WJEC EDUQAS AS BIOLOGY · COMPONENT 1

BIOLOGY



EXAM QUESTION PACK

1.3 CELL MEMBRANES AND TRANSPORT

SCORE	PERCENTAGE
/50	%

STEMUP

These questions belong to WJEC Eduqas, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by WJEC Eduqas. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

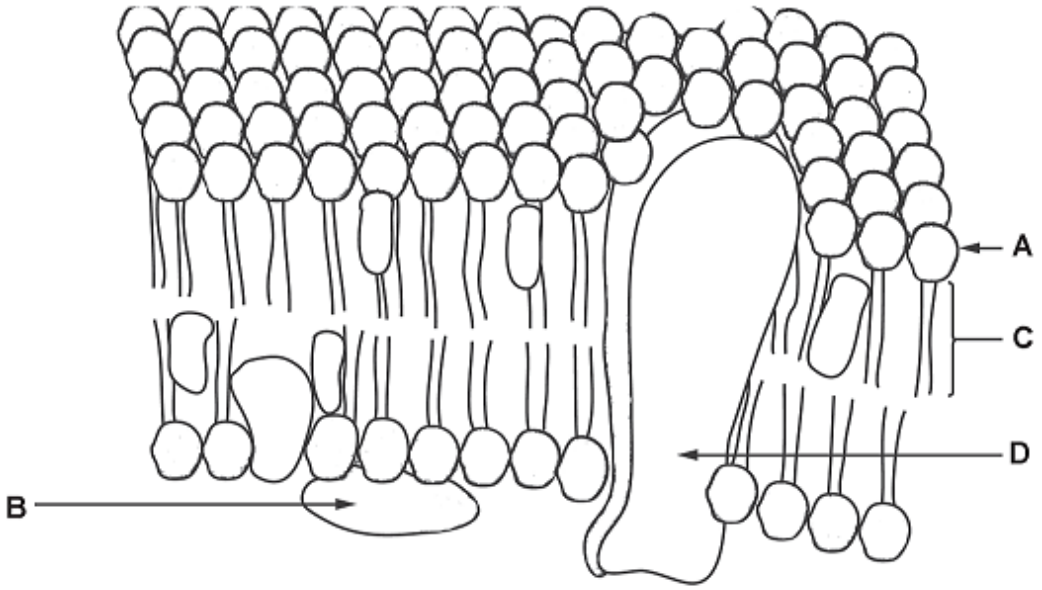
STEMUP is not affiliated with WJEC Eduqas and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. WJEC Eduqas has not endorsed, approved or been involved in the production of it. WJEC Eduqas and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

WJEC Eduqas publishes its past papers, mark schemes and examiner reports free of charge. Always check the current specification at eduqas.co.uk before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

1. The diagram below shows part of the plasma membrane from an animal cell.



(a) Complete the table below to identify the structures **A**-**D** shown in the diagram. [4]

Structure	Name
A	
B	
C	
D	

(b) Describe how structure **D** would transport a molecule against a concentration gradient. [2]

.....

.....

