



ASSESSMENT and  
QUALIFICATIONS  
ALLIANCE

# Mark scheme January 2003

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## GCE

### Biology B

### Unit BYB2

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**Guidance on the award of the mark 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.

## Unit 2: Genes and Genetic Engineering

### Question 1

(a) prophase;	1
(b) uncoiling/elongation (of chromosomes); formation of nuclear membranes/two nuclei formed; loss of spindle; new cell membranes formed/two cells formed;	2 max
(c) one mark for chromatid correctly labelled; one mark for centromere correctly labelled;	2
(d) 6;	1
	Total 6

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### Question 2

(a) P - phosphate; Q - deoxyribose; ( <i>allow pentose/5-carbon sugar, reject sugar</i> ) R - adenine; ( <i>reject base</i> ) S - nucleotide;	4
(b) DNA polymerase;	1
(c) interphase/S phase;	1
	Total 6

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### Question 3

(a) (i) have mechanism for entry into cells/inject DNA into cells/virus can enter cells/virus can infect cells; replicate in cells; target specific cells;	1 max
(ii) may cause disease/infection/harm; immunity may develop to the virus/destroyed by immune response or white blood cells;	1 max
(b) (i) only has to be treated once/permanent; all cells in body have replaced gene; can be passed to offspring;	1 max
(ii) changes to genetic make-up of individual/species/genome/future generations/germ line; may affect normal development; ( <i>reject - not ethical</i> )	1 max
(c) high cost plus reason e.g. compared with conventional treatments; adverse effects not known; use of animals in (preliminary) testing; other genes introduced which may have damaging effects/damage genome/damage other genes;	1 max
	Total 5

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**Question 4**

- (a)(i) increases chance of fertilisation;  
chance of reaching ovum is small/have to travel long distances/  
not all sperm viable/many do not survive; 2
- (ii) egg has food reserves;  
for (initial) growth of embryo; 2
- (b) release energy/carry out respiration;  
for movement; 2
- Total 6

**Question 5**

- (a) involves mitosis;  
producing genetically identical cells/cells with identical DNA/produce clones; 2
- (b) (short) length of DNA;  
single stranded; (*reject reference to RNA*)  
with specific base sequence/complementary base sequence;  
indicates where replication starts/stops annealing; 2 max
- (c) electrophoresis;  
use of electric current and (agar) gel;  
different charged fragments move different distances/speeds;  
smaller fragments move further/travel quicker; 2 max
- Total 6

**Question 6**

- (a) 6, 6;  
12; 2
- (b) (i) between male and female aphids and gametes; 1
- (ii) when gametes fuse or at fertilisation diploid number is restored/  
chromosome number maintained;  
produces variation; 1 max
- (c) asexual reproduction quick;  
so rapid increase in population;  
in favourable conditions;  
energy resources not used in producing males/economical use  
of energy resources; 2 max
- (d) only eggs survive winter;  
variation introduced;  
sexual reproduction can occur; 1 max
- Total 7

**Section B****Question 7**

- (a) DNA uncoils;  
strands separate;  
formation of mRNA;  
complementary base pairing/RNA nucleotides pair with DNA nucleotides;  
RNA polymerase joins nucleotides together/forms mRNA;  
mRNA moves to ribosomes/rough ER;  
tRNA brings amino acids;  
anticodons on tRNA pair with mRNA codon;  
amino acids joined together by peptide bonds;  
ribosome moves along to next codon; 6 max
- (b) (i) high energy radiation/ionising radiation/named chemical/gamma rays/  
X-rays/UV rays/high energy particles; 1
- (ii) substitution; 1
- (c) three bases code for one amino acid;  
one codon in sequence changed/no frame shift;  
all other codons unaffected; 2 max
- (d) normal – glutamic acid;  
sickle cell – valine; 2  
(allow one mark for correct two amino acids the wrong way round)
- (e) sequence of amino acids affects shape of protein;  
as bonding changed;  
shape of molecule determines properties/ability to combine with oxygen; 3
- Total 15
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**Question 8**

- (a) circular DNA;  
separate from main bacterial DNA;  
contains only a few genes; 2 max
- (b) enzymes only cut DNA at specific base sequence/recognition site/specific point;  
sequence of bases/recognition site/specific point (on which enzyme acts)  
occurs once in plasmid and many times in human DNA;  
(*max 1 if no reference to base sequence or recognition site*) 2
- (b) all cut DNA have same/complementary base sequence at ends or  
same/complementary sticky ends;  
random process by which sticky ends join; 2
- (d) (i) replica plating;  
use of pad/velvet surface to transfer bacteria;  
use of agar plate containing ampicillin/no tetracycline and agar plate  
containing tetracycline;  
in bacteria with human DNA tetracycline gene no longer functional/not  
resistant to tetracycline;  
bacteria with human DNA grow on plate with ampicillin/no tetracycline  
but are killed by tetracycline;  
bacteria with no extra DNA in plasmid not killed; 4 max
- (ii) use of gene probes;  
bacteria with insulin gene produce insulin; 1 max
- (e) use of fermenters;  
provides nutrients plus suitable conditions for optimum growth/named  
environmental factor;  
reproduction of bacteria;  
insulin accumulates and is extracted; 3 max
- Total 14

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Quality of Written Communication 1