



General Certificate of Education

Human Biology 5413

Specification A

BYA3 Pathogens and Disease

Mark Scheme

2009 examination - January series

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Question 1

- (a) Made up of many (similar) molecules/monomers/nucleotides/units; 1
Q I :codons R :bases
- (b) (i) Same base only part of code for one amino acid/
 the A in the code for arginine does not code for lysine as well; 1
Q A single mark is awarded here as candidates may simply respond in more general terms and still address the question.
- (ii) More than one code for one amino acid;
 CGA and CGC both code for arginine; 2
- (c) (i) Uracil; 1
- (ii)
- | mRNA | Base Z |
|------------|--------|
| Molecule X | 14 |
| Molecule Y | 26 |
- 1
- (iii) Transcribed/copied from different genes/chromosomes/pieces of DNA;
 Which would have different base sequences;
 Formed by complementary base pairing from DNA; 2 max
- Total 8

Question 2

- (a) Damage cells; *I: bursting out of cells.*
 Produce toxins; 2
Q The specific term, toxins, is required here.
- (b) Snail; 1
- (c) (i) Enables larva to find (human) host;
 Human warm-blooded/high body temperature; 2
- (ii) Molecules are self/won't be recognised as antigens / non-self / foreign;
 Do not trigger an immune response/not attacked by white cells; 2
- Total 7

Question 3

(a)	(i)	2;	1
	(ii)	1;	1
	(iii)	2;	1
(b)	(i)	One mark for curve basically similar in shape to that plotted; Two marks for curve basically similar in shape to that plotted and with values roughly twice those shown;; Q max 1 if increase starts in E or G.	2
	(ii)	Telophase;	1
	(iii)	Shortening of spindle (fibres); Q Answer must relate to spindle but accept references to chromatids being pulled by the spindle fibres.	1
			Total 7

Question 4

(a)	To kill other bacteria/microorganisms; That would use the nutrients/compete with/reduce number of bacteria in population;	2	
(b)	(i)	Two marks for correct answer of 0.3 One mark for correct answer some value for mass has been divided by some value for time;; Q Credit should only be awarded for the single marking point where the candidate has clearly shown what has been done	2
	(ii)	Used by bacteria; Respiration/respiratory substrate/source of carbon;	2
(c)	Faster rate of growth initially; Levels out at same value;	2	
			Total 8

Question 5

- (a) (Each antibody) has two binding sites / 2 antigens can be attached;
Can bind to antigens/microorganisms different distances apart/in different positions
(relative to each other); 2
- (b) The binding site of an antibody has a specific shape;
Only X is complementary/will fit; 2
- (c) Antigens on two viruses are very similar/the same;
B cells/B lymphocytes divide/clone;
Produce memory cells;
Which result in the production of / produce antibodies effective against smallpox virus;
4
- Total 8

Question 6

- (a) Only place where specific base sequence found;
Complementary to/fits active site; 2
- (b) Recognition / base sequence (cut by *Taq1*) only present three times/missing at one
place/ mutation in base sequence (cut by *Taq1*); 1
- (c) (i) Fragments of DNA are of different length / mass / size / charge;
Electric current/electrophoresis results in fragments moving
different distances; **Q R: if largest going furthest** 2
- (ii) Single stranded piece of DNA/
With complementary base sequence to/binding to (part of) DNA
to be located;
Radioactive/fluorescent (marker attached); 2 max
- Total 7

Question 7

- (a) (i) Prevents protein synthesis/translation/binding of tRNA to mRNA;
Prevents/slows down bacteria growth/does not kill bacteria; 2
- (ii) All bacteria have ribosomes/synthesise protein; 1
- (b) Human cells do not have same uptake mechanism as bacterial cells;
Membranes are not (as) permeable to tetracycline;
Suggestion as to how it differs:
E.g. Do not have the necessary carrier/membrane proteins/
do not take up tetracycline by active transport/can only take up
tetracycline by diffusion; 2 max
- (c) (i) A piece of DNA/base sequence that codes for;
Product/substance that will prevent antibiotic from working; 2
Q Second mark for relating product in some way to the prevention of antibiotic action.
- (ii) Genes may be transferred to other harmful/pathogenic bacteria;
Which will then become resistant to the antibiotic (concerned);
Antibiotic (to which resistance given) will be of no value/cannot be used; 2 max
- (d) 1 May prevent DNA/replication;
2 Example identified as bacteriostatic;
3 Bacteria will be killed by the immune system;
4 Affect (bacterial) cell walls;
Q Note allow this mark even if context is destruction of cell walls.
5 By preventing their formation;
6 Lower/more negative water potential inside bacterial cell;
7 Water enters by osmosis;
8 Cell undergoes osmotic lysis/bursts;
9 Kills bacteria so bactericidal; 6 max
Q Point 8. Do not accept cell exploding or blowing up.

Total 15

Question 8

- (a) A = Prothrombin and B = Thrombin; 1
- (b) (i) Calcium (ions) necessary to produce substance B/ thrombin /
unable to produce substance B/thrombin; 1
- (ii) Thrombin is an enzyme/produced by enzyme;
Rate of reaction slow at low temperature / fewer collisions between enzyme and
substrate / fewer enzyme-substrate complex formed; 2
Q Do not credit references to denaturing.
- (c) 1 High blood pressure damages artery wall / endothelium;
2 Exposes cells/collagen under endo/epithelium/in wall to blood/platelets /
thromboplastin released (by damaged tissue);
3 More fibrinogen therefore more fibrin formed;
4 Fibrin traps red blood cells/forms blood clot/thrombus;
5 Thrombus travels to / formed in heart;
6 Blocks coronary artery/arteries in heart muscle;
7 Reduces/stops oxygen/glucose supply;
8 Heart muscle unable to respire/dies; 6 max
- (d) (i) Increases probability from 22 to 29 / 0.22 to 0.29 /by 7% / 0.07;
When exposed to other risk factors/2 of 3 named risk factors;
[high blood cholesterol, low HDL, and high blood pressure] 2
- (d) (ii) No marks for “no”; **Q** max 2 if “yes”;
All other factors / factors in columns 1 and 2 same;
Except for systolic blood pressure/16 and 22 kPa;
BP of 22 causes increase of 5% / 0.05 / from 0.08 to 0.13;
Some other factor might cause high BP and higher probability; 3 max
- Total 15