

# GCE 2004

## *June Series*



# Mark Scheme

## Biology/Human Biology A

### *BYA6*

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**BYA6****Question 1**

- (a) Suitable accepted evidence, 1 mark for evidence and 1 mark for explanation –  
EITHER e.g.guttation  
(only) upward pressure could force liquid water out of leaves;  
OR  
Sap exuding from a cut, rooted stem;  
(only) upward force could make this happen; 2
- (b) *(Note: max. two for any component)*
- (i) Evaporation from leaves during daytime only/mainly;  
tension/negative pressure (on water) in xylem creates inward pull  
(on walls of xylem vessel);  
xylem vessels become narrower;  
due to adhesion of water molecules (to walls of xylem vessels);
- (ii) root pressure gives outward force/push on walls of xylem vessels;  
tree would become wider/stay same diameter;  
xylem vessels become wider/stay same diameter; max 3

Total 5 marks

**Question 2**

- (a) (i) **Many** gill lamellae/gill filaments; (ignore refs to ‘highly divided’) 1
- (ii) Counter-current mechanism/blood and water flow in opposite directions;  
Not enough time for equalisation of concentrations/maintains concentration  
gradient over length of gills/never reaches equilibrium; max 2
- (b) Humidity reduces difference in concentration of water (vapour) between body and air;  
reduces rate of diffusion (of water vapour)(as are proportional); 2

Total 5 marks

**Question 3**

- (a) (More) urea formed from surplus protein/eq./surplus protein deaminated; 1
- (b) (i) In group A, water lost in urine replaced by drinking (water)/converse for group B; 1
- (ii) *For group B:*  
 More concentrated filtrate;  
 Decreased reabsorption from collecting duct;  
 More water lost in urine;  
 Less respiratory water formed by group B;  
 (*Allow reverse arguments for all points for group C*) max 2
- (c) Water withdrawn by osmosis/down water potential gradient; 1

Total 5 marks

**Question 4**

- (a) Structure resulting from aggregation of several polypeptide chains/tertiary structures/eq: 1
- (b) Low pH/(more)H<sup>+</sup> ; due to (increased) CO<sub>2</sub> (increased) respiration;  
 (ignore refs to buffering action of haemoglobin)  
 (increased) dissociation of haemoglobin;  
 Low oxygen tension in tissues/plasma;  
 Oxygen diffuses from r.b.c. to tissues; max 3
- (c) Deaminated for use in respiration/used in protein synthesis/suitable e.g.; 1

Total 5 marks

**Question 5**

- (a) Compact molecule so can store much in one cell;  
 Insoluble so will not affect water potential/will not 'move' from storage site  
 Branched molecule so readily hydrolysed max 2
- (b) Adult needs energy for movement/flight/mating;  
 Sugars easily respired  
 No growth in this phase so no need for protein;  
 Sufficient protein acquired during larval stage (for egg production); max 3

Total 5 marks

**Question 6**

- (a) Flattened squashed/deformation of lamellae/membranes/corpuscle;  
Causes sodium ion channels in axon membrane to open/increases permeability of axon membrane/nerve ending/nerve fibres;  
Movement of sodium ions into axon/nerve ending/nerve fibre  
*[If ions mentioned once, assume candidate is referring to ions throughout; if no mention of ions penalise once only]*
- max 2

- (b) Correct ref to near vision involved;  
tension in suspensory ligaments;  
lens does not become sufficiently convex  
rays of light refracted less/bent less;  
(focusing near objects) requires maximum refraction/maximum bending;  
or rays of light focused beyond retina;  
*Allow converse for a 'young person' if this is made clear.*
- max 3

