PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



MARK SCHEME

TOPIC 6: MICROBIOLOGY AND PATHOGENS

PROBLEMS OF CONTROLLING ENDEMIC DISEASES

SCORE	PERCENTAGE
/58	%

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Mark Scheme

Q1.

Question Number	Answer	Additional Guidance	Mark
(a)	1. bacteria have DNA, viruses have DNA or RNA ; 2. idea that bacteria have {circular / eq} genetic material, viruses have {linear / straight} ; 3. bacterial DNA is double-stranded, viral {DNA / RNA} is single (or double) stranded / eq; 4. bacteria (may) have plasmids, viruses do not have plasmids / eq;	**NB** piece answers together throughout **Do not accept** in context of plasmid	**(2)**

Question Number	Answer	Additional Guidance	Mark
(b)(i)	1. reference to {phagocytosis /endocytosis / engulfing} ; 2. credit details of phagocytosis ; 3. reference to bacterium inside a {vacuole / vesicle / phagolysosome} ;	eg formation of {pseudopodia / membrane extensions around bacteria} / cytoplasmic streaming / binding to bacteria **Not** phagolysozyme	(2)

Question Number	Answer	Additional Guidance	Mark
(b)(ii)	1. idea that bacteria need to be accessible to antibiotics ; 2. idea of bacteria inside macrophages ; 3. reference to waxy layer of (these) bacteria ; 4. idea that (bacteriostatic) antibiotics affect dividing bacteria; 5. reference to antibiotic resistance (of these bacteria) ;	**Not** bacteriocidal antibiotics	(2)

Question Number	Answer	Additional Guidance	Mark
(b)(iii)	1. idea of {dead / attenuated / eq} {organisms / pathogen / bacterium / eq} put into person; 2. reference to (stimulation of) {specific / primary} (immune) response ; 3. credit details of T helper cell activation ; 4. credit details of B cell activation ; 5. credit details of T killer cell activation ; 6. reference to production of memory cells ;	**NB** not simply crediting ref to vaccination as in stem of question **Accept** antigen eg macrophages as APCs eg involvement of cytokines, B cells as APCs eg involvement of cytokines, infected cells as APCs	(3)

Question Number	Answer	Additional Guidance	Mark
(c)	1. reference to {<u>further</u> lung damage / severe breathing problems / eq} ; 2. idea that the *Mycobacterium* get into the {blood / lymph}; 3. idea that organ failure (leads to death) ; 4. idea of {reduced / weakened} immune response (due to a loss of T cells) ; 5. credit detail of role of T (helper) cells ; 6. credit detail of effect of no T killer cells ; 7. credit detail of effect of no B cells ; 8. ref to {secondary / opportunistic / other} infections (causing death) ;	eg cannot obtain enough oxygen eg production of cytokines eg infected cells will not be destroyed eg no antibody produced	(4)

Q2.

Question Number	Answer	Additional Guidance	Mark
	• answer in standard form	e.g. 0.5×10^7 / 5×10^6	(1)

Q3.

Question Number	Answer	Mark
(a)(i)	C T helper cells ;	**(1)**

Question Number	Answer	Mark
(a)(ii)	D reverse transcriptase ;	**(1)**

Question Number	Answer	Additional guidance	Mark
(b)(i)	1. reference to glycoprotein ;	**1. Accept** protein, chains of amino acids	
	2. credit detail of structure e.g. specific (3D) shape, L and H regions, Y-shape, 4 (peptide) chains, disulphide bridges between peptides, hinge region ;	**2. Ignore** active site **Accept** a Y-shaped drawing	
	3. reference to {antigen-binding site / variable region / Fab (region) / eq };	**3. Accept** references to {binding to specific antigen / antigen-specific / antigen receptors}	
	4. idea of antibodies have a {similar / constant / Fc / eq } region;		
	5. produced by plasma cells / present on B cells ;	**5. Accept** present on B effector cells	
	6. role of antibody described e.g. opsonisation, immobilisation, agglutination, lysis ;		**(2)**

