ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Biology 5416/6416
Specification B

Energy, Control and Continuity BYB4

Mark Scheme
2005 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.

Further copies of this Mark Scheme are available to download from the AQA website:
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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 absolutely clear which is being referred to.

Guidance on the award of the marks for Quality of Written Communication on Section B of Unit Tests

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 Section B 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 Section B. 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 Section B 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) cornea; 1

(b) ciliary muscles contract;
suspensory ligaments go slack;
lens bulges/more spherical/thicker/fatter/more convex; (*not rounded*)
due to its elasticity;
shorter focal length / more refraction / more convergence;
eye muscles contract to move eyes in sockets;
pupil enlarges to expose more lens; 4 max

Total 5

Question 2

(a) (i) pigment reflects/does not absorb green or yellow or orange;
pigment absorbs blue or violet;
pigment absorbs red;
(*accept correct wavelengths instead of colours*)
(*any 2 for 1 mark*) 1

(ii) light (energy) absorbed by chlorophyll;
raises energy level of electrons / electrons are excited/emitted;
ATP formed; 3

(b) more wavelengths / colours absorbed;
more (efficient) photosynthesis can occur at these depths / low light intensities
or
more (efficient) photosynthesis can occur when some wavelengths are not present; 2

Total 6

Question 3

(a) (i) different shape/different tertiary structure/
different sequence of amino acids; 1

(ii) insulin unable to attach to receptors;
reduced/no uptake of glucose into cells /
no carrier proteins/channels for glucose transport; 2

(iii) glucose reabsorbed/absorbed into blood;
from proximal tubule;
by active transport/involving membrane carriers; 3

(b) (i) larger genetic component; 1
(*must be comparative*)

(ii) number of cases studied;
matched samples;
age of twins;
named environmental factor;;
(*allow 2 marks for 2 different factors if no overlap in effect*)
family history of diabetes;
method of diagnosis;
same sex in non-identical twins; 2 max

Total 9

Question 4

(a) males are XY and females XX / males have one X chromosome and females two X chromosomes;
males only have one allele (of the gene) present /
recessive allele always expressed;
colour blindness is masked in heterozygote /
female needs 2 recessive alleles to be colour blind; 2 max

(b) (i) 5 - hh X^b Y;
6 - Hh X^B X^b ; 2

(ii) h X^b , h Y, and H X^B, h X^B, H X^b , hX^b; 1

(iii) 1/8 or 12.5% or 0.125;;
either
genetic diagram to show genotypes Hh X^b X^b , Hh X^BY, hh X^B X^b, hh X^BY, HH$X^b$$X^b$, Hh X^bY, hh X^b X^b; hh X^bY;
1/8;
or
P (boy) = 0.5, P (colour blind) = 0.5, P (white streak) = 0.5;
(0.5 × 0.5 × 0.5 =) 0.125; 2

Total 7

Question 5

(a) cerebral hemisphere/cerebrum/cerebral cortex; (*accept left hemisphere*) 1

(b) (i) speech association area – correct word selected or identified from past experience or memory/understanding of language/processes written word; 1

A - speech;
impulses to muscles (to form words);

2

B – receives impulses from eyes/optic nerve or visual cortex;
interprets in light of previous experience / (process in) visual association area/ passes impulse (from visual cortex) to visual association area; 2
(*penalise messages/signals once - applies to A and B)*

(ii)

B or visual cortex or visual association area	→	Speech association area or Wernicke's	→	A or Broca's

1

Total 7

Question 6

(a) discontinuous, as discrete groups; 1

(b) (i) in woods low percentage of banded yellow shells / in grassland/hedgerows high percentage of banded yellow shells; (*gains 2 marks*)
low percentage of yellow shells in woods/higher percentage of yellow shells in grassland/hedgerows / low percentage of banded shells in woods/ higher percentage of banded shells in grassland/hedgerows / distribution similar in grassland and hedgerows; (*gains 1 mark*) 2

(ii) due to natural selection;
in their habitat they are better camouflaged ;
therefore less predation (by birds);
so higher proportion of these survive;
and pass on their alleles/genes; 4 max

Total 7

Question 7

(a) mutations;
which are different/at different positions in the gene; 2

(b) (i) either dominant or recessive allele; 1

(ii) a^ha^h BB, a^haBB, a^ha^h Bb, a^haBb;; 2
(*allow 1 mark for 2 or 3 correct answers*)

If all candidates in centre have not corrected Erratum please complete Script Referral Form and allow A^hA^hBB A^haBB A^hA^hBb A^haBb and possibly A^ha^hBB, A^ha^hBb also (*ignore for marking purposes*)

(iii) temperature lower at extremities;
enzyme active/ not denatured; 2

(c) if allele A is present (normal) tyrosinase/enzyme is produced,
so it does not matter what other allele is present / explanation of why heterozygote is same phenotype as double dominant in terms of enzyme produced;
phenotype/rabbit is black as both have alleles A and B**;** 2

Total 9

Question 8

(a) 1. automatic (adjustments to changes in environment)/ involuntary;
2. reducing/avoiding damage to tissues / prevents injury/named injury e.g. burning;
3. role in homeostasis/example;
4. posture/balance;
5. finding/obtaining food/mate/suitable conditions;
6. escape from predators; 3 max
(ignore 'danger' or 'harm' unless qualified)

(b) (i) 1. (impulse causes) calcium ions/Ca^{++} to enter axon;
2. vesicles move to/fuse with (presynaptic) membrane;
3. acetylcholine (released);
4. (acetylcholine) diffuses across synaptic cleft/synapse;
5. binds with receptors on (postsynaptic) membrane; (*reject active sites, disqualify point)*
6. sodium ions/Na^{+} enter (postsynaptic) neurone;
7. depolarisation of (postsynaptic) membrane;
8. if above threshold nerve impulse/action potential produced; 6 max

(ii) neurone to neurone and neurone to muscle;
action potential in neurone and no action potential in muscle/sarcolemma;
no summation in muscle;
muscle response always excitatory (never inhibitory);
some neuromuscular junctions have different neurotransmitters;
(penalise 'nerve' once) 2 max

(c) 1. motor area of brain involved;
2. impulses from brain;
3. idea of antagonistic muscles;
4. triceps contracts; (*accept correct reference to extensor muscles*)
5. reference to sliding filaments in correct context;
6. biceps relaxes; (*accept correct reference to flexor muscles*)
7. action of lever explained in terms of muscle, joint and bone; 4 max

Total 15

Question 9

(a) large groups are divided into smaller groups; (*not just 'hierarchical'*)
members of a group have features in common;
based on anatomy/fossils/embryology/DNA/specific aspect of cell biology /homologous structures;; (*any two for 2 marks*)
reflects evolutionary history; 3 max

(b) fungi and animals; 1

(c) (insects and fungi) have common ancestor;
they diverged a long time ago / before others referred to in phylogenetic tree; 2

(d) those with similar sequences put in same groups/ are more closely related;
the greater difference in amino acid sequence the longer ago the groups diverged; 2

(e) A - present in all (eukaryotic) species or organisms / quantifiable;
D - extinct species not considered/no timing of events available /only limited number of amino acid sequences /can't include prokaryotic species 2

(f) (i) mitochondrion;
cristae/stalked particle/ inner membrane of mitochondrion; 2

(ii) electrons/hydrogen combine with NAD or FAD/ NADH or FADH in correct context;
electrons passed through series of carriers;
energy released in transfer;
energy used to make ATP;
from ADP and inorganic phosphate/ using ATPase;
(*reject* P, *accept* (P), P_i) 3 max

Total 15

QWC 1