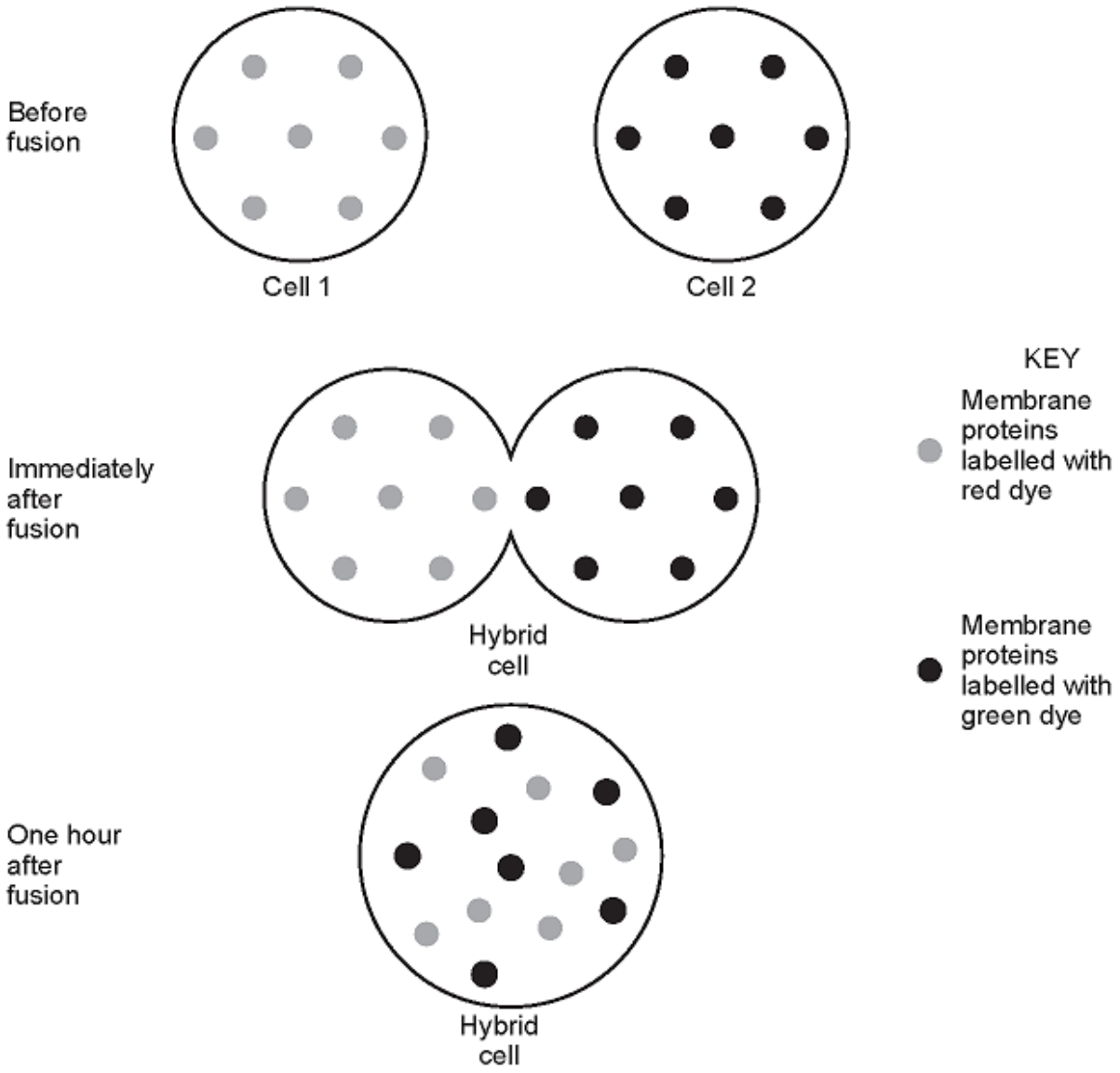
.....

.....

.....

.....

(c) In an experiment to determine the structure of the plasma membrane, scientists labelled the membrane proteins from two different cells using coloured dyes. One cell had its membrane proteins labelled with a red dye, whilst a second had its membrane proteins labelled with a green dye. The two cells were then fused to become a hybrid cell. This cell was viewed immediately after fusion and again after one hour. The results are shown below.



Use your knowledge of the structure and properties of plasma membranes to explain the results seen one hour after fusion. [3]

.....

.....

.....

.....

.....

.....

.....

.....

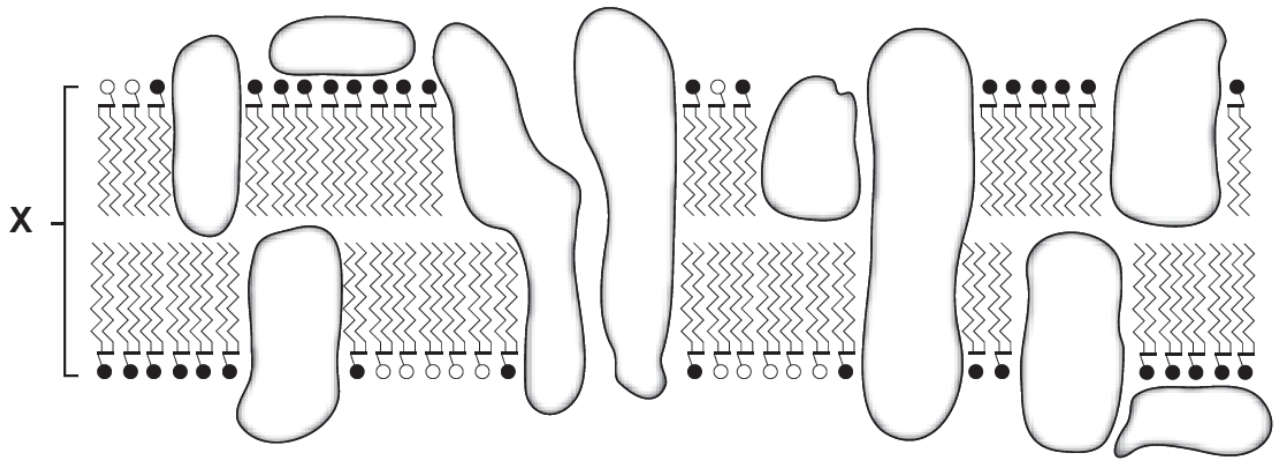
.....

