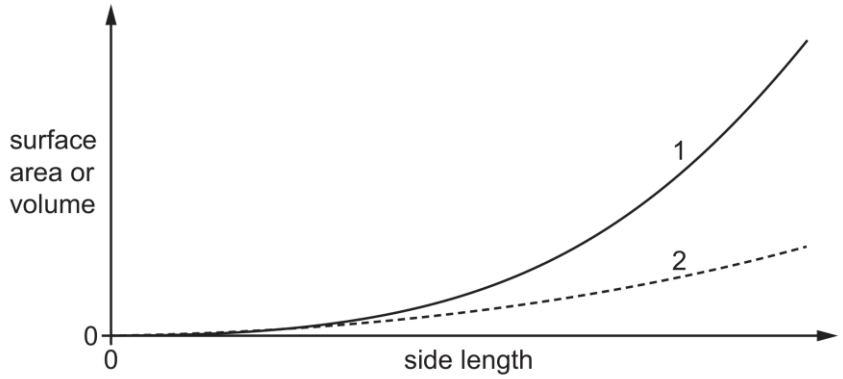
A Cell P has the same concentration of sugar inside and outside the cell.

B Cell Q is flaccid and cell P is plasmolysed.

C Cell Q was placed in the 1% solution.

D The sugar solution outside cell R has a less negative water potential than inside cell R.

20 The graph shows the effect of increasing the side length of agar cubes on the surface area and the volume of the cubes.



Which row correctly identifies line 1, line 2 and the effect of increasing side length on the surface area : volume ratio of the cubes?

	line 1	line 2	surface area : volume ratio
A	surface area	volume	decreases
B	surface area	volume	increases
C	volume	surface area	decreases
D	volume	surface area	increases

21 Some processes occurring in cells are listed.

1 endocytosis of water into cells

2 exocytosis of enzymes from cells

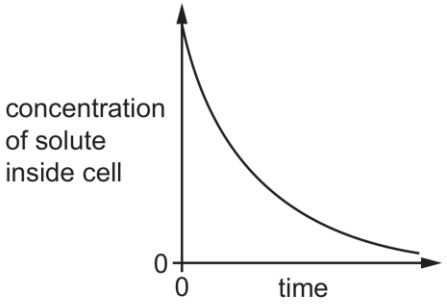
3 facilitated diffusion of glucose into red blood cells

4 phagocytosis of dead cells by macrophages

Which processes use ATP?

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

22 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

23 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 $3 \times 30 \times 30$ **B** $6 \times 6 \times 6$ **C** $6 \times 12 \times 12$ **D** $12 \times 12 \times 12$

24 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

25 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

26 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

27 A cuboidal epithelium cell has a length of 2 μm.

The cell is an approximate cube shape.

What is the most accurate estimate of the surface area : volume ratio of this cuboidal epithelium cell?

A 1 : 2 **B** 1 : 3 **C** 2 : 1 **D** 3 : 1

28 Which statement is correct for facilitated diffusion **and** active transport?

A As the direction of the concentration gradient changes so does the direction of movement of the molecules.

B Molecules always move at the same rate as simple diffusion.

C Specific molecules are transported across a membrane.

D The molecule ATP is required to move specific molecules quickly through proteins in the membrane.

29 Equal sized potato pieces were placed into a test-tube and covered with a sucrose solution. The test-tube was left for 30 minutes. All other variables were standardised.

After 30 minutes, the potato piece had not changed in size.

What can be concluded from this result?

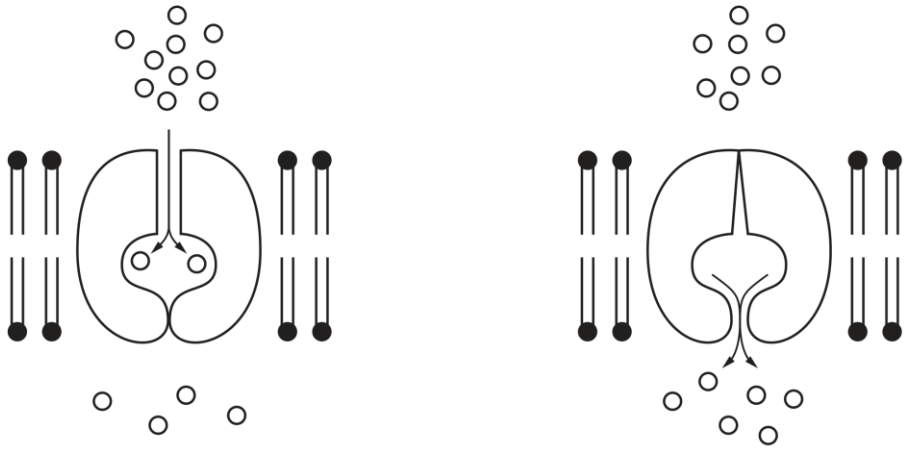
A The concentration of sucrose is the same in the potato and in the solution and there is no more movement of water into or out of the potato.

