

Topic 6 Biology

Booklet 2 of 3

Revision Questions

**Passive / Active
Immunity & HIV**

MARK SCHEME

Question Number	Answer	Mark
6(a)	<ol style="list-style-type: none"> 1. RNA in HIV and DNA in {bacterium / eq} ; 2. comparative description of nucleic acid e.g. circular in bacterium and linear in HIV / eq ; 3. plasmids in {bacterium / eq} and no plasmids in HIV ; 	maximum (2)

Question Number	Answer	Mark
6(b)	<ol style="list-style-type: none"> 1. {keratin / protein} in skin {surface / epidermis} ; 2. idea of forms a {hard / impenetrable / physical / eq} barrier ; 	(2)

Question Number	Answer	Mark
6(c)(i)	<ol style="list-style-type: none"> 1. numbers decrease / eq ; 2. small decrease in {first week / between weeks {4 / 5} and 6} / eq ; 3. large decrease between weeks {1 / 2} to 3 / eq ; 4. credit use of manipulated figures ; 	maximum (2)

Jan 2010

Question Number	Answer	Mark
6* (c)(ii) QWC	<p>(QWC - Spelling of technical terms (<i>shown in italics</i>) must be correct and the answer must be organised in a logical sequence)</p> <ol style="list-style-type: none"> 1. {<i>glycoprotein</i> / gp120} on virus / eq ; 2. binds with {receptors / CD4} / eq ; 3. on (surface) membrane of <i>lymphocytes</i> / eq ; 4. viral RNA enters the <i>lymphocyte</i> / eq ; 5. viral RNA used to produce viral DNA (in <i>lymphocyte</i>) / eq ; 6. by action of <i>reverse transcriptase</i> ; 7. ref to formation of new viruses ; 8. <i>lymphocyte</i> destroyed when new viruses {bud out of / leave} the cell / eq ; 9. T killer {cells / <i>lymphocytes</i>} destroy T helper {cells / <i>lymphocytes</i>} / eq ; 	maximum (5)

Question Number	Answer	Mark
6(c)(iii)	B {cells / lymphocytes} { not activated / not stimulated / are inhibited / eq} / fewer antibodies / T killer cells {increase / multiply / eq} ;	(1)

Jan 2010

Question Number	Answer	Mark
4(a)(i)	C ;	(1)

Question Number	Answer	Mark
4(a)(ii)	A ;	(1)

Question Number	Answer	Mark
4(b)(i)	<p>D = antigens / (glyco)proteins ;</p> <p>E = B {lymphocytes / cells} / plasma cells ;</p> <p>F = antibodies / immunoglobulins ;</p> <p>G = macrophage / phagocyte / eq ;</p> <p>H = enzymes / lysozyme ;</p>	(5)

June 2010

Question Number	Answer	Mark
4(b)(ii)	<ol style="list-style-type: none"> 1. reference to protein nature of {antigens / antibodies} ; 2. antigens are specific (to each bacteria) / eq ; 3. antibodies need to be {complementary / specific} (to the antigen) ; 4. idea that {binding / eq} can take place ; 5. (some bacteria) have {different / changed} antigens / eq ; 6. idea that this is a primary infection ; 7. reference to {mucus / slime} {coat / capsule} (of bacterial cells) ; 8. idea that some bacteria are inside body cells ; 9. idea of antibodies already present e.g. from passive immunity or breast feeding ; 	<p>max (3)</p>

June 2010

Question Number	Answer	Mark										
8(a)	<table><tr><th>Source of antibodies</th><th>Form of immunity</th></tr><tr><td></td><td>D</td></tr><tr><td></td><td>B</td></tr><tr><td></td><td>C</td></tr><tr><td></td><td>A</td></tr></table> <p>Note: [accept descriptions instead of letters]</p> <p>4 correct = 2 marks 2 or 3 correct = 1 mark 0 or 1 correct = 0 marks ;;</p>	Source of antibodies	Form of immunity		D		B		C		A	(2)
Source of antibodies	Form of immunity											
	D											
	B											
	C											
	A											

Question Number	Answer	Mark
8(b)	<ol style="list-style-type: none"> 1. (bacterium) is made of many different {polymers / chemicals / eq} / eq ; 2. which can act as antigens / eq ; 3. reference to B {lymphocytes / cells} ; 4. reference to (individual B-lymphocytes) recognise specific antigens / antibodies are specific / eq ; 5. reference to {activation/ eq} of B-lymphocytes by T {lymphocytes / cells} ; 6. reference to mitosis (in B-lymphocytes or cells) ; 7. to {form / eq} genetically identical plasma cells ; 	max (4)

