

Question		Expected Answers	Marks	Additional Guidance
1	(a)	<p>phospholipid bilayer containing proteins ;</p> <p>head / hydrophilic region, facing outwards OR tail / hydrophobic region, facing inwards ;</p> <p>ref to intrinsic and extrinsic (glyco)proteins / described ;</p> <p><i>idea of:</i> glycoproteins / glycolipids, sticking out (of bilayer / membrane);</p> <p>cholesterol, inside bilayer / between phospholipids ;</p>	3 max	<p>Marks can be awarded for an annotated diagram IGNORE ref to 'fluid mosaic model' ACCEPT glycoprotein / channel protein / carrier protein / etc. for protein</p> <p>DO NOT CREDIT ref to hydrophobic heads or hydrophilic tails</p> <p>ACCEPT transmembrane for intrinsic and on surface for extrinsic</p> <p>IGNORE ref to functions such as 'carrier / channel' etc.</p> <p>IGNORE glycoproteins / glycolipids are, extrinsic / on the outside / on surface</p> <p>CREDIT between fatty acid tails</p>
	(b) (i)	<p><u>active</u> transport / uptake ;</p> <p>(transport / carrier) protein ;</p>	2	<p>Mark the first answer on each prompt line. If the answer is correct and a further answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT intrinsic protein / transmembrane protein DO NOT CREDIT channel protein / extrinsic protein</p>
	(b) (ii)	<p>not permeable to, ammonia / NH₃ / ammonium / NH₄⁺ ;</p>	1	<p>Response must be specific to permeability to ammonia CREDIT ammonia cannot pass through membrane ACCEPT selectively permeable so does not allow passage of ammonia (into the cells) IGNORE 'selectively / partially, permeable' unqualified IGNORE 'not permeable to alkalis'</p>

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(b)	(iii)	<p>phospholipids / (named) molecules, vibrate more / move around more / have more kinetic energy ;</p> <p>increases, size / number, of gaps, in membrane / between phospholipids ;</p> <p>bilayer, becomes more fluid / melts ;</p> <p>proteins / glycoproteins, denatured ;</p> <p style="text-align: right;">max 3</p>		<p>IGNORE refs to increase in permeability / leaky as the question asks about structure not properties</p> <p>CREDIT creates gaps in membrane ACCEPT holes for gaps IGNORE ref to pores, ref to gaps created by proteins denaturing</p> <p>IGNORE membrane / phospholipids become more fluid</p> <p>ACCEPT description of denaturing e.g. 3D shape / tertiary structure, changes IGNORE enzymes denature , ref to active site</p>
		<p>QWC ;</p> <p style="text-align: right;">max 1</p>	4 max	<p>Any two technical terms from the list below used appropriately and spelled correctly :</p> <p>phospholipid(s) bilayer kinetic energy (ref to molecules - do not credit in ref to membrane or cell) denature(d) (must refer to proteins or glycoproteins)</p>
		Total	10	

Question		Answer	Marks	Guidance
2	(a)	<p>forms, vesicles / (named) organelle(s) ;</p> <p>separate (contents of) organelles from cytoplasm / compartmentalisation ;</p> <p>site of (named), processes / reactions ;</p> <p>provides surface for attachment (of enzymes / ribosomes) ;</p> <p>control what substances, enter / leave, organelles ;</p> <p>AVP ;</p>	<p>max 2</p>	<p>ACCEPT transport in vesicles</p> <p>e.g. isolates DNA from cytoplasm / separate different environments / separate organelles</p> <p>e.g. lysosomes isolate enzymes (and prevent damage to cells)</p> <p>e.g. separates (metabolic) reactions</p> <p>IGNORE any ref to nuclear pores</p> <p>DO NOT CREDIT substances, enter / leave, cells</p> <p>e.g. allow creation of concentration gradients</p> <p>e.g. ref to intracellular communication</p> <p>e.g. hold binding sites for movement of organelles</p>

