



ASSESSMENT and  
QUALIFICATIONS  
ALLIANCE

# Mark scheme

# June 2002

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## GCE

## Biology A / Human Biology

## Unit BYA6

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Kathleen Tattersall: *Director General*

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**Question 1**

- (a) Picks up oxygen more readily (in lungs) / greater affinity / idea of more readily saturated;  
Where O<sub>2</sub> is low; **2**  
*Ignore 'rate of loading / unloading'.*
- (b) (i) Can bind to / release H<sup>+</sup> ions; **1**  
*Allow correct equation.*
- (ii) Denatures / alters shape / charge of active site;  
Breaking / forming bonds / named bond; *reject 'peptide'*  
Substrate “repelled” / cannot fit / no E-S complex; **2 max**
- Total 5 marks
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**Question 2**

- (a) High / increasing glucose causes high / increasing insulin;  
*Ignore 'deviates from the norm'.*  
Insulin (concentration) reduces glucose;  
*Ignore references to 'glycogen'.*  
Back to original level;  
This results in / subsequent decrease in insulin level / release; **2 max**  
*Ignore references to 'brain'.*
- (b) (i) Drink in a specified (short) time;  
Idea of fasting / controlled diet shortly before test;  
Same level of activity (as 1<sup>st</sup> test);  
Same (specified) temperature of drink;  
Ensure glucose level returns to normal before test; **2 max**  
*Ignore references to timing of sampling.*
- (ii) Excreted in urine / respired; **1**  
*Reject 'secretion in urine'.*
- Total 5 marks
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**Question 3**

- (a) (Vaso) constriction of arterioles / correct reference to shunt vessels or sphincters; *ignore contraction*  
*Reject this first mark if any reference to moving blood vessels.*  
Less radiation / conduction / convection;  
Less blood to surface / more blood flows beneath fat; **2 max**
- (b) (i) Body cools down / hypothermia;  
(Low body temperature linked to) insufficient metabolism / muscle contraction; *accept references to enzymes / respiration / energy released*  
May drown / unable to escape predators; **2 max**
- (ii) Oxygen consumption linked to respiration;  
Heat production linked to respiration;  
High rate of respiration / more heat production at low temperature; *accept converse* **2 max**  
*Reject any reference to 'energy production'.*

Total 6 marks

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**Question 4**

- (a) (i) Reduces (exposed) surface area so less water loss; **1**
- (ii) Ammonia toxic so cannot be stored / must be excreted / needs lots of water / ref. to dilution;  
Urea less toxic so can be stored / needs less water for excretion; **2**  
*Give maximum of one mark if no reference to 'toxic' in answer but a comparison has been made.*
- (b) (i) Requires energy / ATP; **1**
- (ii) From respiration / condensation; **1**
- Total 5 marks
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**Question 5**

- (a) Accurate description of ventilation by water flow;  
(Oxygen) removal by bloodstream;  
Description of / countercurrent flow of blood and water (at gills);  
*Accept labelled diagram, ignore 'contraflow', reject 'multiplier'.* **2**
- (b) 4.0 seconds / s; *accept 2 x 2s* **1**
- (Total) time when oxygen (concentration) was increasing /  
oxygen diffusing in;  
*OR*  
(Total) time when carbon dioxide (concentration) was decreasing /  
carbon dioxide diffusing out; **1 max**

Total 4 marks

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**Question 6**

- (a) Pituitary; **1**  
*Ignore any reference to lobe / hypothalamus.*
- (b) (i) (Each) protein has a tertiary structure;  
Gives specific / correct shape / size to (inside of) channel / pore; **2**
- (ii) More negative / lower WP (inside tubule cells); *accept  $\Psi$  symbol /  
down a WP gradient*  
Water enters / moves by diffusion / osmosis; *ignore  
water concentration, etc.*

