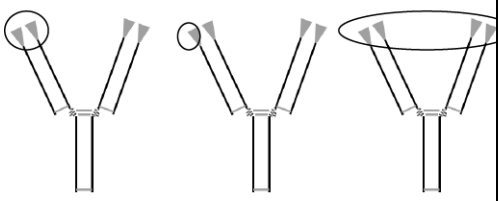
Mark scheme - Communicable diseases, disease prevention and the immune system - Set 2

7 0			(two years later T and B) memory cells produce a, stronger / larger / AW, response to antigens B and D ✓ (two years later, mutated virus) has less of / no longer has, antigens A and C ✓	2(AO3.1)	**ALLOW** 'produce a secondary response to antigens B and D but not to A and C due to presence of memory cells' **IGNORE** 'faster response to antigens B and D' **ALLOW** antigens A and C, are mutated / have changed (shape) **IGNORE** 'virus has more antigens B and D than antigens A and C' **Examiner's Comments** Candidates who did not score well on this question confused antibodies with antigens, referring to the immune system producing antigens in response to the virus. A number of candidates showed that they had not understood the data presented in the question. They often stated that a larger response had been produced to antigens B and D because they had mutated and the immune system could not recognise them, so it had to produce a primary response again. Some candidates who clearly understood the significance of the data presented did not gain marks because they either didn't refer to any of the antigens named in the question, or they didn't explain the changes shown in the graph.
			Total	**2**	
7 1			**L** primary, (just) after vaccination / when the person is vaccinated **and** secondary, (just) after infection / when the person is infected ✓	**3**	**L Comments should relate to Fig 4 (rather than straight recall)** **IF THIS MARK NOT STATED, look on the graph** from appropriate labels on the graph **ACCEPT** a description of the shape of the graph in both responses

			primary **P** slow(er) / delayed, response because of, clonal selection / clonal expansion / production of antibodies ✓ *Secondary* **S** quick(er) response / shorter lag time / more antibodies produced, because of, memory cells / immunological memory ✓		**P ACCEPT** description **Examiner's Comments** Candidates frequently did not describe the changes shown on the graph with sufficient clarity and omitted to mention the slow or delayed primary response. The terms 'clonal selection' and 'clonal expansion' were rarely used in connection with explaining the slow antibody production in the primary response. Memory cells were often correctly referred to as the reason for the quicker secondary response. It was permissible to label the graph to show where the primary and secondary responses were taking place. Some candidates thought primary response was non-specific, related to barriers to infection, and either had not noted or did not understand the use of the word 'specific' in the introduction to the question. Some answers were poorly planned, never reaching an explanation of the events underpinning the secondary response.
			Total	**3**	
7 2	a		1.5 (1) (1)	2	If answer is incorrect **ALLOW** one mark for clear attempt to calculate gradient of a tangent to the line **ALLOW** 1.47 ± 0.02 for two marks
	b		*Max 2 if the idea of parts of the vaccination response taking time is not explicitly stated.* *vaccination involves* clonal selection / antigen presentation (1) clonal expansion / proliferation (1) differentiation (1) memory cells already present in response to infection (1)	3	**ALLOW** primary response for vaccination **ALLOW** secondary response for response to infection
			Total	**5**	
7 3			C	1	**Examiner's Comments** This is another instance where the question

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td>should be read carefully. It was clear that many candidates homed in on the ‘antibody binding sites’ and suggested region A. Careful reading would have revealed that the region was C, the part that flexed and changed the distance between the antibody binding sites.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>1</td><td></td></tr>
<tr><td>7
4</td><td>a</td><td>i</td><td>ring drawn around variable region (1)</td><td>1</td><td>ALLOW
  </td></tr>
<tr><td></td><td></td><td>ii</td><td>disulfide (1)
to hold polypeptides / light chain and heavy chain together (1)</td><td>2</td><td></td></tr>
<tr><td></td><td>b</td><td>i</td><td>abnormal immune response (1)
against tissues normally in the body (1)</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td>ii</td><td>nuclear proteins normally, hidden in nucleus / not exposed to tissue fluids (1)</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td></td></tr>
<tr><td>7
5</td><td></td><td></td><td>clump / aggregate / join, pathogens ✓
stops pathogens, moving / reproducing ✓
(helps) phagocytes then engulf (multiple / clumped) pathogens / phagocytosis of (clumped) pathogens ✓</td><td>2 max
(AO1.2)</td><td><u>Examiner’s Comments</u>

