Transport Across Cell Membranes: AQA A Level Biology Exam Questions

18 questions · 44 marks · about 57 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Paper 1 · June 2025 · Q01.2 · 2 marks

The role of micelles in the absorption of lipids _____

0 1 . 2 Describe and explain the arrangement of phospholipid molecules in the cell-surface membrane.

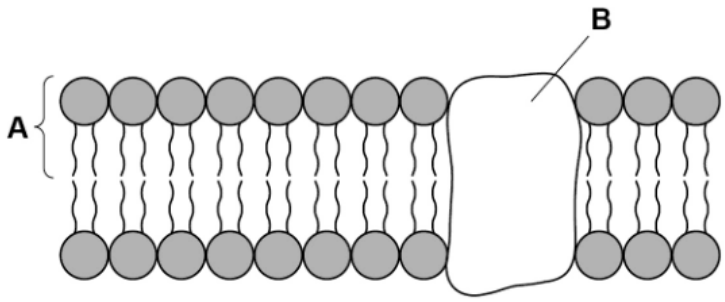
[2 marks]

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Question 2 · AS Paper 1 · June 2025 · Q08.1 · 2 marks

0 8 . 1 **Figure 10** shows a diagram of a cell-surface membrane.

Figure 10



Name **and** give the functions of the molecules labelled **A** and **B**.

[2 marks]

Molecule **A** name _____

Molecule **A** function _____

_____

_____

Molecule **B** name _____

Molecule **B** function _____

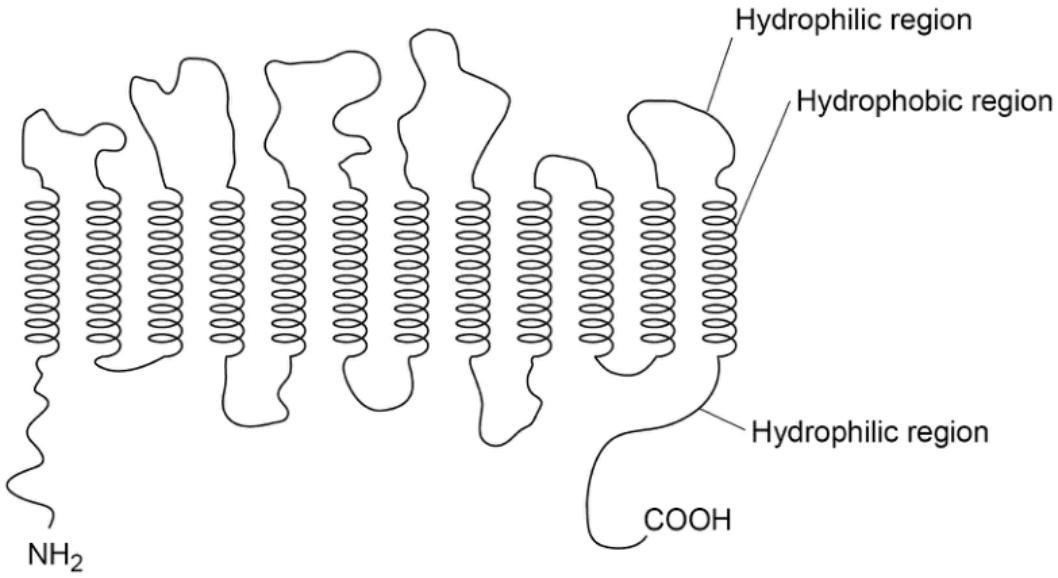
_____

_____

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Figure 2 is a diagram of one SGLT1 carrier protein.

Figure 2



0 1 . 4 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.

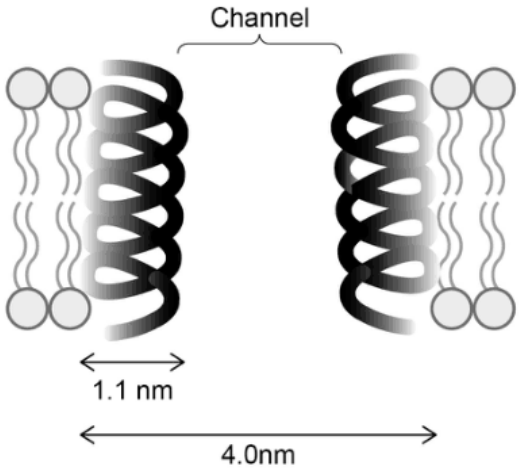
[2 marks]

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Question 4 · information from earlier in the question

Figure 5 shows further information about a channel formed in the cell-surface membrane by the APs.

