



**General Certificate of Education**

**Biology (Human) 5413**

*Specification A*

**BYA3      Pathogens and Disease**

**Mark Scheme**

*2008 examination - January series*

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**Question 1**

- (a) (i) Nucleus; 1
- (ii)

Statement	DNA Replication	Transcription
Involves mRNA synthesis	✗	✓
Requires free nucleotides	✓	✓
Involves complementary base pairing	✓	✓

; ; 2

*I mark for each correct column*

*Mark blank spaces and hybrid tick-crosses as incorrect*

- (b) 12 000;

One deoxyribose per nucleotide / base; 2

Total 5

**Question 2**

- (a) Interphase/S-(phase)/synthesis; 1

- (b) (i) B;  
Acts during DNA replication;  
*Ignore references to wrong named stage* 2

- (ii) This is when chromosomes/chromatids are separating;  
Pulled by spindle fibres : 2

Total 5

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**Question 3**

- (a) *Mycobacterium (tuberculosis);* 1
- (b) (i) **Any two of:**  
Persistent cough;  
Blood-stained mucus/sputum;  
Chest pain;  
Fluid accumulation in pleural cavity;  
Breathlessness;  
Fever;  
Night sweats;  
Loss of appetite;  
Weight loss; 1
- (ii) People living in overcrowded conditions:  
Inhalation of TB bacteria/droplet infection more likely;  
**Or**  
Immigrants;  
From countries where TB more common/not vaccinated;  
**Or**  
Infected with HIV;  
Immune system less effective; 2
- (c) (i) Antibodies made in response to antigen;  
Indicates that bacteria have entered body / passenger has been exposed to antigen / bacteria could have been removed and antibodies remain; 2
- (ii) Droplet infection;  
(Pathogen) inhaled / enters via gas exchange system;  
More droplets near infected person / idea that droplets settle out at greater distances; 3

Total 9

**Question 4**

- (a) (i) (Bacteriostatic) stops bacteria dividing / slows down growth rate;  
(Bacteriostatic) does not kill / bacteriocidal kills; 2
- (ii) Stops/inhibits cell wall synthesis / osmotic lysis;  
*Reject destroys/digests cell wall*  
Stops/inhibits DNA replication;  
Stops/inhibits protein synthesis / transcription / translation / RNA synthesis;  
Disruption of cell membrane function; 2 max
- (b) (i) *Penicillium* has grown; 1
- (ii) *Penicillium* produces penicillin/antibiotic;  
Diffuses into agar;  
Stops bacteria growing / inhibits bacteria / kills bacteria;  
B and D resistant / unaffected / A and C inhibited;  
'Bands' due to bacterial colonies growing (outwards) / reproducing / dividing;  
C most susceptible / least resistant to antibiotic; 3 max
- Total 8

**Question 5**

- (a) Pancreatic duct blocked;  
Enzymes cannot enter gut;
- OR
- Pancreatic cells destroyed/damaged;  
Enzymes enter blood / less enzymes produced; 2
- (b) Combines with glucose;  
Produces colour change / detects hydrogen peroxide; 2
- Total 4

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**Question 6**

- (a) (i) Thromboplastin released (by damaged tissue);  
Converts prothrombin to thrombin;  
Enzyme / thrombin converts fibrinogen to fibrin; 2 max
- (ii) Blocks coronary artery;  
Stops oxygen/glucose getting to heart muscle;  
Heart muscle/cells die/cannot respire; 3
- (b) (Digesting fibrin) releases trapped cells / breaks up/removes clot; 1
- Total 6

**Question 7**

- (a) (i) Joins inserted DNA to host DNA; 1
- (ii) Contains inserted gene/ /gene from other organism;  
Vector/carries gene into (microbial) cells; 2
- (iii) Distinguishes modified microbial cells from non-modified cells; 1
- (b) (i) Cells grow in size (but don't divide);  
Cells may be dormant at beginning;  
Takes time to synthesise new enzymes/proteins/replicate DNA; 2 max
- (ii) All conditions at an optimum/no limiting factors;  
Reference to named factor, e.g. oxygen, nutrients;  
No/few toxic waste products; 2 max
- Total 8

**Question 8**

- (a)
1. Three bases code for one amino acid;
  2. Determine sequence of bases/codons needed;
  3. Synthesise DNA with correct base sequence/codons;
  4. Second strand complementary to first / DNA codons complementary to RNA codons; 3 max
- (b)
- 1 DNA splits / separates / hydrogen bonds break;  
*Accept unzips*
  - 2 Make mRNA/ use RNA nucleotides;
  - 3 Via RNA polymerase;
  - 4 Complementary sequence / eq.;
  - 5 Introns/junk/non-coding DNA spliced out;  
*Maximum of 4 marks from points 1-5*
  - 6 mRNA joins to ribosome;  
*Accept travels to ribosome*
  - 7 tRNA carries a specific amino acid;
  - 8 Codon-anticodon relationship / explained;
  - 9 Peptide bonds form between amino acids; 6 max
- (c)
- (i) Protein/immunoglobulin;  
Made by plasma cell / B cell ;  
Specific to one antigen; 2 max
  - (ii) Macrophage presents antigen;  
B-cell activated/ clonal selection;  
Divide/clonal expansion;  
Produces plasma cells;  
Plasma/ B cells make specific antibodies; 4 max

Total 15

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**Question 9**

- (a) (i) So drug given is the only variable / no other variables;  
Other factors may affect survival rate / results; 2
- (ii) To avoid bias/ idea of psychological effect/expectations affecting results; 1
- (b) 3 / 2.88;; 2  
*Allow one mark for principle of multiplying percentage who die by 288 to find actual number.*
- (c) (i) Allows comparison;  
Children have different levels of infection when admitted; 2
- (ii) Graph shows more rapid response;  
Lower incidence of neurological problems; 2
- (d) 1. Rapid reproduction rate;  
2. Ensures some are passed on / increases chance of finding new host;  
3. 'Hides' inside liver/red blood cells;  
4. Avoids host immune system;  
5. Changes surface antigens;  
6. Part of life-cycle in mosquito /mosquito carries it to new host;  
7. No need for locomotory structures as transported in blood;  
8. No need to move to find food;  
9. Host cells have same water potential as *Plasmodium* / no need to regulate water content; 6 max

Total 15