OCR
RECOGNISING ACHIEVEMENT

GCE

Biology

Advanced Subsidiary GCE

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

Mark Scheme for June 2013

Oxford Cambridge and RSA Examinations

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

Annotations

Available in SCORIS

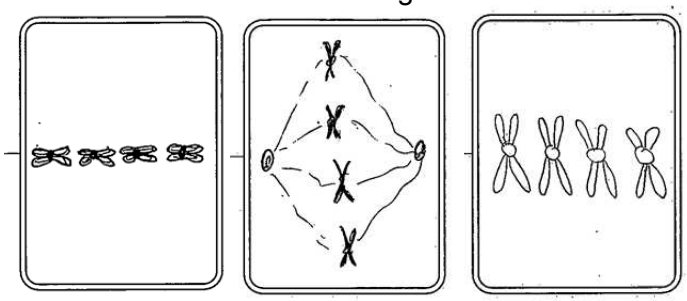
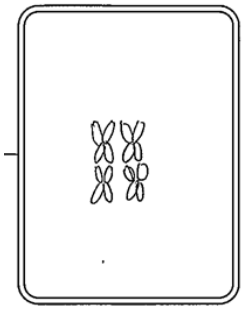
Annotation	Meaning
	Benefit of Doubt
	Contradiction
	Cross
	Error Carried Forward
	Given mark
	Extendable horizontal wavy line
	Ignore
	QWC
	Benefit of the doubt not given
	additional QWC credit given
	Tick
	Tick 1
	Tick 2
	Omission Mark

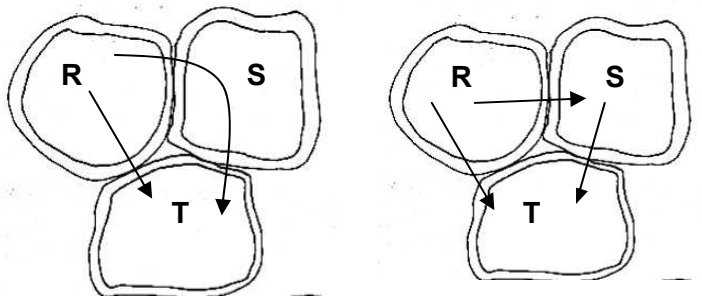
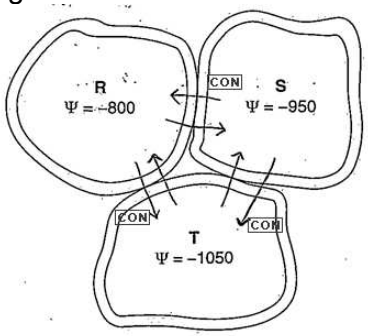
Question			Answer	Marks	Guidance
1	(a)	(i)	**A** nucleus ; **B** chloroplast ;	2	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **DO NOT CREDIT** nuclear envelope / nucleolus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

	(c)		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 **;**	**max 2**	**ACCEPT** distinguish, cells / organelles, (from background) **IGNORE** ref to clarity **IGNORE** substances
			Total	**8**	

Question			Answer	Marks	Guidance
2	(a)	(i)	0.6 : 1 ; ;	2	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 ÷ 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 ;	max 2	**ACCEPT** positive correlation **DO NOT CREDIT** as rate of *diffusion* 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 0.020mms^{-1} which is 0.007mms^{-1} faster than the cube with 0.2:1 SA:VOL ratio
		(iii)	(large plants) have a, small / low, SA : VOL ratio ; *idea of* diffusion too slow (to supply requirements) ; *idea of* need transport system (for water / minerals / assimilates) ; *idea of* 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)
		(ii)	*idea that* student used whole length of side, rather than half length **;**	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)		*squamous epithelium* short(er) diffusion, distance / path **;** *large number of alveoli* large(r) surface area **;** *good blood supply* high / large / steep, concentration gradient OR removes oxygen (from lung surface) / brings carbon dioxide (to lung surface)**;** *good ventilation* high / large / steep, concentration gradient OR supplies oxygen (to alveoli) / removes carbon dioxide (from alveoli) **;**	4	**ACCEPT** reduced / shorter diffusion distance **ACCEPT** thin diffusion barrier **IGNORE** thin diffusion pathway **ACCEPT** increases surface area **IGNORE** SA : Vol ratio **ACCEPT** maintains / creates concentration gradient **IGNORE** ref diffusion gradient **ACCEPT** maintains / creates concentration gradient **IGNORE** ref diffusion gradient **IGNORE** ref to air
			Total	12	

3	(a)	(i)	mitosis / mitotic ;	1	Correct spelling only
		(ii)	four chromosomes on equator ; (each chromosome as) two sister chromatids ;	2	If the image is unclear then pencil or a different colour may have been used - RAISE AN EXCEPTION Award 2 marks for the following  **DO NOT CREDIT** mp 1 if nuclear membrane shown **DO NOT CREDIT** mp 1 if homologous chromosomes paired e.g.  **DO NOT CREDIT** mp 2 if sister chromatids are not joined (at centromere)