.....

.....

9

2. The diagram below shows the fluid mosaic model proposed by Singer and Nicolson in 1972



(a) The width of the membrane as shown by **X** has been measured using transmission electron microscopes. Membrane width does not vary greatly between different organisms. State a value for this width.

[1]

Membrane width = ...

(b) Glucose is water soluble. Vitamin A is lipid soluble. Describe and explain how each molecule crosses the membrane shown above.

[4]

Vitamin A

Glucose

(c) Beetroot vacuoles contain a red pigment called betacyanin. When beetroot discs are cut with a borer and immersed in a solution of 70% ethanol (an organic solvent) at 15°C, the red pigment begins to leak out of the cells into the ethanol turning it red.

(i) Using your knowledge of the structure of cell membranes, explain why this leakage of pigment occurs.

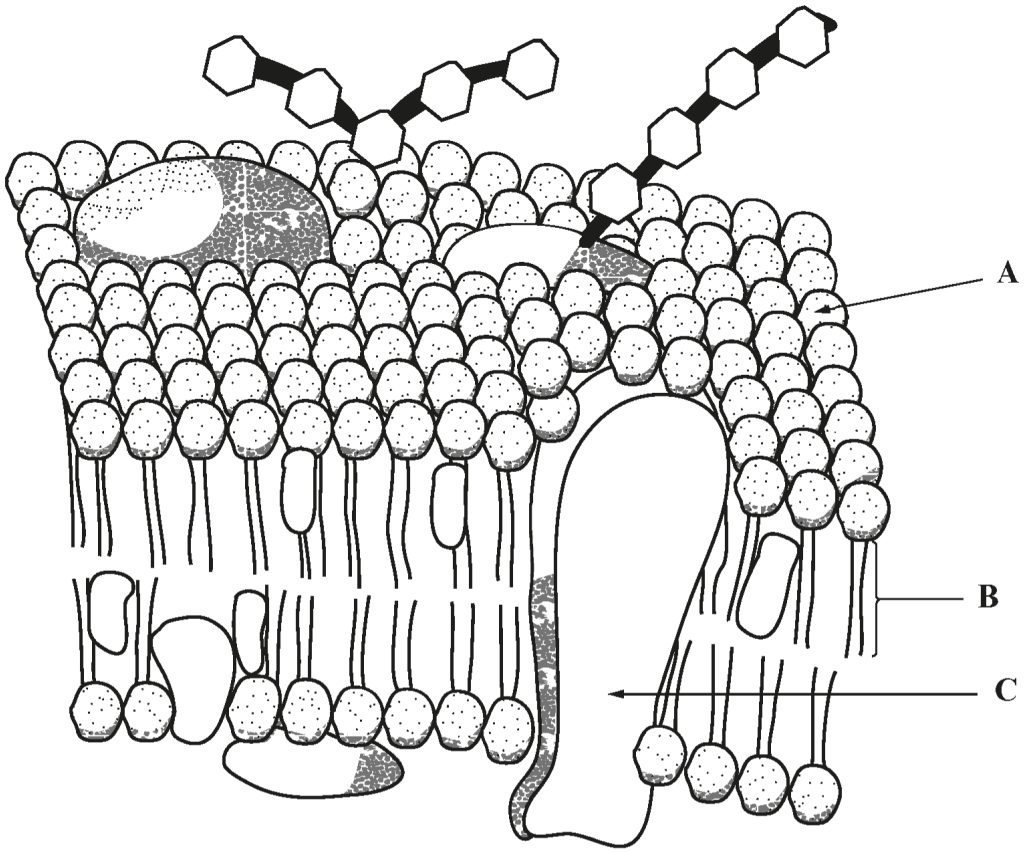
[2]

(ii) When the experiment was repeated at 30°C, the time taken for the ethanol to turn red decreased.

