



## **General Certificate of Education**

# **Biology 6411**

## *Specification A*

**BYA6      Physiology and the Environment**

# **Mark Scheme**

*2008 examination - June series*

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**Question 1**

- (a) Taxis / phototaxis;  
(Ignore positive / negative, but cancel if wrong qualification e.g. chemo)  
Direction of movement determined by direction of light / directional response /  
response to directional stimulus/by example, young swims to light/older away from light;  
2
- (b) (i) Initially towards light and later away from light ;  
(Ignore references to speed) 1
- (ii) Initially (away from parent / dispersal) to avoid competition;  
Later (towards a rock) for attachment;  
2
- Total 5**

**Question 2**

- (a) Between 0.85 – 0.90 and 0.40 – 0.45;  
(Allow reverse sequence) 1
- (b) Oxygen concentration / pO<sub>2</sub> is low in natural environment;  
Haemoglobin has higher affinity for O<sub>2</sub> / picks up O<sub>2</sub> more readily / picks up O<sub>2</sub> at lower  
pO<sub>2</sub> / carries more O<sub>2</sub> at low pO<sub>2</sub>/is more saturated at low pO<sub>2</sub> ;  
Releases O<sub>2</sub> readily with only slight drop in pO<sub>2</sub>/ O<sub>2</sub> released only at very low  
pO<sub>2</sub>;  
(Ignore references to 'speed' of loading / unloading) 3
- Total 4**

**Question 3**

- (a) (On diagram) 'X' on the rise in potential; *Reject 'X' at top or bottom* 1
- (b) Active transport of ions / sodium (-potassium) pump / pumping out of sodium  
ions;  
supplies / uses / requires energy / ATP;  
So faster/more respiration;  
(Reject 'anaerobic') 3
- (c) (Myelination increases rate because:) [*max 1 if "decrease"specified*]  
Myelin insulates / myelin prevents ion movements; *Reject prevents impulse movements*  
Saltatory conduction / node to node / ion movements only at nodes; 2  
*Accept jumps from gap to gap*
- Total 6**

**Question 4**

- (a) Hypothalamus is body's temperature regulation centre / monitors body/blood temperature; *Accept references to 'heat'* 1
- (b) (i) Heat lost / used in evaporation of sweat / evaporation from lungs / evaporation of water / heat used to change liquid to gas; 1
- (ii) Vasodilation / dilation/widening of arterioles/blood vessels, / greater blood flow to the skin / blood flows nearer to body surface ;  
Increased radiation/conduction/convection; 2  
*Reject widening of capillaries / veins*  
*Ignore references to hair flattening/behaviour*
- (c) Answers in range 36.74 - 36.76 to range 36.98 - 37.0(°C) / above 36.74(°C) ; 1

**Total 5****Question 5**

- (a) (i) Might be more values nearer one end of range / not a normal distribution / skewed /range more affected by extreme value/anomalous result; 1
- (ii) Standard deviation takes account of departure of all values from mean / not dependent just on extreme values / extreme values are not representative / standard deviation less affected by extreme values; 1
- (b) Specific receptor found only in blackfly;  
 High pH needed to activate toxin found only in blackfly/ toxin inactive at or < pH8.5/ high pH needed for protease activity;  
 (Specific) protease needed to activate toxin found only in blackfly; 2 max

**Total 4**

**Question 6**

(a) (i) Air enters at anterior (*Accept in thorax*) and leaves through posterior (*Accept in abdomen*) ; 1

(ii) Higher at Y as CO<sub>2</sub> produced by respiration of locust ; 1

(b) (i) Correct answer: 15.6 % / 0.156 ;; = 2 marks  
(*Accept 16% / 0.16*)

**OR**

Correct working:  $\frac{0.22 \times 100 (\times 100)}{6.7 \times 21} / \frac{0.22}{6.7} / 0.03 / 3\%$  = 1 mark

2 max

(ii) 1.0;; = 2 marks

OR

RQ =  $\frac{\text{CO}_2}{\text{O}_2}$ ; [Cancel 1 mark if RQ given as  $\text{O}_2 \div \text{CO}_2$ ] = 1 mark

2 max

**Total 6**

**Question 7**(a) In Diabetic person:

- 1 Lack of insulin / reduced sensitivity of cells to insulin;  
 2 Reduced uptake of glucose by cells / liver / muscles;  
 3 Reduced conversion of glucose to glycogen;
- } *Penalise zero/no  
once only* 3

(b) (i) Leaves the blood at kidney;  
 Taken back into blood / reabsorbed (from kidney tubule);  
*Reject some reabsorption*  
 (Reabsorbed) in 1<sup>st</sup> convoluted tubule;  
*Kidney/named part needs to be mentioned once* 2 max

(ii) Large amount / high concentration of glucose in filtrate;  
 Cannot all be reabsorbed / 1<sup>st</sup> convoluted tube too short to reabsorb  
 all of glucose / saturation of carriers; 2

(c) Enzyme has specific shape to active site/active site has specific tertiary structure;  
 Only glucose fits / has complementary structure/can form ES complex; 2