Figure 5



Question 4 · A level Paper 1 · June 2022 · Q03.5 · 2 marks

0 3 . 5 The APs damage prokaryotic cells but do not damage the eukaryotic cells in the organisms that produce them.
Prokaryotic cell membranes do not contain cholesterol.

Assess why the APs do not damage the eukaryotic cells of the organisms that produce them.

[2 marks]

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Question 5 · A level Paper 2 · November 2020 · Q02.1 · 2 marks

0 2 Testosterone is a steroid hormone that belongs to a group of male sex hormones called androgens.

0 2 . 1 Steroid hormones are hydrophobic.

Explain why steroid hormones can rapidly enter a cell by passing through its cell-surface membrane.

[2 marks]

Question 6 · A level Paper 1 · June 2024 · Q02.1 · 3 marks

0 2 . 1 Describe the processes of facilitated diffusion and active transport.

[3 marks]

Facilitated diffusion

Active transport

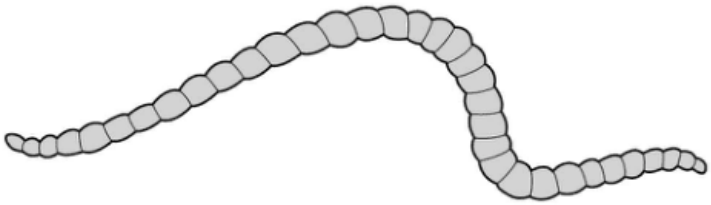
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Question 7 · information from earlier in the question

0 3 Tubifex worms are small, thin animals that live in water. They have no specialised gas exchange or circulatory system.

Figure 2 shows a tubifex worm.

Figure 2



Question 7 · AS Paper 2 · June 2016 · Q03.4 · 2 marks

0 3 . 4 Species of tubifex worm that live in ponds, lakes and rivers cannot survive in seawater.

Use your knowledge of water potential to explain why they **cannot** survive in seawater.

[2 marks]

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Question 8 · A level Paper 3 · November 2020 · Q04.4 · 3 marks

0 4 . 4 A high concentration of sodium in the blood can affect blood volume and cause hypertension.

Use your knowledge of water potential to suggest how high sodium concentrations in the medicines taken could affect blood volume.

[3 marks]

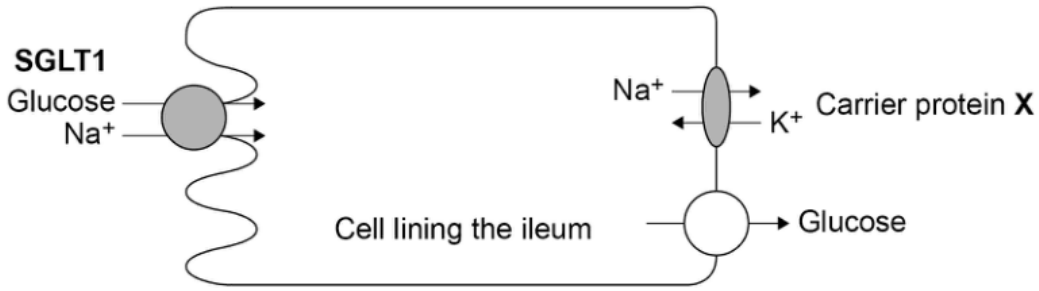
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Question 9 · A level Paper 1 · November 2020 · Q01.1 · 2 marks

0 1 **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



0 1 . 1 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 marks]

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One way in which phosphate can be used by cells

0 2 . 3 Cells lining the ileum of mammals absorb glucose against a concentration gradient.

Describe how.

[3 marks]

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0 5 . 1 Pears are a type of fruit.

