



General Certificate of Education

Biology/Human Biology 5411/5413 *Specification A*

BYA1 Molecules, Cells and Systems

Mark Scheme

2006 examination – June 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.

Question 1

- | | | | |
|-----|------|-------------------------------------------------------------------------------------------------|---------|
| (a) | (i) | no cell wall / only has (plasma) membrane; | 1 |
| | (ii) | has capsule / slime layer; | 1 |
| (b) | | correct approach which makes use of scalebar;
<i>ignore</i> reference to units. | 1 |
| (c) | | cellulose / starch / amylose / amylopectin; | 1 |
| (d) | (i) | <u>water potential</u> lower/more negative in cell;
(water enters by) <u>osmosis</u> ; | 2 |
| | (ii) | plant cell wall made of a different substance/cellulose / penicillin does not affect cellulose; | 1 |
| | | | Total 7 |
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Question 2

- | | | | |
|-----|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| (a) | (i) | plasma; | 1 |
| | (ii) | tissue fluid; | 1 |
| (b) | | fluid Y contains little/no protein; <i>reject blood cells</i>
molecules too large (to pass through capillary wall);
or
fluid Y contains less glucose;
some will have entered tissue cells;
<i>accept any other biologically correct difference marked in a similar way.</i> | 2 max |
| (c) | | hydrostatic pressure / blood pressure / arterial pressure;
greater than osmotic effect;
forces molecules/fluid out;
<i>ignore references here to diffusion or osmosis.</i> | 2 max |
| (d) | | active muscle cells respiring <u>faster/at greater rate</u> ;
therefore less/lower concentration of oxygen in cell;
rate of diffusion proportional to difference in concentration / concentration gradient;
<i>to gain second point, answer must be in terms of using oxygen, not the need for it.</i>
<i>last line is the minimum requirement for Fick's Law.</i> | 3 |
| | | | Total 9 |
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Question 3

- | | | |
|-------|--------------------------------------------------------------------------------------------------------------------------------|---|
| (a) | partially/selectively permeable <i>accept semi-permeable</i>
allows water to pass through but not potassium nitrate/solute; | 1 |
| (b) | potassium nitrate (solution);
cell wall permeable; | 2 |
| (c) | water potential more negative/lower in cell E;
water removed;
greater solute/sap concentration (in cell); | 3 |
| Total | | 6 |
-

Question 4

- | | | |
|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| (a) | (i) the atrioventricular/mitral/bicuspid/tricuspid valves (closing); | 1 |
| | (ii) pressure in artery greater than pressure in ventricle; | 1 |
| (b) | correct answer 5250 = 3 marks;
<i>where answer incorrect:</i>
one heart beat identified as taking 0.8 s;
heart rate calculated as 75 (beats per minute);
cardiac output = heart rate x stroke volume;
<i>marking points to be awarded independently but onus on candidate to show clearly what has been done</i> | 3 |
| (c) | increase in number of impulses; <i>reject faster or larger</i>
in sympathetic/accelerator nerve;
more impulses/signals from SAN;
less parasympathetic activity | 3 max |
| Total | | 8 |
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Question 5

- (a) (i) break open cells / release cell contents; 1
- (ii) keep pH the same / controls pH;
prevent change to / denaturing of proteins/enzymes; 2
- (b) (i) 2
- | | | |
|-----------------|-------------|-------------|
| (supernatant) C | (pellet) B; | (pellet) A; |
|-----------------|-------------|-------------|
- (ii) site of respiration;
releases energy/ATP;
required for movement against concentration gradient; 2 max
ignore first point for thermodynamically incorrect statements such as "making energy".
- Total 7

Question 6

- (a) Benedict's and heat;
yellow/green/brown/orange/red; 2
reference to heat must imply this but exact temperature not required. Thus accept warm, heat etc but not an unqualified reference to putting in a water bath.
- (b) (i) correct representation of β -glucose as shown below; 1
-
- (ii) H at top right end (instead of OH) / OH at bottom in α ;
this represents the lowest level of acceptable answer. Must clearly indicate position of H and OH and which pair the candidate is referring to. 1
- (c) joins (polysaccharide) chains/molecules to each other / makes microfibrils / gives tensile strength; 1
- (d) nitrogen/N;
ignore references to sulphur but mark phosphorus incorrect. 1
- (e) (i) E; 1
- (ii) A; 1
- Total 8

Question 7

- (a) up and out; 1
- (b) (i) does not require work/effort / involve muscle contraction/energy expenditure; 1
- (ii) active as it involves contraction of muscles; 1
- (c) impulses go to diaphragm;
causes muscle/diaphragm to contract and diaphragm to flatten/lower;
impulses stop and diaphragm relaxes/returns to domed shape;
penalise failure to use impulses only in first marking point. 3
- (d) liver moves back;
increases volume of lungs;
pressure lower (in lungs than outside); 3 max
- (e) *maximum of three marks for description, points 1 to 4*
1 inhaled air contains more oxygen than exhaled air;
2 inhaled air contains less carbon dioxide than exhaled air;
3 inhaled air contains less water (vapour);
4 relative amount/percentage of nitrogen also changes;
5 respiration results in lower blood oxygen / higher blood carbon dioxide;
6 oxygen enters blood / carbon dioxide leaves blood in alveoli;
7 by diffusion;
8 water vapour diffuses from moist surface; 6 max
- Total 15
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Question 8

- (a) (i) 150; 1
- (ii) 27; 1
- (b) 100;
 number of peptide bond hydrolysed = total number present / all peptide bonds have been hydrolysed;
accept calculation showing same number top and bottom. 2
- (c) curve rising to peak at pH 2 and falling to zero by pH 6; 1
- (d) (change in pH) leads to breaking of bonds holding tertiary structure/
 changes charge on amino acids;
 enzyme/protein/active site loses shape/denatured;
 substrate will not bind with/fit active site;
 fewer/no ES complexes formed; 3 max
- (e) more resistant to changes in pH and washing conditions variable/
 works in alkaline pH and washing powders alkaline;
mark awarded for indicating aspect of effect of pH and advantage of this in terms of washing powder and conditions in wash. 1
- (f) *maximum of three marks for specificity, points 1 – 4.*
Can only be given credit in context of specificity
 1 each enzyme/protein has specific primary structure / amino acid sequence;
 2 folds in a particular way/ has particular tertiary structure;
 3 active site with unique structure;
 4 shape of active site complementary to / will only fit that of substrate;
maximum of three marks for inhibition, points 5 - 8
 5 inhibitor fits at site on the enzyme other than active site;
 6 determined by shape;
 7 distorts active site;
 8 so substrate will no longer fit / form enzyme-substrate complex; 6 max

Total 15