Jan 2011

Question Number	Answer	Mark
8(c)	<ol style="list-style-type: none"> 1. specific {antigen / virus / pathogen / bacterium / eq} can be {identified / eq} ; 2. idea of {specific / monoclonal} antibody binds to {specific / only one} antigen ; 3. specific treatment can be given / eq ; 4. avoids unnecessary use of {drugs / treatment} / eq ; 5. more likely to be effective / eq ; 	<p>max (3)</p>

Jan 2011

Question Number	Answer	Mark												
8(a)	<table border="1"> <thead> <tr> <th>Statement</th><th>True</th><th>False</th></tr> </thead> <tbody> <tr> <td>HIV infects b-lymphocytes in the human immune system</td><td></td><td>✓</td></tr> <tr> <td>The genetic material in HIV is a form of RNA</td><td>✓</td><td></td></tr> <tr> <td>The enzyme, reverse transcriptase, is used by HIV</td><td>✓</td><td></td></tr> </tbody> </table> <p>1 mark each correct row ;;;</p>	Statement	True	False	HIV infects b-lymphocytes in the human immune system		✓	The genetic material in HIV is a form of RNA	✓		The enzyme, reverse transcriptase, is used by HIV	✓		(3)
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Question Number	Answer	Mark
8(b)(i)	<ol style="list-style-type: none"> change in the {nucleotides / bases} / eq ; in {RNA / DNA} / eq ; which leads to change in the {sequence / eq} of amino acids in (primary structure of) a {polypeptide / protein} / eq ; 	(2)

Question Number	Answer	Mark
8(b)(ii)	<ol style="list-style-type: none"> 1. idea that HIV has {many / variety of / new / eq} {strains / types / antigens / protein coats / eq} (in infected person) ; 2. some strains {are / become} resistant to {an individual / a specific / a particular / eq} drug / eq ; 3. these would survive if (only one drug used) / eq ; 4. {mixture of drugs / eq} has more chance of getting rid of {all / more} (strains / types / eq) / eq ; 5. reference to drugs used together because of mutation ; 6. reference to rapid rate of mutation ; 7. reference to rapid rate of {multiplication / eq} of virus ; 	(4)

Question Number	Answer	Mark
7(a)	C ;	(1)

Question Number	Answer	Mark
7(b)(i)	<ol style="list-style-type: none"> 1. {T helper / CD4 (positive)} (cell / lymphocytes) ; 2. phagocytic cells e.g. macrophages, dendritic cell ; 	(2)

Question Number	Answer	Mark
7(b)(ii)	<ol style="list-style-type: none"> 1. reference to (HIV) binds to (CD4) receptors on cell (surface) ; 2. ref to CD4 (receptors on cells) ; 3. reference to {glycoprotein / gp120} on virus (surface) ; 4. reference to fusion of virus (envelope) with (cell surface) membrane ; 5. idea of phagocytosis (in macrophage / eq) ; 	(3)

Jan 2012

Question Number	Answer	Mark
7(b)(iii)	<ol style="list-style-type: none"> 1. reference to viral RNA ; 2. reference to production of (viral) DNA (using viral RNA as a copy) ; 3. correct ref to reverse transcriptase ; 4. reference to incorporation of viral DNA into host cell's {DNA /genome } / reference to provirus / eq ; 5. correct ref to integrase ; 6. reference to production of {viruses / viral RNA and proteins} / eq ; 7. idea of infection of further (T helper) cells ; 8. reference to destruction of (T helper) cells by T killer cells OR reference to cell lysis / eq ; 9. reference to lowering of immunity ;(to other diseases ; 10. credit reference to role of T helper cells in immune response e.g. produce cytokines, activate B cells / killer cells ; 11. death is caused by e.g. opportunistic disease, pneumonia , TB, Kaposi's sarcoma, cancer, dementia, extreme weight loss, meningitis, toxoplasmosis ; 	(6)

Jan 2012

Question Number	Answer	Mark															
8(a)	<table border="1"> <thead> <tr> <th>Description</th><th>True</th><th>False</th></tr> </thead> <tbody> <tr> <td>B and T cells are formed in the bone marrow</td><td>✓</td><td></td></tr> <tr> <td>B cells stimulate T cells to produce clones of memory cells</td><td></td><td>✓</td></tr> <tr> <td>T helper cells produce chemicals that destroy pathogens</td><td></td><td>✓</td></tr> <tr> <td>B and T cells are able to form clones by mitosis</td><td>✓</td><td></td></tr> </tbody> </table> <p>1 mark each correct row ;;;</p>	Description	True	False	B and T cells are formed in the bone marrow	✓		B cells stimulate T cells to produce clones of memory cells		✓	T helper cells produce chemicals that destroy pathogens		✓	B and T cells are able to form clones by mitosis	✓		(4)
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Question Number	Answer	Mark
8(b)	<ol style="list-style-type: none"> 1. (bacteria are) too small / reference to limitation of {magnification / resolution} ; 2. (bacteria) not stained ; 3. idea of bacteria already {removed / destroyed} e.g. phagocytosis ; 4. idea that bacteria are not present in the blood e.g. only a small {region / sample} shown, reference to local infection ; 	(2)

