

GCE 2004

June Series



Mark Scheme

Biology B

BYB4

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.

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Guidance on the award of the mark for Quality of Written Communication

Quality of Written Communication assessment requires candidates to:

- select and use a form and style of writing appropriate to purpose and complex subject matter;
- organise relevant information clearly and coherently, using specialist vocabulary when appropriate; and
- ensure text is legible, and spelling, grammar and punctuation are accurate, so that meaning is clear.

For a candidate to be awarded 1 mark for quality of written communication on the question identified as assessing QWC in a unit test, the minimum acceptable standard of performance should be:

- the longer parts (worth 4 marks or more) should be structured in a reasonably logical way, appropriate and relevant to the question asked;
- ideas and concepts should be explained sufficiently clearly to be readily understood. Continuous prose should be used and sentences should be generally be complete and constructed grammatically. However, minor errors of punctuation or style should not disqualify;
- appropriate AS/A level terminology should be used. Candidates should not use such phrases as ‘fighting disease’, ‘messages passing along nerves’, ‘enzymes being killed’ etc, but a single lapse would not necessarily disqualify. Technical terms should be spelled correctly, especially where confusion might occur, e.g. mitosis/meiosis, glycogen/glucagon.

The Quality of Written Communication mark is intended as a recognition of competence in written English. Award of the mark should be based on overall impression of performance on the question identified on the paper as assessing QWC. Perfection is not required, and typical slips resulting from exam pressure such as ‘of’ for ‘off’ should not be penalised. Good performance in one area may outweigh poorer performance in another. Care should be taken not to disqualify candidates whose lack of knowledge relating to certain parts of a question hampers their ability to write a clear and coherent answer; in such cases positive achievement on other questions might still be creditworthy. No allowance should be made in the award of this mark for candidates who appear to suffer from dyslexia or for whom English is a second language. Other procedures will be used by the Board for such candidates.

Examiners should record 1 or 0 at the end of the paper in the Quality of Written Communication lozenge. This mark should then be transferred to the designated box on the cover of the script.

BYB4**Question 1**

- | | | | |
|--------------|-------|--|----------|
| (a) | (i) | arc shows 3 neurones;
<i>(3 distinct neurones, one of which is in the grey matter, with correct route through dorsal and ventral roots and indication of synapses. Ignore position of cell bodies.)</i> | 1 |
| | (ii) | neurones labelled sensory, relay/intermediate, motor; | 1 |
| | (iii) | muscle labelled as effector; | 1 |
| (b) | | impulses to brain;
<i>(reject signal, message, information)</i>
sensory areas (in brain);
(in) cerebral hemispheres;
interpretation/processing by association area; | 3 max |
| Total | | | 6 |
-

Question 2

- | | | | |
|--------------|-------|---|----------|
| (a) | (i) | RuBP - 5; GP - 3; TP - 3; Glucose – 6;
<i>(all correct = 2 marks; 3 or 2 correct = 1 mark)</i> | 2 |
| | (ii) | stroma; | 1 |
| | (iii) | light-dependent reaction / (photo)phosphorylation;
<i>(accept photolysis)</i> | 1 |
| | (iv) | 5 out of 6 / 83% / equivalent; | 1 |
| (b) | | enzymes involved / not a photochemical reaction;
slow rate of enzyme/chemical reaction at low temperature /
less kinetic energy / fewer collisions; | 2 |
| Total | | | 7 |
-

Question 3

- (a) (thermo)receptors in skin;
(accept receptors in hypothalamus if after reference to cooled blood)
 impulses via nerves/neurons to or from; *(once only)*
 hypothalamus;
 heat gain/temperature centre (in hypothalamus);
 contraction /constriction of arterioles; *(not capillaries, or just vasoconstriction)*
 diversion through shunt vessels; 4 max
- (b) (i) reduced/no evaporation of sweat;
 due to reduced gradient / saturation/high water content of air;
 less heat loss by (latent) heat of evaporation; 2 max
- (ii) skin vessels open/vasodilatation; *(movement dq)*
 blood diverted from muscles / limited total volume of blood; 2
- Total 8
-

Question 4

- (a) (i) Order, Family, Genus.
(all correct = 2 marks; 2 correct = 1 mark) 2
- (ii) 3 concentric circles in Carnivora, labelled Felidae, Panthera and L; 1
- (b) (i) large groups split into smaller groups (which do not overlap); 1
- (ii) (phylogenetic) based on evolutionary history;
 shows ancestry of groups / points of divergence;
 example, e.g. reptiles and birds separated after mammals / reptiles
 and birds more closely related than mammals;
 (hierarchical) based on shared characteristics (seen today); 3 max
- Total 7
-

