

Separate Science (Biology) Unit 3 Infection and response – mark scheme

Foundation

Question number	Description	Marks	Page number
4.3.1 Communicable diseases			
1	White blood cell recall box ticking, calculating a decrease from two readings on graph, reason antibiotics can't treat measles, controlling spread of gonorrhoea, effectiveness of antibiotics practical questions	13	4
4	Vaccination graph interpretation questions, vaccination recall box ticking, suggesting factors that affects decisions on vaccination.	8	6
5	Calculating a decrease between two values read from a graph on malaria deaths, graph interpretation questions, reasons for vaccine reducing spread of malaria, describing a way to reduce spread of malaria	8	8
5	Gonorrhoea and antibiotics recall box ticking, reducing spread of gonorrhoea, comparing effectiveness of antibiotics by interpreting results to the antibiotic disc practical (6 marks), interpreting a diagram for results of testing bacteria in milk, mean calculation, area calculation, volume calculation, calculation using given equation, interpretation of results table	17	9
7	Bacteria and viruses recall box ticking, symptoms of measles, problem of overuse of antibiotics, describing transmission of athlete's foot, describing how mucus and cilia prevent pathogens reaching lungs.	12	11
4.3.3 Plant disease			
5	(4.2.3 plant tissues recall) Explaining how aphids removing sugar from a plant results in stunted growth (links to 4.4.1), explaining advantages of aphids being able to fly, suggesting how oil in leaf surface protects against aphids, adaptation for rose defence from diagram, rose black spot spread and reducing spread	11	13

Common content

Question number	Description	Marks	Page number
4.3.1 Communicable diseases			
1	Cause of salmonella symptoms, preventing spread of salmonella, drug to treat bacterial infection, explaining why AIDS person would take longer to recover from salmonella than healthy person, effectiveness of cleaning liquids graph and experiment interpretation questions	11	15
2	Malaria recall, using evidence from results table to support a given statement, suggest reasons for results not being valid, making a prediction based on a results table, describing how human body prevents pathogens entering and defends against pathogens inside the body (6 marks)	11	18
5	Explain how a vaccine prevents illness (5 marks) (4.6.2 explaining how bacteria have evolved by natural selection)	8	21
10	Describing process of testing a new drug before it can be used (6 marks)	6	22

Higher

Question number	Description	Marks	Page number
4.3.1 Communicable diseases			
4	Methods and reasons that prevent the spread of malaria, difference between bacteria and eukaryotic cell, explaining different stages of bacterial culture size graph,	12	23
5	Calculating percentage decrease from a results table, explaining how vaccines reduce the spread of virus, explaining differences in antibody production before and after vaccine and exposure to virus using a graph (6 marks)	11	26
7	Calculating a percentage using two values read from a graph, giving reasons for and against a conclusion based on a graph, suggesting ways in which cholera may spread.	9	28
8	Reasons for placebo and double blind trial in drug development (questions continues as 4.3.2)	3	29

4.3.2 Monoclonal antibodies			
8	(Question continued from Q8 4.3.1) explaining how monoclonal antibody work to treat pancreatic cancer	3	30
5	Explaining how to produce monoclonal antibodies	4	31
4.3.3 Plant disease			
4	Explaining how plant diseases have been identified from pictures, describing method to prevent spread of plant disease, method to kill pathogen on one plant but not another (4.1.1 describing how to use a microscope to view pathogen damage to plant cell (5 marks)), calculating how many time longer one cell is than another, reasons for being able to observe a fungal spore but not virus, explaining a fact using results from a table and information in the question.	18	32
5	(4.1.3 linking aphid feeding on plant to diffusion) Explaining how magnesium deficiency causes yellow leaves and stunted growth (5 marks),	6	31

