

**Q1.**

- (a) phloem 1
- (b) translocation 1
- (c) either:
- less (sugars for) respiration 1
- (so) less energy released 1
- 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)
- (d) (aphids) can fly to another plant **or** part of the plant 1  
*ignore to fly unqualified*
- to get (more) food
- allow to find a mate*
- allow idea of less competition for food*
- allow to escape predators*
- do **not** accept escape prey* 1
- (e) (oil) prevents aphids from attaching to leaf **or** causes aphids to slide off leaf 1  
*ignore 'the leaf is slippery'*
- or**
- idea that oil may harm / kill the aphid
- allow oil may be unpleasant to the aphid* 1
- (f) (plant / stem has) thorns 1  
*allow spines / spikes / prickles*  
*ignore stings*  
*do **not** accept thorns protect (the plant) from predators*
- (g) C



*if any other letter given then no marks for the question*

1

(fungi / spores) blown by / in direction of the wind  
*allow black spot / disease is blown by / in direction of the wind*

**or**

it's the closest plant (to A)

*do **not** accept reference to bacteria / viruses / pollen being blown*

1

(h) any **one** from:

- spread rose bushes out more  
*allow isolate the infected plant  
allow idea of barrier around infected plant  
ignore separate unless qualified*
- remove any infected parts of the plant  
*allow remove infected plant / A*
- use a fungicide  
*ignore pesticide  
do **not** accept insecticides / herbicide*

1

[11]

## Q2.

(a) toxins / poisons (secreted by / from / in bacteria)

1

(b) any **two** from:

- wash hands after using toilet / being sick  
**or**  
wash hands before preparing / handling food  
**or**  
do not prepare food (whilst infected)  
*ignore 'wash hands' unqualified  
ignore reference to coughing / sneezing*
- isolate yourself  
*allow examples of how isolation could be achieved*
- disinfect clothes / surfaces
- do not share utensils / cutlery / towels

2

(c) antibiotics

*allow named examples of antibiotics*

1



- (d) immune system is damaged / weakened **or** immune system doesn't function properly  
*allow immunocompromised*  
*allow lack of / no white blood cells* 1
- white blood cells cannot kill bacteria / *Salmonella* (as effectively)  
*allow no / fewer antibodies so bacteria not killed*  
***or** less phagocytosis so bacteria not killed **or** no / fewer antitoxins to counter toxins* 1
- (e) any **one** from:
- (give chickens) antibiotics  
*allow (give chickens) monoclonal antibodies*
  - don't sell infected chickens / eggs  
*allow don't sell the chickens / eggs*  
*ignore don't sell chickens / eggs*
  - keep infected chickens isolated / indoors  
*allow keep the chickens indoors*  
*ignore keep chickens indoors*
  - slaughter the infected chickens  
*ignore vaccination / chlorination / disinfection* 1
- (f) (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
- (g) radius (of area with no bacteria growing)  
*allow diameter (of the area with no bacteria growing)*  
*ignore  $\pi r^2$  unqualified*  
*allow idea of placing agar plate onto graph paper and counting the squares not covered with bacteria* 1
- (h) 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



- (i) any **one** from:
  - toxicity / side / health effects  
*ignore harmful / dangerous*  
*allow reference to allergies*
  - effect on other types of bacteria / pathogens  
*allow not tested on other types of bacteria*  
*ignore germs*
  - interaction with other cleaners
  - ease of use
  - dilution factor of each cleaner (vs. cost)  
*ignore concentration unqualified*
  - time cleaner is effective for  
*ignore how long the cleaner lasts for*  
*allow reference to odour of cleaning liquid*  
*ignore reference to cost unqualified*  
*ignore environmental effects / flammability*

1

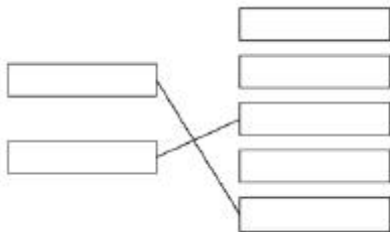
[11]

**Q3.**

(a) bacteria

1

(b)



*extra line from a drug negates the mark for that drug*

2

- (c) any **one** from:
  - to check they are safe
  - to check they are effective  
*allow to check they work or to check for the (right) dose*
  - to check for side effects  
*allow to check for toxicity*

1

(d) testing on healthy volunteers

1

(e) **Level 2 (3-4 marks):**  
 Relevant points (reasons / causes) are identified, and there are attempts at logical linking.

**Level 1 (1-2 marks):**

Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

**0 marks:**

No relevant content

**Indicative content**

- dead / inactive pathogen
- introduced to the body
- white blood cells respond
- produce antibodies
- antibodies are specific to pathogen
- antibodies produced quickly (on reinfection) / rapid response
- in larger quantities
- killing the pathogen

[9]

**Q4.**

- (a) a fungus

1

- (b) **Level 3 (5-6 marks):**

Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

**Level 2 (3-4 marks):**

Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

**Level 1 (1-2 marks):**

Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

**Level 0**

No relevant content

**Indicative content**

	defence	description of defence
<b>animals</b>	skin	sebum / oils to kill microbes dead layer difficult to penetrate
	nose	hairs keep out dust and microbes
	trachea / bronchi	mucus traps microbes cilia moves mucus
	stomach	(hydrochloric) acid kills bacteria
	white blood cells	produces antibodies produces antitoxins

		engulf microbes / phagocytosis
<b>plants</b>	cell wall	tough / difficult to penetrate
	waxy cuticle	tough / difficult to penetrate
	dead cells / bark	fall off, taking pathogens with them
	production of antibacterial chemicals	kill bacteria
<b>fungi</b>	antibiotic production	kill bacteria