On this question few candidates knew the kingdoms to which the pathogens belonged and many seemed unfamiliar with the term agglutinin.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>2</td><td></td></tr>
<tr><td>7
6</td><td></td><td>i</td><td><table><tr><th>Type of immunity</th><th></th></tr><tr><td>natural and active</td><td></td></tr><tr><td>natural and passive</td><td></td></tr><tr><td>artificial and active</td><td></td></tr><tr><td>artificial and passive</td><td>✓</td></tr></table></td><td>1
AO2.5</td><td></td></tr>
<tr><td></td><td></td><td>ii</td><td>injected ✓

(patient) is not <u>producing</u> , antibodies / memory cells / immune response ✓</td><td>2
AO1.1</td><td>IGNORE natural / artificial / active / passive
IGNORE ‘antibodies are given’, as this is in the question</td></tr>
</table>

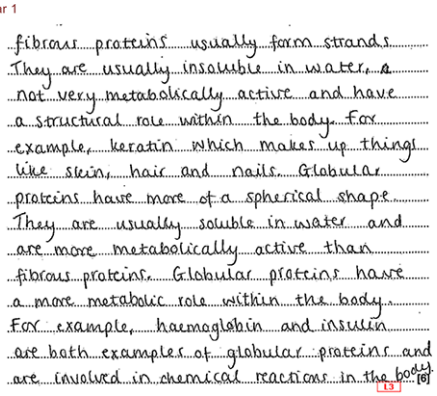
			Total	**3**	
77			B	1	
			Total	**1**	
78			*two from* antibodies produced (by person being vaccinated) (1) activation of (named) lymphocytes (of person being vaccinated) (1) (specific) memory cells remain (in person being vaccinated) (1)	2	
			Total	**2**	
79		i	**FIRST CHECK ANSWER ON ANSWER LINE** *correct answer = 2 marks* 0.00346 x 10^9 / 3.46 x 10^6 / 3, 460, 209 ✓ ✓ *1 mark for working stages or intermediate answer if final answer wrong:* *calculate 1.11% of 2018 population* 7.7 x 10^9 x 1.11 ÷ 100 = 0.08547 x 10^9 ✓ *or calculate 2019 population by adding 1.11% figure to original population* 7.7 x 109 + 0.08547 x 10^9 = 7.78547 x 10^9 / 7, 785, 470, 000 ✓ *or calculate photosensitive lupus sufferers by dividing 2019 population figure by 1350 **and** finding 60% of this:* (7.78547 x 10^9 ÷ 1350) = 0.00577 x 10^9 / 5, 767, 014 (5, 767, 014 x 60 ÷ 100) = 3, 460, 208.8 / 3, 460, 208 ✓	2 (AO2.4)	**ALLOW** rounding to 3.5 x 106 **ALLOW** first two steps combined: 7.7 x 109 x 101.11 ÷ 100 = 7.78547 x 109 (or 7.7 x 109 x 1.0111) **ALLOW** find 0.074% i.e. x 0.074 ÷ 100 instead of dividing by 1350 **Examiner's Comments** Candidates should not be shy of using words in their working to explain the logic of each step, for example in this question headings could be 'finding 1.11% of the 2018 population', finding the 2019 population total', 'finding the number of lupus sufferers' and 'finding the proportion of sufferers that is photosensitive'. Another good tip for candidates is to consider whether their final answer is bigger or smaller than they could reasonably expect. Taking this common sense view should help a candidate with a final answer to this question that exceeds the total population size to see that they must have made an error.