Jan 2012

Question Number	Answer	Mark
8(c)(i)	<p>Either:</p> <ol style="list-style-type: none"> 1. idea of fewer {lymphocytes / eq} ; 2. reference to {lymphocytes / eq} no longer needed / eq ; 3. (as) {antibiotics / drugs} {kill / destroy / eq} bacteria ; <p>Or:</p> <ol style="list-style-type: none"> 4. more {lymphocytes / eq} ; 5. idea of clonal expansion (of lymphocytes) / eq ; 6. idea that the antibiotics have not killed all the bacteria yet ; 	(2)

Question Number	Answer	Mark
8(c)(ii)	<ol style="list-style-type: none"> 1. idea that a placebo has no effect ; 2. (therefore there will be) more bacteria / eq ; 3. (therefore there will be) more {lymphocytes / eq} ; 4. (more lymphocytes due to) clonal expansion / eq ; 	(2)

Jan 2012

Question Number	Answer	Mark
6(a)	C – plasma cell ;	(1)

Question Number	Answer	Mark
6(b)(i)	<ol style="list-style-type: none"> 1. idea of using {virus / PCV2} as vaccine ; 2. which is {modified / attenuated / harmless / similar / part of / eq} ; 3. idea that the vaccine contains the antigen ; 4. idea of {activation / proliferation} of (specific) {B cell / T cell / lymphocyte} ; 5. reference to production of (B / T) memory cells ; 6. idea that body now able to produce (specific) antibody {faster / at higher concentration / eq} on another exposure to PCV2 ; 	(3)

Question Number	Answer	Mark
6(b)(ii)	<ol style="list-style-type: none"> 1. reference to giving a placebo (to group B) ; 2. idea that all (other) {conditions / factors / variables} should be {controlled / same as group A} ; 3. stated example e.g. food, temperature of housing / eq ; 4. reference to group B is a control group ; 5. (so that) only the (effect of) {vaccine / vaccination} is tested / eq ; 6. ref to {valid / validity} ; 	(3)

Question Number	Answer	Mark
6(b)(iii)	<ol style="list-style-type: none"> 1. {Greater change / higher / eq} in group A (than B) / eq ; 2. group A rises for first 30 days, group B rises (slightly) for first 20 days / eq ; 3. (this) rise for group A is {faster / greater} than for group B / eq ; 4. (after the rise) group A falls, group B levels off / eq (until day 140) ; 5. after day 140, group A rises, group B falls / eq ; 6. credit use of comparative manipulated figures (with units) ; 	(3)

Question Number	Answer	Mark
6(b)(iv)	<ol style="list-style-type: none"> 1. idea that (antibodies present at birth as) both groups received antibodies from mother ; 2. via {placenta / blood / milk / breast feeding} ; 3. reference to passive immunity ; 4. group A concentration falls because {piglets not infected by (PCV2) virus/ antibodies excreted / passive immunity is short term} /eq ; 5. group B concentration rises because {PCV2 / virus} present / eq ; 	(3)

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

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

Question Number	Answer	Additional guidance	Mark
2(b)(i)	<ol style="list-style-type: none"> reference to glycoprotein ; credit detail of structure e.g. specific (3D) shape, L and H regions, Y-shape, 4 (peptide) chains, disulphide bridges between peptides, hinge region ; reference to {antigen-binding site / variable region / Fab (region) / eq }; idea of antibodies have a {similar / constant / Fc / eq } region; produced by plasma cells / present on B cells ; role of antibody described e.g. opsonisation, immobilisation, agglutination, lysis ; 	<p>1. Accept protein, chains of amino acids</p> <p>2. Ignore active site Accept a Y-shaped drawing</p> <p>3. Accept references to {binding to specific antigen / antigen-specific / antigen receptors}</p> <p>5. Accept present on B effector cells</p>	(2)

