

Biology

Advanced GCE F211

Cells, Exchange and Transport

Mark Scheme for June 2010

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Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

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Question			Expected Answers	Marks	Additional Guidance
1	(a)	(i)	A = plasma / cell surface, membrane ; B = DNA / chromosome / chromatin / genetic material ;	2	DO NOT CREDIT membrane, cell membrane DO NOT CREDIT chromosomes (do not accept plural) CREDIT loop of / circle of, DNA DO NOT CREDIT plasmid, RNA ACCEPT nucleoid
1	(a)	(ii)	production of ATP ; <u>aerobic</u> respiration ;	max 1	ACCEPT named stages of aerobic respiration e.g. Krebs cycle, oxidative phosphorylation, ETC, chemiosmosis, link reaction, substrate level phosphorylation DO NOT CREDIT glycolysis, ATP <i>for</i> respiration DO NOT CREDIT <i>produce</i> energy (in form of ATP) IGNORE provide / release energy unqualified
1	(a)	(iii)	protein synthesis / translation ; photosynthesis / described ;	2	ACCEPT production / creation, of proteins / polypeptides, assembly of proteins from amino acids IGNORE autotrophic nutrition DO NOT CREDIT absorption of light unqualified
1	(b)		large surface area to volume ratio ; small so demand for, O ₂ / CO ₂ , is low ; <i>idea of:</i> <u>diffusion</u> (alone) is adequate to meet needs ;	2	ACCEPT large SA:Vol or large SA/Vol ACCEPT small Vol:SA ratio or small Vol/SA DO NOT CREDIT large surface area alone IGNORE gases alone, nutrients ACCEPT <i>idea of</i> : body SA large enough to meet needs by <u>diffusion</u> ACCEPT <i>idea of</i> : <u>diffusion</u> distance short

Question	Expected Answers	Marks	Additional Guidance																		
1 (c)	<table border="1"> <tr> <td>cell / tissue</td> <td>function in the lungs</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td> recoil OR return to original, size / shape OR to help expel air OR prevents alveoli bursting ; </td> <td></td> </tr> <tr> <td></td> <td>waft / wave / move / AW, mucus ;</td> <td></td> </tr> <tr> <td></td> <td>secrete / release / produce, mucus ;</td> <td></td> </tr> <tr> <td></td> <td>constrict the airway / AW ;</td> <td></td> </tr> </table>	cell / tissue	function in the lungs						recoil OR return to original, size / shape OR to help expel air OR prevents alveoli bursting ;			waft / wave / move / AW, mucus ;			secrete / release / produce, mucus ;			constrict the airway / AW ;		4	<p>IGNORE stretch / expand ACCEPT ref to lungs, alveoli, airways recoiling etc DO NOT CREDIT ref trachea / bronchi recoiling</p> <p>ACCEPT transport / remove, mucus DO NOT CREDIT dirt particles without ref to mucus</p> <p>DO NOT CREDIT excrete mucus</p> <p>ACCEPT narrows lumen OR controls, airflow / diameter, of airways DO NOT CREDIT ref to alveoli OR greater airflow</p>
cell / tissue	function in the lungs																				
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	waft / wave / move / AW, mucus ;																				
	secrete / release / produce, mucus ;																				
	constrict the airway / AW ;																				
	Total	11																			

Question		Expected Answers	Marks	Additional Guidance
2	(a)	<p>visible / can be seen / increase contrast ;</p> <p>named example of what is now visible (after staining) ;</p>	2	<p><i>First mark is for 'seeing' and the second mark is for 'recognising' what can now be seen.</i></p> <p>ACCEPT see detail IGNORE ref to resolution</p> <p>ACCEPT recognise different <i>types</i> of white blood cell ACCEPT can (now) see, nucleus / organelles / named organelles IGNORE recognise parts inside red blood cell IGNORE can now see red blood cells (already visible)</p> <p>'can now see red and white blood cells' = 2 marks</p>
2	(b)	(i)	max 1	<p>DO NOT CREDIT shape alone</p> <p>ACCEPT 'you can see what is on the surface' IGNORE 'you see the surface better' because this needs further clarification i.e. features, shape, named structure</p>
		(ii)	max 1	<p>ACCEPT named structure(s) such as lysosome, RER, mitochondrion, ribosome, Golgi , vesicle, nucleolus DO NOT CREDIT nucleus or chloroplast (already visible)</p>

