



ASSESSMENT and  
QUALIFICATIONS  
ALLIANCE

**General Certificate of Education**

**Biology/Human Biology**

**5411/5413**

*Specification A*

**BYA1          Molecules, Cells and Systems**

**Mark Scheme**

*2007 examination - June series*

*For Confidential Packs*

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**Question 1**

(a)	(i)	COOH;	1
	(ii)	Peptide (bond); <i>Allow named bond relating to tertiary structure. Reject polypeptide bond.</i>	1
(b)	(i)	Hydrolysis;	1
	(ii)	Only these substances have the right shape/structure (complementary $\Xi$ shape); To fit/bind with active site/form ES complex with active site; or Only trypsin has right-shaped active site; To bind/fit with substrate/ to form ES complex;	2
(c)	(i)	Run chromatogram then turn through 90°/right angle; With a different solvent;	2
	(ii)	Spreads spots/polypeptides out more/ make sure spot only contains one substance;	1
(d)		Haemoglobins will differ in their amino acids; Different <u>pieces</u> result when cut by enzymes; Different <u>pieces</u> will move to different positions/different distances/ have different Rf	2 max
			Total 10

**Question 2**

(a)		Nucleus round/kidney shaped/not lobed; <i>Accept drawings</i>	1
(b)	(i)	Granulocytes are transparent/colourless/stain shows different structures/ shows nucleus;	1
	(ii)	Measure diameter of field with ruler/other appropriate device; Find proportion taken up by granulocyte; or (Measure length) with (eyepiece) graticule/eyepiece scale; Calibrate with stage micrometer/something of known length/ red blood cell;	2
(c)	(i)	Protein <u>and</u> polysaccharides;	1
	(ii)	Granulocyte is eukaryotic; Granulocyte has (membrane-bound) organelles/ named example; (organelle) surrounded by membrane;	2 max
	(iii)	(More in) plant cell as it has a cell wall; Made of cellulose; (Stores large amount of) starch;	2 max
			Total 9

**Question 3**

- |     |      |   |         |
|-----|------|---|---------|
| (a) | (i)  | Box enclosing H from one OH group and OH from the other;  | 1       |
|     | (ii) | C <sub>12</sub> ; H <sub>22</sub> O <sub>11</sub> ;   | 2       |
| (b) |      | Heat/warm with Benedict's solution;<br>Turns green/yellow/orange/red;<br><i>Do not credit use of a water bath unless some indication of temperature provided.</i> | 2       |
| (c) |      | Different number of glucose (units);<br>(Different proportions of) amylose/amylopectin;<br>Different number of branches in molecule/ branches in different places | 1       |
|     |      |   | Total 6 |

**Question 4**

- |     |      |   |         |
|-----|------|---|---------|
| (a) |      | Active site not totally complementary/does not match exactly;<br>Wraps round substrate/ Enzyme changes shape; | 2       |
| (b) | (i)  | Substrate used up/decreases (as time passes);   | 1       |
|     | (ii) | Heating provides more (kinetic) energy;<br>Molecules move faster;<br>More collisions/ES complexes formed;     | 3       |
| (c) |      | Denaturing of enzyme; <i>Accept clear description</i>   | 1       |
|     |      |   | Total 7 |

**Question 5**

- |     |      |  |         |
|-----|------|--|---------|
| (a) | (i)  | They are sections/ cut;<br>Through different planes/parts of cell/ viewed from a different angle;<br>Cells also distorted by passage through capillaries;  | 2 max   |
|     | (ii) | One mark for correct answer of 0.8 – 1.4 µm<br>One mark for dividing measured length by magnification;<br><i>Be reasonable about accepting value for minimum diffusion distance. Answers just outside this range should be accepted providing evidence of method used is sufficiently clear.</i> | 2       |
| (b) | (i)  | (Lining of) alveoli moist/surface film of fluid/water;<br>Evaporates;<br>Due to warm body temperature;   | 2 max   |
|     | (ii) | More carbon dioxide <u>and</u> less oxygen;<br><i>Reference to nitrogen must refer to concentration</i>  | 1       |
|     |      |  | Total 7 |

**Question 6**

- (a) Path marked unambiguously from posterior vena cava to left pulmonary artery; 1
- (b) Increase in blood pressure cause them to stretch/ stretch at high pressure;  
And recoil; 2  
*Do not give credit for references to contracting and relaxing.*
- (c) (i) Sinoatrial node/SAN; 1  
*Do not give credit to pacemaker in the context of this question.*
- (ii) Impulse(s); (*only award in context of nerve supply to heart*)  
Pass along parasympathetic/vagus nerve;  
Lowers rate of impulses/discharge from B/SAN;  
Fewer (impulses) along sympathetic/ accelerator; 2 max
- Total 6

**Question 7**

- (a) (i) (Group of) cells which have a common origin/ similar;  
*Ignore references to function.* 1
- (ii) Gills/mouth/gut; *Reference to lungs negates answer* 1
- (b) Water potential of higher/less negative than sea water/surroundings;  
Water moves (out) by osmosis;  
Ions diffuse (in)/ move from higher concentration (in sea water); 3
- (c) Mitochondria provide ATP/ release energy; *Ignore references to making or producing energy*  
In respiration;  
Higher concentration in sea water/ lower concentration in fish/ movement against concentration gradient; 2 max
- (d) Water and oxygen have similar sized molecules/small molecules/ oxygen (slightly) larger than water;  
Would expect both to be able to diffuse through skin; 2
- (e) 1 Breaks bonds (holding tertiary structure/shape);  
2 Such as hydrogen bonds/disulphide bonds;  
3 Protein loses shape/tertiary structure;  
4 Active site (of enzymes) affected;  
5 Substrate no longer able to fit/bind/form ES complex;  
6 Receptor/binding sites on carrier proteins lose shape/affected;  
7 Therefore unable to move substances by active transport;  
8 And facilitated diffusion;  
9 (Ion) channel distorted/change shape; 6 max
- Total 15

**Question 8**

- (a) Ventricle contracts/ systole;  
(Blood enters aorta) through semilunar valves/semilunar valves open; 2
- (b) (i) Pressure lower (in pulmonary artery); 1
- (ii) Right ventricle has thinner wall/less muscle/does not contract as strongly; 1
- (c) Two marks for correct answer of 1.13 s  
One mark for incorrect answer clearly derived from subtracting 0.37 from length of heartbeat; 2
- (d) (i) Decreases but less steeply with increasing heart rate; 1
- (ii) Filling time decreases so shorter cardiac cycle/greater heart rate;  
Emptying time remains the same so (likely to) pump out as much blood/  
stroke volume unchanged; 2
- (e) 1 Contains no nucleus/ mitochondria/ organelles;  
2 Haemoglobin;  
3 Biconcave shape/small size; *Allow description*  
4 Large surface area to volume;  
5 For diffusion;  
6 Disc means short distance to "centre" of cell/ no point far from surface;  
7 Approx same size/diameter as capillary;  
8 Only pass down in "single file"/ slow passage down capillary gives time for diffusion/uptake;  
9 (Surface pressed against capillary wall therefore) short distance for oxygen to travel; 6 max
- Total 15