Question Number	Answer	Additional guidance	Mark
2*(b)(ii)	<p>(QWC – answer must be organised in a clear, logical sequence)</p> <ol style="list-style-type: none"> 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} ; 	<p>Mps are awarded if the statements are clearly expressed</p> <p>5. Ignore references to production of activated T killer cells</p> <p>6. Ignore references to production of T memory cells</p> <p>7. Accept ref to secondary immune response</p>	(5)

Question Number	Answer	Additional guidance	Mark
2(c)	<ol style="list-style-type: none"> 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)

Question Number	Answer	Additional guidance	Mark
8(a)(i)	<ol style="list-style-type: none"> 1. idea that interferon involved in viral infections, lysozyme affects bacteria; 2. idea of interferon produced by infected cells, lysozyme present in {secretions / phagocytes / neutrophils / macrophages / eq }; 3. interferon {inhibits / eq} {replication / eq} of viruses, lysozyme {kills / destroys} bacteria; 	<p>Piece together throughout Accept lysosome throughout Ignore pathogen throughout</p> <p>2. Accept named secretion {produced / released}</p> <p>3. Accept a reference to lysozyme destroying cell walls</p>	(3)

Question Number	Answer	Additional guidance	Mark
8(a)(ii)	<ol style="list-style-type: none"> 1. reference to (lysozyme) is an enzyme ; 2. idea that {proteins / active sites / enzymes} have a specific shape ; 3. idea that lysozyme acts on cell wall ; 4. of bacteria ; 	Accept lysosome in this context	(4)

Question Number	Answer	Additional guidance	Mark
8(b)(i)	<ol style="list-style-type: none"> 1. reference to histamine released as a result of damaged {tissue / cells} ; 2. (histamine released from) {basophils / mast cells / platelets} ; 3. detail of effect of histamine e.g arterioles dilate, vasodilation, increased blood flow, capillaries more permeable ; 4. named effect of inflammation e.g. {oedema / swelling / redness / heat / pain / eq} ; 	<p>2. Accept white blood cells, macrophages and neutrophils</p> <p>4. Accept raises temperature</p>	(3)

Question Number	Answer	Additional guidance	Mark
8(b)(ii)	<ol style="list-style-type: none"> 1. idea of (only) {a local reaction produced / histamines produced around bite area} ; 2. idea that cream {has been applied to actual site of production of histamine} ; 3. idea of {effect / treatment / relief / eq} {more rapid / immediate / eq} ; 4. idea of higher concentration of antihistamine at site ; 5. idea that the antihistamines will not be {digested (by enzymes) / destroyed (by acid / enzymes) / eq} ; 6. idea that tablets may lower immune response generally / lead to side-effects ; 	2-6 Accept converse	(3)

Question Number	Answer	Additional Guidance	Mark
7(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)
7(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
7(b)	<ol style="list-style-type: none"> reverse transcriptase (required) in HIV, no reverse transcriptase in cold virus ; DNA formed (using RNA) in HIV, {no DNA formed / RNA used to make protein / translation} in cold virus ; 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
7(c)(i)	<ol style="list-style-type: none"> to synthesise (common cold) RNA / eq ; for amino acids to bind to tRNA / eq ; to synthesise (common cold) protein (capsid) / eq ; 	Accept translation	(2)

Question Number	Answer	Additional Guidance	Mark
7(c)(ii)	<ol style="list-style-type: none"> idea of enzyme affecting {molecules in membrane / proteins / (phospho)lipids / cholesterol} ; enzyme breaks {bonds / named bonds / eq} ; reference to {(by) hydrolysis / hydrolytic enzymes} ; credit detail of enzyme action ; reference to enzyme U as {protease / lipase / cholesterae} ; 	<p>eg lowers activation energy, binding of active site to substrate (cannot credit reference to catalyst, as in stem of question)</p> <p>Ignore lysosyme</p>	(3)

Question Number	Answer	Additional Guidance	Mark
2(a)	1. (structure G is {glycoprotein / gp120} ; 2. used for {attachment / eq} to CD4 (molecules / receptors / antigens) ; 3. on T helper {cells / lymphocytes} ;	1. IGNORE gp 41 and gp 160 and other wrong numbers 3. ACCEPT macrophages / dendritic cells / CD4 cells	(3)

Question Number	Answer	Additional Guidance	Mark
2(b)(i)	1. they are globular proteins ; 2. it has an active site ; 3. idea of {charged R groups on outside of molecules / composed of many small R groups} ;	2. idea of active site R groups enable binding of substrate 3. idea of hydrophilic on the outside	(3)

