OCR
RECOGNISING ACHIEVEMENT

GCE

Human Biology

Advanced Subsidiary GCE

Unit **F221:** Molecules, Blood and Gas Exchange

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 used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
	Correct answer
	Incorrect response
	Benefit of Doubt
	Not Benefit of Doubt
	Error Carried Forward
	Given mark
	Underline (for ambiguous/contradictory wording)
	Omission mark
	Ignore
	Correct response (for a QWC question)
	QWC* mark awarded
	Verbal Construction

**Quality of Written Communication*

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>
<table>
<tr><th>statement</th><th>α-glucose</th><th>glycogen</th><th>both α-glucose and glycogen</th><th></th></tr>
<tr><td>a carbohydrate</td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>insoluble in water</td><td></td><td>✓</td><td></td><td>;</td></tr>
<tr><td>a polysaccharide</td><td></td><td>✓</td><td></td><td>;</td></tr>
<tr><td>may affect the water potential of blood</td><td>✓</td><td></td><td></td><td>;</td></tr>
<tr><td>formed by condensation reactions</td><td></td><td>✓</td><td></td><td>;</td></tr>
<tr><td>a hexose sugar</td><td>✓</td><td></td><td></td><td>;</td></tr>
</table>
</td><td>5</td><td>Award 1 mark for each correct row.

Candidates' symbols must indicate correct answers without ambiguity.

DO NOT CREDIT hybrid ticks
IGNORE crosses</td></tr>
</table>

Question			Answer	Marks	Guidance
	(b)	**(i)**	*idea of* lots of 'ends' for enzyme attachment **;** glucose / monomers **,** can be **,** released / added **,** quickly **;**	2	**ACCEPT** glucose can attach or release from multiple ends **CREDIT** glycogen can be hydrolysed or built up quickly **IGNORE** easily released or easily added
		(ii)	muscle (cells) **;**	1	
	(c)		differential (stain) **;**	1	**IGNORE** named stain **DO NOT CREDIT** indicator
	(d)		nuclei (of leucocytes) take up the stain **;** *idea that* different leucocytes have different shaped nuclei **;**	2	**CREDIT** named leucocyte with correct description of nucleus shape
	(e)		**1** drop (of fluid containing cells) placed on slide and spread **;** **2** allow to (air) dry **;** **3** fix with **,** methanol / alcohol **;** **4** add stain **;** **5** rinse with water **;**	3	**Marking points 3 - 5 must be in the correct sequence** **IGNORE** ethanol
			Total	**14**	

Question			Answer	Marks	Guidance
2	(a)		20.6 **;**	2	**Correct answer = 2 marks** If the answer is incorrect **CREDIT** 1 mark for working $\frac{72mm}{3500}$ or $\frac{7.2cm}{3500}$ or $\frac{72000}{3500}$ If the answer is not given to 1dp **CREDIT** 1 mark for a correctly calculated unrounded answer
	(b)	(i)	chloroplast **;** mitochondrion **;** (secretory) vesicles **;**	2	**Mark the first TWO answers.** **IGNORE** lysosome **DO NOT CREDIT** centriole
		(ii)	nucleolus **;**	1	
		(iii)	protein synthesis **;**	1	**ACCEPT** description e.g. assembles amino acids into polypeptide
			Total	**6**	

Question			Answer	Marks	Guidance
3	(a)		**1** (haemoglobin) has four **polypeptide** chains **;** **2** (haemoglobin) has four **,** **prosthetic** / haem **,** groups **;** **3** haem / prosthetic **,** group contains **iron** (**ion**) **;** **4** each **,** iron (ion) / haem **,** can carry one **,** oxygen <u>molecule</u> / O_2**;** **5** forms **oxyhaemoglobin ;** **6** AVP **;**	4	**1** **CREDIT** two alpha and two beta chains referenced to protein structure **3** **CREDIT** ferrous (ion) / Fe^{2+} **4** **DO NOT CREDIT** ref to oxygen atoms (as carried as a molecule) or 'oxygen' unqualified **6** eg *idea of* cooperative binding temporary binding can pick up and drop off O_2 reversible binding saturated when four O_2 bound ***Note*** 'haemoglobin has four iron-containing haem groups, carrying a total of eight oxygen atoms' = 2 marks (mps 2 & 3) **only**
			QWC **;**	1	**Two** of the following terms, used in the appropriate context with correct spelling: **polypeptide** **prosthetic** **iron** **ion** **oxyhaemoglobin**

Question			Answer	Marks	Guidance
3	(b)		dissolved in plasma **;**	1	
	(c)	(i)	*mean oxygen consumption* **1** increases rapidly in first minute **;** **2** increases less rapidly between 1 and 4 minutes **;** **3** plateaus after 4 minutes **;** **4** comparative figures with units stated**;**	3	**4** eg increases from 0.5 to 1.5 $dm^3 min^{-1}$ between 0 and 1 min **CREDIT** a calculated difference eg consumption increases by 1 $dm^3 min^{-1}$ in the first minute
		(ii)	data for plot at one minute is more reliable / data for plot at two minutes is less reliable **;**	1	**DO NOT CREDIT** if accuracy / validity also mentioned
		(iii)	circle around the plot at 5 minutes **;**	1	
		(iv)	*idea that* most of the data must be at the upper end of the range **or** just one very low result (that would be anomalous) **;**	1	
			Total	**12**	