	(b)	<p>A1 phospholipids form bilayer /described OR phospholipid hydrophobic tails pointing inwards and hydrophilic heads pointing out ;</p> <p>F1 provide barrier to, large / polar / (named) molecules OR ions OR described ;</p> <p>A2 proteins form, pores / channel / carriers OR extrinsic / intrinsic / transmembrane / described, proteins ;</p> <p>F2 for (active) transport / cotransport / facilitated diffusion OR enzymes ;</p> <p>A3 cholesterol molecules fit, within bilayer / between phospholipid / between fatty acids / between (phospholipid OR hydrophobic) tails ;</p> <p>F3 stabilise membrane (structure) / regulates fluidity ;</p>	<p>Mark the first <u>two</u> components listed only</p> <p>Award marks for suitably labelled diagram(s)</p> <p>Mark points are linked – ensure the function matches the component e.g. DO NOT CREDIT an enzyme arranged as a channel protein</p> <p>ACCEPT phospholipid bilayer</p> <p>ACCEPT ORA – only allow small / non-polar molecules to pass through e.g. prevents movement of glucose across membrane</p> <p>ACCEPT pore / channel / carrier, protein</p> <p>ACCEPT protein embedded in bilayer</p> <p>ACCEPT correct ref to movement of (appropriate) substance(s) across membrane</p> <p>ACCEPT between bilayer</p> <p>IGNORE increases fluidity / reduces rigidity / strengthens / keeps it fluid</p> <p>max 4</p>
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		<p>A4 glycoproteins / glycolipids , on surface / sticking out from surface, (of cell surface membrane) ;</p> <p>F4 cell signalling / receptor sites / adhesion / antigens / recognition OR stabilising (cell shape) ;</p>		<p>Ensure candidate is referring to the <i>surface</i> of a membrane rather than the cell surface membrane unqualified</p> <p>CREDIT <i>Idea of</i> glycoproteins / glycolipids on inner surface or outer surface of (cell surface) membrane</p> <p>IGNORE glycoprotein / glycolipids embedded in membrane</p>
		<p>QWC ;</p>	<p>1</p>	<p>Note: only award this mark for terms used in description of first two components – and only award if given in correct description as shown below.</p> <p>award if any two terms spelt correctly and used in correct context from:</p> <p><i>for phospholipids accept:</i> phospholipid, bilayer, hydrophilic, hydrophobic</p> <p><i>for proteins accept:</i> protein, pore, channel, carrier, enzyme, intrinsic, extrinsic, transmembrane, cotransport, facilitated diffusion</p> <p><i>for cholesterol accept:</i> cholesterol, fatty acid, phospholipid</p> <p><i>for glycoprotein / glycolipid accept:</i> glycoprotein, glycolipid, cell signal(l)ing, receptor, adhesion, antigen</p>

	(c)	(i)	(phospholipid) bilayer ;	1	
		(ii)	(named) proteins ;	1	ACCEPT glycoproteins DO NOT CREDIT coenzymes
		(iii)	<i>idea that:</i> freezing / defrosting, damages the, peroxisome / (plasma) membrane ; increases permeability of membrane to, enzyme / hydrogen peroxide ; more hydrogen peroxide broken down (so more oxygen released) ;	max 2	eg formation of ice crystals causes membrane damage / peroxisomes burst IGNORE denatured for damaged IGNORE membranes become more leaky unqualified ACCEPT release enzyme ACCEPT hydrogen peroxide / substrate, broken down at a higher rate IGNORE higher rate of reaction unqualified / higher rate of oxygen production
			Total	11	

Question		Answer	Marks	Guidance
3	(a)	partially permeable ;	1	ACCEPT selectively permeable / differentially permeable DO NOT CREDIT semi permeable IGNORE fluid mosaic
	(b)	fluid mosaic ; active ; fats / lipids / oils / cholesterol / oxygen / carbon dioxide / (named) steroid hormones / fat soluble vitamins ; carrier / (co)transport(er) ;	4	ACCEPT phonetic spelling IGNORE 'mosaic structure' ACCEPT O ₂ and CO ₂ ACCEPT Vitamin A / D / E / K DO NOT CREDIT water DO NOT CREDIT channel
	(c)	(i) communication between cells ; <i>idea that:</i> molecule released by one cell, attaches to / causes change in, another cell ;	1 max	ACCEPT cell communication IGNORE ref to cell recognition and cell binding

