PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



MARK SCHEME

TOPIC 2: CELLS, VIRUSES AND REPRODUCTION OF LIVING THINGS

VIRUSES

SCORE	PERCENTAGE
/93	%

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Mark Scheme

Q1.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to four of the following: • Zmapp is effective / more people survive when treated (1) • Zmapp has {little / no} effect up to {5/6} days /deaths rates are the same up to day {5/6} / Zmapp is effective after day {5/6} (1) • 3 doses / treatments are needed (1) • Zmapp side effects decrease over time (1) • sample size is {small / age unknown / sex unknown / trial only lasted nine days (1)	**ACCEPT** deaths with Zmapp level off at 28 **ACCEPT** no more deaths after 3 doses **ACCEPT** converse	**4**

Q2.

Question Number	Acceptable Answer	Additional guidance	Mark
(i)	An explanation that makes reference to the following: • the three antibodies in Zmapp each bind to a specific part of the viral glycoprotein (1) • therefore the protein cannot change shape and fuse the cell membrane (1) • therefore Ebola RNA cannot enter the cell and the virus cannot replicate (1)		**(3)**

Question Number	Acceptable Answer	Additional guidance	Mark
(ii)	An explanation that makes reference to the following: • if mutation causes a change in the shape of the glycoprotein, Zmapp may not bind and will not be effective (1) • if mutation occurs in one of the other genes, the shape of the glycoprotein will not be affected and Zmapp will still be effective (1)		**(2)**

Q3.

Question Number	Answer	Additional Guidance	Mark
	The only correct answer is A **B** is incorrect because the capsid is complex not helical **C** is incorrect because DNA is the genetic material not RNA **D** is incorrect because DNA is the genetic material not RNA		(1) COMP

Q4.

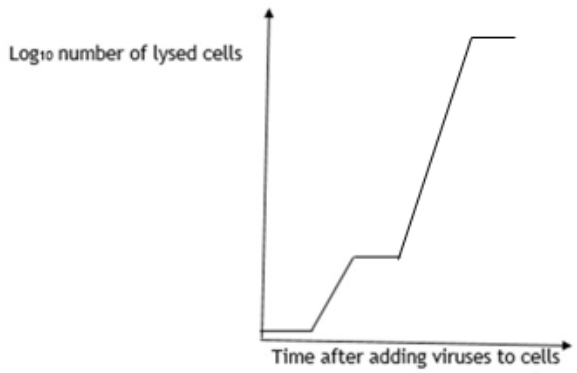
Question Number	Answer	Additional Guidance	Mark
	• drawing length of bacteria given in μm or nm / drawing length of virus given in μm or nm **OR** • ratio of drawing length (1) • actual length of virus given in nm, to the nearest whole number, value between 103 and 143 (1)	**ACCEPT** between 95 000 μm / 95 000 000 nm and 115 000 μm / 115 000 000 nm for bacteria between 7 000 μm / 7 000 000 nm and 8 000 μm / 8 000 000 nm for virus **ACCEPT** between 95 mm and 115 mm for bacteria and between 7 mm and 8 mm for virus ecf if numerals correct but order of magnitude wrong	(2) EXP

Drawing length of bacteria / mm	Drawing length of bacteria / μm or nm	Length of virus / mm	Length of virus / μm or nm	Actual length of virus / nm	Bacteria drawing length: virus drawing length
95	95 000 or 95 000 000	7 8	7 000 or 7 000 000 8 000 or 8 000 000	125 143	95:7 13.571:1 95:8 11.875:1
100	100 000 or 100 000 000	7 8	7 000 or 7 000 000 8 000 or 8 000 000	119 136	
105	105 000 or 105 000 000	7 8	7 000 or 7 000 000 8 000 or 8 000 000	113 130	
110	110 000 or 110 000 000	7 8	7 000 or 7 000 000 8 000 or 8 000 000	108 124	
115	115 000 or 115 000 000	7 8	7 000 or 7 000 000 8 000 or 8 000 000	103 118	115:7 16.428571:1 115:8 14.375 :1

