



General Certificate of Education

Biology 5416 *Specification B*

BYB2 Genes and Genetic Engineering

Mark Scheme

2008 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.org.uk

Copyright © 2008 AQA and its licensors. All rights reserved.

COPYRIGHT

AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

Question 1

- (a) (i) R S T P Q; 1
- (ii) Q = telophase;
T = metaphase; 2
- (b) DNA/chromosomes/chromatin replicated;
(Reject chromatids/genetic material)
Organelles/named organelle(s) replicated;
Increase in ATP/named compound/proteins synthesis;
Cells grow/ get bigger; 2 max
(Accept increase in cytoplasm)

Total 5**Question 2**

- (a) (i) A = phosphate **and**
B = Deoxyribose/ pentose/5-carbon sugar;
(Reject sugar) 1
- (ii) (Nitrogenous/organic) base(s);
(Accept any correctly named base)
Both bonds formed with the same base; 2
- (b) Prevents DNA replication/being copied;
Prevents production of proteins needed (for cell division);
Prevents transcription or a description e.g. forming mRNA;
Blocks (complementary) base pairing/hydrogen bonding;
Blocks (DNA/RNA) polymerase;
Prevents strands separating/helix or DNA unwinding/unzipping/prevents
H bonds breaking (if binds across helix); 3 max

Total 6

Question 3

- (a) Between winged males and/or females and joining of arrows before eggs; 1
- (b) (i) Suitable advantage; with explanation;
- e.g.
Can't leave food source/fly away;
So offspring also produced on food source/plants;
- Do not use energy flying/producing wings;
So more (energy) to produce (more) offspring; 2
- (ii) Suitable suggestion; with explanation;
- e.g.
Winged (female) adults can fly to new food plants;
So eggs laid on suitable food source;
- (Allows for) sexual reproduction/ find a mate;
Producing variation within the offspring;
- Wings are used in courtship;
For species recognition/attract a mate/sexual reproduction;
- Escape from predators;
So they can reproduce; 2
- (c) Two features with advantage;;
- e.g.
All offspring genetically identical/clones,
Favourable characteristics passed on e.g. disease resistance;
- Many offspring produced/ offspring produced rapidly,
Can quickly exploit food plant/more likely to survive;
- Only one parent/no fertilisation needed,
Don't need to find mate/ less energy used/ produced rapidly/clones;
- Uses mitosis,
Genetically identical; 2 max

Total 7

Question 4

- (a) (i) Allows replication/sequencing to start/keeps strands separate;
(Accept starting point for polymerase. Ignore stops replication) 1
- (ii) Enables primers/nucleotides to attach/join to (single stranded) DNA;
(Reject bases attach) 1
- (b) 7; 1
- (c) (i) To identify/locate/label (new) strands/DNA;
(Reject identify primers) 1
- (ii) To separate (new) strands (of different lengths); 1
- (d) Three places where thymine used (in copying so three lengths of new strand);
Where (chemically) altered thymine/terminator nucleotide used, copying stopped;
Where normal thymine used, copying continued; 2 max

Total 7

Question 5

- (a) (i)

DNA	G	C	C	T	A	C	A	A	C	G	C	T
RNA	C	G	G	A	U							

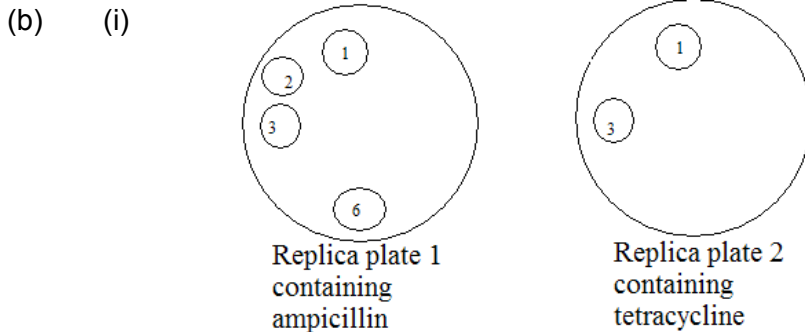
; 1

- (ii) arg-met-leu-arg 1
- (c) (i) No effect/still codes for arg(inine);
Important part of triplet is beginning/any triplet starting GC gives Arg(inine)/code is degenerate/3rd base does not matter; 2
- (ii) Met(hionine) replaced by iso(leucine);
As TA/ first two bases followed by any other letter is iso(lucine); 2
- (d) Deletion causes frame shift/alters base/nucleotide sequence (from point of mutation);
Changes many amino acids/sequence of amino acids (from this point); 2

Total 8

Question 6

- (a) (i) Restriction /endonuclease; 1
 (ii) Ligase; 1



(All correct for 1 mark); 1

- (ii) Colonies 1,2 3 & 6 have taken up the plasmid;
 Because they are resistant to ampicillin/able to grow on ampicillin;
 (Accept reverse argument) 2

- (iii) Colonies 1 & 3 do not have the required gene /recombinant plasmid;
 As they are still resistant to tetracycline;
 (Colonies) with the required gene/recombinant plasmid have tetracycline
 resistance destroyed;
 So required gene must be in must be colonies 2 & 6; 3 max
 (Reject reference to plasmids being resistance)

Total 8

Question 7

- (a) Two suitable mutagenic agents;;

e.g.

High energy radiation =1

High energy particles = 1

Examples to include the following, but not to be credited alongside same
 category:

X-rays/cosmic rays;

Gamma rays;

UV light;

Alpha particles;

Beta particles;

Nitrous oxide;

Benzene;

Tar from cigarettes;

Mustard gas;

Phenols;

Colchicines;

(Reject carcinogen)

2 max

-
- (b) 1 (Defective) CFTR/ carrier / intrinsic protein/ channel in membrane / epithelial cells;
(Accept: no CFTR)
- 2 Blocks outward passage of chloride ions;
- 3 Water retained in cell/prevents water leaving/water enters the cells;
- 4 Unable to remove mucus in lungs so infection/coughing more likely;
- 5 Narrowing/blocking 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 Pancreatic duct blocked so less enzymes present / less efficient digestion;
- 8 Damage to pancreas can cause diabetes;
- 9 Mucus in intestines so poor absorption of nutrients/undernourished;
- 10 Blocked ducts (in reproductive organs) causes fertility problems / sterility; 6 max
(4 max for marks relating to symptoms i.e. points 4 - 10)
- (c) 1 Use liposomes (as vector);
- 2 Fuse with cell membrane;
- 3 Applied by aerosol/sprayed/inhaled;
- 4 Use (harmless) viruses;
- 5 These enter epithelial cells/inject DNA;
- 6 (Healthy) CFTR gene attaches to cell's DNA;
- 7 (Healthy) CFR gene expressed/normal CFTR produced; 4 max

Total 12