B The concentration of sucrose is the same in the potato and in the solution and there is no net movement of water into the potato.

C The water potential is the same in the potato and in the sucrose solution and there is no more movement of water into or out of the potato.

D The water potential is the same in the potato and in the sucrose solution and there is no net movement of water into or out of the potato.

30 The diagram represents a process by which molecules move out of a cell through a cell surface membrane.



Which process does this represent?

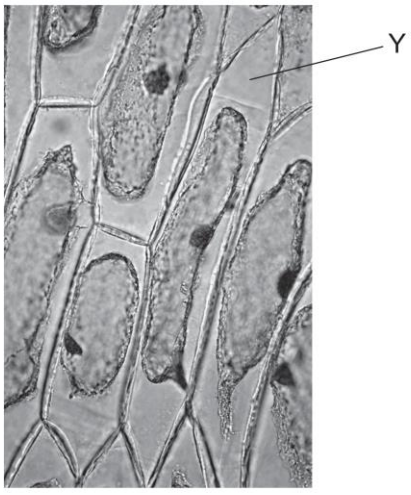
A exocytosis

B diffusion

C facilitated diffusion

D osmosis

31 The photomicrograph shows the appearance of onion epidermal cells after they have been soaked in solution X for one hour.



What fills the space labelled Y?

A air

B cytoplasm

C solution X

D water

32 Sodium chloride is added to a culture solution containing freshwater single-celled plant cells.

What happens to the water potential of the culture solution when the sodium chloride is added and what may happen to the plant cells after 5 minutes?

	water potential of the culture solution when sodium chloride added	single-celled plant cells after 5 minutes
A	becomes less negative	become plasmolysed
B	becomes less negative	become turgid
C	becomes more negative	become plasmolysed
D	becomes more negative	become turgid

33 Which factors can be changed to affect the rate of facilitated diffusion across a cell surface membrane?

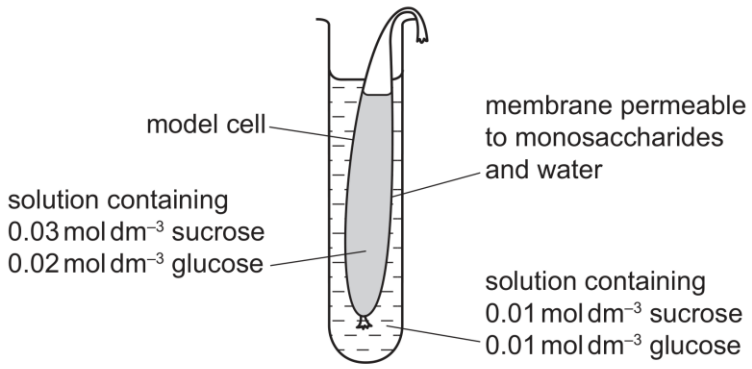
1 the surface area of the membrane

2 the concentration gradient

3 the number of specific protein channels

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

34 The diagram shows an experiment using a model cell to investigate the movement of substances.



Which statements are correct?

1 There is net movement of sucrose out of the model cell.

2 There is net movement of glucose out of the model cell.

3 There is net movement of water into the model cell.

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

35 Some enzymes are produced in the cells of the pancreas. The enzymes are secreted when required.

Which process is used to transport these enzymes out of the cells of the pancreas?

A active transport

B facilitated diffusion

C endocytosis

D exocytosis

36 Plant cells were submerged in a solution with a water potential less negative than that found inside the cells.

What describes the condition of the plant cells after 20 minutes?

A burst

B incipient plasmolysis

C plasmolysed

D turgid

37 Liver cells contain vesicles that have proteins in their membranes which are specific for the transport of glucose.

When these cells need to take up glucose, the vesicles fuse with the cell surface membrane.

How does the uptake of glucose occur?

A exocytosis

B diffusion

C endocytosis

D facilitated diffusion

38 A student set up an experiment to investigate diffusion.

A block of agar, 1.0 cm × 1.0 cm × 1.0 cm, was stained uniformly with a water-soluble blue dye. The block of agar was put into a test-tube containing 10 cm^3 of distilled water at 20 °C.

