ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2003

GCE

Biology / Human Biology A

Unit BYA6

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Question 1

(a)	(i)	Lipase;		1
	(ii)	Small molecule or particle / lipid/fat soluble / non-polar;		1
(b)	(i)	Any **two** from:		
		Determine amount/volumes of O_2 used and CO_2 released; Calculate R.Q./ratio of CO_2 to O_2; [*Reject: O_2 / CO_2*] R.Q. carbohydrate = 1 ***and*** R.Q. lipid/fat 0.7;	max	2
	(ii)	Produce more (metabolic) water/release more energy per gram/eq (when oxidised/respired);		1

Total 5 marks

Question 2

(a)		Correct reference to refraction; By cornea and/or lens; Shape of lens changes;	max	2
(b)	(i)	Any **two** from:		
		Rods; Have poor acuity; As several connected to one (bipolar/ganglion cell/neurone)/synaptic/retinal convergence; [*Ignore: references to summation*]	max	2
	(ii)	Rods activated but don't detect colour/cones detect colour but not activated;		1

Total 5 marks

Question 3

(a) 11.8 - 12%; [*Reject: kP*] 1

(a) Any **three** from:

For animal B
Curve shifted to right;
Lower % saturation (of haemoglobin);
Haemoglobin dissociates (more) readily;
Releases more oxygen to tissues;
(For) more (aerobic) respiration; max 3
[*Allow: converse argument for Animal A*]

(a) Accepts hydrogen ions/forms haemoglobinic acid; 1
[*Accept: correct ionic equations*]

Total 5 marks

Question 4

(a) (i) "Decreases'' in any upper box ***and*** "increases" in any lower box; 1

(ii) Example from flowchart showing that change in water potential brings about corrective response; (e.g. decrease in plasma water potential leads to increased ADH secretion/permeability/reabsorption) 1

(a) Any **three** from:

Correct reference to counter-current multiplier system;
Correct differential permeability to water of the two limbs;
Active transport of ions out of ascending limb/movement of water out of descending limb;
Water potential gradient set up between filtrate in collecting duct and surrounding tissue;
Along the length of collecting duct;
Water withdrawn from collecting duct;
Correct reference to osmosis (once only); max 3

Total 5 marks

Question 5

(a) Enzyme/protease that breaks (peptide bonds) towards the middle of the protein /polypeptide/chain of amino acids/breaks into shorter chains; 1

(b) Trypsin/chymotrypsin as most active/optimum activity in alkaline conditions; 1

(c) Any **three** from:
pH conditions of gut vary in different regions;
Each enzyme has different optimum pH/equivalent;
Enzymes denatured by extremes of pH/pHs far from optimum;
Tertiary structure altered / shape of active site altered; max 3

Total 5 marks

Question 6

(a) (i) Conditioned reflex (action); 1

(ii) Saliva secreted before food in mouth/equivalent;
Digestion commences as soon as food in mouth/equivalent / increased softening/lubrication of food; 2

(b) Diagram shows:
Addition of water molecule(s) to a maltose molecule;
Hydroxyl groups correctly shown on the separated glucose molecules; 2
[*Note: A label "hydrolysis" alone is not enough for first mark. Maltose molecule must show two glucose units linked by an oxygen bridge*] Total 5 marks

Question 7

(a) (i) Any **three** from:

(Depolarisation of axon membrane causes) local currents to be set up;
Change permeability (of adjoining region) to Na^+/open Na^+ gates (in adjoining region);
sodium ions enter adjoining region;
adjoining region depolarises; max 3

(ii) Any **three** from:

Neurone B is myelinated/equivalent;
Correct reference to saltatory conduction/description;
Active transport of ions/ion pumps "only" used/less active transport of ions at nodes of Ranvier;
Less respiration needed / less ATP needed;
For repolarisation/restoration of ion balance; max 3
[*Allow: converse for neurone A*]

(b) (i) Dilates;
More blood (to muscles)/more oxygen/more respiration;
OR Dilates;
Noradrenaline is neurotransmitter/smooth muscle relaxes; 2

(ii) Any **four** from:

Impulses **to SA node**;
Along (branch of) vagus nerve;
Acetylcholine;
Decreases activity of **SA node/equivalent**;
Decreases rate of contraction/decreases heart rate/heartbeat; max 4

(c) (i) P – impulses from same neurones close together in time/temporal summation;
P & Q – impulses from different neurones at the same time/spatial summation; 2

(ii) Inhibitory; 1

Total 15 marks

Question 8

(a)		Any **two** from: Enzymes at optimum temperature; (Metabolic) reactions proceed more quickly; More independent of environment/better able to survive in different environment/equivalent;	max	2
(b)	(i)	Range just shows highest and lowest/SD shows spread of majority; Extreme values give false impression of variation/SD less affected by extreme values/equivalent;		2
	(ii)	Allows comparison of animals with different masses; Increased mass/increased body size means increased heat generation;		2
	(iii)	Both increase proportionally up to 25°C/equivalent; Then heat generation increases faster/equivalent;		2
	(iv)	Any **two** from: Body will "overheat" in very hot environments; As will generate more heat than they can lose; No physiological cooling mechanism;	max	2
(c)	(i)	Relationship is inverse/equivalent;		1
	(ii)	Sweating increases [*Allow: commences*]/panting;		1
	(iii)	Any **three** from: Reduced metabolic rate; Reduced respiration/energy release; Reduced thyroxine secretion; Reduced activity of brown fat cells/body core/liver cells; Reduced physical activity;	max	3

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) Any **five** from:

Water potential in xylem reduced (by entry of ions);
Water potential gradient established between xylem and surrounding cells;
Plasma membranes of surrounding cells are partially permeable;
Water enters xylem by osmosis;
Volume of water in xylem increases;
Cannot move back due to gradient;
Pressure in xylem increases (and forces water upwards); max 5

(b) Any **four** from:

Evaporation from leaves / transpiration;
Water in xylem under ***tension****/negative pressure/pulled up;
Water molecules ***cohere****/stick together/form hydrogen bonds;
[*Ignore: references to adhesion*]
So water a single column;
Air bubble breaks column / prevents cohesion; max 4
[**Note: just mentioning the cohesion-tension theory is not enough*]

(c) 2 marks **per feature** for relating Fick's law to reducing water loss – max. 2 features

reduced number of stomata;	thick waxy cuticle;	leaves reduced to spines;
reduced surface area;	increases diffusion distance;	reduced surface area ;
(epidermal) hairs;	sunken stomata;	curled leaves;
reduce diffusion gradient;	reduce concentration difference;	reduced concentration gradient;

Statement of Fick's law:
Rate of diffusion $\propto$ $\frac{\text{Surface area of exchange surface x concentration difference across surface}}{\text{thickness of exchange surface}}$;

Low surface area, low concentration difference and high thickness/equivalent reduce loss / candidate clearly relates features to equation to show how rate is reduced; max 6

Total 15 marks