(c) any **three** from:

- sterilise agar (before use)
- sterilise (Petri) dish before use
- disinfect bench (before use)
- pass inoculating loop (through flame)
- secure lid with (adhesive) tape
- minimise exposure of agar / culture to air / lift and replace lid as quickly as possible

*allow:*

- *dip loop into ethanol (after flaming)*
  - *keep the lid on the plate for as long as possible*
- or**
- *minimise exposure of agar to air*
- or**
- *only tilt the lid off (rather than remove it)*
  - *flame the neck of the bottle*

(d) to prevent the growth of a harmful pathogen

## Q5.

(a) any **two** from:

- regular hand washing
- or**
- use hand sanitiser / alcohol gel
- cover nose / mouth when coughing / sneezing
- allow wear a face mask*
- put used tissues (straight) in the bin
  - don't kiss uninfected people
- allow isolate patient from others*
- or**
- don't share cutlery / cups / drinks with uninfected people
- clean / disinfect / sterilise surfaces regularly
- ignore responses referring to infected people*

(b) any **three** from:

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6

3

1

[11]

2

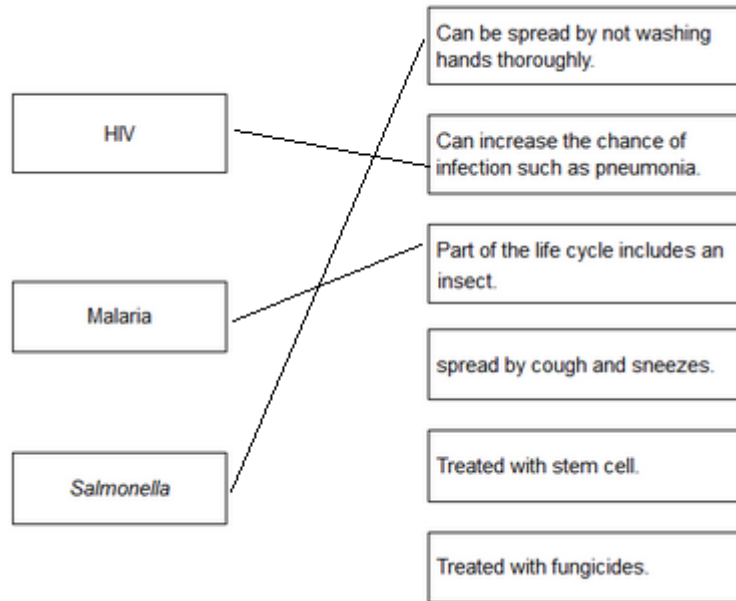


- stimulate (mouse) lymphocytes to produce antibody  
*for marking points 1 and 2 lymphocyte must be used at least once*
  - combine (mouse) lymphocyte with tumour cell  
**or**  
(create a) hybridoma
  - clone (hybridoma) cell
  - (hybridoma) divides rapidly **and** produces the antibody
- 3
- (c) any **two** from:
- (monoclonal) antibody binds to virus **or** antibody binds to antigen on surface of virus
  - (monoclonal) antibody is complementary (in shape) / specific to antigen (on surface of virus)
  - white blood cells / phagocytes kill / engulf the virus(es)
- 2
- (d) as a control  
**or**  
to see / compare the effects of the treatment (vs. no treatment)
- 1
- (e)  $(4.8 + 10.4) \div 2 \div 100 \times 1500$   
**or**  
 $(4.8 \div 100 \times 750) + (10.4 \div 100 \times 750)$
- 1
- 114  
*an answer of 114 scores 2 marks  
allow 228 for 1 mark*
- 1
- (f) **(supports the conclusion because)**  
over double the number / % of patients (in the trial) were hospitalised with the placebo (compared to MAB)
- 1
- (does not support the conclusion because)**  
no information on patients not hospitalised / still unwell at home  
**or**  
other factors may have affected those admitted to hospital  
*allow correct named factor e.g. age / gender / other illness*  
**or**  
don't know if it was a double blind trial
- 1

[12]

**Q6.**

(a)



*each extra line negates a mark*

- 4
- (b) pain when urinating 1
- yellow discharge 1
- (c) three correct plots 2  
*allow 1 mark for two correct plots*
- correctly drawn line 1
- (d) any **three** from: 3
- (fairly) level / steady up to 2009  
*allow numbers of males fall (slightly) and females rise (slightly) up to 2009*
  - (there is a) rise after 2009
  - males are (always) higher than females
  - males rising faster than females  
*allow overall increase (from 2005 to 2013)*
- (e) HIV is a virus 1
- (and) antibiotics are only effective against bacteria  
**or**  
 antibiotics do not kill viruses  
*allow viruses live inside cells* 1

[13]