The intensity of the blue colour of the water after five minutes was measured.

Four other experiments, **A**, **B**, **C** and **D**, were then carried out using different numbers of agar blocks, different sizes of agar blocks and different temperatures. All other variables were standardised.

Which experiment would give a lighter blue colour in the water after five minutes compared to the first experiment?

	size of each agar block / cm	number of agar blocks	temperature of distilled water / °C
A	0.5 × 0.5 × 0.5	8	30
B	0.5 × 0.5 × 0.5	2	20
C	0.5 × 1.0 × 1.0	2	30
D	2.0 × 1.0 × 1.0	1	20

39 Equal sized potato pieces were placed into test-tubes containing equal volumes of different concentrations of sucrose solution and left for 30 minutes. All other variables were controlled.

After 30 minutes, the potato piece in one of the concentrations of sucrose solution had not changed in size.

What can be concluded from this result?

1 There is no net movement of water into or out of the potato.

2 The water potential of the potato is the same as the water potential of the sucrose solution.

3 The concentration of sucrose in the potato is the same as the concentration of the sucrose solution.

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

40 What are the features of facilitated diffusion?

1 It uses protein channels in the membrane and is driven by the energy from ATP.

2 It moves molecules from regions of higher concentration to lower concentration and is driven by the kinetic energy of the molecules which are diffusing.

3 It uses protein channels in the membrane, and the maximum rate of diffusion depends on the number of these channels.

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

41 Which processes can allow transport into or out of a cell?

1 active transport

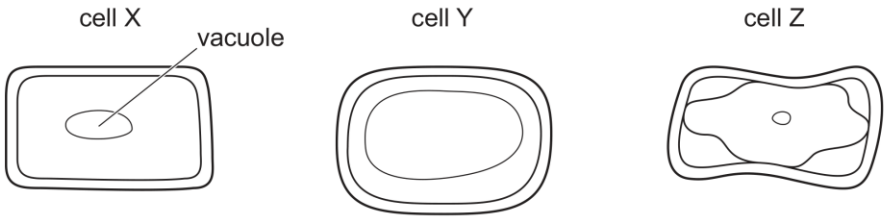
2 facilitated diffusion

3 osmosis

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

42 Plant cells were put into one of three different concentrations of sugar solution, 10%, 5% and 2.5%.

The cells were left for 50 minutes and then observed using a light microscope.



Which statements are correct?

1 Cell Y had a lower water potential than the sugar solution it was put into.

2 Cell Z was put into the 10% sugar solution.

3 Cell Z had a less negative water potential than the sugar solution it was put into.

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

43 Equal-sized potato pieces were placed into test-tubes containing equal volumes of different concentrations of sucrose solution and left for 30 minutes. All other variables were controlled.

After 30 minutes, the potato piece in one of the concentrations of sucrose solution had **not** changed in size.

What can be concluded from the result for this potato piece?

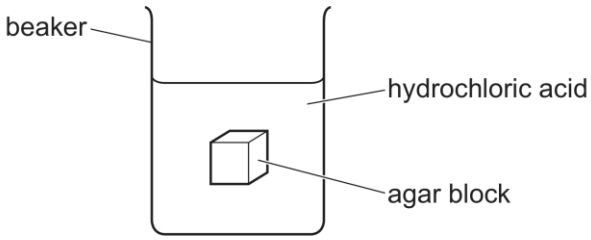
1 The concentration of sucrose in the potato is the same as the concentration of the sucrose solution.

2 The water potential of the potato is the same as the water potential of the sucrose solution.

3 There is no more movement of water into or out of the potato.

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

44 Four agar blocks are stained green using universal indicator and suspended in $1\,\text{mol}\,\text{dm}^{-3}$ hydrochloric acid.



The time taken for the agar blocks to change from green to red was recorded.

Which agar block would be the first to become completely red?