Question Number	Answer	Additional guidance	Mark
***(b)(ii)**	(QWC – answer must be organised in a clear, logical sequence) 1. reference to artificial (active) immunity ; 2. reference to {vaccine / vaccination } ; 3. containing {synthetic molecule / (synthetic) antigen / (synthetic) glycoprotein } ; 4. ref to stimulation of the {specific / humoral} immune response (to the synthetic antigen) ; 5. credit detail of process of producing effector B cells e.g. clonal expansion of B cells, involvement of cytokines, T helper cells activate B cells ; 6. reference to (production of B) memory cells ; 7. idea that (2G12) antibodies are produced {faster / in greater concentration} on {reinfection / eq} ;	Mps are awarded if the statements are clearly expressed **5. Ignore** references to production of activated T killer cells **6. Ignore** references to production of T memory cells **7. Accept** ref to secondary immune response	**(5)**

Question Number	Answer	Additional guidance	Mark
(c)	1. idea that HIV infection does not always produce symptoms ; 2. reference to {provirus / latency } ; 3. reference to test needed to detect (symptomless) HIV ; 4. idea that only people who suspect they may have contracted HIV would have a test ; 5. idea that {some people would not want to be tested / impossible to test everyone} ; 6. idea that symptoms are common to other diseases ; 7. {new cases arising/ patients dying} all the time / eq ; 8. idea of new strains of virus arising ;	**2. Accept** virus is dormant	**(2)**

Q4.

Question Number	Answer	Additional Guidance	Mark
(a)	1. bacteria are cells, viruses are {not / particles} ; 2. idea of bacteria surrounded by {cell wall / slime / capsule } , viruses surrounded by {protein / capsids / envelope} **;** 3. bacteria have { plasmids / ribosomes / other named structure} , viruses do not have {plasmids / ribosomes / other named structure } ; 4. bacteria (genome) are DNA, viruses can be DNA or RNA ; 5. bacterial DNA is double-stranded, viral genetic material is single (or double) stranded / eq ; 6. idea that bacteria have {circular / eq} genetic material, viruses have {linear / straight} genetic material ;	**NB** piece answers together throughout **Accept** only matched structures **2. Accept** for envelope: membrane / phospholipid layer / eq **3. Accept** bacteria have membranes, flagella cytoplasm, glycogen, lipid droplets **6. Not** in context of plasmid	**(3)**

Question Number	Answer	Additional Guidance	Mark
(b)(i)	1. reference to humoral (immune) response ; 2. reference to {phagocytosis / eq} by {phagocytes /named phagocyte} ; 3. reference to macrophages as { antigen-presenting cells / APCs} (to T helper cells) ; 4. reference to B cells as { antigen-presenting cells / APCs} (to itself) ; 5. idea that T helper cells release cytokines for B cell {activation / stimulation} ; 6. idea of B cells {forming clones / dividing /eq} (to form B effector cells) ; 7. reference to {differentiation of B cells into plasma cells / formation of plasma cells from B cells} (subsequent to cloning) ;	**2. Accept** dendritic cells / Langerhans cells / B cells **3 Accept** dendritic cells / Langerhans cells 4. **Accept** antigen binds to B cells **6. Not** to form plasma cells	**(4)**

Question Number	Answer	Additional Guidance	Mark
(b)(ii)	1. reference to {opsonisation / antibodies bind to bacteria / eq} ; 2. (as a result) enhancing phagocytosis / eq ; 3. reference to {immobilisation / agglutination / eq } (of bacteria) ; 4. idea of antibodies neutralising toxins / eq ;	**1. Not** reference to killing bacteria **2. Accept** easier, better	**(2)**

Question Number	Answer	Additional Guidance	Mark
(b)(iii)	1. idea that the immune response will be weaker ; 2. person may not recover from this infection / eq ; 3. idea of {other (opportunistic) infection / cancer} ; 4. reference to cytokines released from {T helper / CD4 } cells ; 5. idea that cytokines are involved in {activation / division } of {B cells / T killer cells} ; 6. credit consequence of impaired B cell function ; 7. credit consequence of impaired T killer cell function ;	**1. Accept** in context of either humoral or cell-mediated immune response **6. Accept** e.g. no antibody produced by plasma cells **7. Accept** e.g. infected cells not destroyed	**(4)**