Explain why.

[2]

3. The diagram shows the plasma membrane of an animal cell.



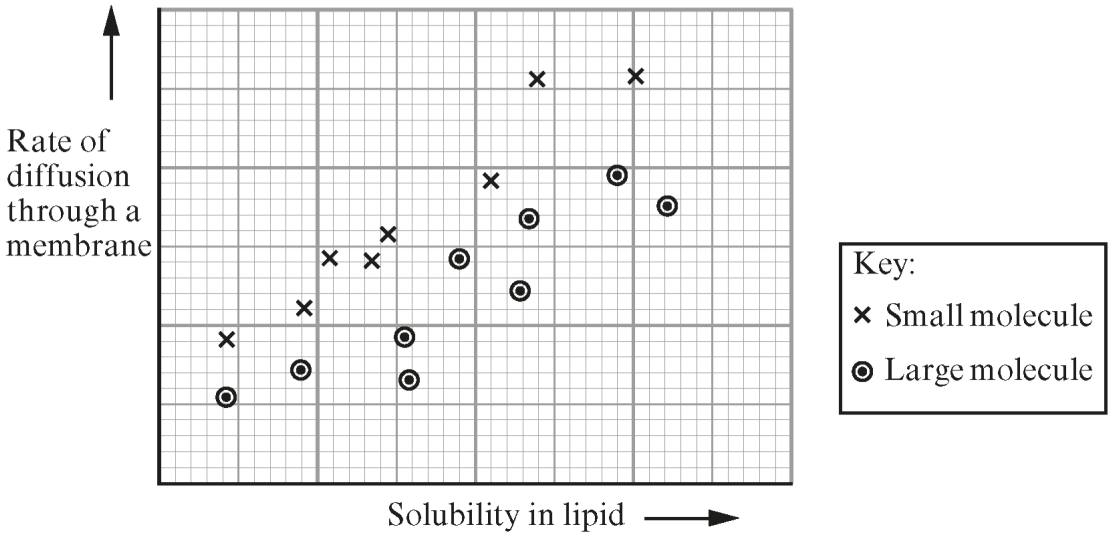
(a) State the names of the structures labelled **A**, **B** and **C**. [3]

A .....

B .....

C .....

(b) The graph shows the effect of molecule size and solubility in lipid on the rate of diffusion of substances through a cell surface membrane.



STEMUP.CO.UK

(i) State with an explanation how the solubility in lipid affects the rate of diffusion through a membrane. [2]

.....

.....

.....

.....

(ii) Describe how molecular size affects the rate of diffusion.
Suggest an explanation for your answer. [2]

.....

.....

.....

.....

(c) Name **two** factors which affect the rate of facilitated diffusion of a substance through a membrane. [2]

1. .....

2. .....

(d) Vitamins B_1 and K enter cells by crossing the plasma membrane. As vitamin B_1 is water soluble while vitamin K is fat soluble they take different routes across the membrane. Explain how the different routes taken by these vitamins into a cell, is determined by the structure of the plasma membrane. [4]

vitamin B_1 .....

.....

.....

vitamin K .....

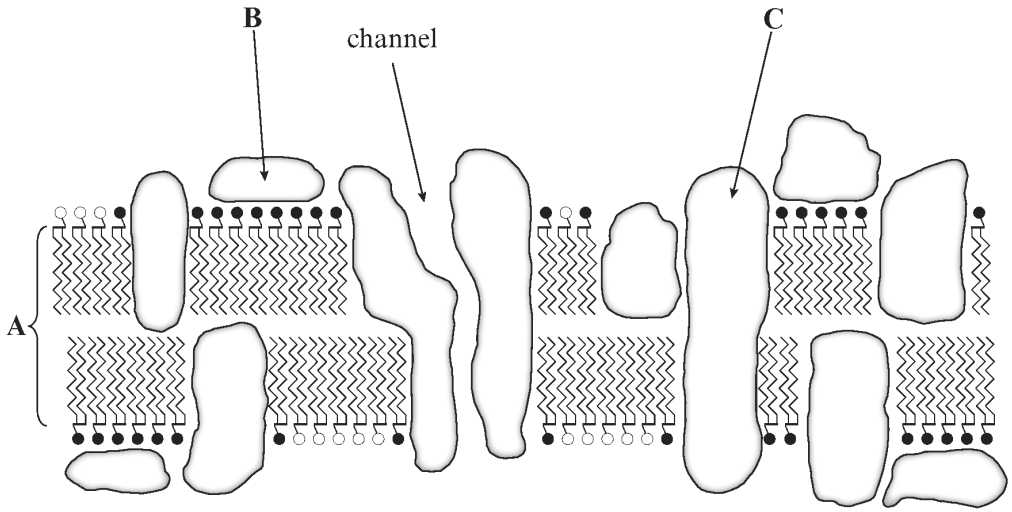
.....

