

Biology

Advanced Subsidiary GCE

Unit **F211**: Cells, Exchange and Transport

Mark Scheme for June 2013

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All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations

Available in SCORIS

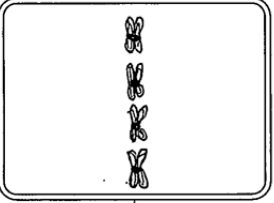
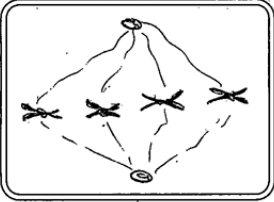
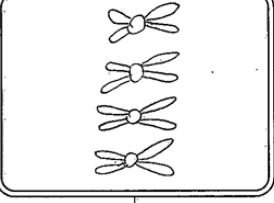
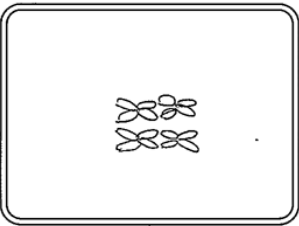
Annotation	Meaning
	Benefit of Doubt
	Contradiction
	Cross
	Error Carried Forward
	Given mark
	Extendable horizontal wavy line
	Ignore
	QWC
	Benefit of the doubt not given
	additional QWC credit given
	Tick
	Tick 1
	Tick 2
	Omission Mark

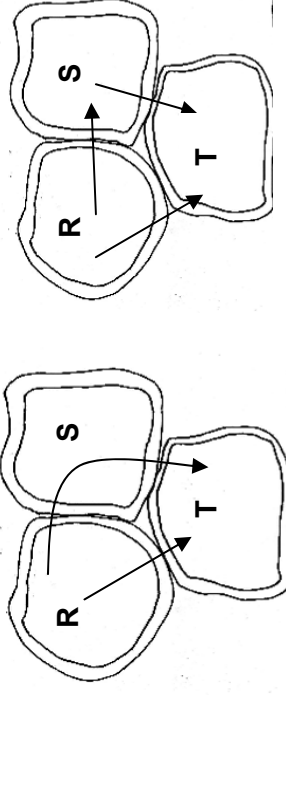
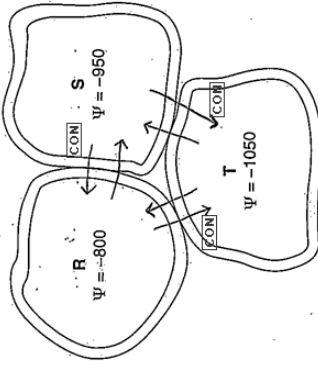
Question	Answer	Marks	Guidance
1 (a) (i)	A <u>nucleus</u> ; B <u>chloroplast</u> ;	2	<p>Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>DO NOT CREDIT nuclear envelope / nucleolus IGNORE chlorophyll</p>
(ii)	<p>C <i>mitochondrion</i> (aerobic) respiration / producing ATP / release energy ;</p> <p>D <i>SER / smooth endoplasmic reticulum</i> transport / production / processing, of, fats / lipids / steroids / carbohydrates ;</p> <p>C / mitochondrion / cristae, too small ;</p>	2	<p>Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>DO NOT CREDIT Function of organelle if organelle identified / named incorrectly (as this would be an incorrect biological statement.</p> <p>DO NOT CREDIT makes / produces, energy ACCEPT produces ATP for respiration</p> <p>IGNORE ref to transport / modification of proteins DO NOT CREDIT ref production of proteins <i>idea of</i> too small / not big enough important IGNORE very small</p> <p>ACCEPT resolution low IGNORE ref to magnification for resolution accept any value in range 0.05 - 0.2 μm</p> <p>IGNORE ref to electron microscope</p>
(b)	<p>resolution (of light microscope), not high (enough) OR <i>idea of</i> only, 0.2μm / 200nm ;</p> <p>wavelength of light too long ;</p>	max 2	

