



General Certificate of Education

Biology 5416

Specification B

BYB2 Genes and Genetic Engineering

Mark Scheme

2008 examination - January series

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Question 1

- (a) Two suitable examples;;
 Examples,
 Hormone;enzyme; antibiotic; vaccine;
 Two named examples of each;; 2 max
- (b) Restriction endonuclease/enzyme to cut plasmid/donor DNA;
 Sticky ends (however formed);
 Use of ligase;
 Method for inserting plasmid; 3 max
- Total 5**

Question 2

- (a) (Free) nucleotides bind to exposed strands;
 A to T and C to G;
 To produce identical copies of DNA; 2
- (b) Forms new strands of DNA (molecules);
 By joining together (single) nucleotides bound to existing strands; 2
- (c) Each new DNA molecule consists of one original (polynucleotide) strand
 and one new one; 1
- Total 5**

Question 3

- (a) (i) Difference;
 Example,
 Sperm has flagellum; 1
- (ii) Explanation;
 Example,
 (Flagellum), so it can swim to the egg; 1
- (b) (i) Homologous chromosomes/chromosomes form pairs;
 One (of each pair) goes to each cell produced; 2
- (ii) Restores diploid number at fertilisation;
 Maintain chromosome number (from one generation to next); 2
- Total 6**

Question 4

- (a) Two suitable mutagenic agents;;
 Examples,
 High energy radiation/example of;
 High energy particles/example of;
 Accept two named examples of mutagenic agent;; 2 Max
- (b) (i) Active site smaller/lower/part covered/shape different (so substrate cannot bind); 1
- (ii) (Mutation) changes base sequence in DNA/ gene;
 Different codon (sequence)/base sequence on mRNA;
 Changes amino acid (sequence)/ primary structure;
 (This leads to) changes tertiary structure (of the enzyme); 3 max
- Total 6**

Question 5

- (a) Centromeres divide/chromatids separate;
 One chromatid/chromosome moves to each pole;
 Spindle fibres shorten; 2 max
- (b) Rate of removal (of tubulin) proportional to shortening of spindle fibres/
 speed of movement of chromatids/fibres control speed of movement;
 Provides force/pulls chromatids or chromosomes apart/movement linked
 to shortening of fibres; 2
- Total 4**

Question 6

- (a) (i) Polymerase chain reaction/PCR; 1
- (ii) Heat to 75 - 95°C;
 Breaks H bonds (between bases); 2
- (b) One form of a gene; 1
- (c) **X** on allele 1 and allele 3;
 Complementary base sequences/base pairing (to two of the test DNA strands)
 / strands complementary; 1
- (d) Each person has (only) two copies of each gene/receives one allele from
 each parent;
 If two different alleles then two spots/ only one spot if both alleles the same; 2
- Total 8**

Question 7

- (a) Two suitable reasons;; with explanation;;

They can divide (to form new blood cells);
So can replace existing (faulty) cells;

OR

They can form (any type of) white blood cell;
So restore ability to fight infection;

OR

Child's own cells;

So no/little risk of rejection;

4 max

- (b) Description of sigmoid curve;
Reference to specific time and event;
Few modified cells to start with/mainly non-functional white cell present;
(Modified) stem cells replace non-functional cells/form new population of (functional) cells;
(Levels off because) the number of (white) cells reaches the normal level;

3

Total 7**Question 8**

- (a) Transcription,

- 1 DNA strands separate;
- 2 (Free) nucleotides bind to (one) strand by specific base pairing;
- 3 U to A (and C to G)/uracil instead of thymine;
- 4 RNA polymerase joins nucleotides to form mRNA;

Translation,

- 5 mRNA translated at/moves to ribosome;
- 6 Codon on mRNA;
- 7 Codon binds with (complementary) anticodon on tRNA;
- 8 Each tRNA specific to one amino acid;
- 9 Formation of peptide bond(s);

7 max

- (b) (i) Label to bond joining pentose sugar and base; 1
- (ii) Stops translation/formation of protein/identified protein;
Prevents mRNA/tRNA binding;
Prevents formation of peptide bond;
Consequence of loss of (identified) protein; 2 Max
- (iii) Animals that eat the plant get ill/killed/avoid plant;
So seeds/plant/species more likely to survive; 2

Total 12