



## **General Certificate of Education**

# **Biology 5416** *Specification B*

## **BYB2      Genes and Genetic Engineering**

# **Mark Scheme**

*2007 examination - June series*

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**Question 1**

- (a) (i) Stage A is anaphase;  
Chromatids/chromosomes moving apart/centomere divided; 2
- (ii) Stage B is telophase;  
Chromosomes are uncoiling;  
(Accept new nuclei forming) 2
- (b) Embryo split into separate cells;  
These (cells) are undifferentiated/totipotent;  
Each cell grows by mitosis (into new embryo/organism); 2 max

**Total 6****Question 2**

- (a) Heat (DNA) to 95°C, to separate strands/break hydrogen bonds/denature;  
Cool to 40°C, to allow primers/nucleotides to bind;  
Primers provide starting point for copying/prevent strands rejoining;  
Heat to 70°C, optimum for polymerase/enzyme;  
DNA polymerase then joins nucleotides together; 4 max  
(Accept Taq polymerase)
- (b) Reason with explanation;;
- For example:  
Easy to insert genes into bacteria;  
Using a vector/plasmid/virus;
- Bacteria reproduce rapidly;  
Producing many copies of (inserted) gene;
- Bacteria can be grown on a large scale/ in industrial fermenters;  
To get a lot of the product of the gene; 2 max

**Total 6**

**Question 3**

- (a) (i) Meiosis;
- (ii) Reference to homologous/pairs of chromosomes/bivalents;  
One of each pair goes to each cell/gamete;  
(In second division) centromere divides/chromatids separate;  
(Accept crossing over/independent assortment for 1 mark) 3 max
- (b) (i) F between 'gamete-producing structure and zygote';
- (ii) M between '2N' and spores; 2
- (c) Advantage and explanation;;
- For example:  
Many spores released nearby;  
So more of nutrient source used/used more rapidly;
- Produces genetically identical fungi;  
So all well suited to nutrient source/ environment; 2 max
- Total 7**

**Question 4**

- (a) Plasmid cut;  
Restriction enzyme/endonuclease;  
(Complementary) sticky ends (however formed);  
Use of ligase; 3 max
- (b) (Bee) gene will get into/expressed in all cells (of the mosquito);  
So, the gene gets passed to future generations; 2
- (c) To identify mosquitoes which had taken up the gene;  
So, only these are used;  
Identify by looking for those that produce green light; 2 max
- (d) Could save birds from malaria, so reversing harm done by humans;  
Islands isolated, so fewer problems if trial goes wrong;  
If malaria parasite becomes resistant to bee protein, resistance not in human malaria strain;  
Resistance will spread through the mosquito population; 1 max
- Total 8**

**Question 5**

- (a) More radiation, more non-mobile sperm;  
Radioactive material source of high energy/ionising radiation/ high energy particles/named;  
Which cause mutations (and abnormal sperm);  
Detail of how mutation affects sperm movement; 3 max
- (b) Both reduced in high radiation area/correct use of figures for both;  
Antioxidant 1 most affected; 2
- (c) Reference to sperm unable to fertilise (eggs);  
Damage to egg DNA (because of lower antioxidants);  
So non-viable egg/zygote/embryo/offspring;  
(Mutations) produces individuals with (new) harmful characteristics; 3 max
- Total 8**

**Question 6**

- (a) Base sequence different/named mutation;  
Comparison to functional allele/gene/DNA/mRNA;  
Leads to different sequence of amino acids;  
So enzyme/protein with different/non-functional shape; 3 max
- (b) Gene inserted into vector/virus/liposomes;  
Inhaled/sprayed (into lungs);  
Vector carries gene into (epithelial) cells;  
(Accept plasmids as a vector) 3
- (c) They will have one functional allele/gene;  
This produces (enough) functional protein; 2
- Total 8**

**Question 7**

- (a) 1 Sequence of bases in gene/on DNA determine amino acid sequence;  
2 Transcription to form mRNA;  
3 Codons on mRNA;  
4 Reference to base-pairing;  
5 A to U, T to A and C to G;  
6 Specific tRNA for each amino acid;  
7 Has anticodon to bind to mRNA codon;  
8 At the ribosome;  
9 Role of sites on ribosomes in translation. 6 max
- (b) (i) X is phosphate and Y is pentose/deoxyribose;  
(ii) Hydrogen; 2

- (c) (i) AZT binds to adenine/ A (on single DNA strand);  
But lacks phosphates/ OH;  
Unable to bind to another nucleotide;  
So (AZT) enzyme unable to form new strand/DNA; 2 max

**Total 10**