



General Certificate of Education

Biology 6416

Specification B

BYB4 Energy, Control and Continuity

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.

General Guidance for the Mark Scheme

The following conventions are used in the mark scheme:

- A semicolon (;) separates each mark point
- An oblique stroke (/) separates alternatives within a mark point
- Underlining of a word or phrase means that the term must be used by candidates
- Brackets are used to indicate contexts for which a mark point is valid, but which may just be implied by a candidate's answer
- '*Accept*' and '*reject*' show answers which should be allowed or not allowed.
- Additional instructions may be shown in *italics*

The scheme shows the minimum acceptable answer(s) for each mark point - better, more detailed, or more advanced answers are always accepted, provided that they cover the same key ideas. Occasionally, a candidate will give a biologically correct answer that has not come up at standardising. If it is equivalent in standard to the mark scheme answers, it may be credited.

In some cases a mark may be awarded for understanding of a general principle, even though the detailed mark points on the scheme have not been made. This will be indicated on the mark scheme.

All mark points are awarded independently, unless a link between points is specified in the scheme.

Converse answers are normally acceptable, unless the wording of the question rules this out.

Disqualifiers

A correct point is disqualified when the candidate contradicts it in the same answer.

The list rule

When a question asks for a specific number of points, and the candidate gives more, any wrong answer cancels a correct answer. For example, if a question asks for two points and three answers are given, two correct and one clearly wrong, the mark awarded is one, whatever the order of the answers.

Valid points from **diagrams** are credited, if they are not duplicated in the text.

Where a question asks for **differences** between X and Y, the mark may be awarded for a feature of X without the converse for Y, if it is absolutely clear which is being referred to.

BYB4 Energy, Control and Continuity

Question 1

- (a) A = suspensory ligaments;
B = ciliary muscles / body; 2
- (b) (i) ciliary muscles / B relax;
suspensory ligaments / A become taut / are pulled;
lens refracting / converging / 'bending' power reduced; 3
- (ii) refraction (by cornea) reduced;
focused / image on retina / fovea; 2
- Total 7**

Question 2

- (a) greater environmental influence than genetic; 1
- (b) identical twins have same genotype / converse for non-identical;
compare identical and non-identical twins / identical twins who have been separated /
non-identical twins in same environment;
if genetic – similarity between identical twins / converse;
large sample required / use a statistical test; 4
- Total 5**

Question 3

- (a) phylum, class, order;
species, *Acinonyx jubatus*; 2
- (b) larger groups containing smaller groups; 1
- (c) (i) do not interbreed to produce fertile offspring / different DNA /
different niches; 1
- (ii) fossil record;
evolutionary history/phylogeny;
biochemical differences e.g. DNA/proteins/cytochromes;
homologous features / named feature;
karyotype / number and form of chromosomes; 2
(discount any example credited in (i))
- Total 6**

Question 4

(a)	(i)	TB Tb tB tb;	1
	(ii)	homologous chromosomes appropriately labelled;	1
	(iii)	separation of chromatids;	1
(b)	(i)	crossing over occurs; between D and G ; sections of chromatids/chromosomes/DNA/genes exchanged;	3
	(ii)	crossing over is infrequent (between close genes);	1
Total			7

Question 5

(a)	e.g. urea / amino acids / fatty acids / glycerol / ion / small protein; (one mark for two of above)	1	
(b)	blood pressure decreased; (less pressure) forms less filtrate;	2	
(c)	microvilli provide large surface area; carrier proteins (in membrane) for active transport; channel proteins for facilitated diffusion; specific carriers for specific molecules / sodium pumps; (many) mitochondria for active transport;	2 max	
(d)	(i)	up to 2.2 mg cm ⁻³ all glucose reabsorbed / above 2.2 mg cm ⁻³ excess glucose not reabsorbed / at 2.2 mg cm ⁻³ threshold value reached; saturation of carriers / active transport mechanism;	2
	(ii)	decrease in insulin production / receptors not responsive to insulin / specific damage to tubule described / membrane less permeable to glucose;	1
Total			8