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	cell membrane	extra ticks negates marks	1	AO1 4.1.1.2
01.2	engulf pathogens produce antibodies produce antitoxins	extra ticks negates marks	1 1 1	AO1 4.2.2.3 4.3.1.6
01.3	2050 – 100 = 1950	an answer of 1950 scores 2 marks allow 1 mark for a correct subtraction of incorrect values	1 1	AO2 4.3.1.2
01.4	any one from: • (more) people vaccinated • (more) people immune • no new measles strain	ignore injections / treatments / medicines unqualified allow vaccine produced allow (more people given) MMR (vaccine) do not allow antibiotics ignore less people infected	1	AO2 4.3.1.1 4.3.1.2 4.3.1.7
01.5	any one from: • measles is (caused by) a virus • viruses cannot be killed / destroyed by antibiotics	allow measles is not caused by a bacterium allow antibiotics only kill / destroy bacteria ignore harmed / treated	1	AO1 4.3.1.1 4.3.1.8 4.3.1.2
01.6	any one from: • use of a barrier method of contraception • use of a condom • vaccination / immunisation • avoid sexual intercourse / contact	ignore use of diaphragm ignore use protection / safe sex do not accept less sexual intercourse / contact	1	AO1 4.3.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	any one from: <ul style="list-style-type: none"> • size / shape/ type of paper disc • concentration of antibiotic • volume / amount of antibiotic • (incubation) time • (incubation) temperature 	ignore paper disc unqualified allow strength / dosage of antibiotic allow 3 days ignore size of petri dish	1	AO2 4.3.1.8
01.8	to check that the disc / water did not have an effect or to make sure it was the antibiotic that had an effect	allow for comparison with the antibiotics allow as a (experimental) control do not accept as a control variable	1	AO3 4.3.1.8
01.9	(antibiotic) A any one from: <ul style="list-style-type: none"> • (antibiotic A) had the largest clear area around it • (antibiotic A) killed the most bacteria 	no marks if wrong antibiotic given	1 1	AO3 4.3.1.8
Total			13	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	virus	allow viral ignore communicable / airborne / microorganism / microbe do not accept bacteria / bacterial / fungus / fungal / protist	1	AO2 4.3.3.6
04.2	white blood cells		1	AO1 4.3.3.4
04.3	57	allow any answer in range 55–59	1	AO3 4.3.3.5
04.4	85	allow any answer in range 84–86	1	AO3 4.3.3.5
04.5	children are less likely to come into contact with someone with the disease more people will have the correct antibodies		1 1	AO2 4.3.3.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	any two from: <ul style="list-style-type: none"> • cost (to the NHS / government) • money saved through not treating people with chickenpox • how effective the vaccine is • severity of the disease • less effect of disease on people with weaker immune systems / elderly / HIV or on unborn babies 		2	AO3 4.3.3.5
Total			8	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	840 000 – 440 000	an answer of 400 000 scores 2 marks allow tolerance of +/- half a small square allow $840 - 440 = 400$	1	AO2 4.3.1.5
	400 000		1	
05.2	2005 to 2010		1	AO3 4.3.1.5
05.3	any one from: <ul style="list-style-type: none"> • data not collected (for 2002) • only shows a trend line • not all deaths reported / recorded 	allow no data plotted for 2002	1	AO3 4.3.1.5
05.4	protist		1	AO1 4.3.1.5
05.5	makes people immune or they do not develop the disease	allow ecf from 05.4 allow correct description of immunity	1	AO1 AO2 4.3.1.5
	(so) fewer (infected) people to pass pathogen on (to mosquitos)	allow idea of disrupting life cycle of parasite	1	
05.6	any one from: <ul style="list-style-type: none"> • (mosquito) nets / long clothing • prevent mosquitos breeding • insecticides • insect repellents • anti-malarial tablets • kill mosquitos 	allow specific method e.g. drain swamps, release GM mosquitos allow DEET / mosquito band allow names e.g. Larium / Malarone allow antibiotics	1	AO1 4.3.1.5 4.3.1.7
Total			8	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	gonorrhoea		1	4.3.1.3 AO1
05.2	the bacteria are resistant to the antibiotics		1	4.3.1.3 AO2
05.3	abstain from sex(ual intercourse) or wash hands after touching penis / urinating / using the toilet	allow abstinence ignore wash hands unqualified	1	4.3.1.1 4.3.1.3 AO2
05.4	Level 2: Scientifically relevant features are identified; the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted.		4–6	4.1.1.6 AO3 x3 AO2 x3
	Level 1: Relevant features are identified and differences noted.		1–3	
	No relevant content		0	
	Indicative Content: qualitative statements <ul style="list-style-type: none"> • 3 works best on A • 1 works best on B • 2 works best on C • 1 is least effective on A • 3 is least effective on B • 3 is least effective or has no effect on C quantitative statements <ul style="list-style-type: none"> • 1 kills more of B and C compared to A • 2 kills more of C than A / B • 3 kills more of A than B and C • 2 kills the same amount of A and B • 2 and 3 killed similar amounts of B • C are resistant to 3 • only 2 worked well on all of the bacteria • for A, 3 works best, 2 is next and 1 is least effective • for B, 1 works best, 2 is next and 3 is least effective • for C, 2 works best, 1 is next and 3 is least effective for level 2 reference to qualitative and quantitative statements is required			

