

OCR AS GCE Biology (11 pages)

F211 Cells, Transport and Exchange

Mark schemes from January 2009-June 2012

Topics:

**1.1.2 Cell Membranes**

Outline the roles of membranes within cells and at the surface of cells;
State that plasma (cell surface) membranes are partially permeable barriers;
Describe, with the aid of diagrams, the fluid mosaic model of membrane structure
Describe the roles of the components of the cell membrane; phospholipids, cholesterol, glycolipids, proteins and glycoproteins
Outline the effect of changing temperature on membrane structure and permeability;
Explain the term <i>cell signaling</i> ;
Explain the role of membrane-bound receptors as sites where hormones and drugs can bind;
Explain what is meant by <i>passive transport</i> (diffusion and facilitated diffusion including the role of membrane proteins), <i>active transport</i> , <i>endocytosis</i> and <i>exocytosis</i> ;
Explain what is meant by <i>osmosis</i> , in terms of water potential. (No calculations of water potential will be required);
Recognise and explain the effects that solutions of different water potentials can have upon plant and animal cells

Question	Expected Answers	Marks	Additional Guidance
2 (a) (i)	<p><b>D</b> cholesterol ; protein / glycoprotein / intrinsic protein / protein channel / protein pump / transport protein / carrier protein ;</p> <p><b>F</b> phospholipid (bilayer) / phospholipid head ;</p>	3	<p>ACCEPT polypeptide chain DO NOT ACCEPT amino acid chain DO NOT ACCEPT extrinsic protein DO NOT ACCEPT lipids / bilayer</p>
2 (a) (ii)	<p><b>D</b> stabilise the membrane OR maintain / affect / control / AW, fluidity OR reduces permeability to, polar / charged, particles ;</p> <p><b>E</b> allow communication across membrane OR allow, polar / charged, particles to pass through membrane ;</p> <p><b>F</b> to act as a barrier (to, polar / charged, particles) / select what enters or leaves cell ;</p>	3	<p><i>mark independently of (a)(i) i.e. NO ecf</i></p> <p>DO NOT ACCEPT refs to rigidity / support / strength ACCEPT reduces / affects, lateral movement of phospholipids ACCEPT cell recognition / receptor site / cell signalling / cell attachment ACCEPT (acts as) selectively permeable or partially permeable membrane ACCEPT allows small / fat soluble molecules to pass through DO NOT ACCEPT separates inside from outside</p>
2 (b) (i)	communication between cells / AW ; cell, recognition / identification ; cells work together / coordination between action of different cells ; to trigger, response / reaction (inside the cell) ;	2 max	ACCEPT example to illustrate the point, e.g. action of hormone / cytokines
2 (b) (ii)	(receptor) specific shape / described ; complementary to (shape of), trigger / named trigger / communicating ; molecule ; (trigger / AW) binds / attaches to receptor ;	2 max	<p>ACCEPT tertiary structure DO NOT ACCEPT ref to active site ACCEPT fits / idea of lock &amp; key in correct context DO NOT ACCEPT 'matches'</p> <p>DO NOT ALLOW joins / bonds / links / combines / fits</p>

Question	Expected Answers	Marks	Additional Guidance
2 (c) (i)	cell surface / plasma, membrane damaged ;  pigment, released / leaks out ; pigment, absorbs / takes up, the light ;	2 max	ACCEPT description of damage e.g. proteins denatured / phospholipids separate / bilayer melts DO NOT ACCEPT bilayer becomes 'more fluid' DO NOT ACCEPT 'cell membrane' unqualified ACCEPT 'cell contents' for pigment DO NOT ACCEPT 'no light transmitted' 'solution is opaque'
2 (c) (ii)	Mark first response on each numbered line. Only return to extra points on first or second line if no response in line two or three  more samples at each temperature ;  same / fixed, volume of water ; all samples same, size / surface area ; ref to further cutting to increase surface area ;  pieces, rinsed / blotted, after cutting ; more (intermediate) temperatures ;  same beetroot used / same part of beetroot used ;	3 max	ACCEPT repeats ACCEPT collect average / mean results DO NOT ACCEPT mass ACCEPT any method of cutting to provide larger surface area ACCEPT list of figures of additional temps between 0-100 DO NOT ACCEPT wider range of temperatures / more evenly spaced temperatures DO NOT ACCEPT leave for longer DO NOT ACCEPT idea of control
<b>Total</b>		<b>15</b>	

Question	Expected Answers	Marks	Additional Guidance
3 (a)	partially / selectively ;  (facilitated) diffusion <b>OR</b> osmosis ; plasma ; phospholipids ; cholesterol ;	5	<b>DO NOT ACCEPT</b> semi <b>ACCEPT</b> differentially  <b>ACCEPT</b> plasma cell