Question 6

(a)	is always expressed (in the phenotype) / produces (functional) proteins;	1
(b)	codominance;	1
(c)	Parental genotypes - hhC ^R C ^W , HhC ^W C ^W ;	
	Gametes - hC^R hC^W HC^W hC^W	
	Offspring genotypes - HhC ^R C ^W , hhC ^R C ^W , HhC ^W C ^W , hhC ^W C ^W ;	
	Offspring phenotypes - hornless roan, horned roan, hornless white, horned white	
	Ratio of offspring - 1 1 1 1;	4

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- | | | | |
|--------------|------|--|----------|
| (d) | (i) | sperm (with more DNA) have X chromosome;
X is larger / has more genes than Y; | 2 |
| | (ii) | female for milk / males for meat / male or female for breeding; | 1 |
| Total | | | 9 |

Question 7

- | | | | | |
|-----|---|---|-----|---|
| (a) | ✓ | ✓ | x ; | |
| | x | x | ✓; | |
| | ✓ | ✓ | ✓; | |
| | ✓ | x | x; | 4 |
-
- | | | | |
|--------------|-------|--|----------|
| (b) | (i) | pyruvate/succinate/any suitable Krebs cycle substrate; | 1 |
| | (ii) | ADP and phosphate forms ATP;
oxygen used to form water / as the terminal acceptor; | 2 |
| | (iii) | Y X W Z;
order of carriers linked to sequence of reduction / reduced carriers cannot
pass on electrons when inhibited; | 2 |
| Total | | | 9 |

Question 8

- | | | | |
|-----|------|---|-------|
| (a) | (i) | maintaining a constant internal environment; | 1 |
| | (ii) | <i>one mark for example of factor kept constant;
one mark for explaining its importance;</i> | |
| | | e.g.
temperature / pH;
optimum for enzymes / effect of pH / temperature on enzyme activity; | |
| | | <i>OR</i> | |
| | | water potential / blood glucose;
effect of osmotic / blood glucose imbalance on cells; | 2 max |

- (b) (i) 1. hypothalamus (contains the thermoregulatory centre);
 2. has receptors which detect temperature changes of blood;
 3. receives impulses from receptors in skin;
 4. nerve impulses transmitted (from hypothalamus / brain);
 5. results in vasoconstriction / constriction of arterioles / dilation of shunt vessels;
 6. diversion of blood to core / specified organ / less blood to skin;
 7. muscular contraction / shivering generates heat via respiration;
 8. release of thyroxine / adrenaline;
 9. increase in metabolic rate / respiration;
 10. correct reference to negative feedback mechanisms; 7 max
- (ii) larger surface area to volume ratio;
 less insulation / steeper thermal gradient;
 more heat loss by conduction; 2 max
- (c) cannot interact with / move tropomyosin;
 (*allow troponin*)
 from binding sites on actin;
 (*reject active sites*)
 myosin (heads) do not bind / actinomyosin not formed;
 does not activate ATPase / energy not released from ATP; 3 max

Total 15

Question 9

- (a) action potential arrives / depolarisation occurs;
 calcium ions enter synaptic knob;
 vesicles fuse with membrane;
 acetylcholine diffuses (across synaptic cleft);
 binds to receptors; 4 max
- (b) inside becomes more negatively charged / hyperpolarised;
 stimulation does not reach threshold level / action potential not produced;
 depolarisation does not occur / reduces effect of sodium ions entering; 3
- (c) (i) inhibits enzyme (which breaks down GABA);
 more GABA available (to inhibit neurone);
- OR*
- binds to (GABA) receptors;
 inhibits neuronal activity / chloride ions enter (neurone); 2 max
- (ii) receptors have different tertiary/3D structure/shape not complementary;
 GABA cannot bind;
 inhibition of neuronal activity does not occur / chloride ions do not enter; 3
- (d) motor area;
 left cerebral hemisphere; 2

Total 14

QWC 1