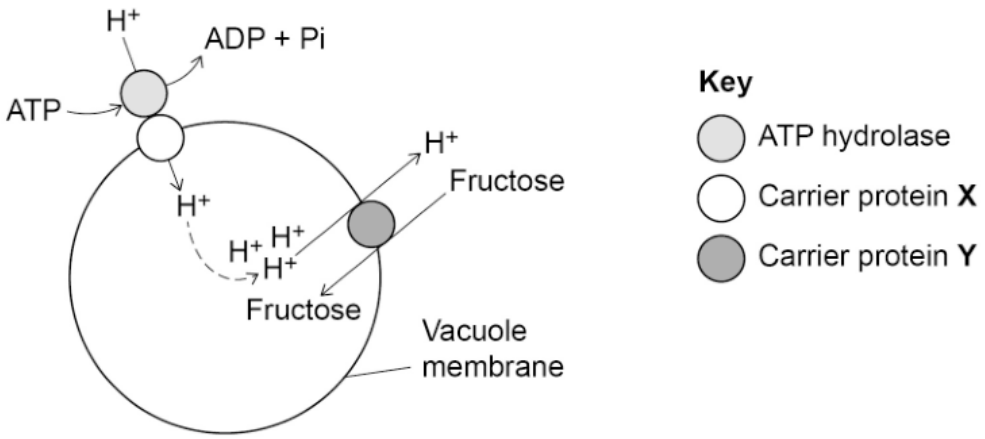
When pears ripen, the:

- fructose concentration increases in cell vacuoles
- volume of cell vacuoles increases.

Figure 2 shows information about a pear cell's vacuole membrane.

- Carrier protein **X** is linked to an ATP hydrolase enzyme.
- Carrier protein **Y** co-transports H^+ ions and fructose molecules in opposite directions.

Figure 2



Explain why the volume of the vacuoles in pear cells increases when pears ripen.

Your answer should refer to the role of:

- ATP hydrolase
- carrier protein **X** and carrier protein **Y**.

[4 marks]

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Question 12 · A level Paper 1 · June 2024 · Q02.2 · 1 mark

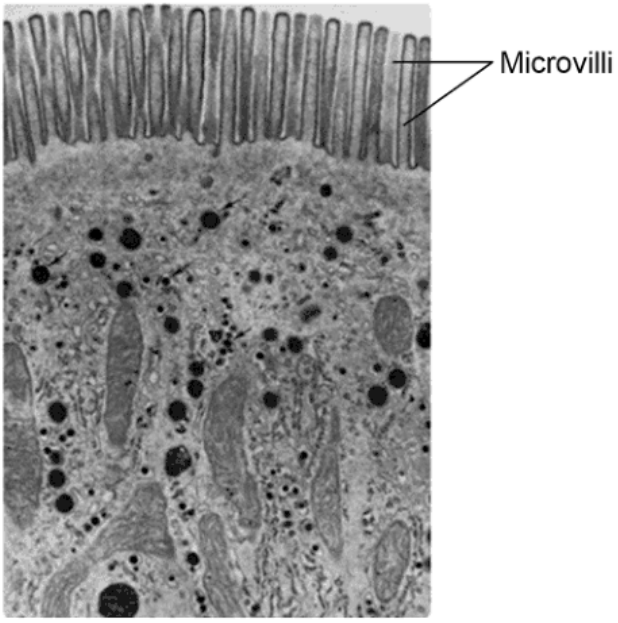
0 2 . 2 What are microvilli?

[1 mark]

Question 13 · AS Paper 2 · June 2022 · Q03.1 · 2 marks

0 3 **Figure 1** is an image of part of a cell lining the ileum.

Figure 1



0 3 . 1 Describe and explain **two** ways that structures shown in **Figure 1** increase the rate of absorption by this cell.

[2 marks]

1

2

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Question 14 · A level Paper 1 · June 2023 · Q04.1 · 3 marks

0 4 . 1 Some hospital patients suffer from diarrhoea caused by infection with the bacterium *Clostridium difficile*. The *C. difficile* bacteria release toxins. These toxins cause the diarrhoea.

The toxins damage the cells lining the ileum, causing them to lose their microvilli. The damage to the cells reduces the absorption of the products of digestion and reduces the absorption of water, resulting in diarrhoea.

Explain why the damage to the cells lining the ileum reduces absorption of the products of digestion **and** why this reduces absorption of water.

