AQA

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Biology 5416/6416
Specification B

Genes and Genetic Engineering BYB2

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:
www.aqa.ork.uk

Set and published by the Assessment and Qualifications Alliance.

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
- <u>Underlining</u> of a word or phrase means that the term <u>must</u> 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 <u>one</u>, 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.

BYB2

Question 1

(a)   25 *(allow 24.75 – 25.25);*   1

(b)   breaks down layer / 'membrane' / 'coat' / cells around ovum;   *(reject wall)*
        allows entry of sperm nucleus / DNA;   2

(c)   provide ATP / release energy / carry out respiration;
        for movement;   2

(d)   increases chance of reaching egg / fertilisation;
        have to travel long distances / not all sperm viable / many do not survive;   2

                                                                                              Total   7

Question 2

(a)   (i)   anaphase;   1

        (ii)   sister / identical <u>chromatids</u> (separate);
                move to opposite poles / ends / sides;   2

(b)   (i)   interphase;   1

        (ii)   <u>ATP</u> production / protein synthesis / replication of centrioles;   1

        (iii)   1.2;   1

(c)   short duration of <u>interphase</u>;   1

                                                                                              Total   7

Question 3

(a)   (i)   ATA;   1

        (ii)   AUA;   1

(b)   tRNA 'clover leaf' shape; *(allow reference to loop / folded structure)*
        tRNA standard length;
        tRNA has an amino acid binding site;
        tRNA has anticodon available / three exposed bases;
        tRNA has hydrogen bonds (between base pairs);   2 max

(c) (i)   ribosome;   1

     (ii) incorrect sequence of amino acids / primary structure;
           non-functional/incorrect polypeptide/protein/enzyme/tertiary
           structure/active site;   2

                                                              Total 7

Question 4

(a) different form of a gene;   1

(b) hydrogen bonds broken;
     semi-conservative replication / both strands used (as templates);
     <u>nucleotides</u> line up;
     complementary / specific base pairing / A and T / C and G;
     <u>DNA</u> polymerase;   4 max

(c) deletion causes frame shift / alters base sequence (from point of mutation);
     changes many amino acids / sequence of amino acids (from this point);
     substitution alters one codon / triplet;
     one amino acid altered / code degenerate / same amino acid coded for;   3 max

                                                              Total 8

Question 5

(a) asexual / vegetative / cloning;   1

(b) (favourable) characteristic can be maintained in all plants;
     virus/disease free plants can be produced;
     larger number of plants produced / higher success rate;
     produced quicker;   2 max

(c) genetically identical / no genetic variation / clones;   1

(d) switch on/express different genes;   1

                                                              Total 5

Question 6

(a)   polymerase chain reaction / PCR;   1

(b)   (i)   joins nucleotide together; *(not complementary bases)*   1

         (ii)   enables replication / sequencing to start / keeps strands separate;   1

(c)   (i)   (modified nucleotide) does not form bonds/react with other nucleotides;
                 does not "fit" DNA polymerase/enzyme/active site;   1 max

         (ii)   AC; *(accept reading from right hand side i.e. TC)*   1

(d)   (i)   different lengths / sizes / mass;   1

         (ii)   <u>radioactive</u> <u>primer</u>;   1

         (iii)   GAAGTCTCAG;   1
                 (accept reading from autoradiogram i.e. CTTCAGAGTC)

                                                        Total 8

Question 7

(a)   1. (defective) carrier / intrinsic / channel protein in membrane / epithelial cells
           / CFTR;
    2. blocks outward passage of chloride ions;
    3. water retained in cell;
    4. unable to remove mucus in lungs so infection more likely;
    5. narrowing of air passages so reduced air flow / breathing more difficult;
    6. increased diffusion distance / reduced surface area for gas exchange
          reduced / reduced surface area so insufficient oxygen received;
    7. <u>pancreatic</u> (duct) blocked so less enzymes present / less efficient digestion;
    8. damage to <u>pancreas</u> can cause diabetes
    9. mucus in intestines so poor absorption of nutrients;
    10. blocked ducts (in reproductive organs) causes fertility problems / sterility;   5 max
    (max 3 marks for marks relating to symptoms i.e. points 4 - 10)

(b)   probe will attach (to mutant allele);
       attaches to <u>one</u> DNA strand;
       as a result of complementary base <u>pairing</u>;
       radioactivity detected on film/X-ray / by autoradiography (if mutant allele
       present);   4

(c)   <u>*for*</u>
gene is only active in mammary cells / only affects milk / easy to obtain product /
/ product produced in large amounts / gene passed to offspring;

                    2

<u>*against*</u>
long term effects not known / qualified reference to animal exploitation e.g.
use of embryos / effect of inserted gene on other sheep tissues/genes;

Total 11

QWC 1

(c)   <u>*for*</u>
gene is only active in mammary cells / only affects milk / easy to obtain
product /