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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Biology 6411
Specification A

BYA6 Physiology and the Environment

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) kinesis;
(*ignore 'ortho-' / 'klino-', allow 'thermo-', reject 'photo-' / 'chemo-' / etc)*

random movements = 1 mark, eg
/ degree of turning / number of turns depends on strength of stimulus /
on temperature/ allow specific ref. to more turning at 35^{o} than at 30^{o} / non-directional stimulus/response; 2
ignore 'speed'

(b) stays longer in warmer area / at 35^{o} / tends to leave cooler area / to leave 30^{o} / stays in favourable conditions ;

remains near food source / on host; 2

Total 4

Question 2

(a) (i) high/higher CO_2 concentration / lack of oxygen; 1

(ii) CO_2 asphyxiates / is toxic;
lack of oxygen for (aerobic) respiration;
lack of energy / ATP (for pumping movements);
reduced muscle function / muscle fatigue 2 max

(b) removal of (excess) CO_2 / oxygen to break down lactate / to repay oxygen debt/ to enable aerobic respiration; 1

Total 4

Question 3

(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 muscles / named muscle; more blood flow to muscles / named muscle / less blood flow to gut;	2
		Total 6

Question 4

(a)	correct answer: 77 – 78 ;; *allow 75 - 80* OR Use of 55 AND 17 saturation / fall = 38; OR (Fall = y % +) use of $\frac{200\ y}{98}$;	= 2 marks = 1 mark = 1 mark	2
(b)	(in exercise) - faster respiration rate; more CO_2 production; CO_2 is acidic / forms carbonic acid; lactic acid production; release of H^+ ions;		3 max
			Total 5

Question 5

(a) three types of cones;
each sensitive to different wavelength / to different colour; 2

(b) parental genotypes correct: $\mathbf{X^RX^r}$ AND $\mathbf{X^RY}$;
gametes correct for candidate's parental genotypes;
offspring genotypes correct and colourblind male identified as $\mathbf{X^rY}$ /
correct genotypes derived from cand's gametes and identify $\mathbf{X^rY}$;
correct probability = ¼ / 0.25 / 25% / 1 in 4 / 1:3 ; 4

Total 6

Question 6

(a) thick cuticle / thick layer of wax/ sunken stomata/fewer stomata /
extensive / deep root system/ rolling of leaves;
ignore C_4 / ignore heat-shock proteins 1

(a) dry conditions – stomata partially closed;
due to less turgor in guard cells;
OR
watered conditions – stomata more open;
due to greater turgor in guard cells; 2

(c) (i) *EITHER*
temperature [*Allow heat*] – higher causes more water evaporation / diffusion [*not just transpiration]*
OR
light – causes stomatal opening
OR
soil texture – determines availability of water
OR
humidity – reduces evaporation / reduces gradient / wind causes more (water) evaporation; 1

(ii) high CO_2 gives less variation AND watering gives less variation ;
OR
insignificant difference in variability as small differences in SD; 1
reject 'no difference'

Total 5

Question 7

(a) (i) nervous system faster;
food in mouth only a short time / provides immediate lubrication /
enzyme already present; 2

(ii) sustained release of digestive secretions / longer-lasting effect; 1

(b) (i) gastrin – causes secretion/production of gastric juice / secretion of HCl / secretion by stomach;
reject enzyme 'production'. Reject 'controls' ONCE only.

secretin – causes secretion of alkali / $NaHCO_3/HCO_3^-$ (from pancreas) /
release/secretion/production of bile / inhibits stomach secretion;

CCK-PZ – causes contraction of gall bladder / release of bile *(reject bile 'production' / reject 'secretion')* / causes release of enzymes from pancreas; 3

(ii) sequence parallels flow of food / release of alkali / neutralisation of acid from stomach / provides optimum pH before pancreatic enzyme release / correct reference to avoiding premature release of enzymes; 1

(c) (i) endopeptidase cuts in middle of (polypeptide) chain / produces several chains;
produces many (free) 'ends' for exopeptidase to act on; 2

(ii) trypsin → APAK + SEGMAR + GAMF ;

carboxypeptidase → 3 correct dipeptides + remaining free amino acids;

(i.e. AP + A + K + SE + G + M + A + R + GA + M + F) 2

(d) microorganisms release cellulase / can digest plant cell walls / can digest cellulose;
makes (internal) cell proteins accessible;
microorganisms use NH_4^+ / NH_3 / urea / non-protein nitrogen; *Reject 'digest'*
microorganisms make amino acids / proteins;
cow digests (dead) microorganisms / digests microbial protein; 4 max

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 <u>higher</u> 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 <u>or</u> 2 is sub-threshold / 1 <u>or</u> 2 does <u>not</u> give action potential;
3. 3 <u>or</u> 4 is above threshold / 3 <u>or</u> 4 <u>does</u> give an action potential;
4. influx of Na^+ <u>ions</u>; (*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 <u>entry</u> 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 <u>and</u> 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) metabolic water / from respiration;
allow condensation reactions. Ignore 'oxidation'.
aerobic / use of oxygen; ('From aerobic respiration' = 2 marks) 2

(b)
1. dry air (inhaled) causes evaporation from nasal passages / or converse;
2. cooling due to evaporation;
3. blood is cooled;
4. (cool blood) flows from nose to brain / cools brain / keeps brain at const. temp.;
5. allows activity (e.g. foraging for food / escaping predators / not restricted to staying in humid burrow (in hot conditions);
6. air with high water vapour content leaves lungs / is exhaled;
7. water condenses in nasal passages;
8. due to lower temperature;
9. water can be reabsorbed (into blood) / swallowed / water conservation / less water loss; 4 max

(c) (i)
1. Reabsorption of Cl^- ions / NaCl / salt ;
allow Na^+
2. By active transport;
3. From (thick) ascending limb;
4. Decreased Ψ in surrounding tissue fluid; *Allow tissue fluid hypertonic*
5. Water reabsorbed from (thin) descending limb / from collecting duct;
6. By osmosis / diffusion;
7. Increased concentration of ions / Na^+ / Cl^- / salt towards bend in loop of Henle / deep in medulla;
8. Increase in concentration of ions proportional to length of loop of Henle;
9. (The longer the loop of Henle) the more water is reabsorbed; 6 max

(ii) ADH acts on collecting duct / distal convoluted tubule;
causes insertion of aquaporins (/ described) in cell membranes /
makes (cell surface membranes) more permeable to water;
increases reabsorption of water; 3

Total 15