Question		Expected Answers	Marks	Additional Guidance
2	(c)	<p><i>This is a QWC question</i></p> <p>1 fetal <u>haemoglobin</u> has a higher <u>affinity</u> (for oxygen) (than adult haemoglobin) ;</p> <p>2 (fetal Hb) takes up oxygen in low(er) partial pressure of oxygen ;</p> <p>3 placenta has low partial pressure of oxygen ;</p> <p>4 at low partial pressure of oxygen / in placenta, adult (oxy)haemoglobin will dissociate / AW ;</p>	max 3	<p>IGNORE oxyhaemoglobin for haemoglobin ACCEPT Hb for <u>haemoglobin</u> (but not HbO)</p> <p>ACCEPT fetal Hb becomes <i>more</i> saturated at a <i>low(er)</i> partial pressure of oxygen ACCEPT ppO₂ / pO₂ / oxygen tension / O₂ concentration, for partial pressure of oxygen</p> <p>ACCEPT in placenta mother's haemoglobin, releases its oxygen / saturation drops</p>
		QWC (two terms used in correct context and spelt correctly);	max 1	Any two terms from the following: affinity, dissociate / dissociation, placenta, partial pressure / oxygen tension, saturation / saturated

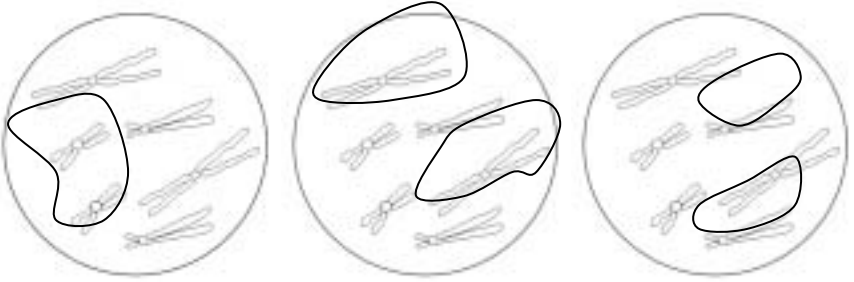
Question			Expected Answers	Marks	Additional Guidance
2	(d)	(i)	curve to right of curve A ; appropriate sigmoid shape ;	2	Curve should start at 0% on y axis and reach at least 80% on y axis
2	(d)	(ii)	<p>1 (actively respiring tissue) needs / requires, <i>more oxygen</i> ;</p> <p>2 for aerobic respiration / to release <i>more energy</i> ;</p> <p>3 (actively respiring tissue produces) <i>more CO₂</i> ;</p> <p>4 haemoglobin involved in transport of CO₂ ;</p> <p>5 less haemoglobin available to combine with O₂ ;</p> <p>6 (Bohr shift) causes <i>more oxygen</i> to be released ;</p>	max 2	<p><i>idea of 'more'</i> should be clear as shown (MP 1,2,3,6)</p> <p>ACCEPT make <i>more ATP</i></p> <p>ACCEPT produces <i>a lot of CO₂</i> / as CO₂ levels rise</p> <p>CREDIT detail to include carbonic acid dissociation / formation of haemoglobinic acid / HHb etc</p> <p>DO NOT CREDIT oxygen released <i>more quickly</i> / quicker</p> <p>ACCEPT oxygen released <i>more, readily / easily</i></p> <p>'More CO₂ produced so more O₂ released' = 2 marks</p>
Total				12	



Question			Expected Answers	Marks	Additional Guidance
3	(a)	(i)	<p>1 at low temperatures, all stain is in cells OR no stain in surrounding solution ;</p> <p>2 (taken up / held) against, diffusion / concentration, gradient ;</p> <p>3 at high temperature stain not held in cells ;</p> <p>4 at high temperature enzymes denatured so no ATP for active transport (of stain) ;</p> <p>5 use of correct comparative figs to illustrate a point ;</p> <p>AVP ; ;</p>	max 2	<p><i>MP 1 awarded for observation that the stain was no longer in the surrounding solution and not for the % of cells containing the stain.</i></p> <p>ACCEPT the stain is not evenly distributed between cells and solution ACCEPT stain doesn't move out of cells</p> <p>ACCEPT <i>up</i> the diffusion gradient</p> <p>ACCEPT solution now contains stain ACCEPT 0% = none / no cells (stained)</p> <p><i>MP 1 and 3 - must be stated rather than inferred from quoted figs</i></p> <p>IGNORE 'enzymes denatured' alone CREDIT active transport / carrier, proteins denatured ACCEPT mitochondria stopped working so no ATP produced</p> <p>e.g. 97% at 30°C but 0% at 80°C IGNORE figs without units</p>