Q5.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to three of the following: • virus to attach to host cells / {genetic material / DNA} to enter host cells (1) • synthesis of DNA (1) • {protein synthesis / transcription and translation} (1) • assembly of new viruses (1)	**ACCEPT** virus {enters / infects} **DO NOT ACCEPT** RNA **IGNORE** nucleic acid **DO NOT ACCEPT** RNA unless already penalised in mp 1 / in the context of {proviruses / latency} **ACCEPT** capsid / capsomeres / tail / base plate / tail (fibres) / collar / J protein / enzymes / protease / permease / other named proteins will need to be checked **DO NOT ACCEPT** reverse transcriptase / integrase **NB ACCEPT** (time for) {replication / multiplication} of the virus in correct context if no other marks awarded.	(3) EXP

Question Number	Answer	Additional Guidance	Mark
(ii)	• correct values read from graph and divided by the time (1) • mean rate calculated (1)	3.8 and 1.7 and a division by 40 / 0.0525 / 3.147 **IGNORE** ref to logs 156 ecf wrong time value but correct answer to whole number e.g.(30 mins) 209 Correct answer only = 2 marks	(2) EXP

Question Number	Answer	Additional Guidance	Mark
(iii)	• line going up and (generally) levelling off (1) • increase greater than the first increase (1)	**IGNORE** a third increase  	(2) EXP

Q6.

Question Number	Answer	Mark
(i)	**The only correct answer is C** ***A*** *is not correct because cellulose is not found in a bacterial cell* ***B*** *is not correct because cellulose and nucleoli are not found in a bacterial cell* ***D*** is not correct because nucleoli are not found in a bacterial cell	**(1)**

Question Number	Answer	Mark
(ii)	**The only correct answer is C** ***A*** *is not correct because Ebola contains RNA* ***B*** *is not correct because HIV contains RNA* ***D*** *is not correct because tobacco mosaic virus contains RNA*	**(1)**

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation that makes reference to the following: • the resolution is higher / better (1) • because wavelength of electrons is short(er) (1)	**ACCEPT** converse **ACCEPT** smaller wavelength	**(2)**

Q7.

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)

Q8.

Question Number	Answer	Additional Guidance	Mark
(i)	A description that makes reference to the following: • viral proteins / capsids made (1) • {viruses multiply / genetic material / RNA / DNA replicate} and {cells lyse / cells burst / viruses released from cell} (1)	**ACCEPT** viral RNA is translated	2

Question Number	Answer	Additional Guidance	Mark
(ii)	An answer that makes reference to two of the following: • virus {nucleic acid / RNA / DNA / genome} incorporated / integrated (into the host cell) (1) • virus is {dormant / inactive} (1) • virus nucleic acid replicates when host cell divides (1)	**ACCEPT** virus is not virulent **ACCEPT** viral RNA is not translated **ACCEPT** viral DNA is replicated when host cell DNA is replicated	2

Q9.

Question Number	Answer	Additional Guidance	Mark
	A description that makes reference to the following: • (viral) RNA made (1) • (viral) {capsid / protein} made (1) • assembly of viruses (1)	**ACCEPT** new virus particles made	(3)

Q10.

Question Number	Acceptable Answer	Additional guidance	Mark
	An explanation that makes reference to the following: • it had not been shown to be safe or effective in humans (1) • however, scientists wanted to collect more data on drug therapy for Ebola (1) • it was ethical because Ebola has a very high death rate so its use could be justified as a last resort (1)		**(3)**

Q11.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to the following: **Similarities** • both contain DNA (1) **Differences** • HPV is surrounded by {protein / capsid} and chlamydia by {a cellwall / peptidoglycan} (1) • HPV is hollow and chlamydia has {cell membrane / cytoplasm / ribosomes / glycogen granules / lipid droplets / plasmids}	**ACCEPT** DNA strands in HPV **ACCEPT** chlamydia has {cell membrane / cytoplasm / ribosomes / glycogen granules / lipiddroplets / plasmids} but HPV does not	(3)

Q12.