(c)	<p>makes visible / easier to see / see more detail ; (staining) provides / increases, <u>contrast</u> ; identify / recognise, cell types / organelles / parts of cell ; identify / recognise, different (named), compounds / molecules ;</p>	<p>max 2 8</p>	<p>ACCEPT distinguish, cells / organelles, (from background) IGNORE ref to clarity</p> <p>IGNORE substances</p>
	Total	8	

Question	Answer	Marks	Guidance
2 (a) (i)	<u>0.6 : 1</u> ; ;		Correct answer = 2 marks Ratio must be correct way round 1: 0.6 is not correct but can still allow mark for correct working if shown If answer incorrect ALLOW 1 mark for working e.g. $600 \div 1000$ $600 : 1000 = 1$ mark
(ii)	as SA:VOL ratio decreases rate of diffusion decreases OR as SA:VOL ratio increases rate of diffusion increases ; use of two pairs of figures with correct units (mms^{-1}) for rate to illustrate trend ; ref to rate of diffusion in either of the first two cubes not fitting trend ;	2 max 2	ACCEPT positive correlation DO NOT CREDIT as rate of <i>diffusion</i> decreases SA:VOL ratio decreases use of figs requires ratio quote and rate quote at two points e.g. at SA:VOL of 3:1 rate is 0.02 mms^{-1} , at SA:VOL ratio of 0.2:1 rate is 0.013 (correct units only need to be used once) DO NOT CREDIT if unit for SA:Vol given ACCEPT correct calculation of rate change e.g. when the SA:VOL ratio was 3:1 the rate of diffusion was 0.020 mms^{-1} which is 0.007 mms^{-1} faster than the cube with 0.2:1 SA:VOL ratio
(iii)	(large plants) have a, small / low, SA : VOL ratio ; <i>idea of</i> diffusion too slow (to supply requirements) ; <i>idea of</i> need transport system (for water / minerals / assimilates) ; <i>idea of</i> need (special) surface area for, gaseous exchange / uptake of minerals ;	 max 2	DO NOT CREDIT smaller unless we know smaller than what ACCEPT e.g. larger plants have a smaller SA : Vol ratio must have idea of too slow ACCEPT diffusion takes too long DO NOT CREDIT transport of gases

Question	Answer	Marks	Guidance
(b) (i)	divided length of side by time taken ;	1	IGNORE divide mm by s (units alone too vague)
(b) (ii)	<i>idea that student used whole length of side, rather than half length ;</i>	1	ACCEPT needs to divide answer by 2 / distance has to be to centre of cube rather than whole length of side / assumed diffusion occurs (across whole cube) from one side
(c)	<p><i>squamous epithelium</i></p> <p>short(er) diffusion, distance / path ;</p> <p><i>large number of alveoli</i></p> <p>large(r) surface area ;</p> <p><i>good blood supply</i></p> <p>high / large / steep, concentration gradient</p> <p>OR</p> <p>removes oxygen (from lung surface) / brings carbon dioxide (to lung surface);</p> <p><i>good ventilation</i></p> <p>high / large / steep, concentration gradient</p> <p>OR</p> <p>supplies oxygen (to alveoli) / removes carbon dioxide (from alveoli) ;</p>	4	<p>ACCEPT reduced / shorter diffusion distance</p> <p>ACCEPT thin diffusion barrier</p> <p>IGNORE thin diffusion pathway</p> <p>ACCEPT increases surface area</p> <p>IGNORE SA : Vol ratio</p> <p>ACCEPT maintains / creates concentration gradient</p> <p>IGNORE ref diffusion gradient</p> <p>ACCEPT maintains / creates concentration gradient</p> <p>IGNORE ref diffusion gradient</p> <p>IGNORE ref to air</p>
	Total	12	

3	(a)	mitosis / mitotic ;	Correct spelling only
	(i)		<p>If the image is unclear then pencil or a different colour may have been used - RAISE AN EXCEPTION</p>
	(ii)	<p>four chromosomes on equator ;</p> <p>(each chromosome as) two sister chromatids ;</p>	<p>Award 2 marks for the following</p> <div style="display: flex; justify-content: space-around; align-items: center;">    </div> <p>DO NOT CREDIT mp 1 if nuclear membrane shown DO NOT CREDIT mp 1 if homologous chromosomes paired e.g.</p> <div style="display: flex; justify-content: center; align-items: center;">  </div> <p>DO NOT CREDIT mp 2 if sister chromatids are not joined (at centromere)</p>
			<p>1</p>
			<p>2</p>