Question			Expected Answers	Marks	Additional Guidance
3	(a)	(ii)	cells, dead / not respiring ; no, (metabolic) energy / ATP, to take up stain ; AVP ;	max1	DO NOT CREDIT 'burst' as these cannot be seen ACCEPT inhibitor present / membrane impermeable ACCEPT no functioning mitochondria
3	(b)	(i)	(membrane) structure disrupted ; (phospho)lipid bilayer, melts / more fluid ; (membrane) proteins / carrier molecules, denatured / unable to function ; (membrane) becomes more permeable ;	max 1	<i>Mark first suggestion and if correct award mark – if further answers contradict first answer do not award mark.</i> ACCEPT damaged, destroyed, break down IGNORE <i>membrane</i> , denatured / more fluid IGNORE lipid <i>molecules</i> melt ACCEPT lose shape for denatured ACCEPT leaky IGNORE refs to bonds breaking

Question			Expected Answers	Marks	Additional Guidance
3	(b)	(ii)	<p>membrane <u>permeable</u> (to stain) ;</p> <p>methylene blue, leaked out of cells / released to solution ;</p> <p>by diffusion / down concentration gradient ;</p>	max 2	<p>IGNORE leaky</p> <p>ACCEPT stain / blue / pigment, moved out</p> <p>IGNORE lost <i>colour</i> / <i>colour</i> moved out (it is in stem of question)</p> <p>ACCEPT by active transport (assuming thermostable enzymes)</p> <p>blue / stain, diffuses out = 2 marks</p>
3	(c)		<p><i>accuracy</i></p> <p>take readings at intermediate temperatures (between 50 °C – 70 °C) ;</p> <p><i>reliability</i></p> <p>take more, readings at each temperature / repetitions ;</p>	2	<p><i>Mark first suggestion only</i></p> <p>DO NOT CREDIT wider temperature range OR more temperatures unqualified OR more regular intervals</p> <p>ACCEPT take readings every 5 degrees / °C</p> <p>ACCEPT ref. to haemocytometer</p> <p>ACCEPT colorimeter used to measure colour intensity of blue solution</p> <p>DO NOT CREDIT ref to use of calorimeter</p> <p>ACCEPT repeat experiment (ideally 3 readings for each temperature) , increase the number of cells observed</p> <p>ACCEPT replica / replicate for repeat</p>

Question		Expected Answers	Marks	Additional Guidance
3	(d)	<p>nucleus divides / mitosis ;</p> <p><i>idea of :</i></p> <p>cell, swells on one side / bulges ;</p> <p>nucleus / cytoplasm / organelles, move into, bud / bulge ;</p> <p>pinches off / cell wall forms, (so bud becomes a separate cell) ;</p>	max 2	<p>ACCEPT asexual reproduction / cloning IGNORE cell splits, ref to genetically identical cells</p> <p>IGNORE <i>bud</i> forms on side</p> <p>IGNORE replicated DNA enters bud</p> <p>ACCEPT cytokinesis IGNORE two cells are formed / bud separates unqualified</p>
Total			10	

Question			Expected Answers	Marks	Additional Guidance
4	(a)	(i)	<p><i>plant cell / Y, has:</i> a wall ; chloroplasts ; vacuole ;</p>	max 2	<p>Credit reverse argument</p> <p>ACCEPT thylakoid, discs / membranes OR granum(a) IGNORE chlorophyll</p>
4	(a)	(ii)	<p>A1 a vacuole ; E1 to take up water / to become turgid ;</p> <p>A2 cell wall thicker on one side ; E2 causes, cell to bend / open stoma(ta) ;</p> <p>A3 mitochondria ; E3 generates ATP (for active transport) ;</p>	max 2	<p><i>Mark adaptation (A) as stand-alone</i> <i>Ensure explanation (E) stated is appropriately linked to adaptation</i></p> <p>DO NOT CREDIT curved cell wall / thick cell wall unqualified ACCEPT close stoma(ta) if adaptation correct</p> <p>IGNORE ref to chloroplasts</p>
4	(b)	(i)	two homologous chromosomes circled ;	1	<p>ACCEPT one circle around both chromosomes or two circles The two chromosomes must be of same length</p> 

4	(b)	(ii)	three chromosomes, one from each pair ; chromosomes drawn as one bar ;	2	<i>Chromosomes should be of different lengths however if two are of similar length, look for different centromere position to award mark</i> ACCEPT  DO NOT CREDIT two joined together at centromere 
			Total	7	

Question			Expected Answers	Marks	Additional Guidance
5	(a)	(i)	osmosis ;	1	
		(ii)	2 = symplast (pathway) ; 3 = apoplast (pathway) ;	2	ACCEPT symplastic ACCEPT apoplastic
		(iii)	S ;	1	