		ii	ultraviolet / UV (light / rays / radiation / photons) **AND** skin rash ✓	1 (AO2.1)	
		iii	*idea that* immune system, attacks / damages, own / self, cells / tissue / antigens ✓ *plus any one of:* genetic / passed down in genes / linked to certain alleles / ref. DNA ✓	2 (AO1.2) (AO2.5)	**ALLOW** own cells, attacked / treated, as, foreign / non-self, by immune system / immune cells / antibodies **DO NOT ALLOW** attacks own, bacteria / molecules **IGNORE** hereditary / inherited **Examiner's Comments** On this question few candidates could draw a peptide bond and some candidates confused autoimmune disease with immune deficiency.
			Total	**5**	
8 0		i	**1** gene / DNA, copied / transcribed, to (m)RNA ✓ **2** (*idea that* RNA goes to / translation is at) ribosome(s) / RER ✓ **3** DNA, is too large to / cannot / is not able to, leave nucleus / cross nuclear envelope / fit through nuclear pores ✓	2 max	**Read all and mark as prose** **ALLOW** used as a template to create / AW, for 'copied to' **ALLOW** RNA, copies / takes a copy of, gene / DNA **DO NOT ALLOW** replicated for 'copied' **ALLOW ORA** 'RNA, is small enough to / can / is able to' or just 'RNA leaves nucleus' **ALLOW** nuclear membrane for 'nuclear envelope' **DO NOT ALLOW** leave the cell for 'leave nucleus' **Examiner's Comments** As a recall question this was done well, particularly with respect to the sizes of molecules being able or unable to leave the nucleus via nuclear pores, and ribosome being the site of translation. Some candidates confused translation with transcription.

					Misconception Some candidates misuse language in describing transcription. Correct: • DNA is transcribed into mRNA. *(Note passive tense)* • mRNA is a transcript of the DNA. • mRNA is a copy of the DNA. Incorrect: • mRNA transcribes the DNA. *(Active tense)* • mRNA copies the DNA. *(RNA polymerase does this)*. • DNA is converted into mRNA.
		ii	90 252 **or** 90 255 **or** 90 258 ✓ ✓	2	**Correct final answer gets 2 marks**, even if no working is shown. Wrong final answer (which may include a 90 252 stage in the working) = **ALLOW 1 mark for seeing any of these:** 327 × 92 × 3 **OR** 30 084 **OR** 981 **Examiner's Comments** Most candidates multiplied the number of amino acids in pepsin (327) by the number of times bigger that titin is compared to pepsin (92). These candidates gained 1 mark for arriving at the figure 30 084. Only a minority of candidates understood that the question information was about the number of amino acids in a polypeptide while the question was asking for the number of bases in the equivalent DNA. Some of those who realised the distinction divided by the number of bases that code for one amino acid in error. The correct process was multiplying by 3 due to the logic that every amino acid in a polypeptide is coded for by 3 bases on DNA. Candidates who followed a different route could calculate the number of bases in DNA coding for pepsin and then multiply by 92, or

					could add 3 or 6 bases to their final answer for a stop and/or start codon.
		iii	For answers marked by levels of response: Read through the whole answer from start to finish, concentrating on features that make it a stronger or weaker answer using the indicative scientific content as guidance. The indicative scientific content indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the science content of the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer using the guidelines described in the level descriptors in the mark scheme. Once the level is located, award the higher or lower mark. **The higher mark** should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met. **The lower mark** should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing. **In summary:** • **The science content determines the level.** • **The communication statement determines the mark within a level.** **Level 3 (5–6 marks)** A detailed comparison of the properties **and** functions of fibrous **and** globular proteins.	6 max	*Communication may be via bullet points, a table of comparisons, labelled diagrams or prose.* Indicative scientific points may include the following: FIBROUS PROTEINS **Properties:** • insoluble • elongated / long / rods / filaments / ropes / strands • strong / tough • flexible IGNORE size refs / compact / coiled / bond types / hard Functions: Look for the general category or for a named protein or glycoprotein example with supporting detail. Related categories and examples are paired or grouped together: • for structure • collagen in, bone / cartilage / connective tissue / tendons / ligaments / skin / blood vessels • fibrin + role described • for protection • keratin in, skin / hair / nails • to give, elasticity / elastic properties • elastin in, (named) blood vessels / alveoli / cartilage • for, contraction / mechanical movement • actin / myosin, in muscle • microtubules in, cilia / flagella / spindle / cytoskeleton GLOBULAR PROTEINS Properties:

			There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated. **Level 2 (3–4 marks)** A comparison of the properties **and/or** functions of fibrous **and** globular proteins. *There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.* **Level 1 (1–2 marks)** A limited comparison of the properties **or** functions of fibrous **and** globular proteins. *A basic structure and some relevant information is provided, although a clear line of reasoning may not be present. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No response or no response worthy of credit.		• soluble • spherical / ball-shaped • have, 3D / tertiary / 3o, shape / structure • specific / complementary (to another molecule) • ref. conjugated / contain prosthetic group • temperature / pH, sensitive • hydrophilic on outside IGNORE size refs, compact, round, bond types Functions: Look for the general functional category name or description, or a named protein or glycoprotein example with some supporting detail. • enzymes / metabolic role / to catalyse reaction(s) / to lower activation energy • named enzyme + its specific role described • hormones / receptors / for cell signalling • named hormone / insulin + role described • opsonin / antitoxin / agglutinin + role described • fibrinogen in blood clotting • to transport substances across cell membranes • carrier / channel / pump + role described • to transport substances in blood • haemoglobin + role described e.g. carry oxygen • to, package / organise DNA **<u>Examiner's Comments</u>** Candidates generally had plenty to say and almost all attempted to fulfil the command word compare by making reference to both fibrous and globular proteins. Level 3 answers fully answered the question brief by providing science content covering at least one property of a fibrous protein and one property of a globular protein and at least one function of each type of protein. The

					word 'property' was confused by some candidates with structure and this resulted in irrelevant material about levels of protein structure and bonding within proteins. Properties may be physical or chemical and relate to aspects like the solubility, strength, flexibility, shape and stability (for example at different temperatures) of molecules. Exemplar 1  fibrous proteins usually form strands. They are usually insoluble in water, a not very metabolically active and have a structural role within the body. For example, keratin which makes up things like skin, hair and nails. Globular proteins have more of a spherical shape. They are usually soluble in water and are more metabolically active than fibrous proteins. Globular proteins have a more metabolic role within the body. For example, haemoglobin and insulin are both examples of globular proteins and are involved in chemical reactions in the body. [6] Exemplar 1 is a level 3 answer that is contained within the line space, answers all aspects of the question and contains an appropriate level of science content. There is a well-developed line of reasoning, a clear and logical structure and all the material is relevant and substantiated by fact, so the communication statement for 6 marks is met.
		i v	**EITHER** **1** 9300 / 9700 ✓ **2** deaths year^{-1} or deaths per year or deaths / year ✓ **OR** **3** 9.3 / 9.7 ✓ **4** thousand deaths year $^{-1}$ or thousand deaths per year or thousand deaths / year ✓	2	Correct answer to 2 s.f. **with** correct matching units = **2 marks** **ALLOW** mark for unit even if no or wrong figure given **ALLOW** minus sign with number or 'fewer' with unit **ALLOW** from AIDS / of AIDS in unit **ALLOW** mp 3 so long as the **word thousand** appears afterwards or in the units (even if the unit is wrong in another respect) **DO NOT ALLOW** '*9.3 1000 deaths per year*' for mp3 (but gets mp 4) **Examiner's Comments** Candidates often achieved one of the two marks available but few successfully worked through all the processes involved in arriving at an answer with appropriate units for the

					rate of decrease over three years. One error was for candidates to calculate not a rate (over time) but a percentage decrease. A breakdown of how to tackle this question is listed in the 'Assessment for Learning' box. This, together with sections from the three tutorial sheets listed under OCR support, could form the basis of a step-by-step worksheet on solving the problem set in this question. Additional questions could be devised using this graph to calculate rates of increase or decrease in the numbers of new diagnoses or those living with an AIDS diagnosis for different time periods.  **AfL** 1. Select the dash-dot line for deaths and read to the nearest half-square of the grid where values for 1995 and 1998 intercept the y axis. 2. Check the left-hand y axis label to see that these figures represent thousands. 3. Subtract one away from the other to find the difference. 4. Divide this answer by the time between the two values on the x axis, 3 years. 5. Give the answer to two significant figures. 6. Determine the units.  **OCR support** Tutorial sheets and quizzes are available to support the teaching of the skills listed in the specification for Maths for Biology. Three areas cover key skills needed to successfully answer this question: http:/www.ocr.org.uk/qualifications/by-