**Q7.**





- (a) to kill virus  
**or**  
to prevent virus spreading 1
- (b) take (stem) cells from meristem  
**or**  
tissue culture  
*allow take cuttings* 1
- (c) use Benedict's solution 1
- glucoses turns solution blue to orange 1
- (d) **Level 2 (3–4 marks):**  
A detailed and coherent explanation is provided. The student makes logical links between clearly identified, relevant points that explain why plants with TMV have stunted growth.
- Level 1 (1–2 marks):**  
Simple statements are made, but not precisely. The logic is unclear.
- 0 marks:**  
No relevant content.
- Indicative content**
- less photosynthesis because of lack of chlorophyll
  - therefore less glucose made  
so
  - less energy released for growth
  - because glucose is needed for respiration  
and / or
  - therefore less amino acids / proteins / cellulose for growth
  - because glucose is needed for making amino acids / proteins / cellulose
- 4

[8]

**Q8.**

- (a) any **two** from:
- acid in the stomach kills pathogens in food
  - skin forms a barrier / produces antimicrobial secretions
  - hairs in the nose trap (particles which may contain) pathogens
  - trachea / bronchi has mucus which traps pathogens
- or**  
bronchi have cilia which waft mucus to throat to be swallowed 2
- (b) **Level 3 (5–6 marks):**  
A clear, logical and coherent answer, with no significant redundancy. The student understands the process and links this to reasons for clinical trials.
- Level 2 (3–4 marks):**  
A partial answer with errors and ineffective reasoning or linkage.

**Level 1 (1–2 marks):**

One or two relevant points but little linkage of points or logical reasoning.

**0 marks:**

No relevant content.

**Indicative content**

- pre-clinical trials of the new drug on cells / tissues / live animals
- to test toxicity, dosage and efficacy
- clinical trials / test on healthy volunteers and Ebola patients at very low doses
- so that you can monitor for safety / side effects
- and only then do trials to find the optimum dosage and test for efficacy
- double blind trial / use of placebo
- which does not contain the new drug
- random allocation of Ebola patients to groups
- so no one knows who has placebo / the new drug
- peer review of data
- to help prevent false claims

6

[8]

**Q9.**

- (a) stomach and pancreas correctly labelled 1
- (b) bacteria not killed (by stomach acid / HCl) and so they damage mucus lining 1
- so acid / HCl damages stomach tissue / causes an ulcer  
*allow bacteria infect stomach tissue* 1
- (c) if the cancer is malignant 1
- (cancer) cells can spread to other organs 1
- via the blood forming a secondary tumour  
*do not award marking points 2 or 3 without marking point 1* 1
- (d) add Biuret reagent to food sample  
*allow sodium / potassium hydroxide (solution) + copper sulfate(solution)* 1
- mauve / purple colour shows protein present 1
- (e) damaged villi reduce surface area for absorption (of food molecules) 1
- (therefore) fewer amino acids and glucose absorbed 1
- with less glucose transfer of energy from respiration is reduced



		1
	and fewer amino acids available to build new proteins	1
		[12]
<b>Q10.</b>		
(a)	vector	1
(b)	any <b>three</b> from: <ul style="list-style-type: none"><li>• destroy the snails</li><li>• isolate infected dogs</li><li>• treat infected dogs <i>allow vaccination</i></li><li>• educate owners about picking up dog faeces</li></ul>	3
(c)	stop mosquitoes breeding <i>allow correct description</i>	1
	use mosquito nets <i>allow use of insect repellent</i>	1
		[6]
<b>Q11.</b>		
(a)	(i) small amounts of dead pathogens	1
	(ii) decrease	1
	by 60 (%) <i>allow from 70(%) to 10(%)</i> <i>allow other correct data treatment</i>	1
(b)	(i) penicillin	1
	(ii) any <b>two</b> from: <ul style="list-style-type: none"><li>• antibiotics only kill bacteria <i>allow antibiotics do not kill viruses</i></li><li>• some bacteria are resistant (to antibiotics) <i>allow MRSA not killed by antibiotics</i></li><li>• (correct) antibiotics not always used <i>allow course not completed</i></li><li>• deficiency disease(s) not caused by bacteria <b>or</b> cannot be treated by antibiotics</li><li>• inherited disease(s) not caused by bacteria <b>or</b> cannot be treated by antibiotics</li><li>• 'lifestyle' diseases not caused by bacteria <b>or</b> cannot be treated by antibiotics</li></ul>	



*eg heart disease / cancer*

*if no other mark given allow 1 mark for not all diseases are caused by bacteria **or** some diseases are caused by viruses*

2

- (c) bacteria grow faster

*allow this is body temp (at which pathogens grow)*

1

[7]

**Q12.**

- (a) 0.67(%)

*allow 0.6 or 0.7*

*allow 1 mark for evidence of  $(2 \times 10^6) \div (3 \times 10^8)$*

**or**

*allow 1 mark for 0.0067 or 0.6*

2

- (b) (i) idea that food chains start with plants / producers

*allow food chains do not start with animals **or** larvae are consumers*

1

idea that these make food (for other organisms in the chain)

*allow idea that plants / producers photosynthesise **or** plants / producers get energy from the sun*

*allow mosquito larvae do not make food / photosynthesise **or** mosquito larvae do not get energy from the sun*

1

- (ii) any **four** from:

- reasoned argument for **or** against release  
*must refer to at least one advantage and one disadvantage.  
max 3 marks for either only advantages **or** only disadvantages*

advantages:

- fewer mosquitos biting **or** spreading malaria
- fewer people get / die from malaria  
*allow people won't get / die from malaria*
- lower medical costs (for those infected **or** for treatment) **or** less healthcare needed
- better economically for developing / tropical countries.