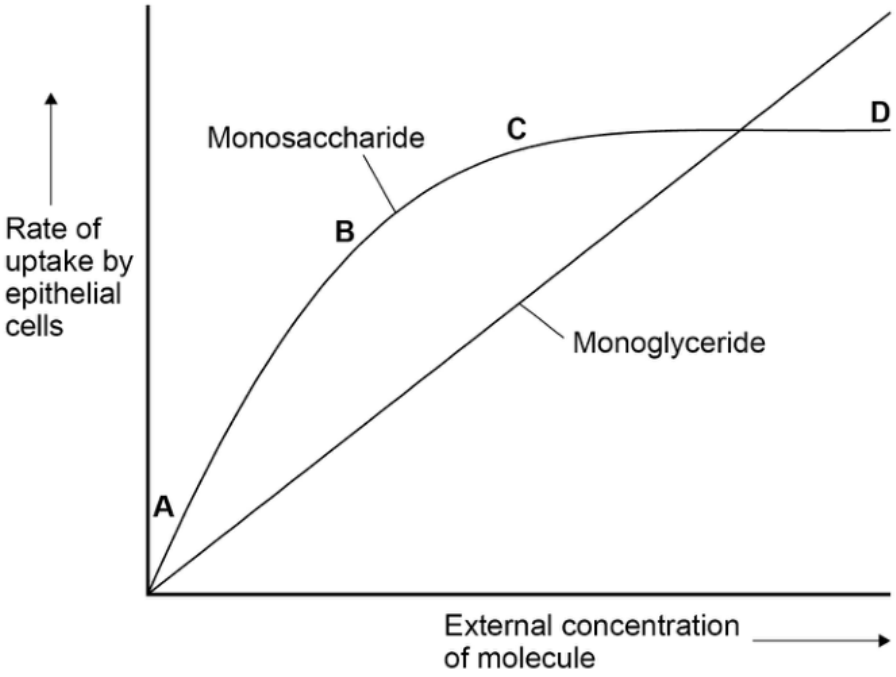
[3 marks]

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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 **Figure 1**.

Figure 1



0 4 . 2 Use your knowledge of transport across membranes to explain the shape of the curve in **Figure 1** for uptake of monosaccharides between concentrations:

[3 marks]

