

GCE 2004
June Series



Mark Scheme

Biology/Human Biology A *BYA7*

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Question 3

- (a) Stage C / formation of secondary spermatocyte;
and two of
Occurs during meiosis;
Shows anaphase of meiosis I / anaphase I;
Shows chromosome number halved/reduced / diploid to haploid; max 3
- (b) Addition of water molecules / hydrolysis;
Protein to amino acids / break peptide bonds;
Carbohydrate to monosaccharides / break glycosidic bonds;
Glycoprotein attaches to active site / forms E-S complex;
Because it has complementary/matching shape; *[reject same shape]*
[allow 1 mark for glycoprotein broken down to amino acids/monosaccharides] max 2
- Total 5 marks

Question 4

- (a) Low partial pressure of oxygen at placenta;
Maternal (oxy)haemoglobin dissociates (in placenta/at low partial pressure of oxygen);
Fetal circulation carries oxygenated blood away;
Higher partial pressure of oxygen in maternal blood than in fetal blood entering placenta;
Maintaining oxygen concentration gradient; *[idea of maintenance required]* max 3
- (b) (Deaminated for) use in respiration;
Used in protein synthesis; *[idea of joining / linking / synthesising / process needed]*
Named example;
Second named example; max 2
- Total 5 marks

Question 5

- (a) Parasympathetic division acts antagonistically to sympathetic division;
Will reduce/stop secretion of saliva;
And prevent unnecessary loss of enzyme / expenditure of energy; max 2
- (b) Increased stimulation / output of SAN;
(Increased) release of (hormone) adrenaline;
More concentration / increase in heart rate; *[reject heartbeat]*
Increase in force of contraction / stroke volume / ejection fraction; 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 fibre to sodium ions;
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 reference to near vision involved;
Tension in suspensory ligaments;
Lens does not become sufficiently convex/
Rays of light refracted/bent less;
(Focusing near objects) requires maximum refraction/bending;
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) H band not visible/reduced / little/no thick filament/myosin only region / ends of thin filaments/actin close together;
I band not visible/reduced / little/no thin filament/actin only region;
A band occupies nearly all sarcomere / thick filament/myosin close to Z line;
Large zone of thick-thin overlap; max 2
- (ii) *Calcium ions:*
Bind to troponin;
Remove blocking action of tropomyosin / expose myosin binding sites;
- ATP:*
Allows myosin to detach from actin / to break cross bridge; [*allow attach and detach*]
Releases energy to recock/swivel/activate myosin head / drive power stroke; max 3
- (b) (i) Depolarisation of axon membrane/influx of Na⁺ establishes local currents;
Change permeability to Na⁺ /open Na⁺ gates of adjoining region;
Adjoining region depolarises / influx of Na⁺ ;
This process repeated along axon / self propagation;
Correct reference to/description of saltatory conduction; max 3
- (ii) Depolarisation of (presynaptic) membrane;
Ca²⁺ channels open / increased permeability to Ca²⁺ ;
Influx of Ca²⁺ ;
Vesicles move towards presynaptic membrane;
Vesicles fuse with presynaptic membrane;
[*If ions mentioned once assume candidate is referring to ions throughout; if no mention of ions penalise once only*] max 3
- (c) (i) 1. Correct axes labelled, correct orientation, linear scale;
2. Key points (100%, 90% and 50%) plotted correctly;
3. Plots joined by straight lines;
[*allow reasonable hand-drawn straight lines*] 3
- (ii) Fast fibres used (in explosive exercise);
[*allow reverse for slow fibres*]

Total 15 marks

Question 8

- (a) (i) Prolactin stimulates production/secretion of milk;
In/from alveoli/mammary glands/breasts;
Oxytocin causes ‘let down’/ejection/release of milk;
(From alveoli) into ducts; 4
- (ii) DNA/gene codes for amino acid sequence / prolactin has a specific amino acid sequence;
mRNA carries code to ribosomes;
Primary structure is sequence of amino acids;
Coils/folds into α -helix/ β - pleat/secondary structure;
Held in place by hydrogen bonds; [**allow once only*]
Folded into tertiary structure;
Held in place by disulphide bridges / ionic bonds;
Held in place by hydrogen bonds; [**allow once only*] max 4
- (b) (i) Study involving many people in each category / of particular ages;
[idea of small / few disqualifies]
At the same time; 2
- (ii) $\left[\frac{21-4}{6} \right] = 2.83 \text{ (kg yr}^{-1}\text{) [allow 2.8] (0-6 years)}$
 $\left[\frac{48-32}{4} \right] = 4.0 \text{ (kg yr}^{-1}\text{) (10-14 years);}$
 $\left[\frac{4.0-2.83}{2.83} \times 100 \right] = 41.3 \text{ (}\% \text{) OR } \left[\frac{4.0-2.8}{2.8} \times 100 \right] = 43 \text{ (}\% \text{);}$
[Correct answer = 2 marks however derived.] max 2
- (ii) Puberty occurs;
Growth spurt;
(Caused by) increased secretion of growth hormone;
(In response to) secretion/release of oestrogens/sex hormones; 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)
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 /when no food given/ (in plasma glucose) stimulates (increased) secretion of glucagon;
 4. Increases (in plasma glucose) stimulate (increased) secretion of insulin;
 5. Correct reference to role of α and/or β cells as secretors;
 6. Correct reference to interconversion of glycogen to glucose;
 7. Increased/decreased uptake of glucose by cells (as appropriate) / correct ref. to change in membrane permeability;
- max 5
- (b)
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;
 4. Dilation of shunt vessels / constriction of pre-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
- (c)
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;
 4. Reactions cease/slowed;
 5. Too little heat reduces kinetic energy of molecules / molecules move more slowly;
 6. Fewer collisions / fewer E-S complexes formed;
- max 5

Total 15 marks