Question		Answer	Marks	Guidance
	(ii)	<p>release of signal molecule by, exocytosis / secretion OR described ;</p> <p><i>idea that:</i> proteins / glycoproteins / glycolipids, act as / have, receptors OR described ;</p> <p><i>idea that:</i> receptor / signal, is specific ;</p> <p><i>idea that:</i> shape of receptor and signal are complementary ;</p> <p><i>idea that:</i> attachment of signal molecule causes change (inside cell / on cell surface) ;</p> <p>cell surface membrane allows entry of some signal molecules ;</p> <p>QWC ;</p>	<p>3 max</p> <p>1</p>	<p>ACCEPT hormone / messenger (molecule) / named hormone for signal throughout IGNORE 'molecule' / 'proteins' alone unless qualified</p> <p>ACCEPT eg 'place for signal molecules to bind' or 'binding site' for 'receptor'</p> <p>IGNORE ref to recognition as meaning specific specific can be described</p> <p>this can be described</p> <p>e.g. cause release of cAMP e.g. hormones trigger a reaction in the cell</p> <p>ACCEPT diffusion (in context of steroid hormones)</p> <p>Award for two terms used appropriately and spelled correctly exocytosis, secretion / secretes / secreted, glycoprotein, glycolipid, receptor, specific, complementary</p>
		Total	10	

Question		Answer	Marks	Guidance
4	(a)	<p>1 form / produce / make, compartments / organelles / named organelles (within a cell) / AW ;</p> <p>2 isolation / AW, of, contents (of organelle) / substance / named substance / reactions / metabolic pathways ;</p> <p>3 site for attachment of, enzymes / other named molecules / ribosomes ;</p> <p>4 provide selective permeability / described ;</p> <p>5 creation of, concentration gradients / specific environments / described ;</p>	3 max	<p>Mark first three suggestions only</p> <p>DO NOT CREDIT ref to cell signalling / cell recognition</p> <p>ACCEPT vesicles as compartments eg mitochondria, ER, nucleus, lysosomes, Golgi, chloroplast</p> <p>ACCEPT compartmentalisation</p> <p>DO NOT CREDIT 'to contain an organelle'</p> <p>eg of AW include hold / contain / store / separates eg of named substance: (hydrolytic) enzymes, hormones / chemical messengers</p> <p>DO NOT CREDIT separates cell contents</p> <p>IGNORE ref to increasing surface area / ref to site for reactions to occur eg of other named molecules : receptors / electron carriers / photosystems / pigments</p> <p>eg controls what can enter and leave an organelle</p> <p>DO NOT CREDIT in context of materials entering and leaving the cell</p> <p>eg of specific environment = pH</p> <p>IGNORE moves substances in vesicles</p>
	(b)	<p>(cytoskeleton / microtubule / microfilament ; provide, pathways / tracks, (for movement) ;</p> <p>(vesicle) moves along, <u>microfilaments</u> / <u>microtubule</u> ;</p> <p><u>microtubules</u>, extended / broken down ;</p> <p>uses, ATP / (metabolic) energy ;</p> <p>AVP ;</p>	2 max	<p>ACCEPT guide the vesicles</p> <p>Mp 3 or 4 scores 2 marks as they include mp 1</p> <p>IGNORE moved by microtubules / microfilaments</p> <p>eg ref to (protein) motor / dynein / kinesin</p>