A and **B**

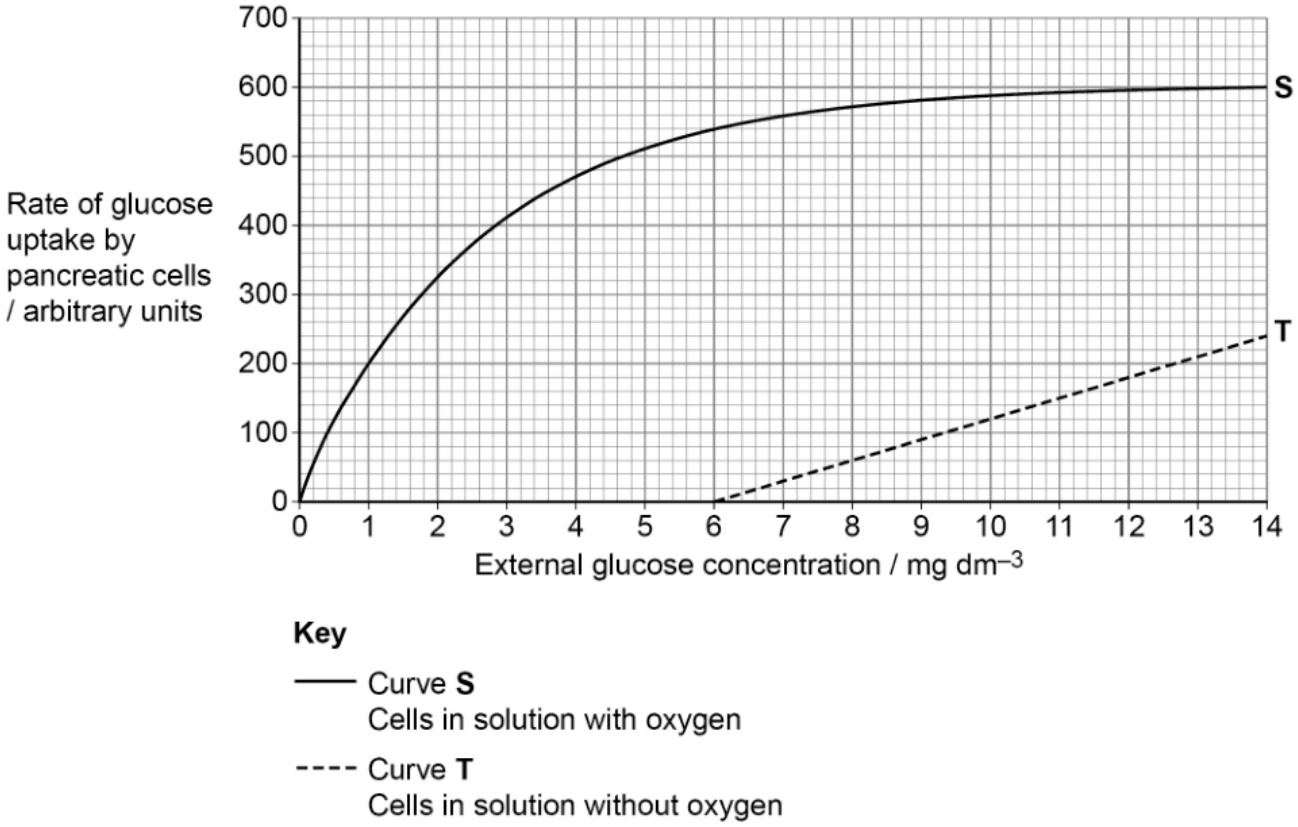
C and **D**

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0 2 . 3 A scientist placed pancreatic cells in solutions containing different concentrations of glucose. The scientist measured the rate of uptake of glucose by these cells.

Figure 4 shows the scientist's results.

Figure 4



Using **Figure 4**, what can you conclude about the processes involved in the uptake of glucose molecules by pancreatic cells?

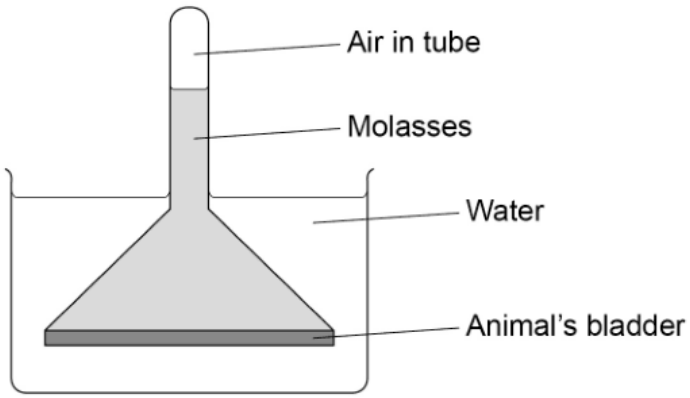
[3 marks]

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Question 17 · A level Paper 1 · June 2024 · Q04.4 · 3 marks

0 4 . 4 A scientist used the apparatus in **Figure 3** to investigate osmosis.

Figure 3



Use your understanding of osmosis to explain why the air pressure in the tube increased.

[3 marks]

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Question 18 · A level Paper 1 · June 2024 · Q04.5 · 2 marks

0 4 . 5 The scientist repeated the investigation, but made **one** change to the molasses. The scientist did **not** change the volume of molasses at the start of the investigation.

The scientist observed that the air pressure inside the tube increased by 160 kPa compared with 800 kPa in the first investigation.

Suggest the change the scientist made to the molasses to cause this smaller increase in air pressure.

Use the air pressure figures in a calculation to support your answer.

[2 marks]

Suggested change _____

_____

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Mark schemes

Question 1 · A level Paper 1 · June 2025 · Q01.2 · 2 marks

01.2	1. Bilayer (of phospholipids); 2. (Because) hydrophilic heads/phosphate attracted/point to water **OR** (Because) hydrophobic tails/fatty acids repel/point away from water;	2 (2 x AO1)	1. Accept a correctly labelled diagram of bilayer OR description of bilayer 2. Accept polar/charged for 'hydrophilic' 2. Accept non-polar/not charged for 'hydrophobic

