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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Biology / Biology (Human) 5411 / 5413

Specification A

BYA1 Molecules, Cells and Systems

Mark Scheme

2008 examination - January series

For confidential packs

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Dr Michael Cresswell Director General

Question 1

(a)	(i)	Hydrogen/H (bond);		1
	(ii)	Binds cellulose (molecules) together/forms fibrils *(reject fibres)*; Strengthens wall/cellulose fibres are strong; Can resist turgor pressure/osmotic pressure/pulling forces;		2 max
(b)	(i)	N(itrogen);		1
	(ii)	Condensation/Polymerisation		1
(c)	(i)	Glycogen;		1
	(ii)	Starch/amylose/amylopectin;		1
			Total	7

Question 2

(a)	(i)	Right atrium;		1
	(ii)	Pulmonary artery;		1
(b)		Thicker muscle/wall/stronger contraction; Of left ventricle;		2
(c)		Delay at atrioventricular node/AVN; Travels to apex/bottom of heart/down bundle of His/Purkyne tissue;		2
(d)	(i)	Parasympathetic/vagus;		1
	(ii)	Sinoatrial node/SAN sends fewer impulses/waves of excitation; Heart rate slower/beats less often; Cardiac output = heart rate x stroke volume;		2 max
			Total	9

Question 3

(a) Group of similar cells/cells with same origin (performing a particular function); 1

(b) 7.5; 1

(c) (i) **B**; 1

(ii) Increased rate of diffusion/more oxygen diffuses/diffusion depends on surface area; 1
Accept diffusion quicker/more efficient. Reject easier

(d) Sucrose solution has lower/more negative water potential/ red blood cell has higher/less negative water potential;
Water moves out of cell by osmosis;
Volume of cytoplasm becomes less; 2 max

(e) Dissolves (phospho)lipids in plasma/cell membrane/bilayer;
Haemoglobin released into solution/ red due to haemoglobin; 2

Total 8

Question 4

(a) Warm/heat/boil with Benedict's solution;
Stays blue/test is negative/does not turn red/orange etc; 2
Do not allow unqualified references to water baths

(b) **Y;**
As three spots present/sucrose, glucose and fructose/both products; 2

(c) Run chromatogram with fructose;
Calculate Rf value (from fructose chromatogram);
As distance moved by substance divided by distance moved by solvent front;
Find spot with same Rf; 3

Total 7

Question 5

(a) (i) Accept any answer between 0.001 and 0.9 as thinner than that of artery (and thicker than that of capillary); 1

(ii) Accept any answer less than 4.0 as blood pressure in vein must be lower than in capillary/blood only flows down a pressure gradient/ pressure lost in capillary; 1

(b) (Leg) muscles contract;
Giving high pressure/ increase pressure of blood in vein;
Valve behind/below closes and prevents backflow/ only valve in front/ above will open; 3

Total 5

Question 6

(a) (i) 0; 1

(ii) Amount of substrate/hydrogen peroxide less;
Fewer collisions with active site (of enzyme)/ fewer E-S complexes formed; 2

(b) Allow 1 mark for a curve showing a decrease but no increase
Allow 2 marks for a curve showing a decrease with maximum at start and falling to zero; 2

(c) Add biuret;
Lilac/purple/mauve; 2
Ignore references to precipitate; do not accept blue or pink although blue-purple would be acceptable.

(d) Rate of reaction will be lower if pH not at optimum/ works best at optimum;
Shape/charge on active site changed/ enzymes denatured/ loses tertiary structure;
Substrate will not fit/bind/form E-S complexes; 2 max

Total 9

Question 7

(a) (i) Large surface area/ SA:volume ratio;
For diffusion/ gas exchange/ oxygen absorption;
A lot of oxygen used in respiration; 2 max

(ii) Alveolar epithelium;
Capillary epithelium/endothelium; 2

(iii) Diffusion rate proportional to concentration gradient;
Capillaries remove oxygenated blood/maintain (oxygen) gradient/replace deoxygenated blood;

OR

Diffusion rate proportional to surface area;
Large amount of capillary surface; 2 max
Accept full statement of Fick's law for first marking points but must relate to diffusion and be correct In the expression do not credit the following
Ficks law rather than rate of diffusion
= rather than is proportional to
Concentration rather than differences in concentration

(b) 75 times;
Pulmonary ventilation = breathing rate x tidal volume; 2

(c) Pulmonary vein, aorta; *Ignore other correct information* 1

(d) 1 Impulses from medulla linked to inspiration; *reject messages and signals*
2 Contraction of diaphragm/intercostal muscles; *ignore external/internal*
3 Diaphragm flattens/ribs move up and out;
4 Volume of lungs increases and pressure falls;
5 Stretch receptors stimulated;
6 Lack of impulses from medulla linked to expiration;
7 Relaxation of diaphragm/intercostal muscles;
8 Internal intercostal muscles contract during deeper expiration/exercise;
9 Phrenic nerve identified; 6 max
If not awarded for inspiration points 3,4 and 5 can be awarded for expiration

Total 15

Question 8

(a) Cell S has more rough endoplasmic reticulum;
Ribosomes are site of protein/enzyme synthesis/
where enzymes are made; 2

(b) (i) Inner membrane folded/forms cristae; 1

(ii) Fewer folds/cristae in cell R; 1
Accept converse; unqualified descriptions refer to cell R.

(c) Only eukaryotic cells have membrane bound organelles;
Nucleus/nuclear envelope;
Endoplasmic reticulum;
Mitochondria;
Lysosomes;
Smaller percentage of membrane is plasma membrane;
Do not have mesosomes; 2
Accept converse; unqualified descriptions relate to cell R. Note that this is an animal cell. Do not accept general statement about membrane-bound organelles in addition to rough endoplasmic reticulum/mitochondria and lysosomes.

(d) Rate of uptake increases then levels out;
At approximately 3 (mmol dm^{-3}); 2

(e) Limited by carrier molecules/ proteins/ carriers are saturated; 1

(f) 1 Homogenise/chop (or otherwise crudely break) leaves;
2 Suspend in/mix with buffer;
3 Cold and isotonic;
4 Filter and centrifuge filtrate;
5 At low speed;
6 Discard pellet/keep supernatant;
7 Centrifuge again at faster speed
8 Chloroplasts are in pellet (formed by second centrifugation); 6 max

Total 15