



ASSESSMENT and
QUALIFICATIONS
ALLIANCE

General Certificate of Education

Biology 5416

Specification B

BYB2 Genes and Genetic Engineering

Mark Scheme

2006 examination - January 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.

BYB2**Question 1**

- (a) (i) allele; 1
- (b) (i) reduced/blocked/stopped/slower;
(CFTR) protein(one)amino acid missing / changed tertiary/3D shape; 2
(*reject irregular shape*)
- (ii) water potential gradient reduced/water potential less negative/
higher in mucus (*accept ref to concentration differences*)
reduced/no movement of water out of the cell / water moves into
the cell, by osmosis; (*must be in context*) 2
- (c) transfer of healthy/normal gene;
viral / liposome transfer / vector; (*reject plasmids*)
gene transcribed and translated; (*or description*)
gene expressed/functional / normal protein/CFTR produced; 3 max

Total 8**Question 2**

- (a) (i) $\frac{800}{40} = x \times 20$ (*principle, sperm magnified more than ovum*)
- OR
- $\frac{33/34/35}{3} = 11.0-11.7$ (*principle, ovum measured diameter more than sperm*);
- answer 220-234 (x); (*correct answer 2 marks*) 2
- (ii) (provide) nutrients, organelles, cytoplasm, stored food, respiratory substrate
(for embryo); 1
- (b) prevent entry of (more) sperm / further fertilisation;
(ensure only) diploid number of chromosomes / transfer of 1 set of chromosomes; 2

Total 5

Question 3

- (a) (i) restriction (endonuclease) enzyme;
cuts DNA at specific/restriction points/after specific base sequence; 2
- (ii) PCR/polymerase chain reaction; 1
- (b) isolated cells divide by mitosis;
can get many plants (producing toxin) / rapid production of (toxin producing) plants;
all cells (in the new plant/clone) will produce the toxin;
only small number of cells in the whole plant would produce the toxin / express gene; 3 max

Total 6

Question 4

- (a) mitosis;
genetically/ genes /genotype identical; 2
(*reject same genes*)
(*ignore references to asexual reproduction*)
- (b) (different)environmental conditions/named environmental factor/mutation; 1
- (c) dispersal / prevent overcrowding / competition / colonise ;
increased number of (proven) offspring; (*not quicker*) 2

Total 5

Question 5

- (a) AGC; TTC; 2
- (b) anticodon complementary to codon/reads message on mRNA;
specific amino acid;
carried/transferred (to ribosome);
correct sequence of amino acids along polypeptide; 3 max
- (c)

(Met)	Phe	Gln	Gln	Lys	Gln	Phe
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2

(*three/four/five correct 1 mark; six correct 2 marks*)

Total 7

Question 6

- (a) high energy radiation /ionising particles;
 named particles/ α , β , γ ;
 colchicine;
 x rays/cosmic rays;
 uv (light);
 carcinogen / named carcinogen;
 mustard gas / phenols / tar (qualified); 1 max

- (b) (i) removal of one or more bases/nucleotide;
 frameshift/(from point of mutation) base sequence change; 2
- (ii) sequence of bases in mRNA would change;
 (sequence of) amino acids different / different primary structure;
 (active site / enzyme 1) changed tertiary shape / changed active sites;
white pigment does not bind;
 lilac pigment not produced / white pigment remains unchanged/
 enzyme 1 does not function; 4 max

- (iii) blue **and** lilac; white;

<i>colour of petal</i>
<i>(white)</i>
blue
lilac;
white;

2

Total 9

Question 7

- (a) 1 two strands therefore semi-conservative replication (possible);
 2 base pairing/hydrogen bonds holds strands together
 3 hydrogen bonds weak/easily broken, allow strands to separate;
 4 bases (sequence) (exposed so) act as template /can be copied;
 5 A with T, C with G / complementary copy;
 6 DNA one parent and one new strand; 4 max

- (b) 1 chromosomes shorten/thicken/supercoiling;
 2 chromosomes (each) two identical chromatids/strands/copies (due to replication);
 3 chromosomes/chromatids move to equator/middle of the spindle/cell;
 4 attach to individual spindle fibres;
 5 spindle fibres contract / centromeres divide / repel;
 6 (sister) chromatids/chromosomes (separate) move to opposite poles/ends of the spindle;
 7 each pole/end receives all genetic information/identical copies of each chromosome;
 8 nuclear envelope forms around each group of chromosomes/chromatids/at
 each pole; 7 max

- (c) cancer cells killed, normal body cells survive; 2
cancer cells low oxygen (as blood supply cannot satisfy demand);

Total 13

QWC 1