Question		Answer	Marks	Guidance
	(ii)	receptor found only on, correct / target, (named) organelle ; <i>idea that:</i> address protein provides a way of, labelling / identifying / recognising, the vesicle ; protein / COPI / COPII, has a specific shape ; (shape of) receptor and (address) protein are complementary ;	2 max	DO NOT CREDIT statements that relate to events outside a cell (eg protein is a complementary shape to the receptor on the surface of a target cell) as the question is in the context of vesicles moving <i>within</i> cells. ACCEPT correct target organelle is identified for each vesicle ACCEPT receptor fits the shape of the, protein / COPI / COPII
	(c)	<u>exocytosis</u> ; vesicle fuses / merges ; (with), cell surface / plasma, membrane ; discharging / releasing, enzyme / contents (to exterior) ;	2 max	IGNORE bind / attach / join IGNORE ref to, cell membrane / phospholipid bilayer, unqualified IGNORE secretion alone as stated in question
Total			9	

Question		Expected Answer	Mark	Additional Guidance	
5	(a)	<p>phospholipids ; proteins ; glycoproteins ; cholesterol ; glycolipids ;</p>	max 3	<p>Mark the first <u>three</u> components in continuous prose or first suggestion in bullet point / (numbered) list.</p> <p>IGNORE lipids, bilayer, hydrophilic head, hydrophobic tail, ref to intrinsic / extrinsic</p> <p>Count all refs to different types of protein as one e.g. intrinsic protein ✓ extrinsic protein Ignore pore protein Ignore glycoprotein ✓ phospholipids ✓ = 3 marks</p>	
5	(b)	(i)	<p>(movement of substances) against / up , concentration gradient or from low to high concentration ;</p> <p>using , ATP / (metabolic) energy ;</p> <p>using a , transport / carrier , protein ;</p>	2	<p>CREDIT diffusion gradient for concentration gradient DO NOT CREDIT along / across , concentration gradient</p> <p>DO NOT CREDIT 'diffusion against concentration gradient'</p> <p>DO NOT CREDIT pore / channel protein</p>

Question			Expected Answer	Mark	Additional Guidance																											
5	(b)	(ii)	<p>(mineral) ions / salts / named e.g, (into) root hair (cell) ;</p> <p>hydrogen ions (out of) companion cells ;</p> <p>(mineral) ions / salts / named e.g, (across) endodermis ; sucrose out of sieve tube at sink ;</p> <p>AVP ; ;</p>		<p>Mark the first <u>two</u> examples. Ensure candidate refers to ions e.g. nitrates, phosphates, calcium ions, magnesium ions etc. ACCEPT correct symbols with charge DO NOT CREDIT ref to water ACCEPT ref to loading of sucrose into , phloem cell / companion cell ACCEPT ref to uptake of glucose by cells lining , (small) intestine / nephron / PCT IGNORE references to endocytosis / exocytosis / phagocytosis / secretion DO NOT CREDIT incorrect direction of movement if stated</p> <p>e.</p> <table border="1"> <thead> <tr> <th>substance</th> <th>cell</th> <th>(direction)</th> </tr> </thead> <tbody> <tr> <td>sodium/potassium ion(s)</td> <td>neurone</td> <td>K⁺ in Na⁺out</td> </tr> <tr> <td>sodium/potassium ion(s)</td> <td>named cell</td> <td>Ion pump to drive cotransport</td> </tr> <tr> <td>potassium ion(s)</td> <td>guard cell (to open stomata)</td> <td>in</td> </tr> <tr> <td>sodium ion(s)</td> <td>cell of loop of Henle</td> <td>out</td> </tr> <tr> <td>calcium <u>ion</u>(s)</td> <td>muscle cell</td> <td>(into sarcoplasmic reticulum)</td> </tr> <tr> <td>calcium ions</td> <td>presynaptic knob</td> <td>out</td> </tr> <tr> <td>hydrogen ions</td> <td>in cell , respiring (aerobically) / photosynthesising</td> <td>for chemiosmosis</td> </tr> <tr> <td>named ion(s)</td> <td>cells lining distal convoluted tubule</td> <td>in / out</td> </tr> </tbody> </table>	substance	cell	(direction)	sodium/potassium ion(s)	neurone	K ⁺ in Na ⁺ out	sodium/potassium ion(s)	named cell	Ion pump to drive cotransport	potassium ion(s)	guard cell (to open stomata)	in	sodium ion(s)	cell of loop of Henle	out	calcium <u>ion</u> (s)	muscle cell	(into sarcoplasmic reticulum)	calcium ions	presynaptic knob	out	hydrogen ions	in cell , respiring (aerobically) / photosynthesising	for chemiosmosis	named ion(s)	cells lining distal convoluted tubule	in / out
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5	(c)		<p>osmosis ; <u>facilitated diffusion</u> ; diffusion ;</p>	<p>max 2</p> <p>3</p>	<p>Mark the first answer for each example. If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p>																											
Total				[10]																												