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	sample E		1	4.1.1.6 AO2
05.6	$\frac{15 + 12 + 13 + 16}{4}$ or $\frac{56}{4}$	an answer of 14 scores 2 marks	1	4.1.1.6 AO2
	14		1	
05.7	(area = 0.1×0.1 =) 0.01	an answer of 140 000 scores 3 marks		4.1.1.6 AO2
	(volume = 0.01×0.01 =) 0.0001	an incorrect answer for one step does not prevent allocation of marks for subsequent steps	1	
	(number = $\frac{14}{0.0001}$ =) 140 000	allow 1×10^{-2} allow 1×10^{-4} allow ecf from question 05.6 allow 1.4×10^5 do not accept 14×10^4	1 1 1	
05.8	Q		1	4.1.1.6 AO2
05.9	(bacteria) could make humans ill or (bacteria) could kill humans or (bacteria) could release toxins	allow reverse argument allow (bacteria) cause infection / disease allow (bacteria) cause appropriately named disease ignore harmful	1	4.3.1.1 AO2
Total			17	

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.															
07.1	plasmid		1	AO1 4.1.3.2															
07.2	genetic engineering		1	AO1 4.4.4.6															
07.3	<table border="1"> <thead> <tr> <th>Disease</th> <th>Caused by a bacterium</th> <th>Caused by a virus</th> </tr> </thead> <tbody> <tr> <td>Measles</td> <td></td> <td>(✓)</td> </tr> <tr> <td>Gonorrhoea</td> <td>✓</td> <td></td> </tr> <tr> <td>AIDS</td> <td></td> <td>✓</td> </tr> <tr> <td>Salmonella</td> <td>✓</td> <td></td> </tr> </tbody> </table>	Disease	Caused by a bacterium	Caused by a virus	Measles		(✓)	Gonorrhoea	✓		AIDS		✓	Salmonella	✓		3 rows correct for 2 marks 2 rows correct for 1 mark	2	AO1 4.3.3.2
Disease	Caused by a bacterium	Caused by a virus																	
Measles		(✓)																	
Gonorrhoea	✓																		
AIDS		✓																	
Salmonella	✓																		
07.4	any three from: <ul style="list-style-type: none"> • fever • (red skin) rash • cough • sneezing 	allow descriptions of symptoms allow spots allow runny nose allow sore throat allow vomiting allow inflamed eyes or conjunctivitis ignore sick / cold / sweating do not accept flu	3	AO1 4.3.3.2															
07.5	(bacteria are more likely to evolve) antibiotic resistance	allow allergic reaction	1	AO1 4.4.4.3															