Question			Answer	Marks	Guidance
4	(a)		polar / a dipole **;** hydrogen **;** solvent **;** non-polar / hydrophobic **;**	4	
	(b)	(i)	sodium <u>ions</u> **;** potassium <u>ions</u> **;** calcium <u>ions</u> **;** AVP **; ;**	2	**Mark the first TWO answers.** **CREDIT** two named <u>ions</u> found in plasma – the answer must either contain the word 'ion' or be the correct chemical symbol with correct charge or be the correctly named anion **CREDIT** Na^+ or Na ions **CREDIT** K^+ or K ions **CREDIT** Ca^{2+} or Ca ions maximum of 2 from eg chloride / phosphate / hydrogencarbonate / sulfate
		(ii)	**1** electrolytes **,** dissolve / are soluble **,** in blood plasma **;** **2** (dissolved) electrolytes lower water potential (of plasma) **;** **3** electrolytes maintain **,** osmotic balance / water potential **,** (of plasma) **;** **4** *idea of* regulation of blood pH **;**	2	**3** **CREDIT** a consequence of imbalance eg low / high blood pressure eg damage to cells caused by osmosis **4** **CREDIT** role as buffers

Question			Answer	Marks	Guidance
	(c)	(i)	**1** detail about preparing the patient **;** **2** electrodes placed on the **,** body / skin **;** **3** (placed on) chest and arms and legs **;**	2	**1** eg patient removes clothing (from upper body) patient **,** lies down / remains still cream used on patient's skin **2** **ACCEPT** electrodes placed on chest ***Note*** 'electrodes placed on chest, arms and legs' = 2 marks (mp 2 and 3)
		(ii)	bradycardia **;** heart attack / myocardial infarction / ischaemia **;** heart block **;** atrial fibrillation **;** ventricular fibrillation **;** pulmonary embolism **;** hypertrophy **;** arrhythmia **;**	2	**Mark the first two answers.** **IGNORE** CHD / angina / heart murmurs / cardiac arrest
			Total	**12**	

Question			Answer	Marks	Guidance
5	(a)	(i)	*idea that* flow of the blood is being smoothed out **;** *idea of* progressively less elastic **,** tissue / recoil **;** *idea that* energy expended as walls of **,** arteries / arterioles **,** are stretched and recoil **;** *idea that* contractions of heart have less effect as distance from heart increases **;**	2	**IGNORE** statements that refer to overall drop in blood pressure as question refers to the rise and fall of the trace
		(ii)	artery has higher (blood) pressure **or** vein has lower (blood) pressure **;**	1	Statement must be comparative.
	(b)		*endothelium* reduces friction **;** *elastic fibres* allows recoil **;** *collagen fibres* protects from damage **;**	3	**IGNORE** to maintain pressure **ACCEPT** stretch and recoil **IGNORE** supports the vein to withstand high pressure (applies to arteries)
	(c)		*idea that* blood 'pools' in vein(s) **;**	1	**ACCEPT** blood flows backwards
			Total	**7**	

Question			Answer	Marks	Guidance
6	(a)		**1** (stored whole) blood contains **,** (clotting) **protein**s / enzymes **;** **2** proteins / enzymes **,** have **specific ,** 3D shape / **tertiary** structure **;** **3** **ionic bond**s / **hydrogen bond**s **,** are disrupted / broken **,** by extremes of pH (from optimum) **;** **4** proteins / enzymes **,** would be **denatured ;** **5** **active site** changes shape **;**	3	**IGNORE** ref to making sure that it remains suitable for use (as given in Q) **DO NOT CREDIT** disulfide bonds are disrupted by extremes of pH **ACCEPT** idea that active site is no longer complementary to substrate
			QWC **;**	1	**Two** of the following terms, used in the appropriate context with correct spelling: **protein**(s) **specific** **ionic bond**(s) **hydrogen bond**(s) **denatured** **active site** **tertiary**

Question			Answer	Marks	Guidance
	(b)	(i)	**1** kinetic energy of molecules increases **;** **2** more successful collisions between enzyme and substrate molecules **or** more enzyme-substrate complexes formed **;** **3** increased rate of (enzyme) reaction **;** **4** product formed more quickly **or** (stored) blood would clot more quickly**;**	3	**1 CREDIT** kinetic energy of enzyme and / or substrate increases **2 CREDIT** named substrate and named enzyme **ACCEPT** more ESCs formed **3 IGNORE** increasing enzyme activity (as given in diagram) **4 ACCEPT** fibrin formed more quickly
		(ii)	4 ^{o}C **;**	1	**CREDIT** any value between 2 ^{o}C and 6 ^{o}C
	(c)		removes **,** cofactor / calcium ions **;**	1	**CREDIT** removes Ca ions / removes Ca^{2+}
			Total	**9**	

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