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6	(a)	(i)	osmosis ;	1	Mark the first answer. If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks . DO NOT CREDIT diffusion
		(ii)	fit between (phospho)lipids / through (phospho)lipid (bi)layer ; via, protein <u>channels</u> / protein <u>pores</u> / aquaporins ;	2	DO NOT CREDIT fit through phospholipids (molecules) DO NOT CREDIT carrier proteins – if this is used do not award mp 2 IGNORE transport proteins
	(b)		cell wall ; provides strength / withstands (internal) pressure / prevents cell membrane over expanding / exerts pressure potential ; limits uptake of water ;	2 max	'has a strong cell wall' = 2 marks IGNORE rigidity (of wall), cytoplasm pushes against cell wall ACCEPT stops uptake of water (when turgid)
	(c)	(i)	between -1451 and -1799 ;	1	Ensure figure is a negative number CREDIT a range or single value within this range

Question	Expected Answers	Marks	Additional Guidance
(ii)	<p><i>idea of:</i> 1 plot, percentage plasmolysed against water potential (of solution) / water potential on X axis and % plasmolysed on Y axis ;</p> <p><i>idea of:</i> 2 read down from 50% plasmolysed to water potential ;</p> <p>OR</p> <p><i>idea of:</i> 1 plot, % plasmolysed against sucrose concentration / sucrose concentration on X axis and % plasmolysed on Y axis ;</p> <p><i>idea of :</i> 2 read down from 50% plasmolysed to sucrose concentration AND look up equivalent water potential ;</p>	2	<p>IGNORE ref to bars / bar graph ACCEPT axes wrong way round ACCEPT marking points shown correctly on annotated sketch line graph</p>

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(d)	<p><i>reliable</i></p> <p>R1 observe more pieces of onion (epidermis from each solution) ;</p> <p>R2 count more cells (in each piece of epidermis) ;</p> <p>R3 calculate a mean ;</p> <p>R4 identify / ignore anomalous results ;</p> <p style="text-align: right;">max 3</p> <p><i>accurate</i></p> <p><i>idea of:</i></p> <p>A1 use, more / intermediate, concentrations within existing range / smaller gap between concentrations / closer (concentration) values ;</p> <p>A2 narrower range around 50% plasmolysis / 0.4 - 0.7 mol dm⁻³ / -1120 to -2180 kPa ;</p> <p>A3 take photographs and mark cells as counting ;</p>	4 max	<p>DO NOT CREDIT 'repeats' unless qualified ALLOW 'repeat the results / experiment' to indicate more pieces of epidermis</p> <p>IGNORE average</p> <p>ACCEPT outliers for anomalies IGNORE removes / avoids, anomalies</p> <p>IGNORE lack of units</p> <p>ACCEPT examples of values quoted in between original values e.g. 0.25, 0.35, etc. ACCEPT 0.2 and 0.9</p> <p>ACCEPT examples of values if clearly showing application of correct narrower range e.g. 0.45, 0.55 , 0.65 For A2 DO NOT CREDIT quoted values extend beyond correct narrower range e.g. 0.35, 0.55, 0.75</p>
	Total	12	