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	person with fungus / athlete's foot walks barefoot (somewhere damp) or fungus is left on shower floor / towel		1	AO2 4.3.3.1
	skin of another person comes into contact with surface or (fungus) gets on to the foot of the next person	if no other mark awarded allow sharing towels / socks / shoes or walking barefoot or direct contact for 1 mark	1	
07.7	(mucus) traps pathogens / bacteria / viruses / microorganisms / microbes		1	AO1 4.3.3.3
	(cilia) move mucus (containing pathogens then they are swallowed)	ignore reference to stomach acid	1	
Total			12	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	phloem		1	AO2 4.2.3.2
05.2	translocation		1	AO1 4.2.3.2
05.3	either: less (sugars for) respiration (so) less energy released or less amino acids made (1) (so) less protein produced or less protein synthesis (1) or less cellulose made (1) (so) weaker cell walls (1)		1 1	AO2 4.4.1.3 4.4.2.1
05.4	(aphids) can fly to another plant or part of the plant to get (more) food	ignore to fly unqualified allow to find a mate allow idea of less competition for food allow to escape predators do not accept escape prey	1 1	AO2 4.3.3.1
05.5	(oil) prevents aphids from attaching to leaf or causes aphids to slide off leaf or idea that oil may harm / kill the aphid	ignore 'the leaf is slippery' allow oil may be unpleasant to the aphid	1	AO2 4.3.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	(plant / stem has) thorns	allow spines / spikes / prickles ignore stings do not accept thorns protect (the plant) from predators	1	AO1 4.3.3.2
05.7	C (fungi / spores) blown by / in direction of the wind or it's the closest plant (to A)	if any other letter given then no marks for the question allow black spot / disease is blown by / in direction of the wind do not accept reference to bacteria / viruses / pollen being blown	1 1	AO3 4.3.1.4 4.3.3.1 AO2 4.3.1.4 4.3.3.1
05.8	any one from: <ul style="list-style-type: none"> spread rose bushes out more remove any infected parts of the plant use a fungicide 	allow isolate the infected plant allow idea of barrier around infected plant ignore separate unless qualified allow remove infected plant / A ignore pesticide do not accept insecticides / herbicide	1	AO2 4.3.1.4 4.3.3.1
Total			11	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	toxins / poisons (secreted by / from / in bacteria)		1	AO1 4.3.1.3
01.2	any two from: <ul style="list-style-type: none"> • wash hands after using toilet / being sick or • wash hands before preparing / handling food or • do not prepare food (whilst infected) • isolate yourself • disinfect clothes / surfaces • do not share utensils / cutlery / towels 	ignore 'wash hands' unqualified ignore reference to coughing / sneezing allow examples of how isolation could be achieved	2	AO2 4.3.1.1
01.3	antibiotics	allow named examples of antibiotics	1	AO1 4.3.1.8
01.4	immune system is damaged / weakened or immune system doesn't function properly white blood cells cannot kill bacteria / <i>Salmonella</i> (as effectively)	allow immunocompromised allow lack of / no white blood cells allow no / fewer antibodies so bacteria not killed or less phagocytosis so bacteria not killed or no / fewer antitoxins to counter toxins	1 1	AO2 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	any one from: <ul style="list-style-type: none"> • (give chickens) antibiotics • don't sell infected chickens / eggs • keep infected chickens isolated / indoors • slaughter the infected chickens 	allow (give chickens) monoclonal antibodies allow don't sell the chickens / eggs ignore don't sell chickens / eggs allow keep the chickens indoors ignore keep chickens indoors ignore vaccination / chlorination / disinfection	1	AO1 4.3.1.3
01.6	(cleaning liquid) B and greater reduction in number of bacteria (after cleaning) in both locations	ignore few bacteria in both locations allow neither / both and idea of experimental error	1	AO3 4.1.1.6 4.3.1
01.7	radius (of area with no bacteria growing)	allow diameter (of the area with no bacteria growing) ignore πr^2 unqualified allow idea of placing agar plate onto graph paper and counting the squares not covered with bacteria	1	AO2 4.1.1.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.8	repeat and look to see if results are similar	ignore repeat unqualified allow repeat and look to see if results are different allow repeat and see if there are anomalies ignore repeat and identify anomalies ignore repeat and compare unqualified	1	AO3 4.1.1.6
01.9	any one from: <ul style="list-style-type: none"> • toxicity / side / health effects • effect on other types of bacteria / pathogens • interaction with other cleaners • ease of use • dilution factor of each cleaner (vs. cost) • time cleaner is effective for 	ignore harmful / dangerous allow reference to allergies allow not tested on other types of bacteria ignore germs ignore concentration unqualified ignore how long the cleaner lasts for allow reference to odour of cleaning liquid ignore reference to cost unqualified ignore environmental effects / flammability	1	AO3 4.1.1.6
Total			11	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	a protist		1	4.3.1.5 AO1
02.2	lower percentage of people with malaria when using (mosquito) nets	allow converse if clearly describing people who do not use (mosquito) nets allow fewer people with malaria when using (mosquito) nets allow only 1.2% of people with malaria when using (mosquito) nets ignore reference to data from table unqualified do not accept incorrectly calculated figures	1	4.3.1.5 AO3
02.3	any one from: <ul style="list-style-type: none"> • some people who use (mosquito) nets have malaria • data from only one area / part of Africa • size of group too small or sample size too small or only 476 people • only 50 people did not use (mosquito) nets or uneven group sizes (nets vs. no nets) • no other information about people considered <ul style="list-style-type: none"> • people may have lied about using (mosquito) nets 	allow people can get malaria when they are not sleeping allow correlation does not imply causation allow examples of information not considered e.g. age, other medical issues such as sickle cell, whether taking anti-malarial medication, vaccination ignore ref to other factors unqualified	1	4.3.1.5 AO3
02.4	any value between 88 – 91	allow decimal values	1	4.3.1.5 AO2