.....

(Total 13 marks)

STEMUP.CO.UK

4. *(a)* The diagram below is of a model of a section through a cell surface membrane, as proposed by Singer and Nicholson.



(i) State the name given to this model and give reasons why it is so-called. [3]

.....

.....

.....

.....

(ii) Name the structures labelled **A**, **B** and **C**. [3]

A .....

B .....

C .....

(iii) Describe the function of the channel shown in the diagram. [1]

.....

(b) Some molecules are transported across the membrane by active transport. Explain what is meant by the term *active transport*. [2]

.....

.....

.....

(c) Suggest **two** reasons why transport across the membrane is vital to the cell. [2]

.....

.....

.....

(Total 11 Marks)

STEMUP.CO.UK

5. • Doxorubicin (DOX) and idarubicin (IDA) are antibiotics.

• They are widely used in human cancer treatment.

• DOX causes rapid changes in red blood cell membranes following injection.

• These changes are

- decreased fluidity of the hydrophobic parts of the lipid bilayer

- the membrane proteins change shape.

• IDA is considered to be less toxic to cancer patients than DOX.

5.

(a) (i) Explain what is meant by the term 'lipid bilayer'. [1]

(ii) Name the 'hydrophobic parts' referred to in the information above. [1]

(iii) State **two** functions of membrane proteins. [2]

(b) Use the information above to suggest why the changes in red blood cell membranes caused by **DOX** make it more toxic than **IDA**.

[2]

5. • Doxorubicin (DOX) and idarubicin (IDA) are antibiotics.

• They are widely used in human cancer treatment.

• DOX causes rapid changes in red blood cell membranes following injection.

• These changes are

- decreased fluidity of the hydrophobic parts of the lipid bilayer

- the membrane proteins change shape.

• IDA is considered to be less toxic to cancer patients than DOX.

(a) (i) Explain what is meant by the term 'lipid bilayer'. [1]

.....

.....

(ii) Name the 'hydrophobic parts' referred to in the information above. [1]

.....

(iii) State **two** functions of membrane proteins. [2]

.....

.....

.....

.....

(b) Use the information above to suggest why the changes in red blood cell membranes caused by **DOX** make it more toxic than **IDA**. [2]

.....