Question Number	Answer	Additional Guidance	Mark
*2(b)(ii)	(QWC – spelling of technical terms must be correct and the answer must be organised in a logical sequence) 1. idea that drugs would prevent viral replication ; 2. idea that T (helper) {cells / lymphocytes} will not be {killed / burst / destroyed} (by virus particles leaving cell) ; 3. idea of {inhibition / eq} of reverse transcriptase ; 4. idea that (viral) DNA could not be made; 5. from the (viral) RNA ; 6. idea of {inhibition / eq} of integrase ; 7. idea that (viral) DNA cannot integrate into (host) {DNA / genome} / eq ;	QWC emphasis on clarity of expression 1. ACCEPT description of virus formation 3. ACCEPT drugs prevent action of reverse transcriptase 4. reject idea that RNA is {turned into / converted into} DNA 6. ACCEPT drugs prevent action of integrase 7. ACCEPT idea that drugs would prevent {latency / formation of provirus / eq} ;	(5)

Question Number	Answer	Additional Guidance	Mark
4(a)	<ol style="list-style-type: none"> 1. idea that {bacteria / pathogen / virus / eq} have to be taken into macrophage / eq ; 2. idea of fusion of {phagosome / eq} with lysosome ; 3. idea that {bacteria/ pathogen / virus / eq} are {digested / broken down / eq} (by enzyme) ; 4. credit named enzyme other than lysozyme ; 5. idea that part of the {bacteria/ pathogen / virus / eq} has to be on {membrane / (outer) surface} (of the macrophage) ; 	<ol style="list-style-type: none"> 1. IGNORE phagocytosis unqualified 2. ACCEPT phagocytic vesicle 3. IGNORE destroy / killed 4. e.g. protease. 5. ACCEPT antigen / protein 	(4)

Question Number	Answer	Additional Guidance	Mark
4(b)	<ol style="list-style-type: none"> 1. idea of macrophage {binding/ eq} to T (helper) {cell / lymphocyte} ; 2. reference to {MHC / major histocompatibility complex } (on macrophage) ; 3. reference to CD4 (receptor on T cell) ; 		(2)

Question Number	Answer	Additional Guidance	Mark
4(c)	<ol style="list-style-type: none"> 1. idea that a mutation has occurred (in the DNA) ; 2. idea that there is a change in {antigen /outer surface / cell wall / slime layer} (of bacteria) ; 3. idea that memory (T) cells will not recognise the (new) antigen ; 4. idea that another (primary) immune response needed e.g. (new) antigen needs to be presented (to the T helper cell) ; 5. to activate (another) population of T (helper) cells / eq ; 6. idea that {phagocytes / macrophages} unable to {recognise / engulf / phagocytose / digest / destroy / eq} the {Mycobacterium tuberculosis / bacteria} ; 7. idea that antigen presentation is not possible ; 	1. NOT a mutation of the antigen	(3)

Question Number	Answer	Additional Guidance	Mark
7(a)(i)	1. levels of antibody rise sooner after infection / eq ; 2. levels of antibody rise faster after infection / eq ; 3. levels of antibody rise higher after infection / eq ; 4. credit comparative manipulation of data ;	do not piece together ACCEPT converse for mps 1, 2 and 3 in context of vaccination 4. e.g. increase after infection is {10 (au) more / 1.83 times more} peak after infection is 13 (au) higher rate of increase after infection is 1.27 au day^{-1} faster	(2)

Question Number	Answer	Additional Guidance	Mark
7(a)(ii)	1. secondary (immune) response ; 2. reference to memory cells ; 3. idea that (on infection / second exposure) memory cells are {activated / cloned / stimulated / eq}; 4. idea that (in secondary response) antibodies are released from plasma cells ;	1. ACCEPT secondary immunity 3. ACCEPT B memory cells differentiate into plasma cells	(3)

Question Number	Answer	Additional Guidance	Mark
7(b)(i)	1. idea that antibodies will only be present if antigen present ; 2. idea that antigen B is not present in vaccine ; 3. vaccination failed to stimulate immune response / eq ;		(2)

Question Number	Answer	Mark
7(b)(ii)	C natural active	(1)

Question Number	Answer	Additional Guidance	Mark
7(c)	1. idea that {a comment cannot be made / caution in interpreting results should be taken / eq} ; 2. no indication of number of rats used / eq ; 3. no data points / eq ; 4. no error bars (on graph) / no indication of variability / eq ; 5. no statistical evidence / eq ; 6. idea that no indication of {experimental details / control variables / control group / eq} ; 7. idea that mean has been used therefore there must have been some repeats / eq ;	1. IGNORE not reliable or is reliable 2. IGNORE no repeats / sample was small ACCEPT number of repeats not known / sample size not known	(3)

