Question			answer		Marks	Guidance
1	(a)				2 max	**Mark the first answer on each prompt line.** **ACCEPT** ora throughout
			1	nucleus / nuclei **;**		**1 ACCEPT** 'DNA not free'
			2	other named organelle / membrane bound organelles **;**		**2** e.g. mitochondria / Golgi / etc **2 ACCEPT** compartmentalized organelles **2 ACCEPT** don't have a mesosome
			3	linear chromosomes **;**		
			4	DNA, associated with / AW, histones / protein **;**		**4 ACCEPT** 'DNA not naked'
			5	80S / 22nm / large, ribosomes **;**		
			6	large cells / AW **;**		
			7	no cell wall **;**		
1	(b)		capital letter on, specific name / Vivax **;** not italicised / not underlined **;**		1 max	**Mark the first answer** **ACCEPT** ora for what student should have typed **ACCEPT** 'the parasite is Plasmodium falciparum / malariae / ovale' if candidate uses capital 'P' and lower case 'f / m / o'
1	(c)	(			3 max	**IGNORE** references to stages of life-cycle **Max 2 if virus / bacterium appears anywhere**
			1	(mosquito), is <u>vector</u> **;**		
			2	*Plasmodium* / parasite, present in (mosquito), saliva / salivary gland **;**		
			3	*idea that* infected mosquito, feeds on / bites, human **;**		**3 IGNORE** case of initial 'P' **3** Must be in context of transmission from mosquito **to** human
			4	*Plasmodium* / parasite, passes (from saliva) to blood **;**		**4** 'blood' can be inferred, e.g. from refs to anticoagulant **4 IGNORE** ref to parasite in blood after liver

Question			Answer	Marks	Guidance
1	(c)	(i	destruction of a species is, morally / ethically, wrong **;** might cause unintended health problems in humans **;** might harm, other / unintended, species **;** *idea of* bioaccumulation / biomagnification **;**	1 max	**Mark the first suggestion** **IGNORE** 'might enter human food' unqualified Answers must imply idea of harm

Question			Answer		Marks	Guidance
1	(c)	(i			5 max	Award marks for either a field or laboratory investigation – **must read whole answer before beginning to mark to decide if field or laboratory.** If candidates answer in terms of incidence of malaria award no marks as question states population of mosquitoes but read whole question in case mosquito study described in addition. If the investigation is in the both field and laboratory mark the investigation which gives candidate most marks.
				Field investigation		
			F1	(sampling) before and after insecticide treatment **;**		**F1 IGNORE** refs to treated and untreated areas as stem refers to 'a population'
			F2	*idea of* , unbiased / random, sampling of population **;**		
			F3	example of sampling technique **;**		**F3** e.g. sweep net, pond net, light trap **F3 ACCEPT** insect net **F3 IGNORE** 'net' **or** 'trap' unqualified
			F4	(sampling in) different, times / weather **;**		**F4 IGNORE** intervals unqualified. Answers must refer to time or weather
			F5	large number of samples taken **;**		**F5** Must imply large number or state five or more
			F6	*idea of* standardised sampling procedure **;**		**F6 ACCEPT** idea of counting by the same method
			F7	*idea of* preventing counting same individual more than once **;**		
			F8	*idea of* capture – recapture **;**		
			F9	calculate mean / calculate standard deviation / apply statistical test **;**		

Continued……..

Question	answer	Marks	Guidance
	OR		
	Laboratory investigation		Laboratory investigation could be done outside
	idea of:		
L1	with and without insecticide exposure **;**		**L1** is for changing the independent variable
L2	measuring mosquito survival / count surviving mosquitoes **;**		**L2** is for measuring the dependent variable **ACCEPT** count the number of dead ones
L3	controlling one named key variable **;**		**L3 and L4** *award up to 2 marks for* exposure time species of mosquito stage of mosquito life cycle sex of mosquito number of mosquitos insecticide type insecticide concentration volume of insecticide temperature
L4	controlling second named key variable **;**		
L5	*idea of* using a range of insecticide concentrations **;**		
L6	replicates **;**		**L6** Minimum of 3 in total, i.e. original plus two
L7	calculate mean / calculate standard deviation / apply statistical test **;**		**L7 IGNORE** average
	Total	**12**	