Total 5 marks

**Question 7**

- (a) (i) Exopeptidase;  
amino acids are being broken off from the end/one by one; 2
- (ii) Hydolysis; ® 'wrong' bond  
(e.g. glycosidic)  
water (molecules) used;  
to break peptide bonds/ to break bonds between amino acids;  
(Accept last two marks from a suitable diagram if one is given) 3
- (b) Small intestine/duodenum/ileum;  
enzyme most active in neutral/alkaline conditions/between pH 7-8;  
found in this region of gut 3
- (c) (i) Organs comprise several tissues;  
capillary comprises only one tissue/endothelial/epithelial tissue; 2
- (ii) A – facilitated diffusion  
as transport protein needed but ATP not needed; In all cases reject  
'energy' unless  
qualified  
B – active transport  
as (transport protein and) ATP needed;  
C – (simple) diffusion  
as neither ATP nor transport protein needed;  
(Ignore all references to concentration gradients) 3
- (iii) creates low concentration of amino acids/Na<sup>+</sup> in cell  
concentration gradient established between lumen and cell  
(of amino acids or Na<sup>+</sup>) 2

Total 15 marks

**Question 8**

- (a) (i) Increase of breathing/increased rate of contraction of intercostals / diaphragm;  
increases tidal volume/depth of breathing/stronger contractions of  
intercostals and/or diaphragm; 2
- (ii) More oxygen/**oxygenated** blood to cardiac muscle;  
more glucose to cardiac muscle;  
allows increased **aerobic** respiration;  
increased heart rate  
increased stroke volume max 4
- (iii) Sympathetic increases (heart rate) parasympathetic decreases (heart rate) 1
- (b) (i) Binds to receptor/proteins; and opens  $\text{Na}^+$  channels;  
 $\text{Na}^+$  enter and make membrane potential less negative/depolarised 2
- (ii) (Vesicles containing) neurotransmitter only in presynaptic membrane/neurone;  
receptor/proteins only in postsynaptic membrane/neurone;  
so neurotransmitter diffuses down concentration gradient; max 2
- (iii) GABA opens  $\text{K}^+$  and  $\text{Cl}^-$  channels;  
 $\text{K}^+$  passes out and  $\text{Cl}^-$  passes in;  
Membrane potential more negative/hyperpolarised;  
Requires increased stimulation/must open more  $\text{Na}^+$  channels/allow more  $\text{Na}^+$  to enter;  
To reach threshold; Max 4

Total 15 marks

**Question 9****Quality of Communication**

The answers to all sections of this question require the use of continuous prose. Quality of language should be considered in crediting points in the scheme. In order to gain credit, answers should be expressed logically and unambiguously, using scientific terminology where appropriate.

- (a)
1. Deviation of a value from norm initiates corrective mechanisms;
  2. fluctuations in plasma glucose concentration detected by hypothalamus/islet cells in pancreas;
  3. initial decrease, no food given (in plasma glucose) stimulates (increased) secretion of glucagon;
  4. increases (in plasma glucose) stimulate (increased) secretion of insulin;
  5. correct ref. to role of  $\alpha$  and/or  $\beta$  cells as secretors;
  6. correct ref. to interconversion of glycogen / glucose;
  7. increased/decreased uptake of glucose by cells (as appropriate)/correct ref to change in membrane permeability;

max 5

- (b)(i)
1. Sensors in skin/hypothalamus detect reduced temperature;
  2. heat gain centre activated/inhibition of heat loss centre;
  3. vasoconstriction/constriction of arterioles in skin surface; (**R** capillaried)
  4. dilation of shunt vessels/constriction of – capillary sphincter;
  5. less blood to skin surface/capillaries
  6. reduced heat loss by radiation;
  7. increased heat gain by increased metabolic rate/respiration/movement/shivering;
  8. decreased heat loss by putting on clothes/huddling/reduced sweating;

max 5

- (ii)
1. Body temp./37°C is optimum temp for enzymes;
  2. excess heat denatures enzymes/alters tertiary structure/alters shape of active site/enzyme;
  3. substrate cannot bind/eq,;
  4. reactions cease/slowed;
  5. too little reduces kinetic energy of molecules / molecules move more slowly;
  6. fewer collisions/fewer ES complexes formed'

max 5

Total 15 marks