



General Certificate of Education

Biology 5416 *Specification B*

BYB2 Genes and Genetic Engineering

Mark Scheme

2008 examination - June series

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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							

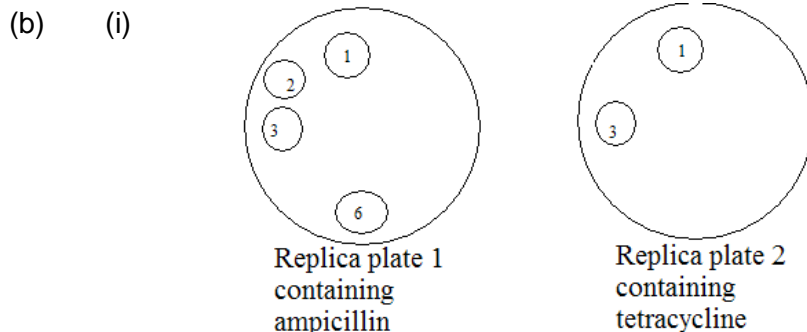
; 1

- (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;
(Reject reference to plasmids being resistance) 3 max

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;
(4 max for marks relating to symptoms i.e. points 4 - 10)
- 6 max
- (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**