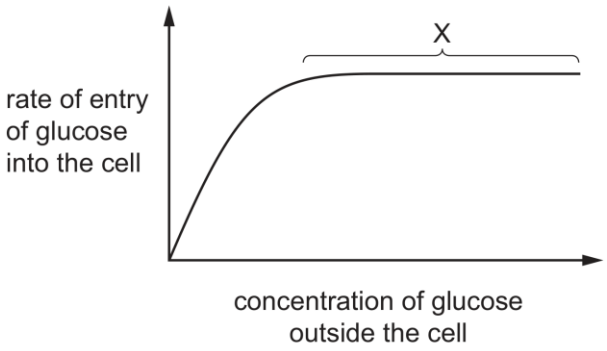
A $2\,\text{cm} \times 2\,\text{cm} \times 2\,\text{cm}$

B $2\,\text{cm} \times 1\,\text{cm} \times 4\,\text{cm}$

C $2\,\text{cm} \times 3\,\text{cm} \times 2\,\text{cm}$

D $5\,\text{cm} \times 2\,\text{cm} \times 3\,\text{cm}$

45 The graph shows how the rate of entry of glucose into a cell changes as the concentration of glucose outside the cell changes.



What is the cause of the plateau at X?

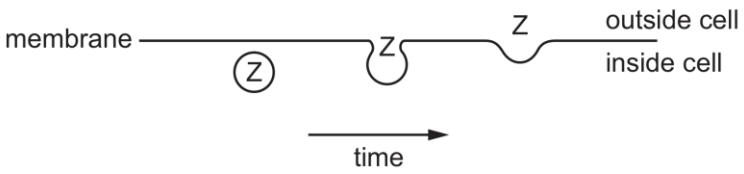
A All the carrier proteins are saturated with glucose.

B The carrier proteins are denatured and no longer able to function.

C The cell has used up its supply of ATP.

D The concentrations of glucose inside and outside the cell are equal.

46 The diagram shows the movement of substance Z across a cell surface membrane.



Which process is involved in this movement?

A endocytosis

B exocytosis

C phagocytosis

D pinocytosis

47 Visking tubing is often used as a model during experiments to investigate osmosis in plants.

What could Visking tubing be used to represent?

	cell surface membrane	cell wall	tonoplast
A	✓	✓	✓
B	✓	✗	✓
C	✓	✗	✗
D	✗	✓	✓

key

✓ = represents

✗ = does not represent

48 Which statement suggests that a membrane protein is involved in active transport?

A It allows movement of molecules across a membrane if concentration differences exist.

B It can only function if mitochondria are supplied with sufficient oxygen.

C It has a tertiary structure with a binding site with a specific shape.

D It is found in the cell surface membranes and the mitochondrial membranes.

49 Which substances can pass directly through cell surface membranes and do **not** use a carrier protein or channel protein?

1 K^+ and Cl^-

2 CO_2

3 $C_6H_{12}O_6$

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

50 A student put a layer of plant epidermal cells on a microscope slide. The student put a drop of potassium nitrate solution on the layer of cells and observed that:

- the cell surface membrane of many of the cells had separated from the cell wall
- the cytoplasm and cell contents had shrunk.

What explains these observations?

	direction of net water movement	water potential of cells at start / kPa	water potential of solution at start / kPa
A	cells to solution	–100	–500
B	cells to solution	–500	–100
C	solution to cells	–100	–500
D	solution to cells	–500	–100

51 Equal sized potato pieces were placed into a test-tube and covered with a sucrose solution. The test tube was left for 30 minutes. All other variables were controlled.

After 30 minutes, the potato piece had not changed in size.

What can be concluded from this result?

A The concentration of sucrose is the same in the potato and in the solution and there is no more movement of water into or out of the potato.

B The concentration of sucrose is the same in the potato and in the solution and there is no net movement of water into the potato.

C The water potential is the same in the potato and in the sucrose solution and there is no more movement of water into or out of the potato.

D The water potential is the same in the potato and in the sucrose solution and there is no net movement of water into or out of the potato.

52 Which of these features increase the efficiency of ion uptake by a root hair cell?

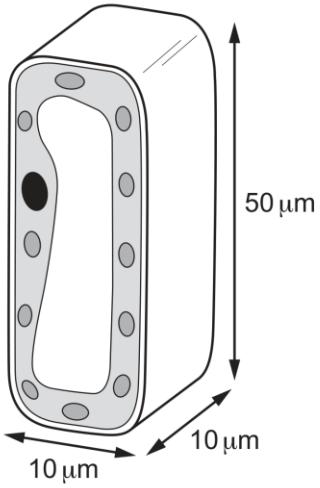
1 many mitochondria in the cell

2 high concentration of ions in the vacuole

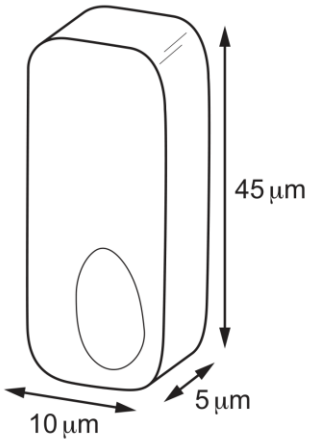
3 protein carriers in the cell surface membrane

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

53 The diagrams show the shape and size of two types of cell.



palisade mesophyll cell
surface area = 2200 μm^2



columnar epithelial cell
volume = 2250 μm^3

Which statement is correct about the palisade cell and epithelial cell shown in the diagrams?