disadvantages:

- fewer crops reproduce  
*allow fewer crops pollinated*
- poorer crop yield
- possible starvation (of people)
- high cost of GM production / mosquito release
- less food for bats / birds **or** bats / birds die  
*allow disruption to food chain / ecosystem **or** reduction of biodiversity*
- gene could 'escape' into other wildlife / species

*ignore into plants*

4

(iii) any **three** from:

- gene from bacteria cut out  
*allow allele for gene*
- ref to enzymes (anywhere in process)  
*allow at any point in process, ie in cutting or in splicing*
- (gene) transferred to chromosome of mosquito  
*allow DNA for chromosome*
- at an early stage of development  
*allow egg / embryo*

3

[11]

### Q13.

(a) immune system

*allow white blood cells / lymphocytes*

*ignore phagocytes*

1

produces antibodies

1

(which) attack the antigens on the transplanted organ / pancreas

*allow transplanted organs have foreign antigens at start of explanation **and** linked to attacking the organ*

1

(b) (i) change / rise detected by the sensor

1

information used to calculate how much insulin she is going to need (bring her blood glucose back to normal)

1

(pump delivers) insulin into the blood

1

(causing) glucose to move into cells

*allow (liver) converts glucose to glycogen*

1

*max 2 if no ref. to artificial pancreas*

(ii) any **one** from:

- it is more accurate **or** less chance of human error
  - (glucose) level will remain more stable **or** no big rises and falls in blood sugar levels
  - you don't forget to test and / or inject insulin
  - if ill or in coma insulin is still injected
- ignore continuous and automatic unqualified*

1

[8]

### Q14.

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(a) 55%

*2 marks for correct answer alone  
accept 54 – 56  
5.5 / 10 × 100 alone gains 1 mark*

2

(b) any **three** from:

- amino acids
- antibodies
- antitoxins
- carbon dioxide
- cholesterol
- enzymes
- fatty acid
- glucose
- glycerol
- hormones / named hormones
- ions / named ions
- proteins
- urea
- vitamins
- water.

*ignore blood cells and platelets*

*ignore oxygen*

*max 1 named example of each for ions and hormones*

*allow minerals*

3

(c) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information in the Marking Guidance and apply a 'best-fit' approach to the marking.

**0 marks**

No relevant content.

**Level 1 (1 – 2 marks)**

There is a description of pathogens with errors or roles confused.

**or**

the immune response with errors or roles confused.

**Level 2 (3 – 4 marks)**

There is a description of pathogens **and** the immune response with some errors or confusion

**or**

a clear description of either pathogens **or** the immune response with few errors or little confusion.

**Level 3 (5 – 6 marks)**

There is a good description of pathogens **and** the immune response with very few errors or omissions.

**Examples of biology points made in the response:**



- bacteria and viruses are pathogens  
*credit any ref to bacteria and viruses*
- they reproduce rapidly inside the body
- bacteria may produce poisons / toxins (that make us feel ill)
- viruses live (and reproduce) inside cells (causing damage).

white blood cells help to defend against pathogens by:

- ingesting pathogens / bacteria / (cells containing) viruses  
*credit engulf / digest / phagocytosis*
- to destroy (particular) pathogen / bacteria / viruses
- producing antibodies
- to destroy particular / specific pathogens
- producing antitoxins
- to counteract toxins (released by pathogens)  
*credit memory cells / correct description*
- this leads to immunity from that pathogen.

6

[11]

**Q15.**

(a) (i) 64

1

(ii) 36

*allow e.c.f from (i) i.e. 100 – answer given in (a)(i)*

1

(iii) any **one** from:

- only considers 16-year-olds  
*ignore lack of evidence*  
*allow does not refer to all ages*
- only about some / 5 countries  
*allow does not refer to all countries.*

1

(b) the more exercise done the healthier a person is

*allow the more exercise done the higher the health rating**allow the less exercise done the lower the health rating*

1

(c) having a high cholesterol level

1

(d) (i) antibodies

1

(ii) antibiotics

1

[7]

**Q16.**

(a) leprosy



- allow bone / blood cancer*  
*ignore cancer* 1
- (b) (i) 6 / six 1
- (ii) from 1120 to 5600  
*allow from 5600 to 1120*  
*allow 4480 (alone)* 1
- (c) any **one** from:  
*ignore side effects, eg allergies*  
*ignore safety / harm unqualified*
- (test for) toxicity  
*allow poisonous*
  - (test for) dosage  
*allow idea of amount*
  - (test for) efficacy.  
*allow to see if it works*  
*allow to check for interaction with other drugs* 1
- (d) (i) any **two** from:  
*ignore reference to cost / addiction*
- more people take / use legal / non-prescribed drugs
  - legal / non-prescribed drugs are (more) readily available
  - alcohol causes liver / brain damage
- or**  
tobacco causes cancer.  
*allow harmful effects of other named legal non-prescribed drugs* 2
- (ii) addiction / dependency  
*allow withdrawal or examples of symptoms of withdrawal (if attempting to stop)* 1
- [7]

**Q17.**

- (a) microorganism / bacteria / virus / fungus that causes (infectious) disease 1
- (b) reduce / stop use of (current) antibiotics 1
- (reduce / stop use) for non-serious / mild / viral infections  
*allow ensure course is completed*  
*allow use of variety of antibiotics* 1





