

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) ;	<b>1 ACCEPT</b> B cell is an antigen-presenting cell  <b>3 ACCEPT</b> CD4 cells	<b>(3)</b>

Question Number	Answer	Mark
1(b)(i)	mitosis ;	<b>(1)</b>

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 ;	<b>1 ACCEPT</b> from blood  <b>2 ACCEPT</b> acetocarmine, Feulgen's, Schiff's, toluidine blue <b>3 ACCEPT</b> squashing of lymph node  <b>4 ACCEPT</b> stages of mitosis	<b>(3)</b>

Question Number	Answer	Mark
1(c)(i)	mitochondrion ;	<b>(1)</b>

Question Number	Answer	Mark
1(c)(ii)	nucleus ;	<b>(1)</b>

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

Question Number	Answer	Additional Guidance	Mark
1(c)(iv)	<p><b>IF RER / SER HAS BEEN GIVEN AS ANSWER IN (iii):</b></p> <ol style="list-style-type: none"> <li>1. {protein synthesis / translation / eq} occurs ;</li> <li>2. on the ribosomes ;</li> <li>3. idea that {polypeptide / protein} {moves into / transported into} the ER ;</li> <li>4. to the Golgi apparatus / through the cytoplasm / eq ;</li> </ol> <p><b>IF GOLGI HAS BEEN GIVEN AS ANSWER IN (iii):</b></p> <ol style="list-style-type: none"> <li>5. it modifies the protein / eq ;</li> <li>6. credit example of modification e.g. addition of carbohydrate group ;</li> </ol>	<p><b>IF CYTOPLASM HAS BEEN GIVEN AS ANSWER IN (ii): apply either the RER OR Golgi Mps</b></p> <p><b>1 ACCEPT</b> description of translation</p> <p><b>4 ACCEPT</b> idea of folding into {secondary / tertiary} structure</p>	
	<ol style="list-style-type: none"> <li>7. idea that antibody moved into vesicles ;</li> <li>8. exocytosis / eq ;</li> </ol> <p><b>IF RIBOSOME HAS BEEN GIVEN AS ANSWER IN (iii):</b></p> <ol style="list-style-type: none"> <li>9. {protein synthesis / translation / eq} occurs ;</li> <li>10. ribosome holds mRNA / eq ;</li> <li>11.ribosome holds two tRNA / eqs ;</li> <li>12.so that peptide bonds can form between (adjacent) amino acids ;</li> </ol>		<b>(3)</b>

Question Number	Answer	Additional Guidance	Mark
<b>2(a)(i)</b>	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} ;	<b>1 ACCEPT</b> phagocyte  <b>2 ACCEPT</b> phagocyte  <b>3 ACCEPT</b> vesicle	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
<b>2(a)(ii)</b>	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 ;	<b>1 NOT</b> reference to immune response  <b>2 ACCEPT</b> idea of no previous infection / responds to any pathogen  <b>3 IGNORE</b> egs of barriers	<b>(2)</b>

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

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



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

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

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

Question Number	Answer	Additional Guidance	Mark
4(a)(i)	<ol style="list-style-type: none"> <li>1. levels of antibody rise sooner after infection / eq ;</li> <li>2. levels of antibody rise faster after infection / eq ;</li> <li>3. levels of antibody rise higher after infection / eq ;</li> <li>4. credit comparative manipulation of data ;</li> </ol>	<p><b>do not piece together</b> ACCEPT converse for mps 1, 2 and 3 in context of vaccination</p> <p>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 <math>1.27 \text{ au day}^{-1}</math> faster</p>	<b>(2)</b>

Question Number	Answer	Additional Guidance	Mark
4(a)(ii)	<ol style="list-style-type: none"> <li>1. secondary (immune) response ;</li> <li>2. reference to memory cells ;</li> <li>3. idea that (on infection / second exposure) memory cells are { activated / cloned / stimulated / eq } ;</li> <li>4. idea that (in secondary response) antibodies are released from plasma cells ;</li> </ol>	<ol style="list-style-type: none"> <li>1. ACCEPT secondary immunity</li> <li>3. CCEPT B memory cells differentiate into plasma cells</li> </ol>	<b>(3)</b>

Question Number	Answer	Additional Guidance	Mark
<b>4(b)(i)</b>	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 ;		<b>(2)</b>

Question Number	Answer	Mark
<b>4(b)(ii)</b>	C natural active	<b>(1)</b>

Question Number	Answer	Additional Guidance	Mark
<b>4(c)</b>	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	<b>(3)</b>