					subject/biology-related/maths-for-biology/m3-graphs/ (calculating a rate from a graph with time on the *x* axis) http:/www.ocr.org.uk/qualifications/by-subject/biology-related/maths-for-biology/m0-arithmetic-and-numerical-computation/ (introduction to significant figures) http:/www.ocr.org.uk/qualifications/by-subject/biology-related/maths-for-biology/m0-arithmetic-and-numerical-computation/ (using and choosing units)
		v	*(answers must relate to **data** on graph)* **1** decrease in new diagnoses, from 1992 / already / began before 1995 ✓ **2** peak / plateau, in deaths, from 1994 / already / began before 1995 ✓ **3** no change in / same, (rate of) increase in people living with AIDS, before / after, 1995 ✓	2 max	**ALLOW** when, saquinavir / drug / medicine, was introduced for '1995' in mps **1**, **2** and **3** **ALLOW** new diagnoses decrease at same time as deaths **ALLOW** from / since / after, 1993 (instead of 1992) **Examiner's Comments** As specified in the question, candidates had to make use of data from the graph in their answer. Ideas from their own knowledge like improved education or increased precautions against transmission of HIV did not therefore score. Strong responses did not just look at 1995 to judge whether the introduction of a drug had an effect (pre-supposing that a change would begin from this point), but instead drew conclusions from ongoing trends that pre-dated 1995. These showed that new diagnoses were already falling, deaths had already peaked and the number living with AIDS experienced no change in its rate of increase.
			Total	**14**	
8 1			antibodies not used / should say antigens used ✓ not natural (immunity) / should say artificial (immunity) ✓ not passive (immunity) / should say active (immunity) ✓	3	**IGNORE** refs to attenuated pathogen **Examiner's Comments** Candidates were asked to 'state three errors'. Many candidates also wanted to correct the errors and it was sometimes difficult to ascertain whether the responses written were the errors or corrections for

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td>those errors. In this situation it may be beneficial for candidates to be creative in their response and use a small table in which the column headings are ‘error’ and ‘correction’. Candidates could use tables and bullet points in their responses if these would help to make the response clearer. Most candidates achieved full marks here. There was some confusion over what vaccinations are routinely provided. Many candidates referred to dead or weakened pathogens being injected rather than antigenic material.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>3</td><td></td></tr>
<tr><td>8
2</td><td>a</td><td></td><td>1 data (as a whole) do not show, direct / positive / indirect / negative / any, <u>correlation</u> ✓

2 direct / positive, correlation is opposite to, conclusion / trend, student describes ✓

3 rest home time trend supports negative correlation / as % vaccination decreases number of flu cases increases in rest homes / when vaccination higher flu cases lower ✓

4 schools trend supports positive correlation / as % vaccination decreases number of flu cases decreases in schools / when vaccination higher flu cases higher ✓

5 hospitals / other, trends show no correlation / as % vaccination decreases number of flu cases may increase or decrease or stay the same ✓

6 idea that need to plot % vaccination against number of flu cases to judge correlation / uptake and cases highest in rest homes ✓

7 compare figures from 2 years for one group OR from 2 groups for one year OR rest homes and other both at 70% uptake ✓

8 limitation of data ✓</td><td>4 max
(AO3.1)
(AO3.2)</td><td>max 3 if do not state mp1

ALLOW ora conclusion / trend, student describes is, indirect / negative correlation

ALLOW ‘flu case figures + / – 20 for mp 7

<table><tr><th></th><th colspan="3">Number of ‘flu cases</th></tr><tr><th></th><th>2015-16</th><th>2016-17</th><th>2017-18</th></tr><tr><td>rest homes</td><td>240</td><td>890</td><td>1690</td></tr><tr><td>hospitals</td><td>120</td><td>170</td><td>240</td></tr><tr><td>schools</td><td>280</td><td>60</td><td>170</td></tr><tr><td>other</td><td>40</td><td>20</td><td>60</td></tr></table>
<table><tr><th></th><th colspan="3">Percentage uptake of vaccine</th></tr><tr><th></th><th>2015-16</th><th>2016-17</th><th>2017-18</th></tr><tr><td>rest homes</td><td>77</td><td>75</td><td>70</td></tr><tr><td>hospitals</td><td>57</td><td>60</td><td>59</td></tr><tr><td>schools</td><td>42</td><td>36</td><td>38</td></tr><tr><td>other</td><td>70</td><td>67</td><td>50</td></tr></table>
8 only three years studied /
small sample sizes /
not a comparison of standardised groups /
case numbers not per 100, 000 /
percentages /</td></tr>
</table>