		(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 **;**	**2**	e.g.  If contradictory arrows to the above are drawn, apply CON for each arrow going from low Ψ to high Ψ. e.g.  gets 0
	(b)		this is where cambium / meristem / xylem / phloem / vascular bundle, is found **;** mitosis/cell division, occurs in cambium (to produce new cells for growth) **;** new cells, differentiate / specialise, (into xylem and phloem) **;** xylem supplies water for, (cell) elongation / (cell) growth ; phloem supplies, sugars / assimilates, for, energy / growth /respiration **;**	**max 2**	**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 **ACCEPT** cambium differentiates **IGNORE** nutrients

	(c)		tip / apex, of, shoot / root **;** meristem **;** bud **;**	**max 1**	**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** **IGNORE** root or shoot unqualified **ACCEPT** behind root tip
	(d)		allow <u>oxygen</u> to reach, cells / tissues (under bark) **;** for (aerobic) respiration **;** animals transport oxygen in, blood / circulation / transport system **;** plants do not transport (much) oxygen in transport system **;** *idea that* (oxygen not supplied from leaves as) stomata only open in day / no leaves in winter **;**	**max 2**	**IGNORE** refs to need for CO_2 / photosynthesis throughout **ACCEPT** correct formula O_2 **DO NOT CREDIT** oxygen for photosynthesis **ACCEPT** gas(es) for oxygen **ACCEPT** gas(es) for oxygen
			Total	**10**	

Question			Answer	Marks	Guidance
4	(a)	(i)	1 placenta has low pO_2 ;		**ACCEPT** oxygen tension for pO_2 throughout **IGNORE** lower
			2 adult (oxy)haemoglobin will, release O_2 / dissociate, (in, low pO_2 / placenta) ;		
			3 fetal haemoglobin has higher affinity for oxygen / described ;		This must be a comparative statement **CREDIT** *Idea that* fetal haemoglobin picks up more oxygen than the adult haemoglobin at a given pO_2 / fetal haemoglobin picks up oxygen at lower pO_2 **IGNORE** ref to easier / quicker, uptake of O_2
			4 fetal haemoglobin, is (still) able to take up (some) oxygen, in placenta / at low(er) pO_2 ;	max 3	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 pO_2 decreases **ACCEPT** fetal oxyhaemoglobin
		(ii)	(fetal) haemoglobin may not crystallise (much) (at low pO_2) ;		assume candidate refers to fetal haemoglobin unless adult / maternal stated
			red blood cells do not change shape ;		
			(fetal) haemoglobin can pick up more oxygen at low pO_2 (than sickle haemoglobin);		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 pO_2 (than sickle haemoglobin) Allow ref to lower pO_2 unless it is implied that fetal haemoglobin picks up more oxygen at lower pO_2 than higher pO_2
			idea that more oxygen, transported / delivered (around body) ;	max 2	Emphasis for this mp is the distribution of oxygen **IGNORE** more oxygen obtained by person (as this implies breathing)

	(b)		**diffusion ;** from high concentration to low concentration / down **concentration gradient;** (**hydrostatic**) **pressure** in capillary high(er than in tissue fluid) **;** capillary (walls) leaky / described **;** fluid / plasma, forced out (of capillary) OR fluid / plasma, moves, from higher pressure to lower pressure / down pressure gradient **;** (as the fluid / plasma moves out) glucose / oxygen / small molecules, leave with, fluid / plasma **;**	**max 3**	**IGNORE** diffusion of glucose throughout answer 'down diffusion gradient' = 1 for 'diffusion' (mp 1 **not** mp 2) **DO NOT CREDIT** diffusion linked to pressure **ACCEPT** pO_2 for concentration **ACCEPT** permeable **IGNORE** pores / fenestrations / holes **ACCEP**T *idea of* small gaps between cells Emphasis here is on pressure forcing fluid out **DO NOT CREDIT** tissue fluid forced out Emphasis here is on glucose/ oxygen being carried out as a result of mass flow of fluid (not diffusion)
			QWC**;**	**1**	**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)		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
				max 2	e.g. hold binding sites for movement of organelles

	(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**	

<table>
<tr><td>6</td><td>(a)</td><td></td><td>transpiration
loss of water <u>vapour</u> / evaporation of water ;
from, aerial parts of plant / leaves / stomata ;

transpiration stream
movement of water (up xylem vessels) ;
from roots to, leaves / air surrounding leaves ;</td><td>max 3</td><td>IGNORE evaporation of water vapour</td></tr>
<tr><td></td><td>(b)</td><td></td><td>F ;
G ;
K ;</td><td>3</td><td>Only one tick per set – if more than one tick then apply CON
IGNORE crosses and hybrid crosses</td></tr>
<tr><td></td><td>(c)</td><td></td><td><table><tr><th>Xylem</th><th>Phloem</th></tr><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></table></td><td>4</td><td>Award 1 mark for a correct row.

IGNORE ions unqualified / nutrients
IGNORE proteins / sugars / minerals / salts for phloem
DO NOT CREDIT glucose

IGNORE continuous tube

DO NOT CREDIT holes / pores</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>10</td><td></td></tr>
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