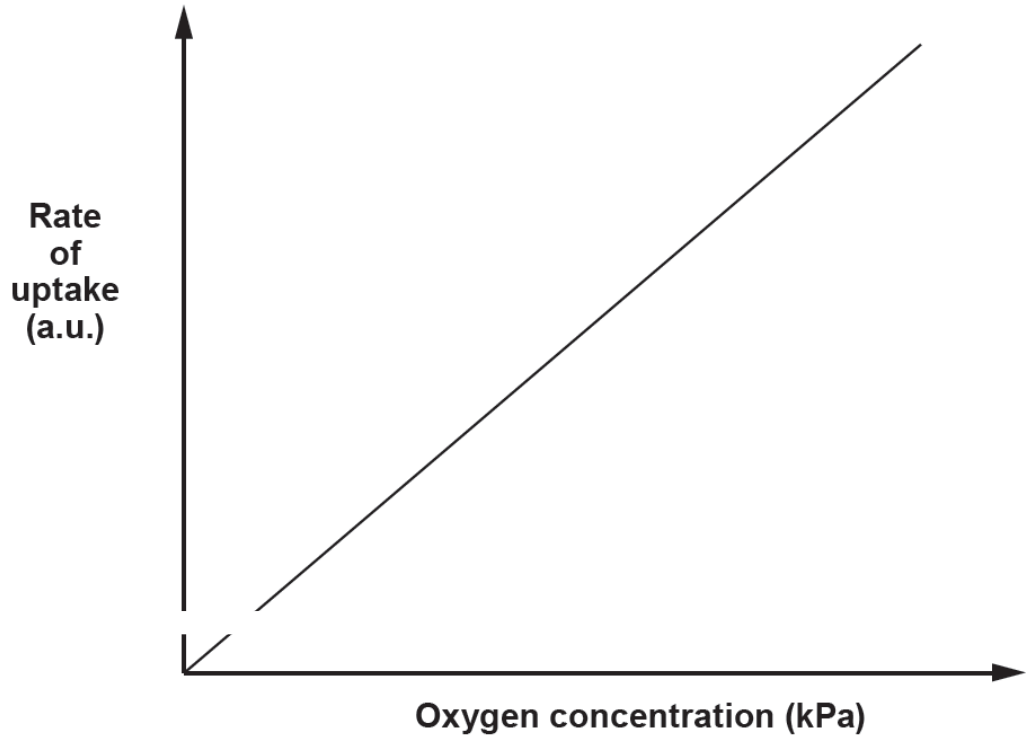
.....

.....

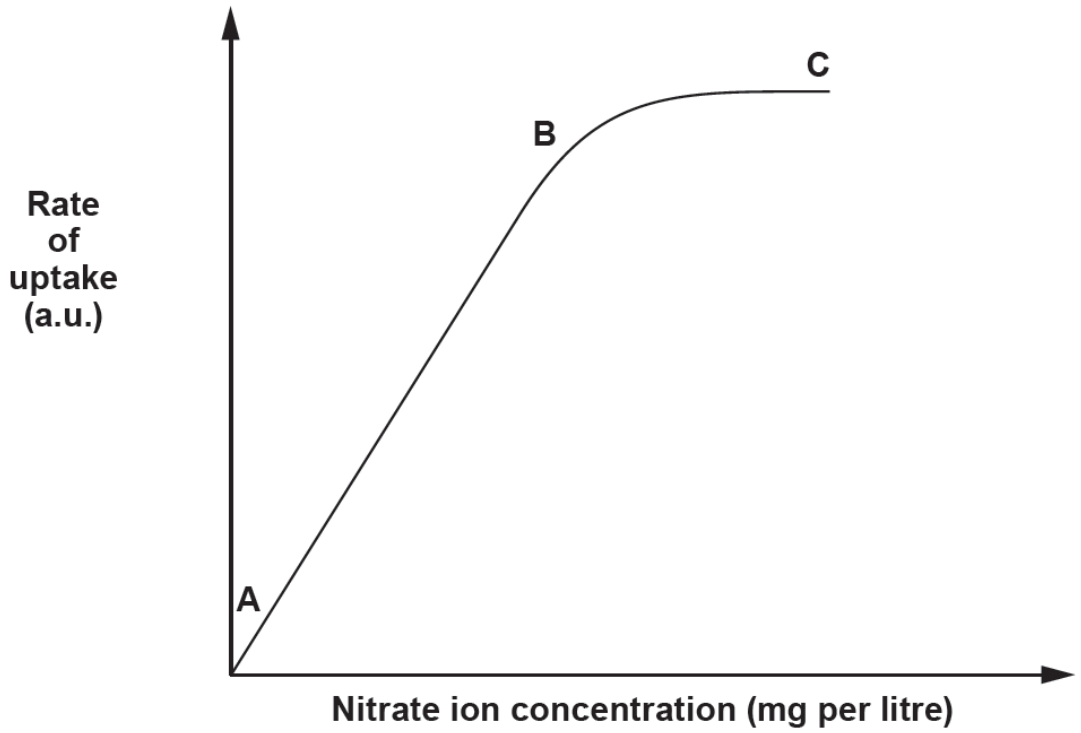
.....

6. The graphs below show the uptake of different molecules into the roots of plants.

I. Oxygen



II. Nitrate ions



(a) Using graph **I**, name the process by which oxygen is absorbed by the roots, giving a reason for your answer.

[2]

(b) Explain why the rate of uptake of nitrate ions increases between points **A** and **B** shown on graph **II**.

