



ASSESSMENT and  
QUALIFICATIONS  
ALLIANCE

## General Certificate of Education

# Biology/Human Biology 5411/5413 *Specification A*

*BYA1 Molecules, Cells and Systems*

## MarkScheme

*2006 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.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

## BYA1

### Question 1

- |     |      |   |     |         |
|-----|------|---|-----|---------|
| (a) | (i)  | Chloroplast;  |     | 1       |
|     | (ii) | Photosynthesis;<br>Uses light (energy);<br>To produce carbohydrates/starch/glucose/sugars/ATP/reduced NADP;<br><i>Note that candidates cannot be expected to have a detailed knowledge of photosynthesis.</i> | max | 2       |
| (b) | (i)  | A;  |     | 1       |
|     | (ii) | C;  |     | 1       |
| (c) | (i)  | Slows enzymes/prevents enzymes being denatured/<br>prevents/stops self-digestion;<br><i>Ignore references to bacteria. Reject enzymes not working</i>   |     | 1       |
|     | (ii) | To remove organelle C/nuclei;<br>Which are larger/more dense;   |     | 2       |
|     |      |   |     | Total 8 |
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### Question 2

- |     |   |  |   |         |
|-----|---|--|---|---------|
| (a) | Lilac/purple/mauve/violet;<br>Xanthine oxidase is a protein;<br><i>Reject pink or blue as the resulting colour with biuret.</i>   |  | 2 |         |
| (b) | Substrate has specific shape;<br>Allows binding/fitting/forms ES complex with active site;<br>Or<br>Active site has specific shape;<br>Allows binding/fitting/forms ES complex with substrate;<br><i>Accept structure ≡ shape</i> |  | 2 |         |
| (c) | Xanthine <u>similar</u> shape to drug;<br>Drug fits active site/competes for active site/is a competitive inhibitor;<br>Less/no uric acid formed;   |  | 3 |         |
|     |   |  |   | Total 7 |
-

**Question 3**

- |     |      |   |         |
|-----|------|---|---------|
| (a) | (i)  | (Lungs) expand/inflate/increase in volume/fill with air/decrease in pressure;<br><i>Ignore inhale/inspire</i>   | 1       |
|     | (ii) | <b>X</b> on line between breathing centre and receptors stimulated;   | 1       |
| (b) |      | Relates diffusion to difference in concentration/correct statement of Fick's law;<br><i>Must relate to diffusion</i><br>Breathing replenishes oxygen/gases/air in the lungs;<br>Maintaining/producing difference in concentration;<br><i>Ignore ref to other features</i>                                       | max 2   |
| (c) |      | Contract more rapidly/frequently;<br>Increases ventilation rate/rate of breathing;<br>Contracts more/for longer;<br>Increases depth of breathing/lung volume/tidal volume;<br><i>The third point will prove difficult to express. Credit any answer which would clearly result in increase in tidal volume.</i> | 4       |
|     |      |   | Total 8 |

**Question 4**

- |     |       |   |          |
|-----|-------|---|----------|
| (a) |       | Measure diameter of field <u>with</u> ruler;<br>And proportion taken up by the cell;<br>or<br>Measure length with (eyepiece) graticule/eyepiece scale;<br>Calibrated against stage micrometer/something of known length;<br><i>Reject divide apparent length by magnification</i> | 2        |
| (b) |       | Membrane/cytoplasm shrinks/pulls away from cell wall/cell plasmolysed/<br>goes flaccid;<br>Water moves down water potential gradient/to lower/more negative<br>water potential;<br>By osmosis;  | 3        |
| (c) | (i)   | Reaches equilibrium/no further/maximum change in length;<br><i>Reject osmosis takes time</i>  | 1        |
|     | (ii)  | Line/curve of best fit;<br>Extrapolate (and read off)/find where it crosses x-axis;   | 2        |
|     | (iii) | Greater decrease/length smaller;<br>More water removed;<br>Greater difference in water potential/cell with higher/less negative water potential;<br>Starch is insoluble/has no effect on osmosis  | max 2    |
|     |       |   | Total 10 |

