Question			Expected Answers	Marks	Additional Guidance
1	(a)		phospholipid bilayer containing proteins **;** head / hydrophilic region, facing outwards **OR** tail / hydrophobic region, facing inwards **;** ref to intrinsic **and** extrinsic (glyco)proteins / described **;** *idea of*: glycoproteins **/** glycolipids, sticking out (of bilayer / membrane)**;** cholesterol, inside bilayer / between phospholipids **;**	3 max	**Marks can be awarded for an annotated diagram** **IGNORE** ref to 'fluid mosaic model' **ACCEPT** glycoprotein / channel protein / carrier protein / etc. for protein **DO NOT CREDIT** ref to hyrophobic heads or hydrophillic tails **ACCEPT** transmembrane for intrinsic **and** on surface for extrinsic **IGNORE** ref to functions such as 'carrier / channel' etc. **IGNORE** glycoproteins / glycolipids are, extrinsic / on the outside / on surface **CREDIT** between fatty acid tails
	(b)	(i)	<u>active</u> transport / uptake **;** (transport / carrier) protein **;**	2	**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** **ACCEPT** intrinsic protein / transmembrane protein **DO NOT CREDIT** channel protein / extrinsic protein
	(b)	(ii)	not permeable to, ammonia / NH_3 / ammonium / NH_4^+ **;**	1	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'

Question			Expected Answers	Marks	Additional Guidance
	(b)	(iii)	**phospholipids** / (named) molecules, vibrate more / move around more / have more **kinetic energy** ; increases, size / number, of gaps, in membrane / between phospholipids ; **bilayer**, becomes more fluid / melts ; proteins / glycoproteins, **denatured** ; **max 3**		**IGNORE** refs to increase in permeability / leaky as the question asks about structure not properties **CREDIT** creates gaps in membrane **ACCEPT** holes for gaps **IGNORE** ref to pores, ref to gaps created by proteins denaturing **IGNORE** membrane / phospholipids become more fluid **ACCEPT** description of denaturing e.g. 3D shape / tertiary structure, changes **IGNORE** enzymes denature , ref to active site
			QWC ; **max 1**	4 max	Any **two** technical terms from the list below used appropriately and spelled correctly : **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)
			Total	**10**	

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

	(b)				**Mark the first <u>two</u> components listed only** **Award marks for suitably labelled diagram(s)** **Mark points are linked – ensure the function matches the component** e.g. DO NOT CREDIT an enzyme arranged as a channel protein
			A1 phospholipids form **bilayer /**described OR phospholipid **hydrophobic** tails pointing inwards and **hydrophilic** heads pointing out **;**		ACCEPT phospholipid bilayer
			F1 provide barrier to, large / polar / (named) molecules OR ions OR described **;**		**ACCEPT** ORA – only allow small / non-polar molecules to pass through e.g. prevents movement of glucose across membrane
			A2 proteins form, **pore**s / **channel** / **carrier**s OR **extrinsic / intrinsic / transmembrane /** described**,** proteins **;**		**ACCEPT** pore / channel / carrier, protein **ACCEPT** protein embedded in bilayer
			F2 for (active) transport / **cotranspor**t / **facilitated diffusion** OR **enzyme**s **;**		**ACCEPT** correct ref to movement of (appropriate) substance(s) across membrane
			A3 cholesterol molecules fit, within bilayer / between **phospholipid** / between **fatty acid**s / between (phospholipid OR hydrophobic) tails **;** **F3** stabilise membrane (structure) / regulates fluidity **;**	**max 4**	**ACCEPT** between bilayer **IGNORE** increases fluidity / reduces rigidity / strengthens / keeps it fluid

