



ASSESSMENT and  
QUALIFICATIONS  
ALLIANCE

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# Mark scheme January 2004

## GCE

### Biology A/ Human Biology

### Unit BYA3

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**Question 1**

- (a) (i) sugar or phosphate / S-P / nucleotide chain/backbone / original/parent DNA; 1
- (ii) X thymine; Y guanine; Z adenine;  
(Allow T, G and A) Reject: thiamine 3
- (b) here two chains constructed – in transcription only one /  
base thymine would be used instead of uracil /  
sugar would be deoxyribose instead of ribose /  
produces DNA, not RNA /  
both strands of DNA copied, not just sense strand /  
uses different enzyme;  
(Allow T, U) 1

Total 5 marks

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**Question 2**

- (a) replication / duplication / doubling of chromosomes / replication of DNA /  
transcription of DNA; 1
- (b) (i) cell to show correct number of chromosomes;  
correct shape & position of centromere; 2
- (ii) as (i) except everything halved - ignore crossing over; 2
- (c) (to compensate for) high loss of cells from lining as food passes; 1

Total 6 marks

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**Question 3**

Please note in this question main ideas

- (a) *Sequence*: mutant allele leads to formation/ref. transcription of mRNA;  
with incorrect base(s)/incorrect codon;  
*Order of amino acids*: therefore translation/arrangement of/order of  
amino acids is incorrect;  
so protein has wrong secondary/tertiary structure/shape; max 3
- (b) pancreatic enzymes/amylase/lipase found in blood;  
where not normally present;  
OR low levels of pancreatic enzymes found in faeces;  
where not normally so low; 2
- (c) (i) (glucose oxidase) catalyses oxidation/breakdown of glucose;  
(ii) H<sub>2</sub>O<sub>2</sub> reduced/broken down (by peroxidase enzyme); 2

Total marks = 7

**Question 4**

- (a) (i) benign does not cause cancer /  
does not invade other tissues causing damage /  
with benign cancer, pieces which break off do not start new tumours  
elsewhere in body/metastasis; 1
- (ii) may damage organ concerned;  
may cause blockages/obstructions;  
may damage/exert pressure on other organs; max 2
- (b) (i) because sun's radiation contains ultra violet radiation;  
this causes mutation of genes which control division; 2
- (ii) because fair skin has little melanin which protects against u.v.  
radiation; 1
- (iii) because cancer has genetic component / may have inherited  
(onco)gene / gene which gives predisposition to/causes cancer; 1

Total 7 marks

**Question 5**

- |     |      |   |        |
|-----|------|---|--------|
| (a) | (i)  | to ensure that no unwanted bacteria will be present;  | 1      |
|     | (ii) | to check that bacteria cells do not die anyway / to show water/solvent has no effect on growth;   | 1      |
| (b) |      | antibiotic damages/prevents formation of cell walls;<br>antibiotic prevents DNA replication so cells die;<br>antibiotic prevents protein synthesis/translation/transcription of mRNA; | max. 2 |
| (c) |      | some bacteria are resistant / some areas of dish have no antibiotic / antibiotic not spread evenly;   | 1      |

Total 7 marks

**Question 6**

- |     |       |  |   |
|-----|-------|--|---|
| (a) |       | converts prothrombin to thrombin;  | 1 |
| (b) | (i)   | fibrin formed from fibrinogen;<br>by the action of thrombin;   | 2 |
|     | (ii)  | forms mesh of fibres which trap (platelets and blood) cells;   | 1 |
| (c) | (i)   | warfarin prevents blood clotting which causes thrombosis in coronary arteries/may block c. arteries/ arteries supplying heart muscle;  | 1 |
|     | (ii)  | ( $\frac{36}{210}$ ) = 17%;  | 1 |
|     | (iii) | ( $\frac{409}{1334}$ ) = 30%;  | 1 |
|     | (iv)  | yes: smaller % age have thrombosis if already taking warfarin;<br>substantial difference in figures/large sample;<br>OR<br>no: those taking warfarin obviously more likely to develop thrombosis;<br>not matched with control group; | 2 |

Total 9 marks

**Question 7**

- (a) (i) because there are big differences;  
any correct named example e.g. lung cancer/bronchitis much lower in  
women than in men; 2
- (ii) easier to compare if sample size effectively the same;  
different numbers of people in each group; 2
- (b) ANY TWO: more stress / more saturated fats in diet / less time to  
exercise / reliance on cars; 2

Total 6 marks

**Question 8**

- (a) molecule (on cell surface);  
that triggers immune response; 2
- (b) (i) axes right way round and labelled;  
2nd peak drawn higher;  
steeper gradient on second rise; 3
- (ii) because one dose does not give a high enough level of antibody to be  
effective/ because the antibody falls after a while; 1
- (iii) antigens are only single molecules/part of parasite;  
do not actually cause disease; 2
- (c) malaria sufferers would have parasites in red blood cells; 1
- (d) 1 complex life cycle with several stages;  
2 allows production of large numbers of offspring;  
3 uses two hosts to transfer it/one stage to next;  
4 therefore no need for/no locomotory organs;  
5 lives inside cells so does not need to regulate water content/digest food;  
6 lives inside host cells so avoids attack by host;  
7 does not need attachment;  
8 penetrates host using vector i.e. mosquito; max. 6

Total 15 marks

**Question 9**

- (a) (i) may be growing but not dividing much;  
may be synthesising enzymes needed in new medium;  
may be coming out of dormancy; max 2
- (ii) total bacterial cells curve stays high because it shows dead and alive cells;  
total living cells curve starts to fall because no. living cells falling;  
because of shortage of oxygen/food or build-up of waste products;  
dead bacterial cells still visible/do not break down; max 3
- (b) (i) correct answer - 640 000 000 = 2 marks;;  
(correct method but 1 error e.g. 1 doubling short, 1 '0' missing = 1); 2
- (ii) not all cells will divide at all/at this rate;  
some of original cells will be dead;  
may be limiting factor e.g. food supply; max 2
- (c) 1 EITHER cut desired gene from DNA of human cell;  
2 using restriction endonuclease/ enzyme;  
1 OR use mRNA from human cell which will code for insulin;  
2 and use reverse transcriptase to form desired DNA;  
1 OR make artificial DNA;  
2 with correct sequence of bases;
- 3 plasmids released from bacteria using  $\text{Ca}^{2+}$ /heat treatment;  
4 cut plasmid open;  
5 with (same) restriction endonuclease;  
6 ref. sticky ends/unpaired bases attached;  
7 use DNA ligase to join free ends;  
8 return plasmid to bacterial cells; max 6

Total 15 marks