A Level AQA Biology

7 Transport across cell membranes – answers

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO
Spec reference</th></tr>
<tr><td>01.1</td><td>B AND C (are plant cells);
as they both have a cell wall;</td><td></td><td>2</td><td>AO1
AO2
3.2.1.1</td></tr>
<tr><td>01.2</td><td>concentrated glucose solution;</td><td></td><td>1</td><td>AO2
3.2.3</td></tr>
<tr><td>01.3</td><td>cell C is plasmolysed / cell surface membrane pulls away from cell wall;
meaning it was previously in a solution with a lower water potential than its cytoplasm / water potential inside cell higher than outside;
leading to water moving out of the cell down the water potential gradient / by osmosis;</td><td></td><td>3</td><td>AO1
3.2.3</td></tr>
<tr><td>01.4</td><td>cells B AND D (were in distilled water);
AND
Any two from:
because cell B is turgid and cell D has burst;
meaning they were in a solution with a higher water potential than their cytoplasm;
leading to water moving into the cells down the water potential gradient / by osmosis;</td><td>One mark for correctly stating the letters of the two cells
Accept description of turgid
Two marks for the explanations</td><td>3 max</td><td>AO1
AO2
3.2.3
3.2.1.1</td></tr>
<tr><td>01.5</td><td>
<table>
<tr><th>Substance</th><th>Mechanism of transport</th><th>Membrane component involved</th></tr>
<tr><td>small, non-polar substances</td><td>(simple) diffusion</td><td>phospholipid bilayer</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>polar substances</td><td>• facilitated transport
• active transport</td><td>channel protein/carrier protein</td></tr>
</table>
</td><td>One mark per row correct</td><td>2</td><td>AO1
3.2.3</td></tr>
</table>

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Question	Answers	Extra information	Mark	AO Spec reference
02.1	red / purple pigment / betalin diffuses out of cells; from high to low concentration of pigment / betalin;		2	AO1 AO2 3.2.3
02.2	temperature of the water		1	AO2 3.2.3
02.3	Any two from: measure mass of beetroot cylinders; ensure same surface area of beetroot cylinders; use same volume of (heated) water; use a thermostatically controlled water bath to maintain a constant temperature (for 10 minutes); use standardised procedure for blotting; calculate percentage change in beetroot masses, rather than just weight change;		2 max	AO3 3.2.3
02.4	Step **2:** allow transport of substances from all surfaces of the beetroot cylinder Step **3:** remove excess water / pigment from surface of beetroot cylinder	One mark per step	2	AO1/AO2 3.2.3
02.5	as the temperature increases, more light is absorbed / higher light absorbance / less light transmitted **AND** Any three from: increasing temperature increases kinetic energy of phospholipids; phospholipids move more / further apart; breaks weak (intermolecular) forces between (fatty acid / hydrophobic) tails; larger gaps between phospholipids / becomes more permeable (for red beetroot particles to escape) / increases cell membrane permeability;	One mark for correct description Three marks for effects on membrane structure	4	AO1 AO2 3.2.3

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Question	Answers	Extra information	Mark	AO Spec reference
03.1	– 13.33;	Do not credit wrong decimal places / significant figures Do not credit if minus sign not included	1	AO1 AO2 3.2.3
03.2	all six points plotted correctly; % change in mass on y and glucose concentration on x-axis; properly labelled; line of best fit drawn through the points;	Allow error carried forward for incorrect value from **03.1**	4	AO2 3.2.3
03.3	at glucose concentrations of 0.0–0.4 mol dm^{-3} the mass of the carrot pieces increases; because the solution is hypotonic/water potential is higher outside than inside the cells, so water moves into cells; at glucose concentrations of 0.6–1.0 mol dm^{-3} the mass of the carrot pieces decreases;	One mark for each description point, and one mark for each accompanying explanation point Description must include relevant values for glucose concentration	4	AO1 AO2 3.2.3
03.4	0.5 (mol dm^{-3});	Accept answer in range 0.45–0.55	1	AO2 3.2.3
03.5	no osmosis / net water movement occurs; due to the carrot cells being in isotonic solution / solution of the same concentration as cell cytoplasm;		2	AO1 AO2 3.2.3
04.1	movement of particles against concentration gradient / from area of low concentration to area of high concentration; requiring energy / ATP and carrier proteins;		2	AO1 3.2.3

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<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO
Spec reference</th></tr>
<tr><td>04.2</td><td>both involve moving a substance against its concentration gradient;

AND

Any one pair from:
AT involves carrier proteins AND CT involves co-transport protein/cotransporter;;
AT uses energy/ATP to move substances against the concentration gradient AND CT uses a pre-established concentration gradient to drive the movement of another substance against its concentration gradient;;
AT moves both substances across the membrane in opposite directions AND CT moves both substances across the membrane in the same direction;;</td><td>One mark for similarity