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08.1	1. A = <u>phospholipid</u> **and** form a barrier to water-soluble/charged/ions/polar substances **OR** A = phospholipid **and** allows lipid soluble/non-polar/hydrophobic substances to pass (through the cell membrane) **OR** A = <u>phospholipid</u> **and** simple diffusion; 2. B = <u>protein</u> **and** allow large/charged/ions/polar molecules to pass (through the cell membrane) **OR** B = <u>protein</u> **and** facilitated diffusion **OR** B = <u>protein</u> **and** active transport **OR** B = <u>protein</u> **and** maintain different concentrations (either side) **OR** B = <u>protein</u> **and** providing support/shape;	2 max (2 x AO1)

Both name and function should be correct for 1 mark

1 and 2. Accept hydrophilic for polar

Accept for 'water-soluble' non-lipid soluble

2. Ignore the type of protein

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Question 3 · A level Paper 1 · November 2020 · Q01.4 · 2 marks

01.4	1. Phospholipids drawn with head and two tails; 2. Correctly positioned as a bilayer on either side of SGLT1;

2	2. Some of every 'head' must extend into the hydrophilic region **and** some of every 'tail' must extend into the hydrophobic region. 2. Reject phospholipids drawn within the protein.

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Question 4 · A level Paper 1 · June 2022 · Q03.5 · 2 marks

03.5	1. Cholesterol stabilises (the membrane) **OR** Cholesterol restricts the movement of molecules/phospholipids/fatty acid (tails) (making up the membrane); 2. (So) APs do not make channels in (eukaryotic) membranes **OR** (So) APs cannot enter the (eukaryotic) membrane;	2 (2 x AO3)

1. Accept makes (membrane) less flexible OR less fluid OR stiffer OR rigid OR gives structural support for stabilises

1. Ignore strength

1. Accept holds together for restricts movement

2. Accept fewer for do not

2. Accept cannot fit OR be positioned OR sit in OR form in OR embed OR disrupt for enter

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Question 5 · A level Paper 2 · November 2020 · Q02.1 · 2 marks

02.1	1. Lipid soluble; 2. (Diffuse through) phospholipid (bilayer);	2	1. Ignore 'not water soluble' or 'fat soluble'. 1 and 2. Ignore reference to joining to receptors/channels/carriers but reject passage through protein channels/carriers.

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02.1	1. (Movement of) polar/charged molecules; 2. (Facilitated diffusion) movement down a concentration gradient via carrier/channel protein; 3. (Active transport) movement against a concentration gradient via carrier protein using ATP;	3 (3 x AO1)

1. Accept ions **OR** non-lipid soluble for polar

1. Accept named polar molecule, eg glucose **OR** amino acids **OR** nucleotides

2. Reject if ATP used

2. Ignore along **OR** with for down

2. Ignore diffusion gradient

3. Reject channel protein

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Question 7 · AS Paper 2 · June 2016 · Q03.4 · 2 marks

03.4	1. Water potential higher in worm **OR** Lower water potential in seawater; 2. Water leaves by osmosis (and worm dies);	2	1. Accept: correct reference to water potential gradient if direction of water movement is given. 1. Accept: Ψ for water potential. 2. Reject: worm/cells burst.

Question 8 · A level Paper 3 · November 2020 · Q04.4 · 3 marks

04.4	1. (Sodium ions) lower the water potential (of blood); 2. Water would move into the blood by osmosis (from cells/tissue fluid); 3. Increasing the blood volume;	3	1. Accept make the blood water potential more negative 1. Accept decrease the blood water potential

Question 9 · A level Paper 1 · November 2020 · Q01.1 · 2 marks

01.1	1. (ATP to ADP + Pi) Releases energy; 2. (energy) allows ions to be moved against a concentration gradient OR (energy) allows active transport of ions;	2	1. Reject 'produces/makes/creates energy'. 2. For 'ions' accept Na^+ or K^+. 2. Do not accept if this movement is of glucose not ions.

