



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_2 is low in natural environment;
Haemoglobin has higher affinity for O_2 / picks up O_2 more readily / picks up O_2 at lower
 pO_2 / carries more O_2 at low pO_2 / is more saturated at low pO_2 ;
Releases O_2 readily with only slight drop in pO_2 / O_2 released only at very low
 pO_2 ;
(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 CO₂ produced by respiration of locust ; 1

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

OR

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

(ii) 1.0;; = 2 marks

OR

$RQ = \frac{CO_2}{O_2}$; [Cancel 1 mark if RQ given as $O_2 \div CO_2$] = 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 1st 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 / 1st 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 Ψ gradient / less difference in Ψ filtrate – Ψ 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) 1st (For Shoot 1 or Shoot 2) Greatest reduction in water uptake / in water loss/in distance moved when lower epidermis covered / in 2nd treatment for shoot 2 / in 3rd treatment for shoot 1;
2nd 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; 1
- 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

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

Adaptation	Explanation
Long roots/widespread/deep roots;	Obtain water from wider area / from deeper / root had large surface area to absorb water;
<u>Thick</u> wax/cuticle;	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⁺ ions / (Active transport) of Na⁺ ions out of epithelium / into blood;

5 max

Total 15