ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2002

GCE

Biology A / Human Biology

Unit BYA7

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Question 1

(a)	(i)	Growth rate is increase (in appropriate feature) per unit time / e.g. absolute growth is total growth	**1**
	(ii)	(Increase in) GH causes secretion of GF1, which inhibits GH secretion;	**1**
	(ii)	(Increase in level of) sex hormones stimulate (increased) secretion of GH;	**1**
(b)		*Two marks for two of:*	
		Gene for human GH inserted into bacterium / eq.; Codes for same sequence of amino acids / has same base sequence; *Reject 'genetically identical' / 'genetically similar'* Hormone has same structure (as normal human GH);	**2 max**
		Total	5 marks

Question 2

(a)	(Increased) sympathetic stimulation increases heart rate (by increasing impulses from SA node); (Increased) parasympathetic stimulation decreases heart rate (by decreasing impulses from SA node); Description of effect on SA node of sympathetic or parasympathetic;	**3**
(b)	*Two marks for two of:*	
	Beta blockers bind to (beta) receptors in myocardium / SA node / pacemaker / heart; Beta blockers prevent adrenaline binding (to receptors in myocardium / SA node / pacemaker); Reduce force / rate of contractions;	**2 max**
	Total	5 marks

Question 3

(a)	(i)	50% scores two marks;; If wrong answer, then 63/126 x 100 or 189/186 x 100 = 1 mark	**2**
	(ii)	More glycogen available at start of exercise / eq.; More energy released / ATP produced / respiration / glucose produced *or* for longer time;	**2**
(a)		Bar indicates range of results / standard deviation / values are means (*allow 'averages'*); *Reject any references to 'time to exhaustion'.*	**1**

Total 5 marks

Question 4

(a) *Three marks for three of*:

Produced my mitosis;
DNA replicates;
DNA / chromosomes divided equally between daughter cells;
Idea of semi-conservative replication and base pairing / complementary strands;
No crossing over;
No random segregation; **3 max**

(b) *Two marks for two of: (for female)*

Polar bodies produced / only one ovum produced (*reject 'fewer ova produced'*) / unequal cell division;
Primary oocytes formed before birth / growth phase before birth;
Pause in meiosis at prophase I / eq.;
Pause in meiosis at metaphase II / eq. / meiosis not complete until fertilisation occurs; **2 max**

Allow reverse argument for male.

Total 5 marks

Question 5

(a) *Three marks for three of:*

Amino acids removed from cell (into blood stream) by active transport;
ATP used for active transport;
Maintains a low concentration in cell;
Idea of concentration gradient between ileum and cell;
Entry by facilitated diffusion; **3 max**

(b) 56.25;; *scores two marks*
40.5; *scores one mark* **2**

Total 5 marks

Question 6

(a) (i) kJ m^{-2} h^{-1} / in words; **1**

(ii) To calculate heat lost to water (jacket); **1**

(iii) To calculate heat lost to air; **1**

(b) *Two marks for two of:*

10-20 years – rapid decrease associated with adolescent growth spurt / eq / decrease in S.A. / mass;
20-35 years – no change as body same size / same composition / same level of activity;
30-70 years – slow decrease associated with loss of muscle / gain of fat / reduced activity;

If none of the above scored, allow one mark for BMR decreases with age due to decrease in activity / high when young as more active; **2 max**

Total 5 marks

Question 7

(a) (i) **A** *Three marks for three of*:

Negatively charged proteins / large anions inside axon;
Membrane more permeable to potassium ions than to sodium ions;
Potassium ions diffuse* out faster than sodium ions diffuse in;
Sodium / potassium pump;
Sodium ions pumped* out faster than potassium ions pumped in / 3 for 2; **3 max**
* *mechanism is necessary for mark*

B Sodium ion gates open / membrane more permeable to sodium ions / sodium ions rush in; **1**

(ii) *Two marks for two of*:

Membrane impermeable to sodium ions / sodium ion channels closed;
Sodium ions cannot enter axon;
Membrane becomes more negative than resting potential; **2 max**

(b) (i) *Two marks for two of*:

Unique shape of receptor protein / binding site; *reject 'active site'*
Due to (tertiary) structure of protein molecule;
Concept of complementary shape / ref. to neurotransmitter 'fitting'; **2 max**

(ii) Cause vesicles to move to presynaptic membrane / fuse with membrane; **1**

(c) (i) *Two marks for two of:*

Impulses / action potentials from neurones A and B together / spatial summation;
Cause sufficient depolarisation / open sufficient sodium ion channels;
For threshold to be reached; **2 max**

(ii) *Two marks for two of:*

Impulses from A and B independent / no summation;
Threshold not reached;
Insufficient sodium ion channels opened; **2 max**

(iii) Inhibitory;
More IPSPs than EPSPs / reduces membrane potential / makes more negative (allow hyperpolarisation) / cancels effect of action potential from A; **2 max**

Total 15 marks

Question 8

(a) (i) Hollow balls of cells;
Cells at one end form embryo; **2**
Accept points from a labelled diagram / diagram accompanying explanation.

(ii) *Four marks for four of:*

Statement of Fick's law –

Rate of diffusion α $\frac{\text{surface area of exchange surface x concentration difference across surface}}{\text{thickness of exchange surface}}$;

High surface area, high concentration difference and low thickness characterise an efficient gas exchange surface / eq.;
Villi / folded surface increase surface area;
Exchange surface is only one cell thick;
Concentration difference maintained by fetal circulation / fetal circulation carries oxygen away from placenta; **4 max**

(b) (i) *Three marks for three of:*

High pp of oxygen in lungs, low pp in placenta;
High percentage of haemoglobin can bind / saturate with oxygen in lungs;
Low percentage of haemoglobin can bind / saturate with oxygen in placenta;
Dissociates in placenta; **3 max**

(ii) *Two marks for two of:*

Fetal haemoglobin has a higher affinity for oxygen / eq.;
At low pps of oxygen;
Fetal haemoglobin can associate with oxygen at low partial pressures;
Maternal haemoglobin dissociates at low partial pressures; **2 max**

(c) (i) Carry oxygenated blood / oxygen to lungs;
To allow respiration in lungs / lungs cannot breathe oxygen / be ventilated before birth; **2**

(ii) A Prevents blood loss; **1**

B Prevents deoxygenated blood entering left side of heart / prevents deoxygenated blood from mixing with oxygenated blood / helps to establish adult (double) circulation / ensure all output from right ventricle goes to lungs; **1**

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) *Four marks for four of:*

Calcium ions bind to troponin;
Remove blocking action of tropomyosin / exposes actin binding sites;
ATP allows myosin to join / bind to actin / form cross-bridge;
'Re-cocks' myosin cross bridge / allows detachment from actin;
Enables calcium ions to be pumped back in;
Phosphocreatine allows regeneration of ATP without respiration;
Phosphocreatine releases Pi to join ADP; **4 max**

(b) *Six marks for six of:*

Endurance athletes exercise for long periods of time;
Respire / release energy aerobically;
Or too much lactate would accumulate;
Slow twitch fibres adapted to aerobic metabolism;
As have many mitochondria;
Site of Krebs' cycle;
And electron transport chain;
Much ATP formed;
Also are resistant to fatigue; **6 max**

(c) *Five marks for five of:*

Receptors in hypothalamus detect increase in core temperature / temperature of blood;
Heat loss centre stimulated;
Skin arteries / arterioles dilate / vasodilation;
Shunt vessels / pre-capillary sphincters constrict;
More blood flows to surface (capillaries);
Heat loss by radiation;
Heat loss by evaporation of sweat;
Reduced metabolic rate;
Remove clothing / seek cooler area / cold drink; **5 max**

Total 15 marks