					age / gender / other health problems, not controlled **Examiner's Comments** This question provided a challenge as candidates needed to integrate two graphs and evaluate their findings in the light of a student statement that included a contradiction. A general exam technique tip is to use all the classes of data in the answer. In this question that would mean commenting on results from rest homes, schools, hospitals and other. A teaching tip is to show candidates examples of positive (direct) and negative (indirect) correlations on scattergraphs. Dose response curves illustrate that effective medical interventions produce a negative correlation when drug dose is plotted against disease incidence or prevalence or against mortality.
	b		*any three matched to steps in correct order:* *step 3* antigen presentation / antigen binds to specific, B / T, lymphocyte / cell ✓ *steps 3 or 4* clonal selection / clonal expansion / plasma cells produced / produce antibodies primary immune response ✓ *step 5* ref. memory cells / secondary immune response ✓	3 (AO1.2)	**ALLOW** two steps in correct order in any two step spaces if one step space left blank (e.g. if whole sequence written as 3 and 4 with no 5)
	c		herd immunity ✓ fewer people can, catch / spread, virus / measles OR vaccinated individuals / most people, cannot catch / spread, virus / measles ✓ $R_{(0)}$ number reduced ✓	2 max (AO2.6)	**ALLOW** less / slower / decreases, transmission / spread **Examiner's Comments** On this question the year's news coverage of the pandemic meant that most candidates introduced the term 'herd immunity' into their answer and used it correctly. Many also referred to the R number or R_0.

			Total	**9**	
83			increase likelihood of phagocytosis (1) *idea that* binds to pathogen and phagocyte / macrophage (1)	2	
			Total	**2**	
84	a	i	108.3	1	**IGNORE** all other responses.
		ii	28.0 (1)(1)	2	**ALLOW** 1 mark if correct answer given to incorrect number of decimal places. *If answer is incorrect* **ALLOW** 1 mark for any number divided by the candidate's answer to part **(i)**. *If the candidates answer to part **(i)** is incorrect apply ecf.*
		iii	*max two from:* *idea that* lowest year has been cherry-picked (1) *idea that* average of several years would have been a better indicator (1) *idea that* level might fluctuate (1) *plus:* use of processed data to support any of the above (1)	3	
	b		*two from* different pathogens have different antigens (1) antigens have specific shape (1) shape of antibody must be complementary to (specific) antigen (1) *any of the above linked to* different antibody needed for each pathogen (1)	3	
			Total	**9**	
85			plants (1) microorganisms (1)	2	**ALLOW** named examples, e.g. St John's Wort, frog skin, *Penicillium,* etc.
			Total	**2**	
86		i	*two from* babies / infants (1) elderly / infirm (1) immuno-compromised / on immunosuppressant drugs / HIV positive (1)	2	

			known to have been exposed (to the infection) (1)		
		ii	*two from* (antibiotic is) selective pressure (1) (bacterial) gene pool / AW, has variation (1) (only) some bacteria have resistance / some bacteria are more resistant than others (1) *two from* when exposed (to antibiotic) most-resistant survive (1) surviving bacteria continue to reproduce to make a resistant population (1) *idea that* over many generations there is an increase in proportion of resistant bacteria (under continued antibiotic pressure) (1) antibiotic becomes ineffective / new antibiotic needed (1)	4	**IGNORE** increase in number of resistant bacteria.
			Total	**6**	
87	a	i	*idea that* the third diagram shows that the resistant, bacteria / colonies, were already present (on the original plate) **or** these (resistant) bacteria on the original plate continued to grow when flooded with penicillin ✓	1	**IGNORE** penicillin will kill them so in order for them to survive the mutation must have already happened **IGNORE** no time for natural selection to take place − as these are explanations and not evidence **Examiner's Comments** Most candidates found this question challenging, tending to repeat or rephrase the stem of the question. Vague or ambiguous references to being exposed to penicillin were insufficient as they needed to clearly refer to the original colonies that survived when the original petri dish was flooded with penicillin. The candidates needed to take careful note of the diagrams and the information provided in order to make an informed statement.
		ii	natural <u>selection</u> ✓	1	**CREDIT** directional <u>selection</u> **IGNORE** evolution / survival of the fittest / binary fission / mutation