Question			Answer	Marks	Guidance
2	(a)		<table><tr><td>form part of cellular response</td><td>both</td></tr><tr><td>mature in thymus</td><td>(only) T (lymphocytes) ;</td></tr><tr><td>secrete substances which kill infected cells</td><td>(only) T (lymphocytes) ;</td></tr><tr><td>manufacture antibodies</td><td>(only) B (lymphocytes) ;</td></tr><tr><td>undergo clonal expansion</td><td>both / B and T ;</td></tr><tr><td>activate other lymphocytes</td><td>(only) T (lymphocytes) ;</td></tr></table>	5	
	(b)	(i)	no antibodies detected before 4 days / antibodies appear at 4 days ; increase then decrease / peak ; figures for peak with time **and** antibody concentration ; decrease less steep than increase / AW ; **ora** antibody concentration returns to zero at 27 days ;	3 max	**ACCEPT** 'around 4 days' **ACCEPT** upper limit of 4.5 days for first appearance of antibodies **IGNORE** 'before 5 days' **IGNORE** references to increase at 4 days, answers must imply none to begin with **ACCEPT** 13 days ± 0.5 day, 25 units ± 0.5 units **ACCEPT** 25 au ± 0.5 au 9 days ± 0.5 day after initial appearance

<table>
<tr><th colspan="3">Question</th><th>answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>2</td><td>(b)</td><td>(i</td><td>the drawn line should show
higher peak and steeper initial increase ;

antibodies appear between days 30 and 34 and concentration at 60 days above peak for primary response ;</td><td>2</td><td>
Peak must be at least 30 au
Compare gradient with initial increase up to day 10
NBOD if gradients are similar
ACCEPT ruled line close to vertical

DO NOT CREDIT vertical
ACCEPT a line that starts to rise at 30 or 34 days</td></tr>
<tr><td>2</td><td>(c)</td><td></td><td>
<table>
<tr><th>region</th><th></th><th>function</th></tr>
<tr><td>A</td><td>hinge (region) ;</td><td>flexibility / binding of more than one antigen ;</td></tr>
<tr><td>B</td><td>constant / Fc (region) ;</td><td>attachment / binding , to phagocytes ;</td></tr>
<tr><td>C</td><td>variable / hypervariable / Fab (region) ;</td><td>binding / attachment , to antigens ;</td></tr>
</table>
</td><td>6</td><td>Marks for name and function should be awarded independently.
DO NOT CREDIT if incorrect answer appears in same box
ACCEPT hinges / hinged

ACCEPT neutrophils / macrophages / granulocytes
ACCEPT monocytes

IGNORE recognise antigens</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>16</td><td></td></tr>
</table>

Question			Expected Answers		Mark	Additional Guidance
3	(a)	(i)				**Mark the first answer on each numbered line.**
			1	the elderly / older people **;**		**1 ACCEPT** ref to any age over 50
			2	'at risk' children / young people **;**		**2 ACCEPT** the young / infants / babies **IGNORE** refs to age
			3	pregnant women **;**		
			4	those with compromised immune systems **;**		**4 ACCEPT** weak **ACCEPT** e.g. with AIDS / HIV / on immunosuppressant drugs / ref cancer
			5	those with chronic diseases **;**		**5 ACCEPT** e.g. heart conditions / lung conditions / asthma / diabetes
			6	health workers **;**		
			7	poultry workers / pig farmers **;**	**2 max**	**7 ACCEPT** other professions working with animals, e.g. ve
3	(a)	(ii)	different strains of the virus / virus mutates (each year) **;**			**IGNORE** 'different types' or 'virus changes' or 'different strands' **ACCEPT** (influenza) pathogen
			(new strains have) different antigens **;** *idea that* antibody produced **,** needs to match new strain / antigen **; ora**		**2 max**	**CREDIT** antigenic shift / drift **ora** original antibody does not match new antigen

Question			Expected Answers		Mark	Additional Guidance
3	(a)	(iii)	secondary response **,** starts earlier / has shorter delay before response **;** **ora** secondary response **,** more rapid / faster **;** **ora** secondary response **,** higher / produces more antibodies **;** **ora**		**2 max**	**Mark the first <u>two</u> differences** **IGNORE** answers, e.g. 'size of response' or 'response is faster' that do not refer to a feature of the secondary or primary response **CREDIT** 'shorter lag time' **ACCEPT** steeper **ACCEPT** bigger **IGNORE** 'secondary response lasts longer' as this is not clear from graph
3	(a)	(iv)	**1**	recognise **,** virus / antigen / pathogen **;**	**3 max**	**1** **ACCEPT** description of recognition **IGNORE** find / detect **2** **ACCEPT** ref to clonal expansion **ACCEPT** 'divide by mitosis to produce large numbers' **4** **IGNORE** 'reproduce antibodies' **IGNORE** 'release antibodies' **5** **IGNORE** refs to speed of response unqualified
			2	produce a clone **;**		
			3	can , change to / form **,** plasma cells (on infection) **;**		
			4	make antibodies (against influenza **,** virus / antigen) **;**		
			5	responsible for secondary response / destroy virus before symptoms appear **;**		
			6	can , change to / form **,** named T-cell **;**		