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02.3	1. Sodium ions actively transported out (of cells); 2. Maintains/generates a concentration/diffusion gradient (for sodium ions); 3. Co-transport (with sodium ions);	3 (3 x AO1)

1, 2 and 3. Accept Na^+ for sodium ions
1. Accept 'pumped using ATP' for active transport
1,2 and 3. Reject lack of 'ions' once
3. Accept 'co-transporter' for 'co-transport'

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Question 11 · A level Paper 1 · June 2025 · Q05.1 · 4 marks

05.1	1. (Hydrolase/ATP hydrolysis) releases <u>energy</u>; 2. (For) active transport (by X) of H^+ in(to vacuole); 3. (Causes) <u>co-transport</u> (by Y) of H^+ out **and** fructose in; 4. Decreases water potential **so** water moves in(to vacuole) by osmosis;	4 (4 x AO2)

1. Reject make/ create/produce energy 2 and 3 Reject hydrogen once 2 and 4 Accept 'cell' for 'vacuole' 4. Accept more negative water potential for 'decreases water potential' 4. Accept Ψ for 'water potential', but ignore WP

Question 12 · A level Paper 1 · June 2024 · Q02.2 · 1 mark

02.2	(Highly) folded <u>cell</u>(-surface) <u>membrane;</u>	1 (1 x AO1)	Accept invaginated **OR** projections **OR** extensions for folded Reject hairs Ignore brush border

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Question 13 · AS Paper 2 · June 2022 · Q03.1 · 2 marks

03.1	1. Microvilli increase surface area **for** diffusion/facilitated diffusion/active transport/co-transport **OR** Microvilli increase surface area **for** (more) channel/carrier proteins; 2. (Many) mitochondria release energy/ATP **for** active transport;	2 (2 x AO2)

1. Accept folded cell (surface) membrane or brush border for microvilli

1. Accept high/large for 'increased'
1. Accept 'they' for microvilli

2. Accept 'uptake' for 'transport'
2. Accept 'cotransport' for 'active transport'

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04.1	1. Reduced surface area **OR** Fewer co-transport/carrier/channel proteins; 2. Decreases water potential in ileum/lumen **OR** Increases water potential in cells; 3. (So) water moves out of cells/into ileum by <u>osmosis</u> **OR** (So) less/no water moves into cells/out of ileum by <u>osmosis</u>;	3 (3 x AO2)

1. Ignore references to diffusion OR facilitated diffusion OR active transport

1. Ignore SA

Accept gut for ileum

2. Accept Ψ for water potential

2. Ignore WP

2. Accept reduces water potential gradient

3. Accept lumen for ileum

3. Accept absorbed for moves

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Question 15 · AS Paper 2 · June 2018 · Q04.2 · 3 marks

04.2	1. Movement through carrier proteins; **OR** Facilitated diffusion; **Between A and B** 2. Rate of uptake proportional to (external) concentration; **Between C and D** 3. All channel / carrier proteins in use / saturated / limiting;	3	Accept MP1 in either section 1. Ignore co-transport / active transport 1. Accept channel proteins 2. Accept description of proportional 3. Accept used up 3. Accept transport proteins

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02.3	1. Curve S/with oxygen active transport of glucose occurs **OR** Curve S/with oxygen the cells to use ATP to take up glucose; 2. Curve S levels off when all carrier proteins are in use; 3. Curve T/without oxygen facilitated diffusion occurs **OR** Curve T/without oxygen movement through channel/carrier proteins **OR** At 6 mg dm^{-3} facilitated diffusion; 4. Uptake in curve T/without oxygen starts when glucose concentration outside cells is greater (than inside cells);	3 max (3 x AO3)

1. Accept co-transport for active transport

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04.4	1. Molasses/solution has a lower water potential **OR** Water (in beaker) has higher water potential; 2. Water moves in (across) partially/selectively permeable bladder; 3. Increased (molasses/solution) volume **OR** Decreased air volume;

3 (3 x AO2)	1. Accept more negative for lower **OR** less negative for higher 1. Accept Ψ for water potential 2. Accept semi-permeable

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04.5	Suggested change 1. Diluted (molasses) **OR** Decreased (molasses) concentration **OR** Increased (molasses) water potential **OR** Decreased water potential gradient; 2. (Reduction by) 80% / 5 times **OR** (Reduction to) 20% **OR** (Used) 1 in 5 molasses to water **OR** (Used) 1 : 4 molasses to water;	2 (2 x AO3)	Ignore reduced temperature 1. Accept less negative for increased 1. Accept Ψ for water potential 2. Accept description of 1 : 4 ratio, eg 20 (cm^3) molasses (added) to 80 (cm^3) water **OR** 2. Accept fivefold **OR** factor of 5 for 5 times dilution

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