- (c) (i) 40 °C 1
- (ii) any **one** from:
  - microorganisms grow / reproduce / work / act faster
  - results / product acquired sooner 1

[5]

**Q18.**

- (a) any **two** from:
  - only one 'chromosome'  
*allow one strand of DNA*
  - circular  
*allow loop*
  - may have plasmids
  - not in a nucleus / no nucleus 2

- (b) (i) any **one** from:
  - London is much higher  
*or converse*
  - more variable / wider range  
*allow 'on average it is 5 / 6 times greater'* 1
- (ii) increases  
*Included figures must be correct* 1
- (iii) overall slight increase  
*accept 'doesn't change much'* 1
- variable / goes up and down 1

- (c) (i) both axes correctly labelled
  - x = Year
  - y = Number of cases 1
  - correct points  
*all correct = 2 marks*  
*1-2 errors = 1 mark*  
*> 2 errors = 0 marks* 2

suitable line of best fit  
*accept straight line or smooth curve*

(ii) doesn't fit the pattern / line of best fit

1

1

(d) provides immunity / protection (to TB)  
*ignore 'stops people catching it'*  
*ignore 'resistance'*

1

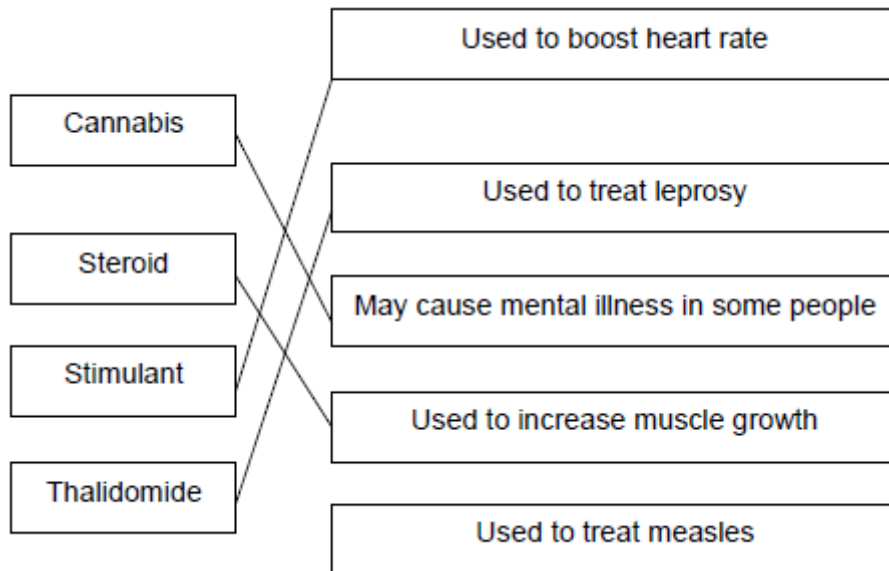
prevents TB spreading  
*accept ref to herd immunity*

1

[13]

**Q19.**

(a)



extra line from any drug cancels that mark

4

(b) (i) any **one** from:

- (live) animals  
*accept named examples, eg mice*  
*ignore people / volunteers*
- cells
- tissues  
*do **not** allow plants*

1

(ii) to check that the drug works

1

to find the best dose to use

1

(iii) only scientists at the drug company

1



- (c) (i) 420 1
- (ii) statin(s) 1
- (iii) any **one** from:
- side effects  
*allow cost*
  - other medication  
*allow patient choice*
  - other (medical) conditions  
*allow family history **or** age*
- 1

[11]

**Q20.**

- (a) mumps 1
- in either order rubella / German measles  
both needed for the mark  
ignore measles unqualified*
- (b) (i) 80(.0) 2
- allow 1 mark for  $\frac{504}{630}$  **or** 0.8*
- (ii) less chance of epidemic / pandemic 1
- or**  
less chance of spread of disease / measles / mumps / rubella  
*allow idea of herd immunity (increased protection for those who are not vaccinated)  
ignore less chance of getting the disease **or** to eradicate the disease*
- (c) (i) dead / inactive pathogens / viruses / bacteria 1
- allow antigens / proteins from pathogens / viruses / bacteria  
ignore microorganisms*
- (ii) white blood cells produce antibodies 1
- antibodies produced rapidly (on re-infection) **or** response rapid (on re-infection)  
*allow ecf if antibodies incorrectly identified in first marking point*
- 1



these antibodies kill pathogens / viruses / bacteria  
*do **not** accept idea that original antibodies remain in blood and kill pathogens*

1

- (d) (i) antibiotics don't kill viruses  
*allow antibiotics only kill bacteria*

1

(because measles) virus / pathogen lives inside cells  
*allow antibiotics do not work inside cells **or** killing virus / pathogen would kill / damage cell*

1

- (ii) (bacteria / pathogens) develop resistance (to antibiotic)  
*ignore reference to immunity*  
*ignore viruses develop resistance*

1

[11]

**Q21.**

- (a) pathogens

1

- (b) (i) A disease affecting people in many countries

1

- (ii) birds fly / migrate  
*accept converse*

OR

human contact with birds more likely  
*birds not contained / difficult to control movement*

OR

there are more birds (than pigs)

1

- (c) (i) antibiotics (only) kill bacteria  
*ignore flu is caused by a virus unqualified*

OR

antibiotics don't kill viruses  
*ignore virus resistant / immune*

1

- (ii) painkillers  
*accept any correct named painkiller, eg aspirin or paracetamol*  
*allow antivirals / Tamiflu*  
*ignore medicine / tablets*



	1
(iii) resistant	1
bacteria	1
<i>in this order</i>	

[7]

**Q22.**

- (a) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the [Marking guidance](#), and apply a 'best-fit' approach to the marking.