Question 5

- (a) (i) paternal grandmother: $X^G X^G$ or $X^G X^g$ 1
- (ii) grandparent genotypes: $[X^g Y]$ $[X^g X^g]$ $[X^g Y]$;
 gametes: $[X^G$ and X^g , or X^G only] $[X^g$ and $Y]$ $[X^g]$ $[X^g$ and $Y]$;
 parents genotypes: $[X^G Y]$ $[X^g X^g]$
 gametes: $[X^G$ and $Y]$ $[X^g]$
 daughter: $[X^G X^g]$;
(all correct = 3 marks);
(max 2 if no distinction between pairs of gamete genotypes, e.g. comma, space or circle);
(allow omission of gametes clearly not involved in next generation);
(all males XY and females XX = 1 mark, if no other marks); 3
- (iii) nil;
 X chromosome, without G allele, inherited from mother / Y must
 be inherited from father, not X^G ; 2
- (b) X and Y chromosomes are different sizes / shapes;
 chromatids unable to line up and form bivalent / only
 short pairing region / most of length not homologous; 2
- Total 8
-

Question 6

- (a) ADH; (*accept vasopressin*) 1
- (b) reabsorption / passes back into blood;
 by active transport; 2
- (c) (sodium) ions pumped out of ascending limb;
 water passes out of descending limb (into high concentration in
 tissue fluid / interstitial fluid);
 some sodium ions re-enter descending loop (by diffusion);
 high concentration at base of loop / some ions diffuse out near base
 increasing concentration outside loop; 3 max
- Total 6
-

Question 7

- (a) (more cristae / larger surface area) for electron transport chain / more enzymes for ATP production/oxidative phosphorylation; muscle cells use more ATP (than skin cells)(not just more respiration); 2
- (b) (i) pyruvate; 1
- (ii) carbon dioxide formed / decarboxylation; hydrogen released / reduced NAD formed; acetyl coenzyme A produced; 2 max
- (c) NAD/FAD reduced / hydrogen attached to NAD/FAD; H^+ ions/electrons transferred from coenzyme to coenzyme/carrier to carrier / series of redox reactions; energy made available as electrons passed on; energy used to synthesise ATP from ADP and phosphate / using ATPase; H^+ / protons passed into intermembrane space; H^+ / protons flow back through stalked particles/enzyme; 3 max
- Total 8
-

Question 8

- (a) (i) radial and circular muscles in iris; opposing action = antagonistic; radial contraction increases pupil diameter / circular contraction reduces (or vice versa for iris). 3
- (ii) (bright) light stimulates retinal cells / impulses from eye to brain; parasympathetic system; acetylcholine secreted; stimulates contraction of circular muscles; 3 max
- (b) the more convex the lens, the greater the refraction; high refraction/high refraction needed for near vision / explanation or diagrams of image formation; lens becomes less elastic with age; hence difficulty in focusing on close objects / reading; minimal change beyond about 55; 4 max

(c)	(i) rhodopsin bleached/broken down by light; time for resynthesis;	2
	(ii) rhodopsin/pigment absorbs green light more readily than red / is more sensitive to green light; (after resynthesis) less (intense) green light needed to break down rhodopsin (than red);	2
	(iii) white has (high proportion of) wavelengths to which rhodopsin not sensitive;	1
	Total	15

Question 9

(a)	sections of chromatids exchanged; sections have different alleles; new combinations of (linked) alleles; <i>(allow 1 mark for idea that 'genes' are exchanged, if no other marks gained)</i>	3
(b)	(i) length controlled by many genes / polygenes; each gene may have different alleles / idea of additive effects; OR environmental factors / or named factor; how named factor may affect growth of seeds;	2 max
	(ii) 1. selection of large seeds for sowing; 2. higher proportion of alleles for long length; 3. loss of alleles for short seeds from population; 4. reference to distribution curves, e.g lower end 'cut off'; 5. (possible appearance of) new alleles through mutation; 6. process repeated over many generations; <i>(G - allow 1 mark idea for that 'largeness' selected, survives and inherited)</i>	4
(c)	1. isolation of (ancestral) finches on (different) islands; 2. range of habitats/environmental conditions; 3. competition for seeds/food; 4. variation amongst finches; 5. some more suited to different food sources / differential survival; 6. alleles/genes for specific adaptations/features passed on; 7. different selection in separate populations, e.g. on different islands; 8. different populations unable to interbreed;	6 max
	Total	15

QWC (See guidance) 1