			A4 glycoproteins / **glycolipid**s , on surface / sticking out from surface, (of cell surface membrane) **;** **F4 cell signalling** / **receptor** sites / **adhesion / antigens /** recognition OR stabilising (cell shape) **;**		Ensure candidate is referring to the *surface* of a membrane rather than the cell surface membrane unqualified **CREDIT** *Idea of* glycoproteins / glycolipids on inner surface or outer surface of (cell surface) membrane **IGNORE** glycoprotein / glycolipids embedded in membrane
			QWC **;**	**1**	**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.** **award** if any two terms spelt correctly and used **in correct context** from: *for phospholipids accept*: **phospholipid, bilayer, hydrophilic, hydrophobic** *for proteins accept*: **protein, pore, channel, carrier, enzyme, intrinsic, extrinsic, transmembrane, cotransport, facilitated diffusion** *for cholesterol accept*: **cholesterol, fatty acid, phospholipid** *for glycoprotein / glycolipid accept*: **glycoprotein, glycolipid, cell signal(l)ing, receptor, adhesion, antigen**

	(c)	**(i)**	(phospholipid) bilayer **;**	**1**	
		(ii)	(named) proteins **;**	**1**	**ACCEPT** glycoproteins **DO NOT CREDIT** coenzymes
		(iii)	*idea that:* 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 **;** *idea that:* 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)		3 max	**ACCEPT** hormone / messenger (molecule) / named hormone for signal throughout **IGNORE** 'molecule' / 'proteins' alone unless qualified
			release of signal molecule by, **exocytosis** / **secretion** **OR** described **;**		
			idea that: proteins / **glycoprotein**s / **glycolipid**s, act as / have, **receptor**s **OR** described **;**		**ACCEPT** eg 'place for signal molecules to bind' or 'binding site' for 'receptor'
			idea that: receptor / signal, is **specific ;**		**IGNORE** ref to recognition as meaning specific specific can be described
			idea that: shape of receptor **and** signal are **complementary ;**		this can be described
			idea that: attachment of signal molecule causes change (inside cell / on cell surface) **;**		e.g. cause release of cAMP e.g. hormones trigger a reaction in the cell
			cell surface membrane allows entry of some signal molecules **;**		**ACCEPT** diffusion (in context of steroid hormones)
			QWC **;**	1	Award for **two** terms used appropriately and spelled correctly **exocytosis**, **secretion / secretes / secreted**, **glycoprotein**, **glycolipid**, **receptor**, **specific**, **complementary**
			Total	**10**	

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

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

<table>
<tr><th colspan="3">Question</th><th>Expected Answer</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>5</td><td>(b)</td><td>(ii)</td><td>(mineral) ions / salts / named e.g, (into) root hair (cell) ;

hydrogen ions (out of) companion cells ;

(mineral) ions / salts / named e.g, (across) endodermis ;
sucrose out of sieve tube at sink ;

AVP ; ;</td><td>max 2</td><td>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

e.
<table>
<tr><th>substance</th><th>cell</th><th>(direction)</th></tr>
<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>
</table>
</td></tr>
<tr><td>5</td><td>(c)</td><td></td><td>osmosis ;
<u>facilitated</u> <u>diffusion</u> ;
diffusion ;</td><td>3</td><td>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</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>[10]</td><td></td></tr>
</table>

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

Question	Expected Answers	Marks	Additional Guidance
(d)	*reliable* **R1** observe more pieces of onion (epidermis from each solution) ; **R2** count more cells (in each piece of epidermis) ; **R3** calculate a mean ; **R4** identify / ignore anomalous results ; **max 3** *accurate* *idea of:* **A1** use, more / intermediate, concentrations within existing range / smaller gap between concentrations / closer (concentration) values ; **A2** narrower range around 50% plasmolysis / 0.4 - 0.7 mol dm^{-3} / -1120 to -2180 kPa ; **A3** take photographs and mark cells as counting ; **4 max**		**DO NOT CREDIT** 'repeats' unless qualified **ALLOW** 'repeat the results / experiment' to indicate more pieces of epidermis **IGNORE** average **ACCEPT** outliers for anomalies **IGNORE** removes / avoids, anomalies **IGNORE** lack of units **ACCEPT** examples of values quoted in between original values e.g. 0.25, 0.35, etc. **ACCEPT** 0.2 **and** 0.9 **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
	Total	**12**	