**0 marks**

No relevant content.

**Level 1 (1-2 marks)**

There is a brief description of at least one of the stages (pre-inoculation, inoculation, post-inoculation).

**Level 2 (3-4 marks)**

There is a simple description of at least two stages and an explanation of at least one of them.

**Level 3 (5-6 marks)**

There is a clear description of all three stages and an explanation of at least two of them.

**Examples of Biology points made in the response:*****Pre-inoculation***

- Petri dish and agar sterilised before use
- to kill unwanted bacteria
- inoculating loop passed through flame / sterile swab
- to sterilise / kill (other) bacteria

***Inoculation***

- loop/swab used to spread/streak bacterium onto agar

*Allow other correct methods, eg bacterial lawns*

- lid of Petri dish opened as little as possible
- to prevent microbes from air entering

***Post-inoculation***

- sealed with tape

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- to prevent microbes from air entering
- incubate
- to allow growth of bacteria

6

(b) (i) bacteria killed / destroyed  
*ignore fights / attacks / stops growth / got rid of*

1

(ii) *Might be correct*

largest area / space where no bacteria are growing  
*allow most bacteria killed*

1

*Might not be correct*

(need more evidence as) D may be harmful to people / animals / surfaces

*ignore ref to cost / dangerous or harmful unqualified*

1

**or** may work differently with different bacteria

**or** disinfectants may be different concentrations

*ignore different amounts of disinfectant unless reference to different drop size*

**or** may not last as long

*ignore take longer to work*

*allow reference to anomalous result or not repeated*

[9]

**Q23.**

(a) (i) any **one** from:

- (produce) toxins / poisons

- (cause) damage to cells

*kill / destroy cells*

*allow kills white blood cells*

1

(ii) produce antitoxins

1

engulf / ingest / digest pathogens / viruses / bacteria / microorganisms

*accept phagocytosis or description*

*ignore eat / consume / absorb for engulf*

*ignore references to memory cells*

1



- (b) (i) dead / inactive / weakened  
*accept idea of antigen / protein* 1
- (measles) pathogen / virus  
*ignore bacteria* 1
- (ii) (after infection)  
*accept converse if clearly referring to before vaccination* 1
- rise begins sooner / less lag time
- steeper / faster rise (in number) 1
- longer lasting **or** doesn't drop so quickly  
*idea of staying high for longer*  
*ignore reference to higher starting point* 1
- (iii) antibodies are specific or needs different antibodies  
*accept antigens are different **or** white blood cells do not recognise virus* 1
- (c) reduces spread of infection / less likely to get an epidemic  
*accept idea of eradicating measles* 1
- [10]**

**Q24.**

- (a) antibodies 1
- antitoxins 1
- antibiotics 1
- (b) any **two** from:
- measles
  - mumps
  - rubella / German measles
- 2
- (c) less / low / no chance of getting named or all condition(s) if vaccinated 1
- quantitative figure(s) eg 5 times less likely to get convulsions 1

[7]

**Q25.**

- (a) (i) viruses live inside cells 1
- viruses inaccessible to antibiotic  
*allow drug / antibiotic (if used)*  
*would (have to) kill cell* 1
- (ii) any **two** from eg 2
- non-resistant strains killed (by antibiotics)
  - so less competition
  - overuse of antibiotics / antibiotics prescribed for mild infections  
*if no marks gained allow one mark for 'people do not finish course of antibiotics'*
- (b) (stimulate) antibody production 1
- ignore antitoxin*
- (by) white cells 1
- rapidly produce antibody on re-infection  
*ignore antibodies remain in blood* 1

[7]

**Q26.**

- (a) 40 – 60 hours 1
- (b) (i) decrease 1
- 1<sup>st</sup> slowly then faster / appropriate detail from the graph – e.g. from 7.8 to 0 / faster after 4 – 10h 1
- (ii) oxygen after glucose 1
- extra box ticked cancels 1 mark*
- oxygen less than glucose 1
- (iii) respiration 1

[6]



**Q27.**

(a) (i) decrease 1

rate of decrease slows 1

(ii) any **one** from: 1

- more use of disinfectant  
*allow any reasonable increase in hygiene or sterilisation precautions*
- more use of hand washing
- more careful / more often cleaning of patient facilities
- raised awareness / education about hygiene

Explanation: 1

stops / reduces the bacteria being transferred / spreading

(iii)  $800 - 500 / 800 \times 100 =$  1

37.5 (%) 1

*correct answer with or without working gains 2 marks*

(iv) any **one** from: 1

- numbers quite low now so hard to reduce further
- was a big campaign / much publicity (in 2009) so more people already doing it
- hygiene / cleaning now good so hard to improve
- hospitals short of money so less staff to clean