	<p>(iii) arrow from R to T ; arrow from R to S AND arrow from S to T OR arrow from R to S to T ;</p>	<p>e.g. </p> <p>If contradictory arrows to the above are drawn, apply CON for each arrow going from low Ψ to high Ψ. e.g. </p> <p style="text-align: right;">gets 0</p>
<p>(b)</p>	<p>this is where cambium / meristem / xylem / phloem / vascular bundle, is found ;</p> <p>mitosis/cell division, occurs in cambium (to produce new cells for growth) ;</p> <p>new cells, differentiate / specialise, (into xylem and phloem) ;</p> <p>xylem supplies water for, (cell) elongation / (cell) growth ;</p> <p>phloem supplies, sugars / assimilates, for, energy / growth /respiration ;</p>	<p style="text-align: center;">2</p> <p>CREDIT from a labelled diagram CREDIT description of position being close to the edge of trunk DO NOT CREDIT responses that suggest that cambium etc. are in or outside bark OR under cut surface</p> <p>ACCEPT cambium differentiates IGNORE nutrients</p> <p style="text-align: right;">max 2</p>

(c)	tip / apex, of, shoot / root ; meristem ; bud ;	max 1	<p>Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>IGNORE root or shoot unqualified ACCEPT behind root tip</p>
(d)	<p>allow <u>oxygen</u> to reach, cells / tissues (under bark) ;</p> <p>for (aerobic) respiration ;</p> <p>animals transport oxygen in, blood / circulation / transport system ;</p> <p>plants do not transport (much) oxygen in transport system ;</p> <p><i>idea that</i> (oxygen not supplied from leaves as) stomata only open in day / no leaves in winter ;</p>	max 2	<p>IGNORE refs to need for CO₂ / photosynthesis throughout</p> <p>ACCEPT correct formula O₂</p> <p>DO NOT CREDIT oxygen for photosynthesis</p> <p>ACCEPT gas(es) for oxygen</p> <p>ACCEPT gas(es) for oxygen</p>
	Total	10	

Question	Answer	Marks	Guidance
4 (a) (i)	<p>1 placenta has low pO₂ ;</p> <p>2 adult (oxy)haemoglobin will, release O₂ / dissociate, (in, low pO₂ / placenta) ;</p> <p>3 fetal haemoglobin has higher affinity for oxygen / described ;</p> <p>4 fetal haemoglobin, is (still) able to take up (some) oxygen, in placenta / at low(er) pO₂ ;</p>	max 3	<p>ACCEPT oxygen tension for pO₂ throughout IGNORE lower</p> <p>This must be a comparative statement CREDIT /<i>idea that fetal haemoglobin picks up more oxygen than the adult haemoglobin at a given pO₂ / fetal haemoglobin picks up oxygen at lower pO₂</i> IGNORE ref to easier / quicker, uptake of O₂</p> <p>This is not a comparative point, the emphasis is on the ability of fetal haemoglobin to take up some oxygen even when little is available DO NOT CREDIT if response suggests that % saturation increases as pO₂ decreases ACCEPT fetal oxyhaemoglobin</p> <p>assume candidate refers to fetal haemoglobin unless adult / maternal stated</p>
(ii)	<p>(fetal) haemoglobin may not crystallise (much) (at low pO₂) ;</p> <p>red blood cells do not change shape ;</p> <p>(fetal) haemoglobin can pick up more oxygen at low pO₂ (than sickle haemoglobin) ;</p> <p><i>idea that more oxygen, transported / delivered (around body) ;</i></p>	max 2	<p>Emphasis for this mp is the fetal haemoglobin being able to pick up more oxygen than sickle haemoglobin CREDIT (fetal) haemoglobin becomes more saturated at low pO₂ (than sickle haemoglobin) Allow ref to lower pO₂ unless it is implied that fetal haemoglobin picks up more oxygen at lower pO₂ than higher pO₂</p> <p>Emphasis for this mp is the distribution of oxygen IGNORE more oxygen obtained by person (as this implies breathing)</p>