**Question 5**

- |     |       |  |                   |
|-----|-------|--|-------------------|
| (a) | (i)   | H at top right end (instead of OH)/OH at bottom;<br><i>This represents the lowest level of acceptable answer. Must clearly indicate position of H and OH and which pair the candidate is referring to.</i> | 1                 |
|     | (ii)  | Carbon 1 joined to carbon 4 with removal of water molecule;<br>Completely correct;   | 1 mark<br>2 marks |
| (b) | (i)   | Correct position indicated;  | 1                 |
|     | (ii)  | C;   | 1                 |
|     | (iii) | Turn through 90° / two-way chromatography/2D;<br>Run in a different solvent;   | 2                 |
|     |       |  | Total 7           |
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**Question 6**

- |     |      |  |         |
|-----|------|--|---------|
| (a) |      | The muscle in the wall/sphincter contracts;<br><i>Accept converse</i><br>Reducing blood flow/narrowing/closing arteriole;<br><i>The muscle to which the candidate is referring must be clearly in the wall of the arteriole.</i> | 2       |
| (b) | (i)  | Blood flow increased in humans/reduced in seals;   | 1       |
|     | (ii) | Less oxygen/blood taken to muscles;<br><i>None is incorrect</i><br>(More) oxygen available for organs/brain;<br>Can stay under water longer (without breathing);   | max 2   |
|     |      |  | Total 5 |
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**Question 7**

- (a) (i) Made up of several layers of tissue/tissues; 1
- (ii) Several/more than one polypeptide chain in molecule; 1  
*Evidence must only relate to 4<sup>o</sup> structure*
- (b) Chemical bonds formed between sulphur-containing groups/R-groups/form disulphide bonds;  
Stronger bonds;  
Bind chain(s) to each other; max 2
- (c) Different number of amino acids;  
Different sequence of amino acids;  
Bonds in different places;  
Gives different shape; max 2
- (d) Outer layer of skin cells are dead;  
Do not respire/Do not contain mitochondria;  
Do not produce ATP/release energy;  
Cells do not have required proteins/carriers; max 3
- (e) 1 TEM uses (beam of) electrons;  
2 These have short wavelength;  
3 Allow high resolution/greater resolution/Allow more detail to be seen/greater useful magnification;  
4 Electrons scattered (by molecules in air);  
5 Vacuum established;  
6 Cannot examine living cells;  
7 Lots of preparation/procedures used in preparing specimens/  
fixing/staining/sectioning;  
8 May alter appearance/result in artefacts; max 6
- Total 15
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**Question 8**

(a)	0.1/0.9 (s);	1
(b)	Two marks for correct answer of 75 (beats per minute); One mark for incorrect answer based on cardiac cycle taking 0.8 seconds;	2
(c)	(i) Pressure in ventricle higher than pressure in atria;	1
	(ii) Prevents backflow of blood/prevents flow from ventricles to atria;	1
(d)	Increase (in stroke volume) as blood pressure increases, remains constant/plateaus; after 3 kPa/when stroke volume = $82\text{cm}^3$ ;	2
(e)	Two marks for correct answer of 80; One mark for incorrect answer recognising that ventricle contracts once every cardiac cycle/stroke volume = $70\text{ cm}^3$ ;	2
(f)	1 Muscles (surrounding veins) contract; 2 Press on (walls of) vein; 3 Squeezes blood along veins; 4 Valves prevent backflow/ensure flow in one direction; 5 Systole/contraction of heart pumps blood (through arteries) into veins/residual arterial pressure; 6 Negative pressure in chest due to inspiration; 7 Recoil of heart muscle during diastole/after contraction; 8 Draws blood from veins into atria; <i>Accept sucks</i> 9 Wide lumen little resistance/friction	max 6
		Total 15