Question	Expected Answers	Marks	Additional Guidance
3 (b)	<p>1 (acting as) <b>antigens</b> ;</p> <p>2 identification / <b>recognition</b>, (of cells) as, self / non-self / AW ;</p> <p>3 <b>cell signalling</b> / described ;</p> <p>4 <b>receptor</b> / binding site, for, <b>hormone</b> / (chemical) signal / (medicinal / named) drugs ;</p> <p>5 ref. to <b>receptor</b> / binding site / trigger, on transport proteins / AW ;</p> <p>6 <b>cell adhesion</b> / to hold cells together (in a tissue) ;</p> <p>7 attach to water molecules (to stabilise membrane / cell) ;</p> <p>4 max for description</p> <p><b>QWC:</b> three technical terms used and spelt correctly ;</p>	5 max	<p><b>Look for <u>description</u> not list of functions</b></p> <p><i>Do not credit repetition of same point</i></p> <p><b>ACCEPT</b> foreign for non-self</p> <p><b>ACCEPT</b> description e.g. communication <i>between</i> cells / cell responds to, chemical / signal, <i>from another cell</i></p> <p><b>ACCEPT</b> description of attachment <i>process</i> for receptor / binding site</p> <p><b>DO NOT ACCEPT</b> molecule unqualified</p> <p><b>ACCEPT</b> binding site for foreign antigen</p> <p><b>ACCEPT</b> ref to receptors on ion channels</p> <p><b>ACCEPT</b> bind to other cells for cell adhesion</p> <p>Any <b>three</b> from: receptor, antigen, hormone, <u>cell signal(ing)</u>, adhesion, recognition, <u>facilitated diffusion</u>, <u>active transport</u></p>
	<b>Total</b>	<b>10</b>	

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2	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 80%;">description</th> <th style="width: 20%;">letter</th> </tr> </thead> <tbody> <tr> <td>an animal cell that has been placed in water</td> <td>N ;</td> </tr> <tr> <td>an animal cell that has been placed in a strong sugar solution</td> <td>K ;</td> </tr> <tr> <td>a plant cell that has been placed in water</td> <td>L ;</td> </tr> <tr> <td>a plant cell that has been placed in a strong sugar solution</td> <td style="background-color: black;"></td> </tr> </tbody> </table>	description	letter	an animal cell that has been placed in water	N ;	an animal cell that has been placed in a strong sugar solution	K ;	a plant cell that has been placed in water	L ;	a plant cell that has been placed in a strong sugar solution		3	
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2	<p>(a)</p> <p>(b) water moves out of cell ; by osmosis ;</p> <p>cell has, higher / greater / less negative, <u>water potential</u> (than surrounding solution) / ORA ;</p> <p>(water moves) <u>down water potential gradient</u>/from high to low <u>water potential</u> ;</p>	3 max	<p><i>note: this is explain not describe</i></p> <p><b>ACCEPT <math>\psi</math></b> for water potential must be comparative – <b>DO NOT ACCEPT</b> high alone</p> <p><b>DO NOT ACCEPT</b> across or along water potential gradient</p> <p><b>DO NOT ACCEPT</b> ref to water concentration anywhere</p> <p><b>IGNORE</b> ref to solute potentials</p>										

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2 (c)	<p><i>small, non-polar substances diffuse (through membrane / phospholipid bilayer) ;</i></p> <p><i>large substances (using), transport / carrier, proteins ;</i></p> <p><b>endocytosis / phagocytosis / described ;</b></p> <p><i>polar substances through, pore / channel, proteins ; (using), transport / carrier, proteins ;</i></p> <p><i>general – must be used in correct context, each once only ref to facilitated diffusion ;</i></p> <p><b>ref to active transport / use of ATP ;</b></p> <p><b>4 max</b></p> <p><b>QWC – technical terms spelled AND used in correct context ;</b></p> <p><b>1</b></p>	<p><b>5 max</b></p> <p><b>[Total : 11]</b></p>	<p><b>ACCEPT</b> diffusion / diffuses</p> <p><b>ACCEPT</b> protein pump</p> <p><b>DO NOT ACCEPT</b> channel proteins here</p> <p><b>ACCEPT</b> pinocytosis</p> <p>apply only to large / polar substances</p> <p>apply only to large / polar substances</p> <p><b>DO NOT ACCEPT</b> ref to active transport with channel proteins</p> <p>(three from: phospholipid / bilayer / diffusion / facilitated diffusion / active transport / transport protein / carrier protein / channel protein / pinocytosis / endocytosis / phagocytosis)</p> <p>if protein spelled incorrectly throughout, only penalise once</p>