Two marks for difference

A comparative statement must be given to gain the two marks for the difference</td><td>3 max</td><td>AO1
3.2.3</td></tr>
<tr><td>04.3</td><td><table><tr><th>Substance</th><th>Diffusion</th><th>Facilitated diffusion</th><th>Active transport</th><th>Co-transport</th></tr><tr><td>oxygen</td><td>✓</td><td></td><td></td><td></td></tr><tr><td>glucose</td><td></td><td>✓</td><td>✓</td><td>✓</td></tr><tr><td>sodium ions</td><td></td><td>✓</td><td>✓</td><td>✓</td></tr></table></td><td>One mark for each correct row</td><td>3</td><td>AO1
3.2.3</td></tr>
<tr><td>04.4</td><td>occurs during transport of organic materials in the phloem;
sucrose and H^+ are both moved into cells by co-transport (down a H^+ concentration gradient)</td><td>Allow sucrose and translocation as organic materials</td><td>2</td><td>AO1
3.3.4.2</td></tr>
<tr><td>04.5</td><td>Any one from:
to increase surface area (to increase rate of transport across membrane);
to hold more intrinsic proteins (to increase rate of transport across membrane);</td><td></td><td>1 max</td><td>AO1
3.2.3</td></tr>
<tr><td>04.6</td><td>Mechanism:
active transport;
Explanation:
energy is needed OR H^+ being moved from a low to high concentration;</td><td>One mark for mechanism

One mark for explanation</td><td>2</td><td>AO1/AO2
3.5.2</td></tr>
</table>

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Question	Answers	Extra information	Mark	AO Spec reference
04.7	***Mechanism:*** facilitated diffusion; ***Explanation*** moving down a concentration gradient;	One mark for mechanism One mark for explanation	2	AO1/AO2 3.5.2
05.1	***Structure comparison:*** (glycoproteins) consist of a carbohydrate chain attached to (extrinsic) protein; **AND** (channel protein) is an intrinsic protein / embedded within membrane, forms a pore/channel through the membrane; ***Function comparison:*** (glycoproteins) act as hormone / antigen receptor / help attach cells together in tissues **OR** (glycoproteins) are involved in cell signalling / communication; **AND** (channel proteins) allow facilitated diffusion **OR** (channel proteins) allows polar / hydrophilic substances to pass through the cell membrane;	Max 2 marks for structure Max 2 marks for function	4 max	AO1 3.2.3
05.2	Any three from: enzyme / catalase active site has a specific shape and substrate / hydrogen peroxide has a complementary shape (to active site); forms ESC; induced fit model; lowers activation energy;		3 max	AO1 3.1.4.2
05.3	(3.6×5 =) 18 (cm^3);		1	AO2 3.1.4.2
05.4	*idea that:* freezing/defrosting damages the (plasma) membrane of liver cube B; higher permeability of membrane to hydrogen peroxide (than that of liver cube A); more hydrogen peroxide broken down (so more oxygen released);		3	AO2 3.2.3 3.1.4.2

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Question	Answers	Extra information	Mark	AO Spec reference
05.5	catalase denatured; active site no longer complementary to substrate / hydrogen peroxide or no ESCs formed;		2	AO1 AO2 3.1.4.2
05.6	Any two from: use the same surface area of liver cubes; allow all three cubes of liver to return to room temperature before placing them into hydrogen peroxide solution; use the same volume of hydrogen peroxide solution; use of buffer to control pH; control temp constant ref. to room temp or thermostatically controlled water bath;	Allow equilibrate with room temperature	2 max	AO3
06.1	High SA:V; **AND** Any one from: so diffusion is efficient / quick, and sufficient for survival; can absorb nutrients and oxygen directly from environment; can remove waste products quickly (e.g., Carbon dioxide); only 1 cell so small metabolic needs; diffusion fast enough to meet metabolic needs; ref diffusion of oxygen in / carbon dioxide out;		2 max	AO1 3.2.1.2 3.3.1
06.2	No **AND** Any two from: unnecessary as *Salmonella* infection should go away on its own with mild case; prevent *Salmonella* from developing resistance to antibiotics/infection with antibiotic-resistant *Salmonella* could be more serious; cost of treatment (e.g., to healthcare system / individual) when unnecessary; antibiotics can have negative side effects;	No mark for saying yes or no alone, only for supporting the relevant judgement Accept any reasonable statement explaining their judgement	2 max	AO3 3.2.4 3.4.4

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Question	Answers	Extra information	Mark	AO Spec reference
	OR Yes **AND** Any two from: antibiotics would reduce the suffering / symptoms of the person unethical to not treat a person if it is possible; a mild case could get worse / lead to more serious health issues if left untreated;			
06.3	Any four from: the detergent can interact with the hydrophobic core of the phospholipid bilayer; by disrupting the weak intermolecular forces between the fatty acid tails disrupts the membrane integrity / structure / fluidity; membrane becomes more fluid / permeable; cell content / cytoplasm can spill out; bacteria often attach to surfaces using lipids; detergent hydrophobic end can attach to these bacterial lipids, and hydrophilic end to water; causing bacteria to be washed away;		4 max	AO1 AO2 3.2.3 3.2.1.2
06.4	Any two from: high number of sodium-potassium ion pumps / glucose-sodium co-transporter proteins; allow increased rate of active transport of sodium ions from the epithelial cells into the blood; allow increased rate of co-transport of glucose (and sodium ions) from the small intestine into epithelial cells (for absorption of glucose during digestion);		2 max	AO1 AO2 3.2.3 3.3.3
06.5	move more K^+ into cell (by active transport); reduce water potential in cytoplasm / water potential in cytoplasm becomes similar to the surrounding environment; decreases water loss from the cell by osmosis;		3	AO1 AO2 3.2.3