Question Number	Answer	Additional Guidance	Mark
1(a)(i)	1. (skin flora) {prevent growth of / kill} {pathogens / microorganisms / bacteria / eq} ; 2. competition for {space / nutrients / water / minerals / eq} ; 3. release of {chemicals / toxins / antimicrobials / lipids / enzymes /eq } ;	1 ACCEPT prevent colonisation IGNORE antigens / viruses / infections / diseases 2 IGNORE food / resources 3 NOT sebum / lysozymes	(2)

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	B they have antimicrobial properties that inhibit the growth of bacteria		(1)

Question Number	Answer	Additional Guidance	Mark
1(b)(i)	C keratin		(1)

Question Number	Answer	Additional Guidance	Mark
1(b)(ii)	1. idea of little {tertiary / quaternary } structure / eq OR mainly secondary structure ; 2. made up of {long / linear / straight / eq} {molecules / (poly)peptides / polymers } ; 3. idea of cross-linking (between one polypeptide chain and another) ; 4. idea of repeating amino acid sequences / eq ; 5. insoluble / eq ; 6. tough / strong / eq ;	3 NOT peptide bonds 5 IGNORE hydrophobic on outside	(4)

Question Number	Answer	Additional Guidance	Mark
1(b)(iii)	1. {DNA / (m)RNA} contains the {genetic code / triplet codons / base sequence coding for amino acids / eq}; DNA : 2. Idea that the DNA strand is used {in transcription / to make (m)RNA / eq} ; mRNA : 3. (m)RNA is a copy of the DNA ; 4. mRNA carries this {information / code /eq} {out of the nucleus / to the ribosomes / eq} ; 5. idea that amino acids {arranged in sequence / eq } ;	1 ACCEPT (DNA) template 4 IGNORE to cytoplasm	(4)

Question Number	Answer	Additional Guidance	Mark
4(a)(i)	1. idea of binding of {bacteria / virus / pathogen / microorganism / antigen / non-self / foreign matter / eq} to (phagocytic) cell ; 2. idea that {bacteria / virus / pathogen / microorganism / antigen / eq} is {engulfed by / taken into / endocytosis into } (phagocytic) cell ; 3. idea of bacteria being inside a {vacuole / phagosome / eq} ;	1 ACCEPT phagocyte 2 ACCEPT phagocyte 3 ACCEPT vesicle	(2)

Question Number	Answer	Additional Guidance	Mark
4(a)(ii)	1. idea that the body {reacts / defends itself / responds / eq} to a {bacteria / virus / pathogen / microorganism / antigen / non-self / foreign matter / eq} ; 2. idea that the response is not dependent on the specific {bacteria / virus / pathogen / microorganism / antigen / eq} ; 3. credit named reaction e.g. lysozymes , inflammation, phagocytosis, interferon production ;	1 NOT reference to immune response 2 ACCEPT idea of no previous infection / responds to any pathogen 3 IGNORE egs of barriers	(2)

Question Number	Answer	Additional Guidance	Mark
4(a)(iii)	1. reference to {bacteria / virus / pathogen / microorganism / eq} ; 2. being inside {tissues / cells } / eq ;	1 IGNORE disease / infection / foreign matter / antigen 2 IGNORE body ACCEPT idea that has evaded barriers, named cell or tissue IGNORE {infects / attaches / harms / attacks} cells	(2)

Question Number	Answer	Additional Guidance	Mark
4(b)	reaction A = phosphorylation ; reaction B = hydrolysis ;		(2)

Question Number	Answer	Additional Guidance	Mark
4(c)(i)	<p>Diagram marks :</p> <ol style="list-style-type: none"> 1. two membranes shown ; 2. inner membrane folded into cristae ; <p>Label marks (correct) : [max 2 marks]</p> <ol style="list-style-type: none"> 3. outer membrane and {inner membrane / cristae} ; 4. matrix ; 5. stalked particles / ATPase / eq (labelled on inner membrane) ; 6. DNA (circular / loop) ; 7. ribosomes ; 	<p>1 NOT if cristae shown as a 3rd membrane</p> <p>NB do not choose which labels to accept eg 2 right + 1 wrong = 1 mark 2 wrong = 0 marks</p> <p>5 ACCEPT oxisome</p> <p>6 ACCEPT plasmids</p> <p>7 IGNORE size references</p>	(4)
4(c)(ii)	chloroplast ;	IGNORE chlorophyll	(1)

Question Number	Answer				Mark
2(a)					
	Feature	Bacteria only	Viruses only	Both bacteria and viruses	
	Cytoplasm	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	Nucleic acids	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	Protein coat (capsid)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
					(3)

