



ASSESSMENT and  
QUALIFICATIONS  
ALLIANCE

**General Certificate of Education**

**Biology/Human Biology**

**5411/5413**

*Specification A*

**BYA1          Molecules, Cells and Systems**

**Mark Scheme**

*2007 examination - January series*

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

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**Question 1**

- (a) Mix with ethanol/alcohol/meths then water;  
Milky/white (emulsion)/ emulsion produced; 2  
*Do not accept unqualified reference to cloudy.*  
*Ignore incorrect references to precipitate etc.*  
*"Do the emulsion test" gets mark for result.*
- (b) (i) Glycerol; 1
- (ii) Has a phosphate/ (only) two fatty acids; 1  
*Unqualified references refer to the phospholipids shown in the diagram*
- (iii) 
$$\begin{array}{c} \text{H} - \text{C} - \text{H} \\ | \\ \text{H} - \text{C} - \text{H} \\ | \\ \text{H} - \text{C} - \text{H} \\ | \\ \text{H} \end{array}$$
  
/ CH<sub>2</sub>CH<sub>2</sub>CH<sub>3</sub>; 1
- (iv) Hydrophobic/"hate" water/ non-polar;  
Attracted to tails of other phospholipids /  
tails face inwards/away from water; 2
- Total 7**

**Question 2**

- (a) (i) Decreases then increases; 1
- (ii) Move up/out;  
Increasing volume; 2
- (b) Rate of diffusion is proportional to;  
*Accept equals*  
(Surface) area x difference in concentration/concentration gradient  
Thickness (of exchange surface) ; 2
- (c) (i) Smaller area;  
Therefore (rate of) diffusion (of oxygen) will be lower; 2
- (ii) Breathing out removes carbon dioxide (from the lungs);  
Increases difference in concentration / increases concentration gradient; 2
- Total 9**

**Question 3**

- (a) (i) **E**/exocytosis; 1
- (ii) **C**/osmosis; 1
- (iii) **D**/active transport: 1
- (b) (i) Movement is against concentration gradient;  
As hardly any potassium ions in external solution /  
final concentration very low; 2
- (ii) Final concentration high(er)/same as original / less taken up;  
Link between oxygen and respiration;  
Less/no ATP/energy released; 3  
*Do not credit last point if answer refers to 'making energy'*
- (c) Water has been absorbed (increasing the calcium concentration); 1

**Total 9**

**Question 4**

- (a) (i) Left ventricle; 1
- (ii) Higher pressure / stronger contraction to pump blood round/to body; 1
- (b) (i)

Open	Closed
Semi-lunar valve	Atrio-ventricular valve;

- Accept other non ambiguous names for these valves or descriptions of valve locations* 1
- (ii) Heart rate increases / length of cardiac cycle shorter / curve narrower;  
(Stroke) volume / (ventricular) volume increased / curve taller; 2
- (iii) Cardiac output = heart rate x stroke volume;  
Heart rate correctly calculated as 75;  
Correct answer of 6000 cm<sup>3</sup> / 6 litres/dm<sup>3</sup> per minute;  
*Correct answer of 6000 gains 3 marks* 3

**Total 8**

**Question 5**

(a)

Feature	Leaf Cell	Red Blood Cell	Bacterial Cell
Plasma membrane	✓	✓	✓
Mitochondrion	✓	✗	✗
Chromosomes containing both DNA and protein	✓;	✗;	✗;

One mark for each correct column

3

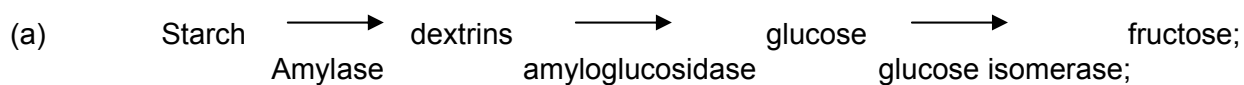
*Do not accept marks as bring equivalent to crosses*

- (b) Light microscope has low resolution;  
Light has long wavelengths;  
*Accept converse providing candidate is referring to optical microscope* 2
- (c) Specimen thin / plane / section; *Ignore "plane of focus"*  
May not go through branch / only go "across" mitochondrion; 2

**Total 7****Question 6**

- (a) Lowers activation energy (of reaction);  
More molecules able to react;  
By splitting the reaction into stages;  
Allows E-S complex to be formed;  
Provide a surface/place for reaction; 2 max
- (b) (i) Sand + (boiled potato) + hydrogen peroxide/substrate;  
To show that the enzyme produced the reaction / sand had no effect /  
see if sand has an effect; 2
- (ii) High temperature denatures / temperature affects rate of reaction /  
volume of gas affected by heat / only one variable; 1

**Total 5**

**Question 7**


2

*Accept any version of a flow chart, ignoring additional information.*

*Where enzymes and products are not distinguished allow max 1 for products*

(b)      Elements/atoms/C, H and O arranged in a different way / they are isomers / they have different structural formulae;      1

(c)      Starch/substrate has a specific shape/structure;  
 Allows binding to/fitting with/ forming E-S complex with active site;  
 or  
 Active site has specific shape;  
 Allows binding to/fitting with/ forming E-S complex with substrate/starch;      2  
*Complementary  $\equiv$  shape*

(d) (i)      Condensation;      1

(ii)      Nitrogen/N;      1

(e) (i)      7/7.1/ 7.14;      1

(ii)      0.05 / 0.06 / 0.055 / 0.056 / 1/18;      1

(f)      1 Formed from  $\alpha$  glucose;  
 2 Joined by condensation/ by the removal of a water molecule/ glycosidic bonds;  
 3 Between (carbons) 1 and 4 (and 1 and 6);  
 4 Coiled chain; )  
 5 (Allows) storage of large amount in a small space; )  
 6 Insoluble so has no effect on osmosis/water potential;  
 7 Branches; )  
 8 (Allows) rapid breakdown/release of glucose / hydrolysis; )      6 max  
*Accept information shown clearly in a diagram*  
*Reject easily/readily broken down*

) indicates linked marks  
 )

**Total 15**

**Question 8**

- (a) Flows from high to low pressure / down pressure gradient / pressure higher at top / lower at bottom; 1
- (b) (i) Two marks for correct answer of 1.2 mm;  
*Accept limits of 1.1 – 1.3*  
One mark for incorrect answer showing evidence of dividing by 100; 2
- (ii) Divide length/answer to (b) (i) by time / 1.3; 1
- (iii) Allows time for e.g. substances to be forced out/ diffusion; 1
- (c) (i) One mark for an answer which merely describes the change in terms of a decrease  
Two marks for an answer which describes the rate of decrease becoming steeper with distance. 2
- (ii) Friction;  
From contact with wall;  
Decrease in volume of blood;  
Fluid/water is forced out/lost;  
During tissue fluid formation; 2 max
- (d) 1 At arteriole end high hydrostatic pressure/blood pressure;  
2 Hydrostatic pressure higher than effect of osmosis;  
3 Forces out;  
4 Small molecules/named example;  
5 Proteins remain in blood/ not removed as they are large;  
6 Proteins lower water potential of blood;  
7 Water/fluid moves back into blood;  
8 Water moves by osmosis; 6 max

**Total 15**