A An increase in surface area reduces the distance for gases to reach the centre of the cell.

B The surface area of the palisade mesophyll cell is 500 μm^2 greater than the columnar epithelial cell.

C The surface area to volume ratio is greater in the columnar epithelial cell than the palisade mesophyll cell.

D The volume of the palisade mesophyll cell is 2500 μm^3 greater than that of the columnar epithelial cell.

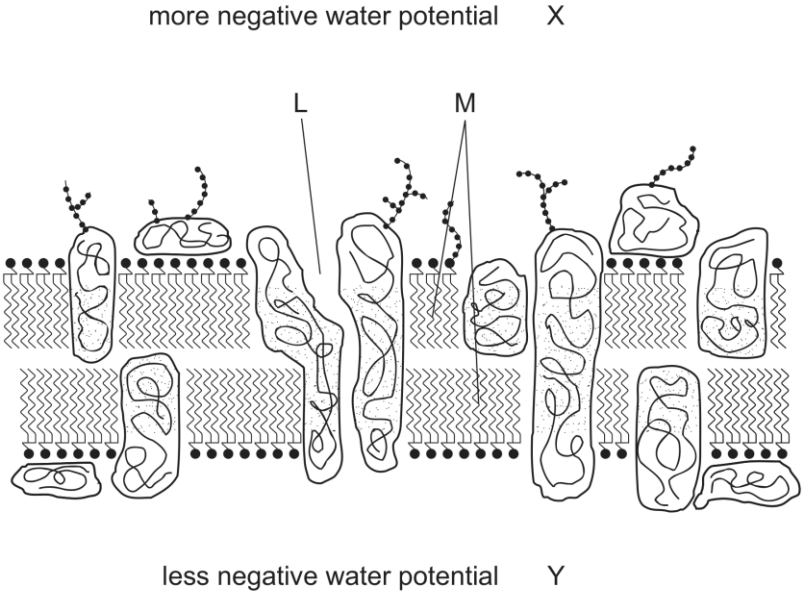
54 The formula shows how the rate of diffusion across a cell surface membrane can be calculated.

$$\frac{\text{surface area} \times \text{difference in concentration}}{\text{thickness of membrane}}$$

Which row shows how the fastest rate of diffusion can be achieved?

	surface area available	difference in concentration	thickness of membrane
A	high	high	high
B	high	high	low
C	low	high	low
D	low	low	high

55 The diagram shows part of the cell surface membrane of an active animal cell.



Which statements correctly describe the net movement of molecules across this membrane?

1 Oxygen diffuses through molecules M from X to Y.

2 Carbon dioxide diffuses through molecules M from X to Y.

3 Water moves from Y to X through molecule L.

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

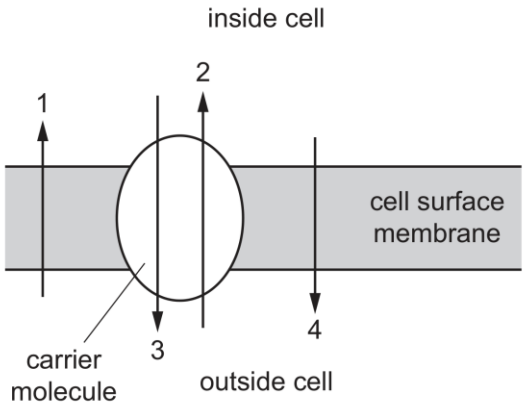
56 Some epidermal cells from a well-watered plant are placed in three solutions which have different water potentials.

Which row correctly shows the state of the plant cells in each of the solutions?

	water potential of solution		
	lower than cells	equal to cells	higher than cells
A	plasmolysed	turgid	plasmolysed
B	plasmolysed	turgid	turgid
C	turgid	plasmolysed	plasmolysed
D	turgid	plasmolysed	turgid

57 The diagram shows the transport of ions across the cell surface membrane. Inside the cell there is a low concentration of sodium ions (Na^+) and a high concentration of potassium ions (K^+). Outside the cell there is a low concentration of K^+ and a high concentration of Na^+.