Question	Answers	Extra information	Mark	AO / Spec.. Ref
02.5	any one from: <ul style="list-style-type: none"> • improved health care • use of mosquito control methods • changing behaviour to avoid being bitten (by mosquitoes) 	allow examples of improved health care such as more / cheaper / new treatments / vaccinations / antibiotics allow descriptions such as spraying of insecticides / repellent or draining water holes or preventing mosquitoes from breeding allow descriptions such as wear long clothing or avoid going out at dusk	1	4.2.2.5 4.3.1.5 AO2

Question	Answers	Mark	AO / Spec. Ref.
02.6	Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4–6	4.3.1.6 4.3.1.7 AO1
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–3	
	No relevant content	0	
	Indicative content <i>prevents pathogens from entering skin</i> <ul style="list-style-type: none"> • tough / dry / dead outer layer • skin acts as a <u>barrier</u> • sebum / oil on (surface of) skin • sebum / oil repels pathogens • scabs form over cuts or scabs form a barrier • platelets are involved in forming clots / scab stomach <ul style="list-style-type: none"> • contains (hydrochloric) acid • (HCl) kills bacteria • in food or in swallowed mucus eyes <ul style="list-style-type: none"> • produce tears • contains enzymes to kill bacteria • tears are antiseptic breathing system <ul style="list-style-type: none"> • trachea / bronchi / nose produce mucus • mucus is sticky • (mucus) traps bacteria • (mucus) carried away by cilia <i>defends itself against pathogens inside the body</i> <ul style="list-style-type: none"> • immune system / white blood cells (WBCs) • WBCs engulf pathogens • antitoxins are produced • (antitoxins) neutralise toxins / poisons (produced by pathogen) • antibodies are produced • (antibodies) help destroy pathogens • memory cells (are formed) • (memory cells give a) more rapid response if pathogen re-enters a level 2 response should refer to body defence and the immune system		
Total		11	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	<u>antigen</u> (in vaccine) stimulates white blood cells	allow leucocytes / lymphocytes do not accept phagocytes	1	AO1 4.3.3.5
	to produce specific antibodies		1	AO1 4.3.3.5
	(so) if the person ingests salmonella	allow idea of secondary exposure	1	AO1 4.3.3.5
	(so on secondary exposure to antigen / bacteria white blood cells) produce the (correct) antibodies faster or in larger quantities	allow idea of memory cells produced	1	AO1 4.3.3.5
	(so) toxins (produced by the bacteria) don't reach high enough concentrations / levels (to make the person have symptoms)		1	AO2 4.3.3.2
05.2	(random) mutations (in the population of bacteria)	do not accept bacteria deliberately mutate	1	AO1 4.4.4.1 4.4.4.3
	(so that) resistant salmonella / bacteria are not killed by the antibiotic / nalidixic acid	allow those bacteria without the mutation are killed by antibiotic / nalidixic acid do not accept immune bacteria	1	AO1 4.4.4.3
	(so) these bacteria reproduce to pass on the gene for resistance (to their offspring)		1	AO1 4.4.4.3
Total			8	