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Spec reference</th></tr>
<tr><td>07</td><td>The importance of chemical transport within living organisms

<table>
<tr><th>Specification reference</th><th>Topic area</th></tr>
<tr><td>3.1.4.2</td><td>Enzyme-catalysed reactions</td></tr>
<tr><td>3.1.5.2</td><td>DNA replication</td></tr>
<tr><td>3.1.6</td><td>ATP</td></tr>
<tr><td>3.2.2</td><td>Cell division</td></tr>
<tr><td>3.2.3</td><td>Transport across membranes</td></tr>
<tr><td>3.2.4</td><td>Immune response</td></tr>
<tr><td>3.3.2</td><td>Gas exchange</td></tr>
<tr><td>3.3.3</td><td>Digestion and absorption</td></tr>
<tr><td>3.3.4</td><td>Mass transport</td></tr>
<tr><td>3.4.2</td><td>DNA and protein synthesis</td></tr>
<tr><td>3.4.3</td><td>Meiosis</td></tr>
<tr><td>3.5.1</td><td>Photosynthesis</td></tr>
<tr><td>3.5.2</td><td>Respiration</td></tr>
<tr><td>3.6.1.1</td><td>Survival and response</td></tr>
<tr><td>3.6.1.2</td><td>Receptors</td></tr>
<tr><td>3.6.1.3</td><td>Control of heart rate</td></tr>
<tr><td>3.6.2.1</td><td>Nerve impulses</td></tr>
<tr><td>3.6.2.2</td><td>Synaptic transmission</td></tr>
<tr><td>3.6.3</td><td>Skeletal muscle stimulation</td></tr>
<tr><td>3.6.4.2</td><td>Control of blood glucose concentration</td></tr>
<tr><td>3.6.4.3</td><td>Control of blood water potential</td></tr>
</table>
</td><td>Focus on mechanisms of transport (diffusion, osmosis, active transport, co-transport etc.) and how chemicals can be transported throughout the body (e.g., bloodstream, nerve impulse transmission along neurone and across synapses)

Requires discussion of the importance of different methods/ examples of chemical transport, not just description of each example</td><td>25</td><td>3.1.4.2
3.1.5.2
3.1.6
3.2.2
3.2.3
3.2.4
3.3.2
3.3.3
3.3.4
3.4.2
3.4.3
3.5.1
3.5.2
3.6.1.1
3.6.1.2
3.6.1.3
3.6.2.1
3.6.2.2
3.6.3
3.6.4.2
3.6.4.3
3.8.2.2
3.8.2.3</td></tr>
</table>

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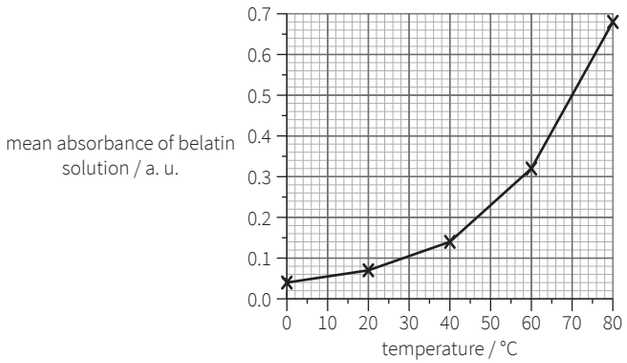
Question	Answers	Extra information	Mark	AO Spec reference
	3.8.2.2 Regulation of transcription and translation 3.8.2.3 Gene expression and cancer Students may be able to show the relevance of other topics from the specification. **Note:** other topics from beyond the specification can be used, providing they relate to the title and contain factually correct material of at least an A-level standard. Credit should not be given for topics beyond the specification which are below A-level standard.			

Skills box answers

Question	Answer
1	

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Question	Answer
2	**Describe:** As the temperature increased, the absorbency increased. The relationship is not linear. There is a sharp rise in absorbency between 40 °C and 60 °C (from 0.14 to 0.43 AU). **Explanation:** The increase in temperature causes the phospholipids to move more (increased kinetic energy) and the bilayer becomes leaky. The betalains diffuse out through the cell surface membranes. As the temperature increases, the cell-surface membranes undergo damage. As protein carriers and channels in the cell-surface membrane start to denature at 40 °C. The integrity of the cell surface membrane is reduced further and more pigment leaks out, which increases absorbency.
3	The formation of ice crystals may puncture the phospholipid membranes, resulting in an increased leakage of pigments.