Question	Expected Answer	Mark	Additional Guidance
2 (a)	<p>phospholipids ;            proteins ;            glycoproteins ;            cholesterol ;            glycolipids ;</p>	max 3	<p>Mark the <u>first three</u> components in continuous prose or first suggestion in bullet point / (numbered) list.</p> <p><b>IGNORE</b> 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>
2 (b) (i)	<p>(movement of substances) against / up , concentration gradient <b>OR</b> from low to high concentration ;            using , ATP / (metabolic) energy ;            using a , transport / carrier , protein ;</p>	2	<p><b>CREDIT</b> diffusion gradient for concentration gradient  <b>DO NOT CREDIT</b> along / across , concentration gradient  <b>DO NOT CREDIT</b> 'diffusion against concentration gradient'  <b>DO NOT CREDIT</b> pore / channel protein</p>



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2 (b) (ii)	(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 ; ;	max 2	<p>Mark the first two 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.g.</p> <table border="1" data-bbox="395 1344 869 2004"> <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<sup>+</sup> in Na<sup>+</sup> 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 ion(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 <sup>+</sup> in Na <sup>+</sup> 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 ion(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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2 (c)	osmosis ; facilitated diffusion ; diffusion ;	3	<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>																											
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Question	Answer	Marks	Guidance
4 (a) (i)	<p>1 cell (cytoplasm) has a lower <b>water potential</b> than (distilled) water / ORA ;</p> <p>2 water moves (into cells) , down <b>water potential gradient</b> / from high <math>\psi</math> to low <math>\psi</math> ;</p> <p>3 (water) enters the cell by <b>osmosis</b> ;</p> <p>4 <b>idea of: cell surface / plasma, membrane</b> (of blood cell) weak so, bursts / cannot withstand pressure / <b>haemolyses</b> ;</p> <p>5 <b>idea of:</b> (plant) cell wall , strong / provides support, so, does not burst / can withstand pressure ;</p> <p>6 (plant) cell becomes <b>turgid / turgidity</b> increases, which reduces water uptake ; 4 max</p> <p>QWC – <b>two</b> technical terms used in context and spelt correctly ; 1</p>	5 max	<p><b>CREDIT</b> mps 1-3 in context of either blood cell or plant cell Comparative statement must be made.</p> <p>1 <b>ACCEPT</b> <math>\psi</math> <b>ACCEPT</b> more negative water potential</p> <p>2 <b>IGNORE</b> 'along' or 'across' <b>IGNORE</b> definition of osmosis in isolation, must be in context of explaining observations</p> <p>3 <b>ACCEPT</b> 'water osmoses into cell' <b>IGNORE</b> ref to diffusion</p> <p>5 <b>IGNORE</b> ref to rigid wall, wall acts as barrier</p> <p>6 <b>IGNORE</b> ref to plasmolysis anywhere in response</p> <p>any two from: gradient, water potential, osmosis, cell surface membrane / plasma membrane, turgid / turgidity, (derivatives of) haemolysed (note: only allow turgid for plant cells)</p>

Question	Answer	Marks	Guidance
(ii)	use a, salt / sugar, solution <b>OR</b> add solute to water ;  use a solution with the, same / similar / lower, water potential as blood cells ;	1 max	<b>ACCEPT</b> saline solution <b>ACCEPT</b> isotonic / hypertonic <b>ACCEPT</b> same solute concentration / potential <b>IGNORE</b> same water concentration <b>IGNORE</b> use less water / solution with low water potential
(b)	<u>diffusion</u> ;	1	<b>DO NOT CREDIT</b> facilitated diffusion
(c)	1 active, transport / uptake ;  <i>plus any two from:</i> 2 cells have, extensions / hairs ; 3 thin cell wall ; 4 large / increased, <u>surface area</u> ; 5 many / more, mitochondria ; 6 (many) carrier proteins in cell (surface) membrane ;	3 max	1 <b>ACCEPT</b> facilitated diffusion IGNORE transport using ATP <b>DO NOT CREDIT</b> osmosis  Allow max two marks for specialised features 2 <b>ACCEPT</b> cells have root hairs IGNORE roots have root hair cells  4 <b>ACCEPT</b> high, <u>surface area</u> to volume ratio / SA:vol credit in context on root hair cell or root having large surface area  6 <b>ACCEPT</b> transport proteins / protein pumps <b>ACCEPT</b> channel protein in context of facilitated diffusion
	<b>Total</b>	<b>10</b>	