Question	Expected Answers	Marks	Additional Guidance
5 (b)	<p><i>This is a QWC question</i></p> <p>1 water moves into xylem down water potential gradient ;</p> <p>2 root pressure / high (hydrostatic) pressure at bottom of xylem ;</p> <p>3 water vapour loss / transpiration / evaporation, at leaves / top of plant ;</p> <p>4 (creating) low (hydrostatic) pressure at top of xylem ;</p> <p>5 water, under tension / pulled up (in a continuous column) ;</p> <p>6 cohesion between water molecules / described ;</p> <p>7 adhesion of water molecules to xylem / described ;</p> <p>8 capillary action / described ;</p> <p>9 water moves up (xylem / stem) by mass flow ;</p> <p>10 from high(er) (hydrostatic) pressure to low(er) (hydrostatic) pressure / down (hydrostatic) pressure gradient ;</p>	max 4	<p>ACCEPT ψ for water potential</p> <p>ACCEPT water moves from high ψ to low ψ</p> <p>IGNORE drawn for pulled up</p> <p>ACCEPT ref to xylem being very narrow so water rises</p>
	<p>QWC (three terms used in correct context and spelt correctly) ;</p>	1	<p>Any three terms from the following :</p> <p>water potential, hydrostatic pressure, transpiration / evaporation, cohesion / cohesive, adhesion / adhesive, tension, root pressure, capillary action / capillarity, mass flow</p>

Question	Expected Answers	Marks	Additional Guidance																		
5 (c)	<table border="1"> <tr> <td>xylem vessel</td> <td>phloem sieve tube element</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> </tr> <tr> <td>present</td> <td>absent</td> <td>;</td> </tr> <tr> <td>present</td> <td>absent</td> <td>;</td> </tr> <tr> <td>(water and), minerals / ions / salts</td> <td>products of photosynthesis / sucrose / assimilates / amino acids / minerals / ions / salts / plant 'hormones'</td> <td>;</td> </tr> <tr> <td>(only) up stem / towards leaves</td> <td>both directions / up and down / from source to sink</td> <td>;</td> </tr> </table>	xylem vessel	phloem sieve tube element					present	absent	;	present	absent	;	(water and), minerals / ions / salts	products of photosynthesis / sucrose / assimilates / amino acids / minerals / ions / salts / plant 'hormones'	;	(only) up stem / towards leaves	both directions / up and down / from source to sink	;		<p><i>One mark per row</i> <i>Both statements must be correct to achieve mark</i></p> <p>DO NOT CREDIT ticks and crosses</p> <p><i>Read whole list – if any suggestion is wrong then do not award mark</i> <i>XYLEM</i> DO NOT CREDIT 'nutrients' OR 'water' alone <i>PHLOEM</i> ACCEPT 'sugar' in place of sucrose IGNORE unspecified 'solutes' DO NOT CREDIT glucose</p> <p>ACCEPT arrows ↑ (xylem) ↓↑ (phloem) DO NOT CREDIT 'all directions' IGNORE ref to pits / lateral movement</p>
xylem vessel	phloem sieve tube element																				
present	absent	;																			
present	absent	;																			
(water and), minerals / ions / salts	products of photosynthesis / sucrose / assimilates / amino acids / minerals / ions / salts / plant 'hormones'	;																			
(only) up stem / towards leaves	both directions / up and down / from source to sink	;																			
	Total	13																			

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6	(a)	a single value between 67 and 80 ; ;	max 2	two marks for correct answer If answer incorrect, allow one mark for appropriate working i.e. 60 divided by time from trace selected by candidate
6	(b)	heart rate, slower / lower / reduced / 60 – 63 beats per minute ; rest period / diastole longer ; ventricle takes longer to contract / ventricular systole longer ;	max 2	<i>Mark first point on each numbered line</i> ACCEPT length of one beat is longer DO NOT CREDIT 'slows heart's activity' ACCEPT T wave elongated / increases from 0.24s to 0.32s / increases by 0.1 s IGNORE name of chamber ACCEPT R wave slightly elongated / increases from 0.07s to 0.12s / increases by 0.05 s
6	(c)	SAN, is pacemaker / initiates heart beat ; (SAN sends) impulse / wave of excitation, over atria (walls) ; AVN delays impulse ; (AVN) sends impulse down, septum / bundle of His / Purkyne fibres ;	max 3	ACCEPT <i>starts</i> , wave of excitation / action potential / electrical impulse IGNORE 'sends out' (wave) IGNORE <i>through / to</i> , the atrium DO NOT CREDIT signal / message for impulse, allow ecf DO NOT CREDIT pulse IGNORE delays contraction ACCEPT Purkinje
Total			7	

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