



General Certificate of Education

Biology 5416

Specification B

BYB2 Genes and genetic Engineering

Mark Scheme

2007 examination - January series

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Question 1

- | | | | |
|-----|-------|---|---|
| (a) | (i) | Shorten/thicken /coil/condense; | 1 |
| | (ii) | (Line up) at equator (of spindle)/centromeres attach to spindle;
(accept move towards middle of the cell) | 1 |
| | (iii) | Chromosomes or chromatids moving apart/centromere divides; | 1 |
| (b) | | Telophase; | 1 |
| (c) | | (Cells with 9.4) replicated DNA/chromatids joined together / late interphase/prophase/metaphase/before cell division; | 1 |
| | | (Cells with 4.7) single chromatids/DNA is not replicated/telophase/early interphase; | 1 |
| | | (must be clear reference to which cells are being discussed) | |

Total 6

Question 2

- | | | | |
|-----|-------|---|--------|
| (a) | | Idea of both original strands being copied;
Each new DNA molecule consists of one original <u>and</u> one new strand of DNA; | 1
1 |
| (b) | (i) | To separate strands/breaks bonds between DNA strands or bases/
produces single-stranded DNA; | 1 |
| | (ii) | Allows primers/short pieces of RNA /single-strand DNA to bind
(to DNA strands); | 1 |
| | (iii) | Idea of optimum temperature of DNA polymerase (to make new
strands of DNA/join nucleotides);
(must be in the correct context) | 1 |

Total 5

Question 3

- | | | | |
|-----|-------|--|-------|
| (a) | | Serine AGC, tyrosine UAU, cysteine UGU; | 1 |
| (b) | (i) | Top end of the molecule; | 1 |
| | (ii) | On/next to the bottom loop; | 1 |
| | (iii) | Anticodon binds to codon;
(Because bases) on anticodon are complementary to those on the mRNA codon;
Idea of the correct amino acid (brought to the ribosome); | 2 max |
| (c) | | 122;
(award 1 mark for the principle of 3 bases coding for 1 amino acid) | 2 |

Total 7

Question 4

- (a) *One e.g. from;*
- Ionising radiation
 High energy radiation
 High energy particles
 Example of radiation
 Named mutagenic agent; 1
- (b) Methionine:
- Substitution (always) gives different amino acids;
 Substitution of C gives isoleucine;;
- Glycine or isoleucine:
- Substitution of either of first two bases gives different amino acid;
 In glycine, substitution of third base still codes for glycine; 3
- Total 4**

Question 5

- (a) One/different form of a gene (positioned in the same locus/relative position); 1
- (b) (Homologous chromosomes) have same genes;
 At the same loci;
 Different alleles (usually) only small differences in base sequence; 2 max
- (c) (i) 125: 1
- (ii) Egg contains a store of energy/food/nutrients for the developing embryo (after fertilisation); 1
- Total 5**

Question 6

- (a) Produces haploid cells (somewhere in the life cycle);
 (Allows for) diploid number to be restored when gametes fuse at fertilisation;
 Maintains/constant chromosome number from one generation to the next;
 (accept *genetic variation through crossing over/independent assortment*) 2 max
- (b) (i) Diagram shows polyp, medusa and gametes in correct sequence in cycle; 1
- Mitosis shown between polyp and medusa;
 Meiosis shown between medusa and gametes;
 Fertilisation between from gametes and zygote/polyp;
 2n shown for polyp and for medusa and n shown from gametes; 2 max
- (ii) *Appropriate suggestion and reason, e.g.;*
- Polyp produces many offspring;
 So greater chance of passing on its genes/alleles/survival of the species;
- Polyp attached to rock/immobile/not able to swim;
 Less chance of finding a mate; 2
- Total 7**

Question 7

- (a) Appropriate references to the following:
- 1 Virus used as a vector;
 - 2 Method used to isolate donor gene e.g. restriction enzyme/
 endonuclease/reverse transcriptase on mRNA/idea of sequencing
 protein;
 - 3 Sticky ends used to join donor gene into viral DNA;
 - 4 Complementary sticky ends by using same endonuclease/adding
 artificial sticky ends;
 - 5 Ligase used to join (donor to viral DNA);
 - 6 Inhaled/use of aerosol;
 - 7 Virus enters/injects DNA into lung cells; 6 max
- (b) Idea of linking more DNAase with a greater number of shorter pieces of DNA; 1
- Idea of linking shorter pieces of DNA with a reduction in the viscosity of the
 mucus; 1
- Idea that a reduction in the viscosity of the mucus means more air can pass
 through the airways/airways are no longer blocked/mucus more easily
 removed from airways; 1
- Total 9**

Question 8

- (a)
- 1 Plate(s) with antibiotic;
 - 2 Method of transferring colonies to plate(s);
 - 3 Only bacteria with antibiotic resistance (marker genes) grow;
 - 4 These are the transformed bacteria/contain the insulin gene;
 - 5 Use of (industrial) fermenter/vats;
 - 6 Idea that large quantities of bacteria are grown;
 - 7 Conditions for growth/named suitable condition e.g.nutrients/oxygen/
suitable temperature/suitable pH;
 - 8 Idea of asepsis, e.g. sterile medium/filtered air; 6 max

- (b) Method 2 because:

- 1 Cells/embryos/goats produced are a clone/genetically identical;
 - 2 Nuclei/cells will contain the human gene;
 - 3 The goats will be female;
 - 4 So the embryos/goats produced will produce the protein;
 - 5 Animal's good qualities already known as cloning from an adult; 4 max
- (accept converse of all marking points to reject method 1)*

Total 10

QWC 1