Question	Answers	Mark	AO/ Spec. Ref
10.3	Level 2: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	4–6	AO2 AO1
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–3	AO1
	No relevant content	0	
	<p>Indicative content</p> <ul style="list-style-type: none"> • pre-clinical trials of the new drug on cells / tissues / live animals • to test for toxicity / dosage / efficacy • clinical trials / tests on healthy volunteers • clinical trials / tests on children with Dravet syndrome at very low doses • so you can monitor for safety / side effects • and only after these stages trial to find optimum dosage / test for efficacy • trial could be double blind / use a placebo • which does not contain the new drug • children with Dravet syndrome would be randomly allocated to the test groups • so no one knows who has the drug / placebo • comparison to existing drugs • peer review of data • to help prevent false claims • approval by NICE <p>to access level 2 the key ideas of testing on healthy volunteers followed by testing on patients must be given</p>		4.3.3.7
Total		9	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	protist		1	AO1 4.3.1.5
04.2	any two methods with reason from: <ul style="list-style-type: none"> • Method: insecticides Reason: to kill mosquitos / vector • Method: (mosquito) nets Reason: to avoid being bitten • Method: insect repellents Reason: less likely to be bitten • Method: vaccination Reason: so people are immune (to malaria) • Method: anti-malaria tablets Reason: kills the pathogen / protist	1 mark for method and 1 mark for a correctly linked reason ignore kill insects unqualified allow long clothing ignore acts as a physical barrier allow DEET or named insect repellent allow named anti-malarial e.g. Larium / Malarone allow antibiotics allow ecf from 04.1 ignore kills malaria allow Method: drain swampy ground or remove pots of water or put oil on water / pond Reason: fewer breeding grounds for mosquitos allow Method: release GM / sterile mosquitos Reason: prevent / reduce reproduction if no other marks awarded allow 1 mark for kill mosquitos	4	AO1 4.3.1.1 4.3.1.5 4.3.1.7

<p>04.3</p>	<p>any two from: (bacterial cell):</p> <p>does not have a nucleus</p> <p>has plasmids</p> <p>is smaller</p>	<p>allow DNA is free in cytoplasm allow has a single loop of DNA allow has a single strand of DNA</p> <p>allow description, e.g. (small) ring(s) of DNA</p> <p>allow bacterial cells do not have mitochondria or do not have membrane bound organelles</p> <p>allow bacteria have smaller ribosomes</p> <p>ignore bacterial cells do not have chloroplasts</p>	<p>2</p>	<p>AO1 4.1.1.1</p>
<p>04.4</p>	<p>to allow air / oxygen in for bacteria to respire</p> <p>or</p> <p>so bacteria can respire aerobically</p>	<p>allow to allow carbon dioxide produced in respiration to escape</p>	<p>1</p>	<p>AO3 4.4.2.1</p>

04.5	(A) (no change in population size) because no / limited cell division / reproduction	allow (no change in population size) because bacteria / cells adjusting to environment / culture conditions ignore reference to growth unqualified	1	AO2 4.1.2.2 4.3.1.1 4.4.2.1 4.4.2.3
	(B) (rapid increase in population size) as cells dividing rapidly as (plentiful) supply of nutrients / food	allow rapid binary fission as (plentiful) supply of nutrients / food	1	
	(C) (population size stays the same) as rate of cell death equals rate of cell division		1	
	(D) (population size decreasing) as cells dying due to nutrients running out or (population size decreasing) as cells dying due to toxins / carbon dioxide / cell wastes building up (in solution)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	<p>any one from:</p> <ul style="list-style-type: none"> not everyone would go to the doctor sample will not always be sent for analysis some cases not tested / diagnosed / confirmed 	<p>allow not all cases recorded allow only medically confirmed cases recorded ignore some cases are unknown</p> <p>allow idea that doctor may make a judgemental error or mis-diagnosis</p>	1	AO2 4.3.1.2
05.2	$\frac{1939}{2030} \times 100$ <p>96 / 95.5</p>	<p>an answer of 96 / 95.5 scores 2 marks allow 1 mark only for 95 or other incorrect rounding</p> <p>allow for 1 mark: $\left(\frac{91}{2030} \times 100 =\right) 4.5\%$</p> <p>allow 2 marks for correct rounding of 95.51724138</p> <p>allow 1 mark for correct calculation using incorrect subtraction only if working shown</p>	<p>1</p> <p>1</p>	AO2 4.3.1.2
05.3	<p>most people are immune so do not become ill (from infection)</p> <p>less chance of non-immune / unvaccinated individuals being exposed to pathogen / measles / virus</p>	<p>allow herd / community immunity so do not become ill (from infection)</p> <p>allow most people are immune so do not become infected</p> <p>ignore most people are immune so don't get / catch it</p> <p>reference to an organism is needed</p> <p>allow 'it' for the measles virus</p> <p>allow fewer people to pass it on to non-immune people</p>	<p>1</p> <p>1</p>	AO1 4.3.1.1 4.3.1.7

