

GCE 2005

January Series



Mark Scheme

Biology Specification A

BYA7 The Human Life-Span

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Dr Michael Cresswell Director General

BYA7**Question 1**

- (a) Cross-sectional – quick / easy to monitor large numbers / do not lose track of individuals with time;
Longitudinal – more representative of the individual / do not lose detail by averaging; 2
- (b) Sequence – 2, 1, 4, 3;; 2
[allow 1 mark for any 2 or 3 correct]

Total 4 marks

Question 2

- (a) (i) Myosin filaments drawn longitudinally in A-band region;
Actin filaments drawn longitudinally from Z-line to edge of H-zone; 2
[Max. 1 mark if Actin and Myosin are not correctly labelled]
- (ii) Electron microscope has greater resolution / able to tell two close objects apart better / electrons have shorter wavelength/higher frequency; 1
- (b) Correct answer = 20;;
Allow 1 mark for:
 $\frac{16 \times 1000}{8000}$
- OR
- $40 \div \frac{16}{8000}$ 2

Total 5 marks

Question 3

- (a) Concentration gradient – so digested products/correct named example can diffuse (into epithelium cell); 1
- (b) Emulsification → large S.A for lipase action / for digestion / for better water miscibility; 1
- (c) Exocytosis to leave (distal side of epithelium) cell; 1
- (d) Solubility in lipids allows products of digestion/glycerol/fatty acids/ monoglycerides to pass through plasma membrane; 1

Total 4 marks

Question 4

(a) On graph: **X** where glucose level is below norm
AND **Y** where glucose level is above norm; 1

(b) EITHER
1. Use m-RNA + reverse transcriptase to produce gene / (c)-DNA;
2. Restriction enzyme to cut open plasmid;
3. Add sticky ends (to insulin gene and to plasmid);

OR Allow:

1. Cut out insulin gene / cut open plasmid with restriction enzyme;
2. Use same restriction enzyme on second DNA;
3. Reference to (complementary) sticky ends;

4. Use ligase to join 2 DNA molecules;
5. Modified plasmid taken up by bacteria;

max 4

Total 5 marks

Question 5

(a) (i) **1 and 2** share neurone but **2 and 3** have separate neurones (to brain); 1

(ii) 1. 1 unit is sub-threshold;
2. (1 unit) No action potential/impulses in (sensory) neurone / does not stimulate (sensory) neurone;
3. (Spatial) summation / sufficient neurotransmitter released (from 3 receptors);
[Reject temporal summation] 3

(b) (i) (Three) different types of (cone) cells / types **6 and 7** sensitive to different wavelengths/different frequencies/different colours;

(ii) Impulses along separate neurone from each receptor cell / each receptor cell connects to separate neurones; 2

Total 6 marks

Question 6

- (a) (Increased) respiration produces (more) CO₂;
Increased H⁺ ion concentration (in RBC);
(H⁺ ions) cause more O₂ to be released from Hb / HbO₂ dissociates more readily /
affinity of Hb for O₂ decreases;
Use of O₂ by muscle lowers O₂ concentration so more rapid diffusion of O₂ from
RBC / more dissociation of HbO₂; max 3
[Need 'increased' / 'more' ONCE only – If not, max 2]
- (b) (i) CO₂ enters blood / More CO₂/lactic acid (formed); *[allow lactate]* 2
Forms carbonic acid / H⁺ ions;
- (ii) Hb combines with H⁺ ions / releases H⁺ ions; 1
- Total 6 marks

Question 7

- (a) B – It is the 2nd contraction / occurs (immediately) after A / occurs after atrium;
Larger/more force / more pressure; 2
- (b) Correct answer = 37-38;;

$$\frac{60}{\text{time for 1 cycle}} \quad ;$$
 2
- (c) (i) (Heart rate) reduced;
(Stroke volume) no effect; 2
- (ii) Reduced because C.O. = H.R. x S.V.; 1
- (iii) Parasympathetic; 1
- (d) (i) 1. Coordination via medulla (of brain)/cardiac centre;
2. (Increased) impulses along sympathetic (/ cardiac accelerator) nerves;
3. To S.A. node/pacemaker;
4. Release of noradrenaline;
5. More impulses sent from / increased rate of discharge of S.A. node/pacemaker;
6. Increased heart rate / increased stroke volume; max 4
- (ii) 1. In exercise – more energy release / more respiration / actively respiring muscles /
for aerobic respiration;
2. Higher cardiac output – increases O₂ supply / glucose supply (to muscles);
3. Increases CO₂ removal / heat removal / lactate removal (from muscles); 3

Total 15 marks

Question 8

- (a) (i) Movement/activity/muscle contraction requires energy;
Digestion of food requires energy;
Temperature regulation mechanism (in changing environment);
Maintenance/restoration of resting potentials in nervous system; max 2
- (ii) Woman B (is taller, therefore) has higher S.A.: volume;
Loses more heat/energy to environment;
OR
Taller person has more muscle;
Muscle has higher rate of metabolism (than fat); 2
- (iii) Reduced cardiac output;
More fat / less muscle;
Homeostatic control reduced; max 2
- (b) (i) Vegetable matter indigestible due to high fibre content;
Low in protein;
Lacks some essential amino acids;
Low in iron/causes anaemia / low in other named mineral – e.g. calcium/zinc;
Low in vitamin D/causes rickets / low in other named vitamin – e.g. vitamin B₂ / B₁₂;
max 2
- (ii) Different quantities of particular nutrients in different vegetable foods /
deficiency in one food made up for in another; 1
- (c) Males – greater standard deviation; 1
- (d) (i) There was no difference in iron consumption between males and females; 1
- (ii) Accept null hypothesis;
No significant difference / difference due to chance; 2
- (e) Iron present in haemoglobin/in red blood cells;
Correct reference to menstruation / pregnancy; 2

Total 15 marks

Question 9

- (a)
- Principle: 1 mark for correct feature + 1 mark for linked explanation.*

Folded surface / villi / microvilli;	Large surface area (to transfer large amounts of materials / named example);
Surface one-cell thick / thin / breakdown of material tissue;	Short/reduced distance for diffusion;
Blood circulates / flows / counter current;	Maintains concentration gradient;
Large 'lakes' / lacunae / sinuses of blood;	Slow flow for more exchange;
Many mitochondria;	ATP for active transport;
Transport proteins present;	Allows facilitated diffusion / active transport;
Feature from Fick's Law, e.g. large surface area;	Rapid rate of diffusion;

max 6

- (b) 1. Ductus arteriosus – blood bypass from pulmonary artery to aorta;
 2. Foramen ovale – blood bypass from right atrium to left atrium;
 3. Allows oxygenated blood (from placenta) to bypass lungs / to be taken to body tissues/organs; 3

- (c) Oestrogen stimulates development of mammary glands;
 maintains endometrium/uterus lining;
 falling level triggers birth;
- Progesterone inhibits release of FSH;
 stimulates development of mammary glands; [*reject 'lactation'*]
 maintains endometrium/uterus lining;
 falling level triggers birth / inhibits oxytocin/prolactin;
- hCG (chorionic gonadotrophin) maintains corpus luteum;
- Prolactin milk secretion/production;
- Oxytocin contractions (in uterus wall);
 stimulates milk release / stimulates ducts in mammary glands;

max 6

Total 15 marks