					Examiner's Comments This question elicited the following incorrect answers on a frequent basis: binary fission, mutation, evolution and mitosis. Some misunderstood the question and referred to antibiotic resistance, immunity or vaccination.
	b	i	3140 ✓ ✓	2	**Correct answer = 2 marks**, even if no working shown. • If the answer is incorrect or has not been rounded to 3 sig. figs., then **award 1 mark** for seeing **either** $\frac{1652 - 51}{x}$ or $\frac{1601}{x}$ where x = any number **or** an unrounded answer (e.g. 3139.2156 or 3139) • If the incorrect peak has been chosen, then **award 1 mark only for a correct answer which is correctly expressed to 3 sig. figs.** Using 1649 the correct answer is 3130 Using 1593 the correct answer is 3020 **Examiner's Comments** Candidates should be encouraged to always show their working for calculations. Those who did were frequently able to be awarded a mark for working despite having the incorrect answer. Most were able to select the correct figures but were unable to manipulate them correctly. Calculation of percentage increase, decrease or change proves to be challenging for candidates.
		ii	was lower (in 1993) **or** has increased / is higher (in 2012) ✓	2	**IGNORE** ref to raw data **ACCEPT** 'over 4 x greater in 2012'

			(in 2012) 52% or 0.52 ✓		**ACCEPT** 52.4% **Examiner's Comments** In contrast, most candidates performed this calculation correctly and were able to make a suitable comment relating to its increase since 1993.
		iii	*two of* 1 (trend is) decrease in (number of) deaths (since 2007) ✓ 2 consistent / steady / large / dramatic, decrease in (deaths from *S. aureus* specified as) MRSA (from 2007) ✓ 3 ref to better specific cross-infection control measure in health care ✓ 4 any correct processed data comparing either years or cause of death using figures from table 6 ✓	2	**IGNORE** raw data quotes 2 *idea that* non-specified fluctuates **Note** 'a large decrease in the number of deaths from MRSA' = 2 marks (mps 1 & 2) 3 e.g. isolating MRSA cases / dress code for health professionals / hygiene measures / pre operation screening 4 *MRSA* e.g. decrease of, 1301 / approx. 260 per year 2012 value is, 18.3% / approx. 20% / approx. ⅕, of 2007 value a drop of, 82% / approx. 80%, from 2007 to 2012 *total* e.g. decrease of, 1495 / approx. 39 per year 2012 value is, 27.1% / approx. 25% / approx. ¼, of 2007 value a drop of, 73% / approx. 70% / approx. 75%, from 2007 to 2012 **Examiner's Comments** Most candidates observed the correct trend but did not clearly distinguish between total certificates mentioning *S. aureus*, those mentioning *S. aureus* specified as MRSA and those mentioning *S. aureus* not specified as resistant. Data quoted was frequently raw data rather than processed. Measures to

Year	% death certificates mentioning *S. aureus*		Total number of death certificates mentioning *S. aureus*
	S. aureus not specified as resistant	*S. aureus* specified as MRSA	
2007	22 or 22.4	78 or 77.6	2052
2008	18	82	1500
2009	38 or 37.7	62 or 62.3	1253
2010	49 or 49.5	51 or 50.5	960
2011	43 or 42.9	57 or 57.1	638
2012	48 or 47.6	52 or 52.4	557

					prevent cross-infection were only credited if they were specific rather than vague references to 'better hygiene'.
			Total	**8**	
88			*Advantages* *idea of* less chance of resistance due to fewer years of use **OR** (slightly) more effective against MRSA / AW **OR** smaller chance of, nausea / constipation ✓ *Disadvantages* *idea of* long-term effects less certain (due to being used for only 4 years) **OR** (much) less effective against *Streptococcus* **OR** greater chance of, headache / diarrhoea ✓	2 (AO3.2)	**ORA** for vancomycin **IGNORE** ref to vomiting **IGNORE** ref to being less effective against *Staphylococcus* **IGNORE** ref to dizziness
			Total	**2**	
89		i	*any three from:* greater use / overuse / over prescription, of methicillin ✓ not completing course (of methicillin) ✓ *idea of:* use (of methicillin) in farming ✓ natural selection of MRSA ✓ *idea that:* large % increase (in a short time) due to fast generation time ✓	3 max	
		ii	*idea of:* universal language ✓ shows evolutionary relationship between species (at the genus level) ✓	1 max	
			Total	**4**	