Question	Answers	Mark	AO / Spec. Ref.
05.4	Level 3: Relevant points (comparisons / reasons) are identified, given in detail and logically linked to form a clear account.	5–6	AO1
	Level 2: Relevant points (comparisons / reasons) are identified and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO2
	No relevant content	0	
	Indicative content differences (after exposure to measles virus): <ul style="list-style-type: none"> • greater number / higher concentration of antibodies produced • quantitative statement, eg 9 times higher or 0.8 to 7.2 • antibodies produced sooner – idea of immediate response • antibodies produced quicker • antibodies stay (in higher concentration) for longer explanation <ul style="list-style-type: none"> • white blood cells / leucocytes / lymphocytes / B cells ignore phagocytes / macrophages • reference to previous exposure (of white blood cells) to pathogen / virus • (white blood cells) recognise pathogen / virus / antigen • memory cells • production of specific / correct antibodies 		4.2.2.3 4.3.1.2 4.3.1.6 4.3.1.7
Total		11	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	(number of deaths =) 91 and (number of cases =) 3.4×10^3 $\frac{91}{3.4 \times 10^3} (\times 100)$ (=) 2.68 2.7 (%)	an answer of 2.7 (%) scores 4 marks allow readings in range 90 to 92 allow readings in range 3.3×10^3 to 3.5×10^3 allow correct substitution of incorrect readings from 2004 allow correct calculation using incorrect readings from 2004	1 1 1 1	AO2 4.3.3.2
07.2	the number of deaths peaked (to 120 in 2008) (but) the number of reported cases fell / did not rise	ignore numbers the percentage deaths peaked (to 3.2%)	1 1	AO3 4.3.3.2
07.3	we don't know what the data was before 2002		1	AO3 4.3.3.2
07.4	any two from: <ul style="list-style-type: none"> • poor sanitation • or idea of poor toilet hygiene • drinking contaminated water • eating contaminated food • or using contaminated water to grow crops 	ignore overcrowding	2	AO2 4.3.3.1 4.3.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	(cancer) cells cannot divide or (cancer) cells are destroyed / killed	do not accept reference to the drug killing (cancer) cells	1	4.2.2.7 AO3
	(so) tumour doesn't grow / get bigger or tumour less likely to spread or tumour less likely to form secondary tumours	allow cancer cells less likely to spread / metastasise	1	
	(because) enzymes A and B are not working / active / effective / present or (because) enzymes A and B are inhibited	allow reference to both enzymes ignore enzymes unqualified	1	
08.5	(functional) enzyme B would still be made / present	allow enzyme B is not inhibited	1	4.2.2.7 AO3
	(therefore cancer) cells would still divide uncontrollably or (therefore cancer) cells would not be destroyed or (therefore) the tumour will (continue to) grow / get bigger / spread or the tumour will form secondary tumours		1	
08.6	any two from: <ul style="list-style-type: none"> • to avoid the patients thinking they feel better with the drug or • to take into account a psychological effect • as a control / comparison • to avoid bias(ed results) 	ignore to make it more valid unqualified ignore to provide an independent variable	2	4.3.1.9 AO2
08.7	testing on volunteers with the disease		1	4.3.1.9 AO1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.8	<p>monoclonal antibody is attached to radioactive substance / toxin / drug / chemical</p> <p>monoclonal antibody will (only) attach to / target (antigen on) cancer cells / tumour</p> <p>(so) radioactive substance / toxin / drug / chemical will (bind to cancer cells and) stop them growing / dividing</p>	<p>allow radioactive substance / toxin / drug / chemical will kill / destroy the cancer cells</p> <p>OR</p> <p>monoclonal antibody interrupts the cell cycle or monoclonal antibody aids immune response (1)</p> <p>monoclonal antibody will (only) target cancer cells / tumour (1)</p> <p>(so) action of monoclonal antibody stops cancer cells growing / dividing or (so) action of monoclonal antibodies helps immune system kill / destroy cancer cells (1)</p>	<p>1</p> <p>1</p> <p>1</p>	<p>4.3.2.2 AO1</p> <p>AO1</p> <p>AO1</p>
Total			19	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	(mouthpiece) has pierced / entered the phloem or (the aphid) has been feeding from the phloem		1	AO2 4.2.3.2
05.2	yellow leaves due to lack of chlorophyll	ignore 'chloroplasts' ignore magnesium is needed to make chlorophyll	1	AO1
	(therefore) less / no light absorbed (by chlorophyll)		1	AO2
	(therefore) lower rate of / no photosynthesis	do not allow 'energy is produced by photosynthesis'	1	AO1
	(therefore) plant makes less / no sugar / glucose		1	AO1
	(therefore) plant converts less / no sugar / glucose into protein (for growth, so growth is stunted)	allow less glucose / sugar converted into cellulose (cell wall) allow less energy for protein synthesis	1	AO1 4.3.3.1 4.4.1.1 4.4.1.3
05.3	inject the protein / it into a mouse		1	AO1 4.3.2.1
	combine lymphocytes with tumour / cancer cells to make hybridoma (cells)	ignore white blood cells allow T or B lymphocytes ignore tumour unqualified	1	
	find a hybridoma which makes a monoclonal antibody specific to PVY		1	
	(the scientist) clones (the hybridoma) to produce many cells (to make the antibody)	do not allow cloning of original stem cells allow many rounds of cloning / mitosis	1	
Total			10	