[1]

(c) In the presence of a respiratory inhibitor such as cyanide, the rate of nitrate uptake falls to zero. Name the process by which nitrate ions are taken up.

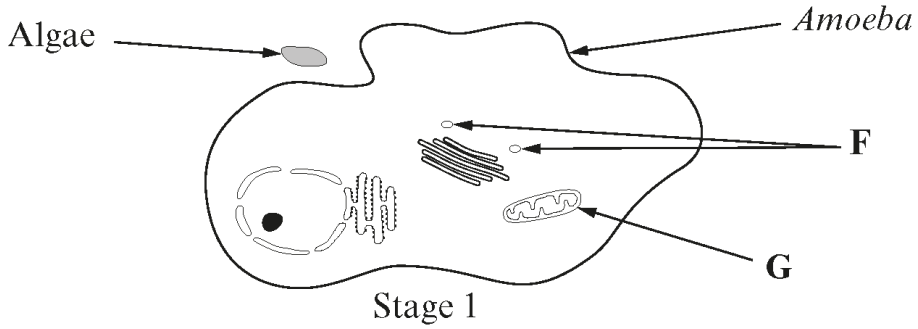
[1]

(d) Water enters root hair cells by osmosis. Calculate the solute potential (Ψ_S) of the root hair cell, when there is no net movement of water, the water potential of the soil water is –100 kPa and the pressure potential (Ψ_P) inside the root hair cell is +200 kPa. Use the formula $\Psi = \Psi_S + \Psi_P$.

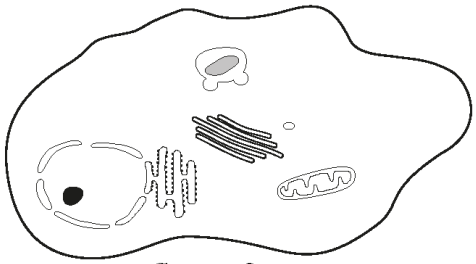
Show your working and units. [2]

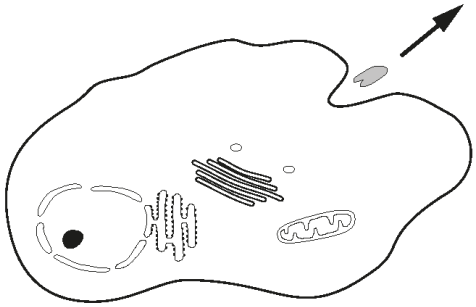
Answer .....

7. *Amoeba proteus* is a single celled eukaryotic organism that can be found living in shallow freshwater ponds and streams. *Amoeba proteus* feeds on algae and other unicellular organisms. The diagrams below show the sequence of events during feeding.



Stage 1


Stage 2


Stage 3

(a) (i) Name and describe the process that has occurred between stages 1 and 2 on the diagram opposite. [2]

.....

.....

.....

.....

(ii) Structures **F** on the diagram opposite are involved in the digestion of the *Amoeba's* food.
Name the organelle where Structures **F** are formed. [1]

.....

(iii) State the name of the process occurring at stage 3 on the diagram o posite. [1]

.....

1.

Question			Marking details	Marks Available
1	*(a)*		A {polar / hydrophilic / phosphate} {head / group}; NOT layer Glycerol = neutral B extrinsic protein; C {non-polar / hydrophobic} tails / fatty acids ; NOT lipid tail D transmembrane protein / carrier protein / channel protein / intrinsic protein;	4
	(b)		active transport / reference to {carrier protein / protein pump} changing shape; NOT channel protein NOT reference to more than one type of transport using ATP / energy;	2
	(c)		1. ref to fluid mosaic (model); 2. proteins free to move (within membrane / bilayer); NOT in the cell 3. {after fusion / 1 hour} there is a new arrangement of proteins / OWTTE;	*3*
			Question 1 total	**[9]**

STEMUP.CO.UK

2.