Question Number	Answer	Additional Guidance	Mark
2(b)(i)	<ol style="list-style-type: none"> idea of little difference between the groups (at each incubation time) ; idea of {large / eq} error bars ; idea of {overlapping / eq} error bars ; 	2 and 3 ACCEPT range bars	(2)

Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	<ol style="list-style-type: none"> idea that membrane {receptors / proteins / glycosidic groups / eq} interacts with bacteria ; idea of {pseudopodia formed around / macrophage surrounds} the bacteria ; idea that membranes (of pseudopodia) {fuse / pinch off / eq} ; to form a vacuole (that contains the bacteria) / eq ; idea that {change in shape / fusion / movement / eq} of membrane is due to fluidity of membrane ; caused by the {movement of phospholipids / presence of cholesterol / eq} ; 	<p>1 ACCEPT antibodies bind to both bacteria and macrophage / opsonisation</p> <p>2 IGNORE engulf</p> <p>4 ACCEPT vesicle, phagosome</p>	(4)

Question Number	Answer	Additional Guidance	Mark
2(c)(i)	<ol style="list-style-type: none"> bacteriostatic antibiotics stop the bacteria from dividing / eq ; bactericidal antibiotics {kill / eq} the bacteria ; 	<p>IGNORE description of mechanism</p> <p>1 ACCEPT growing, replicating</p>	(2)

Question Number	Answer	Additional Guidance	Mark
2(c)(ii)	<ol style="list-style-type: none"> idea that viruses are non-living ; 	ACCEPT viruses do not have the target sites for antibiotics	(1)

Question Number	Answer	Additional Guidance	Mark
1(a)	1. {antigen / bacteria / virus / pathogen} {binds / eq} to B cell ; 2. {antigen / bacteria / virus / pathogen} {binds / eq} to MHC (antigen) ; 3. T helper {lymphocytes / cells} {bind / eq} (to B cell) ; 4. reference to cytokines (from T helper cells) ;	1 ACCEPT B cell is an antigen-presenting cell 3 ACCEPT CD4 cells	(3)

Question Number	Answer	Mark
1(b)(i)	mitosis ;	(1)

Question Number	Answer	Additional Guidance	Mark
1(b)(ii)	1. idea of sample of B cells from lymph nodes ; 2. reference to named stain e.g. (acetic) orcein ; 3. credit correct details of method for B cells e.g. heating / add { HCl / acid } ; 4. idea of looking for mitotic features ;	1 ACCEPT from blood 2 ACCEPT acetocarmine, Feulgen's, Schiff's, toluidine blue 3 ACCEPT squashing of lymph node 4 ACCEPT stages of mitosis	(3)

Question Number	Answer	Mark
1(c)(i)	C mitochondrion ;	(1)

Question Number	Answer	Mark
1(c)(ii)	C nucleus ;	(1)

Question Number	Answer	Additional Guidance	Mark
1(c)(iii)	endoplasmic reticulum / ER ;	IGNORE smooth , rough ACCEPT RER / SER / ribosome	(1)

Question Number	Answer	Additional Guidance	Mark
1(c)(iv)	<p>IF RER / SER HAS BEEN GIVEN AS ANSWER IN (iii):</p> <ol style="list-style-type: none"> 1. {protein synthesis / translation / eq} occurs ; 2. on the ribosomes ; 3. idea that {polypeptide / protein} {moves into / transported into} the ER ; 4. to the Golgi apparatus / through the cytoplasm / eq ; <p>IF GOLGI HAS BEEN GIVEN AS ANSWER IN (iii):</p> <ol style="list-style-type: none"> 5. it modifies the protein / eq ; 6. credit example of modification e.g. addition of carbohydrate group ; 	<p>IF CYTOPLASM HAS BEEN GIVEN AS ANSWER IN (iii): apply either the RER OR Golgi Mps 1 ACCEPT description of translation</p> <p>4 ACCEPT idea of folding into {secondary / tertiary} structure</p>	

	<ol style="list-style-type: none"> 7. idea that antibody moved into vesicles ; 8. exocytosis / eq ; <p>IF RIBOSOME HAS BEEN GIVEN AS ANSWER IN (iii):</p> <ol style="list-style-type: none"> 9. {protein synthesis / translation / eq} occurs ; 10. ribosome holds mRNA / eq ; 11. ribosome holds two tRNA / eqs ; 12. so that peptide bonds can form between (adjacent) amino acids ; 		(3)
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Question Number	Answer	Additional guidance	Mark
*5(a)(i)	<p>(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)</p> <ol style="list-style-type: none"> 1. idea that {vaccine / antigens / attenuated virus / eq } needs to be injected into person ; 2. to stimulate the (primary) immune response / eq ; 3. idea that macrophages present the antigen (in the vaccine) to T helper cells ; 4. idea that T helper cells release cytokines to stimulate {B cells / T killer cells} ; 5. resulting in formation of memory (T / B) cells ; 6. idea that memory cells remain in the body ; 7. idea that these memory cells are activated on infection (with the virus) ; 8. idea that the resulting immune response will be faster ; 	<p>Emphasis is on logical sequence</p> <p>1 Do not accept killing virus</p> <p>8 e.g. idea of {faster / more} antibody produced (by plasma cells), idea of (macrophages) destroying virus before it has chance to replicate, idea that T killer cells would be able to destroy host-infected cells sooner</p>	(6)