(d) Glucose in filtrate lowers water potential;  
*Ignore 'urine'. Accept increase solute potential*  
Lower  $\Psi$  gradient / less difference in  $\Psi$  filtrate –  $\Psi$  plasma;  
*Ignore 'concentration'*  
 Less water reabsorbed by osmosis;  
*Accept diffusion of water. Reject no water reabsorbed if implied* 3

(e) 1 Glomerulus / Bowman's capsule / renal capsule;  
 2 Basement membrane;  
 3 Proteins are large (molecules)/ proteins cannot normally pass through filter / proteins  
 can only pass through if filter damaged; 3

**Total 15**

**Question 8**

- (a) (i) 1<sup>st</sup> (For Shoot 1 or Shoot 2) Greatest reduction in water uptake / in water loss/in distance moved when lower epidermis covered / in 2<sup>nd</sup> treatment for shoot 2 / in 3<sup>rd</sup> treatment for shoot 1;  
2<sup>nd</sup> Stomata present only in lower epidermis / stomata would be blocked/covered by petroleum jelly; 2
- (ii) (For Shoot 2) Water still taken up / still lost when only lower epidermis covered;
- OR**
- Reduction in water uptake / water loss occurs when upper surface covered (where no stomata are present); 1
- (iii) Some water is still taken up / still lost when both sides of leaf covered; 1
- (b) (i) 1. Increased flow in branch occurs before increase in flow in trunk;  
2. Occurs during warmest / brightest time of day when maximum evaporation / transpiration/ stomata fully open;  
3. Evaporation / transpiration/water loss pulls water upwards/causes tension;  
4. H-bonding between water molecules; Reject 'particles' 4 max
- (ii) 1. Diameter falls during daylight hours;  
2. When flow is slow diameter is large / when flow is fast diameter is small;  
3. Adhesion of water to walls of xylem / H-bonding to walls of xylem;  
4. Xylem walls pulled inwards / negative pressure inside xylem / tension in xylem;  
5. More inward pull if higher flow rate; 3 max

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(c) Any **two** adaptations and correct explanation for each, from:

<b>Adaptation</b>	<b>Explanation</b>
Long roots/widespread/deep roots;	Obtain water from wider area / from deeper / root had large surface area to absorb water;
<u>Thick wax/cuticle</u> ;	Waterproofs / reduces water loss;
Reduced number of stomata;	Reduced area for water loss / most water loss usually via stomata;
Sunken stomata;	Area of still air / humid air outside stoma / less affected by wind;
Stem hairs/hairy leaves;	Area of still air / humid air outside stoma / less affected by wind;
Water storage tissue / swollen stem / swollen leaves;	Sufficient water to withstand drought;
Ability to roll leaves;	Covers stomata with humid area;
Small leaves/leaves reduced to spines;	Reduced surface area for water loss / reduced number of stomata;
Stomata only open at night;	Cooler so less water evaporation;

4 max

**Total 15**



**Question 9**

- (a)
- 1 Hydrolysis/described;
  - 2 (Protein digested) by endopeptidase(s) / correctly named example;
  - 3 Produces peptides/short chains of amino acids;
  - 4 Produce more/many ends ;
  - 5 (Peptides digested) by exopeptidase(s);
  - 6 Produces dipeptides/amino acids;
  - 7 (Di)peptidase on cell surface membranes of/inside epithelium of small intestine;
- 5 max

- (b) *(Must score at least 1 mark for nervous and 1 mark for hormonal for maximum marks)*

Nervous –

- 1 Secretion of gastric juice / pancreatic juice;
- 2 Fast response compared with sustained (response) for hormonal;
- 3 Reflex response;
- 4 Response to sight / smell of food / food in mouth;
- 5 Coordinated by medulla in brain;

Hormonal –

- 2 *alt* Sustained digestion compared with fast response for nervous ;  
*(Allow once only)*
- 6 Secretin stimulates release of alkali from pancreas / from small intestine;
- 7 CCKPZ/CCK/PZ stimulates release of bile / alkali from liver / from gall bladder;
- 8 CCKPZ/CCK/PZ stimulates release of enzymes / protease(s) / endopeptidase(s) from pancreas;
- 9 (Alkali) provides optimum pH for enzymes(in small intestine)/acid/HCl provides optimum pH for enzyme(in stomach);
- 10 Gastrin stimulates release of HCl / release of pepsin(ogen) / gastric juice / gastric protease;

5 max

- (c) *(Must score at least 1 mark for A and 1 mark for B for maximum marks)*

1 **A** / Microvilli – Large S.A.; *Reject 'Villi'*  
 2 Carrier proteins;  
 3 (Carrier proteins for) facilitated diffusion; (linked context)

4 **B** / Mitochondria – Aerobic respiration ; *Reject wrong name for B*  
 5 Produce ATP / release energy; *Reject 'produce' energy*

6 Active transport/transport up gradient;  
 7 Co-transport of amino acids with Na<sup>+</sup> ions / (Active transport) of Na<sup>+</sup> ions out of epithelium / into blood;

5 max

**Total 15**