Total 5 marks

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**Question 7**

- (a) (Pressure) deforms / opens (sodium) channels; *reject any other ion*  
Sodium ions enter;  
Causing depolarisation;  
Increased pressure opens more channels / greater sodium entry; **2 max**
- (b) (i) Arrow (labelled K) pointing out of node; **1**
- (ii) Same amplitude of action potentials as in medium pressure graph  
but of a greater frequency; **1**
- (c) (i) Answer between 0.7 and 0.9(ms); **1**
- (ii) Correct answer based on candidate's response to (c) (i)  
(i.e. 80 divided by answer to previous question)  
*Accept correct working shown with no final answer* **1**
- (d) (i) Action potential / impulse unable to “jump” from node to node /  
no saltatory conduction / action pd / impulse must pass through  
a greater amount of membrane;  
Slows / prevents impulse; **2 max**
- (ii) Greater entry of sodium ions / greater exit of K<sup>+</sup> in  
de-myelinated neurone;  
Ref. to active transport / ref. to ion pumps; **2**
- (e) (i) Kinesis; *ignore prefix* **1**
- (ii) Response is non-directional / related to intensity of the stimulus; **1**
- (iii) Idea that tentacle behaviour is genetically controlled;  
Idea of variation in population regarding speed of tentacle movement;  
Individuals with ability to increase tentacle movement more  
likely to reproduce / pass on characteristic;  
Over many generations increasing frequency of allele(s) for this  
type of behaviour; **3 max**  
*Maximum of one mark may be awarded if no reference to  
tentacle / feeding behaviour.*

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Total 15 marks

**Question 8**

- (a) (i) Hydrolysis; **1**
- (ii) For new cells / growth; **1**
- (b) (i) Microbial / bacterial enzymes / bacteria (in gut); *reject 'protozoa' in context of N fixation OR ignore.*  
Produce amino acids (from nitrogen gas / by nitrogen fixation); **2**
- (ii) TERMITE context:  
Microorganisms consume glucose / produce methane / organic acids / fix N;  
*Accept converse for PEACOCK BUTTERFLY context.*  
*Reject references to incorrect organism.*
- (iii) Nitrogen is a large component of air / oxygen is small component;  
(So) only a small amount of air needed for nitrogen fixation;  
Oxygen removed by respiration (of microbes / termite cells); **2 max**
- (c) C = Microvillus and E = Mitochondrion;  
*Accept A = lysosome / vesicle / vacuole*  
*B = nuclear membrane / envelope*  
*D = ER / rough ER (reject smooth ER)*  
*Accept any two correctly named, labelled features.*
- Microvillus / C increases surface area;  
So greater diffusion / active uptake / greater number of protein channels / carriers;  
Mitochondria / E produce ATP / release energy; *reject 'making energy'*  
For active transport; **3 max**
- (d) (i) For nervous system:
- |   |   |   |
|---|---|---|
| Mainly electrical impulses not chemicals; | } | must have both sides<br>i.e. comparison |
| Use of neurones not blood;                |   |   |
| Discrete compared to broadcast;           |   |   |
| Shorter lasting;                          |   |   |
| Quicker;                                  | } | OR converse <b>2 max</b>                |
- (ii) Stimulates:  
Production / secretion of bile / alkali from liver;  
Production / secretion of alkali from pancreas;  
*Ignore 'pancreatic juice'. Reject 'enzyme secretion'.*  
Smooth muscle contraction / emptying of gall bladder;  
Inhibits gastric gland secretion; **2 max**

Total 15 marks

**Question 9**

- (a) Root pressure:
1. Active transport of salts into xylem;
  2. Endodermis / Casparian strip;
  3. Prevents leakage / water / ions must use symplast pathway;
  4. Lower water potential inside xylem;
  5. Water (enters xylem) down WP gradient / by osmosis;
  6. Upward water movement by root pressure is relatively low; **4 max**

Cohesion tension:

7. Transpiration / evaporation of water;
8. From spongy mesophyll / through stomata;
9. Lowers water potential of mesophyll;
10. Water molecules hydrogen bond / stick together;
11. Ref. to columns / chains;
12. Water pulled up xylem (creating tension);
13. Adhesion between water molecules and xylem vessel walls;
14. Responsible for majority of water movement up xylem vessels; *Only credit if earlier reference to limited water movement by root pressure has not been credited.* **5 max**

- (b) Trap moist air / increase humidity;  
Reduce air flow (around leaf surface / stomata);  
Lower WP / water vapour concentration gradient (between inside and outside of leaf);  
Shield stomata from high temperature / high light intensity / wind; *ignore 'sun'*  
Reduce transpiration / evaporation / diffusion of water (vapour); **4 max**

- (c) EITHER:  
Plasmid / virus / bacterium (vector is one of these);  
Vector / Yambean DNA / gene cut open with restriction enzyme;  
Same enzyme used to cut other DNA;  
Production of sticky ends;  
Joined by ligase;

OR:

- (Vector is) bacterium / plasmid / virus;  
Vector DNA cut open with restriction enzyme;  
Use reverse transcriptase / mRNA to make gene / DNA;  
Add sticky ends;  
Joined by ligase; **4 max**

Total 15 marks

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