Question			Marking details	Marks Available
2	(a)		7/8 **nm** (must have correct units); Accept range of 6-10	1
	(b)		Vitamin A - {Dissolves in /can pass directly through} {phospholipid layer/ hydrophobic regions}; By diffusion; Glucose – Cannot pass through phospholipid layer therefore uses {protein channels/ carriers/ transport proteins/ hydrophilic channels/intrinsic proteins}; By facilitated diffusion; Accept active transport	4
	(c)	(i)	Ethanol {dissolves/emulsifies} (phospho)lipids/ denatures protein; NOT cell membranes Creates {gaps/holes/pores} in the membrane/ makes membrane more porous; NOT makes membrane more permeable	2
		(ii)	Increased temperature increases kinetic energy of {dye/membrane} molecules; Increases (rate of) diffusion (of dye across membrane)/dye diffuses across the membrane more rapidly;	2
			Question 2 Total	**[9]**

3.

(a)	A = phospholipid head/hydrophilic head/phosphate/polar group;	1	
	B = hydrophobic tails/ fatty acids/ non polar tails: (Not: tails/ lipid layer)	1	
	C = transmembrane protein/ carrier protein/ channel protein/	1	

STEMUP.CO.UK

intrinsic protein.

(b) (i) As lipid solubility increases the rate increases; NOT rate of reaction — 2

Membrane contains (a double layer) of phospholipids/
Lipid soluble substances can {move/pass/ diffuse} through the membrane (more easily than water soluble substances.)
(any two)

(ii) small molecules diffuse faster(or converse); — 1

Higher kinetic energy/ easier to pass between phospholipid molecules. — 1

(c) concentration/ diffusion gradient/ concentration difference; — 2

{amount/number} of carriers/ channel proteins/ larger surface area contains more carrier proteins;

temperature. (any two)

(d) vitamin B_1 – polar/ ionic; — 2

Cannot pass through phospholipid layer/ hydrophobic region;

Uses protein channels/ carriers/ transport proteins/

Hydrophilic (lining to) channels;

(any two)

Vitamin K - non polar/non ionic;

dissolves in phospholipid/ hydrophobic regions; — 2

so can pass (directly) through phospholipid/ hydrophobic regions;

(any two)

(Total 13 marks)

4.

4. (a) (i)	fluid mosaic model;	
	mosaic of protein molecules/irregularly or randomly arranged;	
	lipid layer fluid/can move;	**3**
(ii)	A = phospholipid bilayer/fatty acid tails; (not: ref. hydrophobic)	
	B = extrinsic/surface protein/glycoprotein;	
	C = transmembrane/carrier/intrinsic protein;	**3**
(iii)	allows passage of polar/charged/ionic/hydrophilic molecules/facilitated diffusion; (allow: ref. water/non lipid soluble; not: named molecule)	**1**
(b)	movement up/against a concentration gradient; requires energy/ATP;	**2**
(c)	maintain water potential;	
	obtain nutrients/metabolites or named e.g. glucose;	
	obtain oxygen/remove carbon dioxide;	
	secrete molecules;	
	remove toxic substances or named; (not: waste products)	**2 max**
		(Total 11 marks)

5.

Question			Marking details	Marks Available
5.	(a)	(i)	two layers/ double layer of phospholipids; NOT bilayer	1
		(ii)	fatty acid;	1
		(iii)	Any 2 from: transport/ form hydrophilic pores/ active transport/ channel proteins/ facilitated diffusion; receptors/ cell recognition; enzyme systems;	2 max
	(b)		Decreased fluidity/ rigid membrane - cells/ membranes more easily damaged (as blood flows)/ cannot pass through capillaries so easily; Membrane proteins change shape / denatured {carriers/ receptors/membrane enzymes} - so {reduced/no} {transport/movement} of molecules;	2
			Question 5 Total	**[6]**

STEMUP.CO.UK

6.

Question		Marking details	Marks Available
6	(a)	(Method) Diffusion; (Reason) Rate is proportiona to concentration; NOT graph is proportional	2
	(b)	(Increasing ion concentration) increases chance that (a molecule will) {collide with/ pass through} {pump/carrier/protein};	1
	(c)	Active transport;	1
	(d)	$\Psi_s = \Psi - \Psi_p$ / i.e. -100 -200; -300 kPa; (Must have units) Correct answer + unit = 2 marks Correct answer + no unit = 1 mark	2
		Question 6 Total	**[6]**

7. *(a)* (i) Phagocytosis/ endocytosis; 2
the (cell) membrane {invaginates/infolds/ surrounds/ wraps around/ engulfs} (to form a vesicle (allow vacuole))around the {food particle/ algae};

(ii) Golgi {Body/apparatus}; 1

(iii) Exocytosis; 1