(b)	<p>diffusion ;</p> <p>from high concentration to low concentration / down concentration gradient;</p> <p>(hydrostatic) pressure in capillary high(er than in tissue fluid) ;</p> <p>capillary (walls) leaky / described ;</p> <p>fluid / plasma, forced out (of capillary)</p> <p>OR</p> <p>fluid / plasma, moves, from higher pressure to lower pressure / down pressure gradient ;</p> <p>(as the fluid / plasma moves out) glucose / oxygen / small molecules, leave with, fluid / plasma ;</p>	<p>IGNORE diffusion of glucose throughout answer</p> <p>'down diffusion gradient' = 1 for 'diffusion' (mp 1 not mp 2) DO NOT CREDIT diffusion linked to pressure</p> <p>ACCEPT pO₂ for concentration</p> <p>ACCEPT permeable IGNORE pores / fenestrations / holes ACCEPT <i>idea</i> of small gaps between cells</p> <p>Emphasis here is on pressure forcing fluid out DO NOT CREDIT tissue fluid forced out</p> <p>Emphasis here is on glucose/ oxygen being carried out as a result of mass flow of fluid (not diffusion)</p>
		max 3
	QWC;	award if any two terms spelt correctly and used in correct context from: diffusion / diffuse, pressure, hydrostatic, concentration gradient
	Total	9

Question	Answer	Marks	Guidance
5 (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>	max 2	<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 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>
		max 4

	<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>QWC ;</p>		<p>Ensure candidate is referring to the <i>surface</i> of a membrane rather than the cell surface membrane unqualified CREDIT /dea of glycoproteins / glycolipids on inner surface or outer surface of (cell surface) membrane IGNORE glycoprotein / glycolipids embedded in membrane</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: <i>for phospholipids accept: phospholipid, bilayer, hydrophilic, hydrophobic</i></p> <p><i>for proteins accept: protein, pore, channel, carrier, enzyme, intrinsic, extrinsic, transmembrane, cotransport, facilitated diffusion</i></p> <p><i>for cholesterol accept: cholesterol, fatty acid, phospholipid</i></p> <p><i>for glycoprotein / glycolipid accept: glycoprotein, glycolipid, cell signal(l)ing, receptor, adhesion, antigen</i></p>
		1	

(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) ;		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	max 2 11	

6	(a)	<p><i>transpiration</i> loss of water <u>vapour</u> / evaporation of water ; from, aerial parts of plant / leaves / stomata ;</p> <p><i>transpiration stream</i> movement of water (up xylem vessels) ; from roots to, leaves / air surrounding leaves ;</p>	max 3	<p>IGNORE evaporation of water vapour</p>										
	(b)	<p>F ; G ; K ;</p>	3	<p>Only one tick per set – if more than one tick then apply CON IGNORE crosses and hybrid crosses</p>										
	(c)	<table border="1" data-bbox="614 1198 925 1758"> <thead> <tr> <th>Xylem</th> <th>Phloem</th> </tr> </thead> <tbody> <tr> <td>(named) mineral(s) / salts</td> <td>sucrose / amino acids</td> </tr> <tr> <td>no, end / cross, walls</td> <td></td> </tr> <tr> <td>lignin</td> <td></td> </tr> <tr> <td>(bordered) pits</td> <td>Plasmodesmata</td> </tr> </tbody> </table>	Xylem	Phloem	(named) mineral(s) / salts	sucrose / amino acids	no, end / cross, walls		lignin		(bordered) pits	Plasmodesmata	4	<p>Award 1 mark for a correct row.</p> <p>IGNORE ions unqualified / nutrients IGNORE proteins / sugars / minerals / salts for phloem DO NOT CREDIT glucose</p> <p>IGNORE continuous tube</p> <p>DO NOT CREDIT holes / pores</p>
Xylem	Phloem													
(named) mineral(s) / salts	sucrose / amino acids													
no, end / cross, walls														
lignin														
(bordered) pits	Plasmodesmata													
	Total		10											

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