Question Number	Answer	Mark
	The only correct answer is B human immunodeficiency virus (HIV) *A is incorrect because Ebola virus does not have reverse transcriptase* *C is incorrect because lambda phage has DNA* *D is incorrect because tobacco mosaic virus does not contain reverse transcriptase*	**1**

Q13.

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)**

Q14.

Question Number	Acceptable Answer	Additional guidance	Mark
(a)	C		**(1)**

Question Number	Acceptable Answer	Additional guidance	Mark
(b)	B		**(1)**

Question Number	Acceptable Answer	Additional guidance	Mark
(c)	An explanation that makes reference to the following: • virus can {bind to / infect} cells of {throat / lung} (1) • virus has {haemagglutinin / glycoprotein / receptors} (on its surface) (1) Plus two from: • detail of viral replication (1) • leads to cell {lysis / tissue} damage (1) • immune response is triggered which results in symptoms that include {fever / headaches / fatigue / sore throat} (1)		**(4)**

Q15.

Question Number	Answer	Mark
(i)	**The only correct answer is C** ***A*** *is not correct because not all RNA viruses have envelopes and only the retroviruses contain reverse transcriptase* ***B*** *is not correct because only the retroviruses contain reverse transcriptase* ***D*** *is not correct because not all RNA viruses have envelopes and they are not all helical*	**(1)**

Question Number	Answer	Mark
(ii)	**The only correct answer is A** ***B*** *is not correct because λ phage has DNA* ***C*** *is not correct because λ phage has DNA* ***D*** *is not correct because λ phage has DNA*	**(1)**

Q16.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to three of the following: • because more viruses delivered (1) • because {lipid / sphere} can pass through cell membrane / no need to bind to (cell) receptors / can bind to any cell (1) • because {lipid / sphere} protects viruses from {enzymes / stomach acid / phagocytes / immune system} (1) • credit a link between one reason and the information given (1)	e.g. more cells infected so symptoms develop faster more cells infected so symptoms are worse virus particles not destroyed so more cells infected	(3)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to two of the following: • because the lipids could be {targetted / broken down} (1) • by an enzyme (that breaks down lipid) (1) • resulting in {fewer virus particles arriving at cells (in one go) / exposure to immune system} (1)	**ACCEPT** using a drug that can penetrate the lipid **ACCEPT** therefore destroying the viruses **ACCEPT** {fewer / no} viruses (arriving at the cells)	(2)

Q17.

Question Number	Answer	Additional Guidance	Mark
(i)	315		**(1)**

Question Number	Answer	Additional Guidance	Mark
(ii)	A description that makes reference to the following: • used in translation to make (viral) protein (1) • more RNA is produced (1)		**(2)**

Q18.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	C (nucleic acid and protein)		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	B (human immunodeficiency virus)		**(1)**

Q19.

Question Number	Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to the following: • because viruses are {not living / not cells / have no metabolism / have no protein synthesis organelles / lack a cell wall / lack peptidoglycan} (1) • antiviral drugs used because they inhibit replication (1)		(2)

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to four of the following: • identify mosquitoes that fluoresce (1) • because these mosquitoes are {genetically modified / contain the gene} (1) • allow {those that fluoresce / GM mosquitoes} to interbreed (1) • repeat for several generations (1) • offspring with the gene for fluorescence are selected to produce a population of GM mosquitoes (1)	**Do not accept** eggs	(4)

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation that makes reference to two of the following: • to prevent (people with Zika) being bitten (1) • therefore preventing {spread of Zika / biting uninfected people / increase in infected mosquitoes} (1) • mosquitoes spread other diseases (1)		(2)

Q20.

Question Number	Acceptable Answer	Additional Guidance	Mark
	A description that makes reference to the following: **Latency:** • virus genetic material inserted into host cell and integrated into host DNA (1) • viral DNA replicated each time the host cell replicates (1) **Lytic cycle:**		**(4)**
	• virus genetic material inserted into host cell and synthesis of viral particles by host cell (1) • lysis of host cell (1)		