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	(rose bush) has rose black spot		1	4.2.2.8 AO3
	(because) it has black spots	allow dark / purple spots	1	AO2
	(tomato plant) has tobacco mosaic virus / TMV	allow tomato mosaic virus / ToMV allow cucumber mosaic virus / CMV	1	AO3
	(because) it has a mosaic pattern of discolouration	allow description of mosaic pattern of discolouration	1	AO2
04.2	remove the infected plants / leaves and burn / destroy them	ignore clean gardening tools do not accept fungicide	1	4.2.2.8 AO2
04.3	(use) fungicide	allow named fungicide allow anti-fungal spray ignore fungal spray	1	4.2.2.8 AO2
04.4	<p>any five from:</p> <p>preparation of sample:</p> <ul style="list-style-type: none"> • make a (thin) section of leaf • place on a microscope slide • add a stain <p>use of microscope:</p> <ul style="list-style-type: none"> • place slide on stage • switch light on or adjust mirror • select the lowest power objective lens • move stage close to lens • turn (coarse) focussing knob until cells in focus • position damaged area in centre of (field of) view • switch to high power (objective) lens • use fine focussing knob to focus 	<p>reference to preparation of sample needed for full marks</p> <p>allow named stains</p> <p>ignore place slide on microscope</p>	5	4.1.3.2 AO1

04.5	(plant cell) (60 μm =) 6.0×10^{-5} m or (bacterial cell) (5.0×10^{-7} m) = 0.5 μm	an answer of 120 scores 3 marks	1	4.1.3.1 AO2
	$\frac{6.0 \times 10^{-5}}{5.0 \times 10^{-7}}$ or $\frac{60}{0.5}$	allow incorrectly / not converted value for length correctly substituted	1	AO2
	(=) 120	allow a correctly calculated value using an incorrectly / not converted value for length	1	AO2
04.6	a virus is too small to be seen under a light microscope or needs an electron microscope to see a virus	ignore a virus is too small to see	1	4.1.3.2 4.1.3.1 AO2
04.7	the higher the concentration of sulfur dioxide in the air the lower the percentage of rose bushes with infection or investigation shows at 100 ($\mu\text{g}/\text{m}^3$) SO_2 there are no rose bushes with infection (so) before 1956 there was a lot of SO_2 in the air which killed the microorganisms / pathogens / spores / fungi (but) after 1956 the levels of SO_2 in the air fell so the microorganisms / pathogens / spores / fungi were able to survive	ignore sulphur	1	4.2.2.8 4.4.1.6
		allow above 60 ($\mu\text{g}/\text{m}^3$) most rose bushes are not infected allow converse		AO3
		ignore reference to infection		AO3
		allow Clean Air Act for 1956 ignore reference to infection	1	AO3
Total			18	