The carrier molecule is a pump which exchanges Na^+ for K^+.



Which ionic movements are represented by the arrows?

	active transport of K^+	active transport of Na^+	diffusion of Na^+	diffusion of K^+
A	2	3	1	4
B	2	3	4	1
C	3	2	1	4
D	3	2	4	1

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

Some blocks of agar containing cresol red were cut to different sizes and put in an acid. All other variables were kept constant. The blocks were measured in mm.

Which block became completely yellow most quickly?

A $3 \times 30 \times 30$ **B** $6 \times 6 \times 6$ **C** $6 \times 12 \times 12$ **D** $12 \times 12 \times 12$

59 When red blood cells are put into pure water they burst (haemolysis).

Which statements explain this haemolysis?

1 The water potential of the surrounding liquid is lower than the water potential of the contents of the red blood cell.

2 The cell surface membranes of red blood cells are not supported by cell walls.

3 More water moves into the red blood cells by osmosis than leaves the cells.

4 Water enters the red blood cells by osmosis but does not leave the cells.

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

60 The removal of a plant cell wall by enzyme digestion leaves an intact membrane-bound structure called a protoplast.

Which statement explains why protoplasts are easily damaged?

A Mitochondria stop producing ATP to maintain membrane integrity.

B Net movement of water is no longer limited by turgor.

C Secretory vesicles are unable to fuse with the cell surface membrane.

D The shape of the cell structures is changed by the loss of cell shape.

61 How could water molecules cross the cell surface membrane of animal cells?

1 carrier proteins

2 channel proteins

3 cholesterol molecules

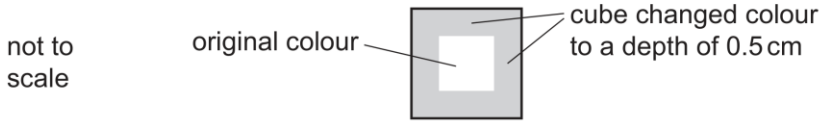
A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 2 only

62 Agar cubes can be used to demonstrate the effect of changing surface area to volume ratio on diffusion.

Three different agar cubes made using a dilute acid were placed into an indicator solution that diffused into the cubes. When the indicator came into contact with the acid it changed colour.

The cubes were 1 cm^3, 2 cm^3 and 3 cm^3 and were left in the indicator solution for 10 minutes. All other variables were kept the same. The results were recorded as diagrams.

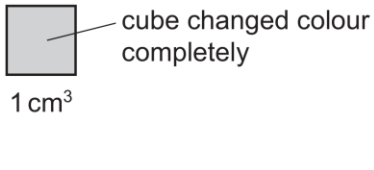
The results for the 2 cm^3 cube are shown.

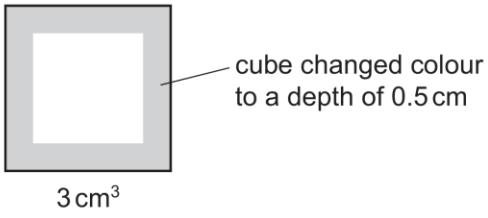


Which diagrams represent the results for the 1 cm^3 and the 3 cm^3 cubes?

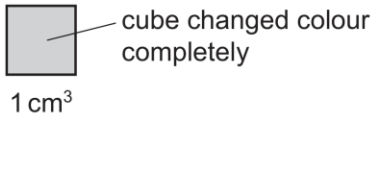
not to scale

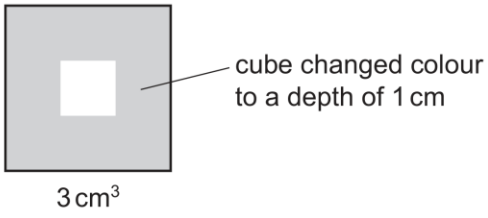
A



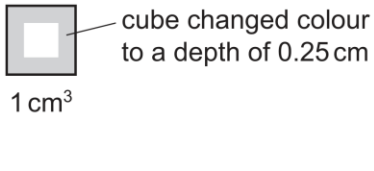


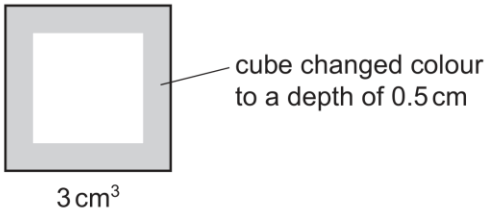
B





C





D