Question			Expected Answers		Mark	Additional Guidance
3	(b)	(i)	(antibiotics) are, not effective against viruses / effective (only) against bacteria (and fungi / protozoa) ;		1	**ACCEPT** antibiotics do not kill viruses **IGNORE** viruses are resistant to antibiotics **ACCEPT** correct ref to detail of antibiotic action, e.g. 'antibiotics attack cell wall which is not present in influenza (virus)'
3	(b)	(ii)	1	Tamiflu® is , competitive / non-competitive inhibitor ;	2 max	
			2	correct detail of inhibition method that does not contradict stated type of inhibition ;		2 e.g. fits or binds to active site / complementary shape to active site / competes for the active site **OR** fits into allosteric site or site other than active site / changes shape of active site
			3	prevents , substrate binding to active site / formation of enzyme-substrate complex / formation of ESC ;		3 **IGNORE** substrate binding to enzyme
3	(b)	(iii)	fewer , viruses / pathogens , produced ; fewer , viruses / pathogens , (in droplets) when , sneezing / coughing ; (as) viruses / pathogens , cannot leave cell ; (so) cannot , infect / spread to , other cells ; *idea of* treating , large / proximate , population ;		2 max	**IGNORE** herd immunity / ring vaccination
3	(c)		(plants) already identified as likely to have , medicinal properties / few side effects / AW ; reduces , time / effort , in finding , plants / active chemicals ; (possibly) reduces cost ;		2 max	**ACCEPT** 'known / proven to work' **ACCEPT** reduced time for testing
				Total	[16]	

Question			Expected Answer	Mark	Additional Guidance
4	(a)	(i)	human immunodeficiency virus / HIV **;**	1	**DO NOT CREDIT** if there is any ref to AIDS
4	(a)	(ii) 1	(infective agent), in blood / body fluids **;**	2 max	**1 ACCEPT** any infective agent even if incorrect as question asks for *mode of transmission*
		2	*idea of:* used needles are contaminated **; ora**		**2 ACCEPT** e.g. 'used needles are infected' **2 ACCEPT** e.g. 'new needles are sterile' **2 DO NOT CREDIT** 'dirty' / 'clean' needles
		3	reduces chance of sharing needles **; ora**		**3 IGNORE** 'prevents' / 'stops'
4	(b)	(i)	amino acid(s) **;** nucleotide(s) **;**	2	*Answers must be on correct line* **ACCEPT** phonetic spelling for both **DO NOT CREDIT** if ref to DNA / 'nucleosides' **ACCEPT** 'ribonucleotides'
4	(b)	(ii) 1	reverse transcriptase in (host) nucleus **;**	2 max	
		2	viral DNA, (inserted) in (host), chromosome / DNA **;**		
		3	*idea of:* (viral) RNA / mRNA produced / transcribed **;**		
		4	(to) code for / make / translate, viral proteins **;**		**4 IGNORE** 'different protein'

Question			Expected Answer	Mark	Additional Guidance
4	(c)	(i)			**Mark the first three answers only regardless of which line they are on**
		1	not vaccinated against TB **;**		**1 IGNORE** general refs to lack of medical care
		2	weakened immune system **;**		
		3	(lifestyle) e.g. poor diet / lack of protein / malnourished / smoking / alcoholism **;**		**3 DO NOT CREDIT** 'alcohol' unqualified **IGNORE** 'poor health'
		4	homelessness **;**		
		5	poor ventilation (of housing) / AW **;**		
		6	overcrowding **;**		
		7	close contact with people from / visiting, area where TB is common **;**		**7 ACCEPT** area where those with TB are not quarantined
		8	close / prolonged, contact with individual(s) with TB **;**		
		9	consumption of milk or beef, from infected cattle / in developing countries **;**		
				3 max	

Question			Expected Answer	Mark	Additional Guidance
	(c)	(ii)			
		1	cytokine / interleukin / receptor has, specific / unique, shape ;		**1 DO NOT CREDIT** 'cytokine is specific to receptor' as this is implied in question
		2	(cytokine / interleukin), binds / attaches / bonds to / fits into, receptor ;		
		3	receptor on (cell surface) membrane (of B lymphocyte) ;		**3 DO NOT CREDIT** 'antibodies' (on cell surface)
		4	(receptor and cytokine have) <u>complementary</u> <u>shapes</u> ;		
		5	<u>activates</u> / <u>stimulates</u>, clonal expansion / <u>mitosis</u> ;		**5 ACCEPT** activates / releases 2nd messenger
				3 max	
			Total	**13**	