Question Number	Answer	Mark
5(a)(ii)	<p>5(a)(ii). The only correct answer is A – artificial active</p> <p><i>B is not correct because a vaccine contains antigen and therefore stimulates an immune response</i></p> <p><i>C is not correct because a vaccine is not natural</i></p> <p><i>D is not correct because a vaccine contains antigen and therefore stimulates an immune response and is not natural</i></p>	(1)

Question Number	Answer	Additional guidance	Mark
5(a)(iii)	<ol style="list-style-type: none"> 1. tested on animals ; 2. tested on (small number of) healthy individuals ; 3. tested on small number of people who are likely to come in contact with Zika ; 4. idea of (then) testing on a small number of pregnant women (to check for side effects in the baby) ; 5. idea that it is unlikely that phase III will be carried out first 	<p>1 Accept cells, tissues</p> <p>3 Accept women before they got pregnant Do not accept people infected with the disease</p> <p>4 Accept testing on pregnant animals</p>	(3)

Question Number	Answer	Additional guidance	Mark
5(b)	<ol style="list-style-type: none"> 1. idea of analysing the structure of { RNA / protein / genetic material } from all three viruses ; 2. to determine the sequence of {bases in the RNA / amino acids in the protein} ; 3. reference to use of phylogenics ; 4. use of gel electrophoresis to analyse {RNA / proteins / eq} of the three viruses ; 5. idea of closely-related viruses will have similar {protein / RNA} ; 	<p>NB penalise reference to DNA only once</p> <p>3 Accept proteomics</p> <p>4 Accept DNA made using RNA as a template</p>	(3)

Question Number	Answer	Additional guidance	Mark
6(a)	1. idea that they can reduce the number of {(foreign) bacteria / fungi / yeast / pathogen} in the wound ; 2. by competing with them for {space / nutrients / eq} ;	1 Accept prevent colonisation by {(foreign) bacteria / fungi / yeast / pathogen} Do not accept virus	(2)

Question Number	Answer	Additional guidance	Mark
6(b)(i)	1. red / swollen ; 2. because of {increased blood flow to the area / histamine release / eq} ;	1 Ignore painful or hot 2 Accept vasodilation	(2)

Question Number	Answer	Additional guidance	Mark
6(b)(ii)	1. idea that it results in skin cells to {cover / close / repair / eq} wound ; 2. produce identical cells so that the (new) skin carries out the same { function / appearance / eq } ;	1 Accept replace the damaged cells	(2)

Question Number	Answer	Additional guidance	Mark
6(b)(iii)	1. idea of long (poly)peptide chains ; 2. {little / no} tertiary structure / {hydrogen bonds / cross links} between (poly)peptide chains ; 3. idea of repeating amino acid sequences ;	1 Ignore long proteins 2 Accept mainly secondary structure	(2)

Question Number	Answer	Additional guidance	Mark
6(c)(i)	<ol style="list-style-type: none"> 1. idea that <i>E. coli</i> and <i>Pseudomonas</i> are found in all the ulcers ; 2. idea that <i>Pseudomonas</i> is the most common bacteria found in ulcers ; 3. idea that the presence of <i>S. aureus</i> depends on the type of ulcer ; 	<p>1 piece together</p> <p>3 Accept e.g. of ulcers it does not contaminate, not found in all ulcers</p>	(3)

Question Number	Answer	Additional guidance	Mark
6(c)(ii)	<ol style="list-style-type: none"> 1. idea that doctors cannot know which type of bacteria has caused the ulcer ; 2. therefore {do not know which antibiotic will be effective / may prescribe the wrong antibiotic} ; 3. idea that a {wrong prescription of / broad spectrum} antibiotic can result in the increase in antibiotic resistance ; 	<p>1 Accept idea that ulcers are caused by a number of different types of bacteria</p> <p>2 Accept problem of prescribing only one antibiotic</p> <p>3 Ignore unnecessary prescription Do not accept immune</p>	(2)