Q5.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to **one pair** from the following: • mosquito coils / mosquito nets / insect repellent (1) • because {too expensive / not always available} (1) OR • anti-malarial tablets (1) • because {too expensive / not always available / side effects} (1) OR • avoiding stagnant water (1) • because impractical as people's {homes / work} are near stagnant water (1) OR • long clothing (1)	**ACCEPT** {removing / adding chemicals} to stagnant water **ACCEPT** affects organisms living in the water	(2)

	• because impractical for working (1) OR • insecticide (1) • expensive / can {poison / kill} other organisms / can affect the food chain (1) OR • sterile insect technique (1) • not fully tested / expensive (1) OR • biological control (1) • can affect the food chain (1)		

Question Number	Answer	Additional Guidance	Mark
(ii)	• percentage of deaths in 2015 compared to 2010 (1) • number of deaths in 2010 (1)	Example of calculation: 100 - 29 = 71 429 000 × 100 ÷ 71 = 604 225 / 604 000	(2)

Q6.

Question Number	Answer	Additional Guidance	Mark
(i)	Correct answer gains both marks {332 + 23 + 444 / 799 } and {338 + 450 / 788 } ; (799 – 788) = 11 (au) ;	**CE** applies	**(2)**

Question Number	Answer	Additional Guidance	Mark
(ii)	1. idea that rate of production of carbon dioxide is greater than rate of removal of carbon dioxide ; 2. idea of using of {fossil fuels / named fossil fuel / forests / eq} {releasing / producing} carbon dioxide ; 3. idea that this carbon (in fossil fuels / forests) was {locked up / removed from the air } years ago ; 4. idea of deforestation resulting in less {photosynthesis / carbon fixation / light independent reaction / eq} ;	**1 ACCEPT** carbon dioxide **{**production / release} is greater than used in photosynthesis **3 ACCEPT** ref to carbon sink **4 ACCEPT** less carbon dioxide used for photosynthesis	**(3)**

Q7.

Question Number	Answer	Additional Guidance	Mark
(a)(i)	1. {skin / epidermis} is a barrier / eq ; 2. reference to keratin ; 3. reference to lack of receptors (for the virus) ;	**Accept** prevents entry but **not** prevents infection **NB** keratin in skin forms a barrier = 2 marks **Accept** skin has different receptors	**(2)**

Question Number	Answer	Additional Guidance	Mark
(a)(ii)	1. idea that viruses only {infect / attach to / eq} {specific receptors / specific cells / host cells} ; 2. idea that receptors not present on {blood cells / endothelial cells / eq} ; 3. reference to {destruction / eq} of viruses by phagocytes ;	**Accept** white blood cells. neutrophils; PMN **Ignore** macrophages **Not** lymphocytes, T cells, plasma cells	**(2)**

Question Number	Answer	Additional Guidance	Mark
(b)	1. reverse transcriptase (required) in HIV, no reverse transcriptase in cold virus ; 2. DNA formed (using RNA) in HIV, {no DNA formed / RNA used to make protein / translation} in cold virus ; 3. reference to {provirus / latency / delay in virus formation / eq} in HIV infection, {no provirus / lytic cycle / (immediate) formation of virus particles / eq} in cold virus ;	**NB** answers can be pieced together but candidates still have to state both parts of mark point	**(2)**

Question Number	Answer	Additional Guidance	Mark
(c)(i)	1. to synthesise (common cold) RNA / eq ; 2. for amino acids to bind to tRNA / eq ; 3. to synthesise (common cold) protein (capsid) / eq ;	**Accept** translation	**(2)**

Question Number	Answer	Additional Guidance	Mark
(c)(ii)	1. idea of enzyme affecting {molecules in membrane / proteins / (phospho)lipids / cholesterol} ; 2. enzyme breaks {bonds / named bonds / eq} ; 3. reference to {(by) hydrolysis / hydrolytic enzymes} ; 4. credit detail of enzyme action ; 5. reference to enzyme U as {protease / lipase / cholesterase} ;	eg lowers activation energy, binding of active site to substrate (cannot credit reference to catalyst, as in stem of question) **Ignore** lysosyme	**(3)**