



General Certificate of Education

Human Biology 6413

Specification A

BYA7 The Human Life-Span

Mark Scheme

2006 examination - June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Question 1

- (a) use of water; *must be above arrowhead*
OH drawn correctly in place of glycosidic bond on each monosaccharide; 2
- (b) water potential made lower / more negative;
less water absorption / water enters gut – by osmosis / by diffusion; 2
- Total 4
-

Question 2

- (a) complete combustion / to release all the energy; 1
- (b) (i) correct answer: 1672 ;; = 2 marks
- OR
$$\frac{(22.10 - 20.10) \times 4.18 \times 100 \times 1000}{0.5 \times 1000} ; = 1 \text{ mark}$$
 2 max
- (ii) heat loss / lack of insulation / heat used to warm apparatus / incomplete combustion / loss due to light / *allow ref. to variation in peanuts*; 1
- Total 4
-

Question 3

- (a) minimum energy requirement per day / per hour / per ‘unit time’ ;
further qualification – at rest / recently woken / 12+ hours after a meal /
warm environment / naked; 2
- (b) (i) *EITHER*
warm environment;
less heat loss / less energy loss /
less energy needed to maintain body temperature;
OR
Malaysians smaller / shorter / more rounded shape;
lower SA to volume ratio for heat loss;
OR
this is a sub-set of the whole world population / an isolated population;
local genetic variation; 2
- (ii) excess food changed to fat as lower metabolic rate / less energy used (than other
populations / than average); 1
- Total 5

Question 4

- (a) breakdown of glycogen (to glucose);
glucose released into blood / from liver;
hepatic portal vein low because little from gut / between meals 2 max
- (b) insulin causes uptake of glucose (by liver) / glucose converted to
glycogen (in liver); 1
- (c) insulin affects liver and hepatic vein carries blood out of liver / hepatic portal
vein carries blood into liver; 1
- (d) constriction of arterioles/arteries in gut / vasoconstriction in gut /
dilation of arterioles/arteries in muscle / named muscle /
more blood flow to muscles / named muscle / less blood flow to gut; 2
- Total 6

Question 5

- (a) three types of cones;
each sensitive to different wavelength / to different colour; 2
- (b) parental genotypes correct: $X^R X^r$ AND $X^R Y$;
 gametes correct for candidate's parental genotypes;
 offspring genotypes correct and colourblind male identified as $X^r Y$ /
 correct genotypes derived from candidates gametes and identified as $X^r Y$;
correct probability = $\frac{1}{4}$ / 0.25 / 25% / 1 in 4 / 1:3 ; 4
- Total 6
-

Question 6

- (a) on graph:
 bell-shaped curve;
 maximum approx. 12 – 15 years; 2
- (b) *EITHER*
 (i) amount of food – more food → more energy
 OR
 proportions of carbohydrate, fat & protein different food types
 OR
 amount of exercise – movement uses energy / increases lean muscle mass
 OR
 racial group – different genetic makeup → different metabolic rate ; 1
- (ii) lean body mass (and adipose tissue) and bone density;
allow lean body mass and bone density
 $p \leq 0.05$; 2
- Total 5
-

Question 7

- (a) (i) A band; 1
- (ii) H zone and I band; 1
- (b) filaments in I / thin filaments / actin filaments slide in between myosin / thick filament;
thin filaments enter H zone / meet in middle of A band / pull Z lines closer; 2
- (c) correct answer: 22.5 mm ;; = 2 marks
- OR relaxed sarcomere length = $\frac{48}{16}$ / = 3 μm ; = 1 mark 2 max
- (d) (i) In table:
- | | |
|------|------|
| low | high |
| low | high |
| high | low |
- (1 mark per row;;;) 3
- (ii) 1. overall rate of contraction limited by rate of ATP-splitting;
2. ATPase splits ATP / hydrolyses ATP / converts ATP to ADP (+ phosphate);
3. ATP-splitting provides energy for *any TWO* from
myosin-actin interaction;
myosin head movement / actin to move relative to myosin;
to 'cock' myosin head; 4 max
- (iii) lactate = product of anaerobic respiration;
- type 1 has higher activity of glycolytic enzymes / has lower activity of
Krebs cycle enzymes / has fewer mitochondria; 2

Total 15

Question 8

(a) In table:

D
B
C

All 3 correct = 2 marks;;

2 correct = 1 mark;

0 or 1 correct = 0 marks

2

(b) (i) myelin insulates / prevents ion movement;
saltation / described re leaping node to node; 2

(ii) cat has higher body temperature;
ignore references to homoiothermy/warm-blooded
faster diffusion of ions / faster opening of ion pores / gates / channels; 2

(c) 1 increasing stimulus (potential) causes decrease in potential difference / rise in potential at P;
2 1 or 2 is sub-threshold / 1 or 2 does not give action potential;
3 3 or 4 is above threshold / 3 or 4 does give an action potential;
4 influx of Na⁺ ions; (*not just Na/sodium*)
5 voltage-gated channels (in axon membrane) opens / opens Na⁺ channels /membrane more permeable to Na⁺ (*not just Na/sodium*);
6 sufficient for stimulation of adjacent region of axon;
7 impulse propagated (from P to Q);
8 suitable ref. to ‘all-or-nothing’ law; 5 max

(d) 1. X / Acetylcholine → opening of Na⁺ channels / increases Na⁺ permeability;
2. X / Acetylcholine → Na⁺ ion entry into Z;
3. X / Na⁺ entry - raises potential / reduces potential difference / makes potential less negative;
4. Y / Cl⁻ entry - lowers potential / increases potential difference / makes potential more negative;
5. X stimulates and Y inhibits (Z);
6. balance of impulses from X and Y determines whether Z fires action potential / determines whether potential rises above threshold; 4 max

Total 15

Question 9

- (a)
- N.B. Must give **at least one** similarity for full marks*

Similarities:

1. mitosis producing cells for meiosis / other stages/ mother cells;
2. growth phase (between mitosis and meiosis);
3. both involve meiosis;

Differences:Any **five** from:

4. female mitotic phase in fetus / male mitotic phase begins at puberty;
allow oogonia in fetus / spermatogonia produced at puberty
5. male continues into old age / female ceases at menopause;
6. male produces large number of gametes / female just one (/ a few);
7. gap between meiosis 1 and meiosis 2 in female / end of meiosis I before egg release / meiosis II after fertilisation/ male no gap between meiosis 1 and meiosis 2;
8. female has asymmetric division / one egg + polar bodies / male forms 4 sperm;
9. female cyclic / male noncyclic; 6 max

- (b) statement of Fick's Law as : Rate of diffusion
- $\propto \frac{SA \times \text{Concentration difference}}{\text{Thickness}}$

Any **four** from:

1. large surface area due to folding / villi;
2. large surface area due to microvilli;
3. thin surface described – e.g. 2-3 cells thick / flattened epithelium / endothelium;
4. slow flow allows sufficient time for exchange;
5. counterflow allows maintenance of concentration gradient;
6. proteins in membrane allow facilitated diffusion ; 5 max

- (c)
- locations:
- | | |
|--------------------|-------------------------------------|
| ductus arteriosus: | Between pulmonary artery and aorta; |
| foramen ovale: | Between right and left atria; |

functions:

- (oxygenated) blood on right side of heart transferred to left / to aorta / to bypass lung;
 (because) blood oxygenated in placenta / not oxygenated in lungs; 4

Total 15