GCE 2005
January Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Biology Specification B

BYB2 Genes and Genetic Engineering

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.org.uk

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales 3644723 and a registered charity number 1073334. Registered address AQA, Devas Street, Manchester. M15 6EX. *Dr Michael Cresswell Director General*

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.

BYB2

Question 1

(a)		appropriately placed box;	1
(b)	(i)	B;	
	(ii)	A;	2
(c)	(i)	determines (sequence of) amino acids / specific protein produced / mRNA formation;	1
	(ii)	hydrogen bonds;	1
	(iii)	stability / protects bases / replication;	1
			Total 6

Question 2

(a)	(i)	8 'chromatids' each side; spindle drawn;	2
	(ii)	4 chromosomes; 1 from each homologous pair;	2
(b)		produces haploid cells / chromosome number halved; fertilisation; maintains the diploid / chromosome number (in next generation);	2 max
			Total 6

Question 3

(a)		introduction of healthy gene / 'replacement' of defective gene;	1
(b)		can enter cells / infect cells / inject DNA into cells; targets specific cells; replicates (in cells);	2
(c)		reproductive cells/gamete cells do not contain ADA allele / gene;	1
(d)	(i)	to 'prevent' rejection / immune response;	1
	(ii)	T lymphocytes have a limited life span / die off / do not reproduce; bone marrow provides continual supply of T lymphocytes / (ADA) gene enzyme;	2
			Total 7

Question 4

(a) to separate the two strands / break hydrogen bonds; 1

(b) (i) enables replication/sequencing to start (*allow keeps strands separate*); 1

(ii) joins DNA nucleotides (*not complementary bases*); 1

(c) (i) 64; 1

(ii) replication of DNA from crime scene/tissue sample / for DNA sequencing / gene cloning; 1

(d) (transcription uses) RNA polymerase;
RNA nucleotides / uracil;
one (template) strand / PCR both strands;
start / stop codons; 2 max
(*accept enzyme separates strands*)

Total 7

Question 5

(a) 387; 1

(b) (i) CCAG; 1

(ii) 5; 1

(c) high energy radiation / X rays / ultraviolet light / gamma rays;
high energy particles / alpha particles / beta particles;
named chemical mutagens e.g. benzene / caffeine / pesticide / mustard gas / tobacco tar / free radicals;
(two named examples of any of the above = 2 marks)
length of time of exposure (to a mutagen);
dosage (of mutagen); 2 max

(d) (i) UAC UUA UGG; 1

(ii) addition and deletion (of bases/nucleotides);
thymine added;
adenine deleted;
(addition of thymine and deletion of adenine = 3 marks)
(allow addition of adenine (RNA) and deletion of uracil (RNA) = 2 marks) 3

Total 9

Question 6

(a)	genetically identical cells/individuals;	1
(b)	mitosis;	1
(c)	no differentiation at this stage / same genes being expressed;	1
(d)	brown - genes/DNA/genetic 'information' from the nucleus (expressed);	1
(e)	embryo cell diploid, egg cell haploid; contain different alleles/forms of the colour gene;	2
(f)	damage to nucleus / cells during transfer;	1
		Total 7

Question 7

(a)	(cut out gene using an) endonuclease / restriction enzyme; reference to specificity / recognition site; sticky ends; use the same enzyme to cut; plasmid / virus / potato DNA; fixed by ligase; method of introducing vector e.g. micropipette / virus injects DNA / remove plant cell wall;	6 max
(b)	introduced gene / characteristic passed to offspring; rapid process; larger number of plants produced; asexual reproduction genetically identical / sexual reproduction causes variation;	3 max
(c)	different genes are expressed; producing different enzymes/proteins;	2
		Total 11

QWC (See guidance) 1