(b) mutation occurred giving resistance (to methicillin) 1

*do **not** accept overuse caused mutation*

resistant bacteria not able to be treated / not killed 1

these bacteria multiplied / reproduced / spread quickly 1

**[10]****Q28.**

(a) sporozoites (from mosquito saliva) divide / multiply / reproduce 1

*ignore schizonts*

*do **not** accept sexual reproduction*

become thousands / many (of merozoites) 1



merozoites released (from liver) into blood / red blood cells

1

(b) any **three** from:

*answer must include at least one pro **and** one con for full marks*

- reduces incidence of disease = **pro**
- success in mice indicates likely success in humans = **pro**  
*accept stops people getting malaria*
- but success in mice does not ensure success in humans **or** needs to be trialled in humans  
**or** need to check for side effects = **con**
- removal of genes should prevent parasite multiplying in liver **or** release of parasites into blood = **pro**  
*allow you should not get malaria / the disease from these parasites*
- the injected parasite stimulates antibody production = **pro**
- but still possible danger since living parasite injected into human = **con**
- possible liver damage = **con**

3

[6]

### Q29.

(a) (i) lower percentage (of women) who died  
*allow fewer (women) died*

1

numerical reference to a pair of figures to show this  
*allow any difference in a pair of figures*

1

(ii) doctors were not transferring  
*ignore reference to nurses*

1

pathogens / bacteria / viruses / microorganisms / microbes  
*allow fungi*  
*ignore disease / germs / infection*

1

(b) any **three** from:

- lower percentage of patients died (when doctors washed hands or in ward A)  
*allow fewer for lower percentage*
- large decrease or reference to proportional decrease  
*ignore raw data*
- little / no difference / similar to ward B
- continued drop (in ward A)

3



(c) any **two** from:

- better understanding / knowledge of immunity  
*accept ref to immunisation / vaccination*
- better / new drugs  
*accept examples, e.g. antibiotics / penicillin (discovered)*  
*allow better / new medicines*
- sterilisation of equipment **or** isolation of patients **or** some infectious diseases wiped out **or** earlier identification / treatment of infections  
*ignore references to general hygiene*

2

**[9]****Q30.**

(a) (i) 25°C

1

(ii) pathogens

1

(b) **D**

1

more / most bacteria killed

*accept biggest area / ring where no bacteria are growing*

1

(c) viruses live inside cells

1

**[5]****Q31.**

(a) (i) addictive

*allow addicting / addict / addicted / addiction or similar*

*allow phonetic spelling*

*do **not** accept / additive / addition*

1

(ii) junction / gap / space between neurones

*allow nerve cells / nerves for neurones*

*allow idea where neurones /*

*nerve cells / nerves meet / join*

1

(b) (i) tablet with no drug

*accept answers that convey this idea eg fake / dummy / sugar pill*

*allow injection with no drug*

*ignore drugs that don't work.*

1



- (ii) for comparison  
*accept to see if drug / it works*  
*allow to see psychological effect **or** make sure, it is not all in the mind*  
*allow as a control*  
*ignore 'to make test fair / unbiased'* 1
- (iii) Neither doctors nor volunteers 1
- (iv) any **two** from:  
 • age (range)  
 • sex / gender (mix)  
 • previous smoking habits **or** eg number smoked (before trial) **or** length of time smoked  
 • number in the group  
 • other drugs being taken **or** general health **or** height / weight / BMI / lifestyle / fitness  
*ignore factors already controlled*  
*ignore reference to all smokers **or** all want to give up* 2
- (c) higher percentage / number of smokers who had stopped smoking (than Drug B)  
*answers must refer to data and be comparative*  
*allow best results / most effective*  
*ignore best drug unqualified*  
*ignore references to 12 weeks / 1 year* 1

**[8]****Q32.**

- (a) both lead to reduction / fall (in measles cases)  
*can be implied* 1
- measles vaccine caused a big drop **or** correct use of figures 1
- MMR wipes out measles **or** drops to (almost) zero **or** doesn't fall as much as measles vaccine **or** correct use of figures. 1
- (b) mump(s) 1
- rubella / german measles  
*either order*



*allow phonetic spelling*

1

(c) white blood cells

*allow lymphocytes / leucocytes*

*ignore memory cells*

1

(wbc) produce antibodies

*ignore antitoxins / antigens / antibiotics / engulfing*

1

in future / if re-infected antibody production rapid / fast(er) / quick(er)

*allow ecf from antitoxins / antigens / antibiotics*

*ignore engulfing*

*ignore reference to specificity*

1

[8]

**Q33.**

(a) (i) any **one** from:

- cells
- tissues
- (live) animals / named  
*allow mammals*

1

(ii) any **three** from:

(to test for)

- toxicity / check not poisonous / not harmful  
*allow side-effect*  
*allow converse*
- interaction with other drugs
- efficacy **or** to see if they work **or** check if they treat the disease  
*allow converse*
- dosage **or** how much is needed

3

(b) **argued evaluation**

*comparison can be written anywhere in evaluation allow use of 'only' for implied comparison for each point eg **only** statins damage muscles / kidneys / organs*

any **six** from:

- statin can damage / muscles / kidneys / organs but cholesterol blockers don't



*ignore liver*

*if neither of the first 2 points are given accept for 1 mark*

- statins can cause death but cholesterol blockers don't  
*statins are more dangerous than cholesterol blockers or statins have more side effects*
- cholesterol blockers can interfere with action of other drugs but statins don't
- statins are for a life time but cholesterol blockers are not
- statins (might) reduce cholesterol to zero but cholesterol blockers only reduce it **or** statins reduce cholesterol more  
*allow statins (might) stop membrane / hormone production but cholesterol blockers don't*
- statins better for people with inherited high cholesterol
- cholesterol blockers better for people with dietary cholesterol problems
- taking/using statins/cholesterol blockers is better than dying from heart attack or build up of fat in blood vessels or reduced blood flow

6

[10]

### Q34.

(a) hearsay

1

(b) (volunteers with feet in) empty bowls

*accept bowl with no (iced) water*

*do **not** accept mention of bowl with iced water*

1

(c) any **three** from:

*ignore control variables, eg age, gender*

- only some of those whose feet were in cold water caught colds
- some controls caught colds
- only feet were cold in experimental group  
*allow (control) not wrapped up warm*
- only kept feet in cold water for 20 minutes
- insufficient evidence for 'proof' / only showed increased risk  
*allow small sample size*
- don't know activities of individuals before / after the investigation (eg exposure to cold virus) / reference to immune system  
*allow investigation done in 'cold season'*

3

[5]

**Q35.**

- (a) (i) kills / gets rid of / reduces methane bacteria  
*allow kills / gets rid of / reduces bad bacteria*  
*ignore acts like antibiotic* 1
- (ii) less food converted to methane  
*allow can keep more cattle without further environmental damage*  
*ignore energy* 1
- more growth / meat / muscle / milk produced / more profit / fatter animals  
*ignore references to bacteria and disease* 1
- (b) absorbs energy / heat radiated by Earth  
*allow absorbs / traps energy / heat / from Earth*  
*do **not** allow absorbs energy / heat from Sun* 1
- some energy / heat reradiated  
*ignore reflected*  
*do **not** allow reradiates energy / heat from Sun* 1
- leading to global warming / enhanced greenhouse effect  
*accept effects of global warming eg melting ice caps*  
*accept methane is a greenhouse gas*  
*ignore references to ozone* 1

**[6]**





**Q1.**

- (a) dead or inactive or weak form of pathogen / bacterium / virus / microorganism introduced  
*ignore disease / germ* 1
- (stimulates) white cells / lymphocytes / leucocytes  
*accept B and T cells*  
*ignore phagocytes* 1
- to produce antibodies  
*ignore antitoxins / antigens* 1
- antibodies made quickly on re-infection / idea of memory cells  
*ignore already has antibodies*  
*ignore 'body remembers'* 1
- (b) (i) alters / causes chemical processes / body chemistry  
*ignore craving / withdrawal symptoms* 1
- (ii) any **two** from:
- combined molecule / vaccine stimulates antibody production
  - if nicotine taken, antibodies bind to nicotine molecules  
*ignore destroys nicotine*
  - making them too large to get to brain / making them ineffective  
*allow prevents nicotine entering brain* 2

[7]

**Q2.**

- (a) don't kill pathogens / bacteria / viruses / microbes / microorganisms  
*allow don't contain antibiotics*  
*ignore antibodies / attack / fight*  
*allow only treat symptoms / pain*  
*ignore kill disease / germs* 1
- (b) any **two** from:
- age
  - gender
  - extent / severity of pain



- or how long had pain before trial
- type of pain / illness / site of pain  
*accept 'the pain' for 1 mark, if neither extent or type given  
ignore pain threshold*
  - (body) mass / weight / height  
*allow body size / physique*
  - other medical issues / drugs taken / health / fitness
  - ethnicity
- 2
- (c) (i) 75  
*ignore calculations / %*
- 1
- (ii) faster pain relief / decrease  
*allow pain relief sooner  
or it works quicker*
- $\frac{3}{4}$
- or more pain relief at start / in first  $1 \frac{3}{4}$  hours*
- 1
- (iii) decrease of pain higher / more
- $\frac{3}{4}$
- ignore more effective unless qualified by time  $> 1 \frac{3}{4}$   
hours allow effect lasts longer*
- 1
- decrease of pain is longer lasting
- 1
- (d) any **three** from:  
*ignore yes or no*
- (Yes because)**
- rapid pain relief (from A)
  - long lasting pain relief (from B)
  - and it costs less
  - the sum of the pain relief (from A + B) is greater (than X)
- (No because)**
- drug X gives more pain relief
  - (A + B / they ) might interact with each other
  - could result in overdose



- could be more / new side effects  
*if neither points gained*  
*allow (more) dangerous*

3

[10]

**Q3.**

- (a) (i) dead / inactive / weakened  
*allow antigen / protein*  
*ignore ref to other components*  
*ignore small amount*

1

pathogen / bacterium / virus / microorganism  
*ignore germs / disease*

1

- (ii) *antigen / antibiotic instead of antibody = max 2*

white blood cells produce / release antibodies  
*accept lymphocytes / leucocytes / memory cells produce antibodies*  
*do **not** accept phagocytes*

1

antibodies produced quickly

1

(these) antibodies destroy the pathogen  
*allow kill*  
*do **not** accept antibodies engulf pathogens*

1

- (b) (i) (live) bacteria still in body  
*ignore numbers*

1

would reproduce  
*ignore mutation / growth*

1

- (ii) antibiotics / treatment ineffective **or** resistant pathogens survive  
*accept resistant out compete non-resistant*

1

these reproduce

1

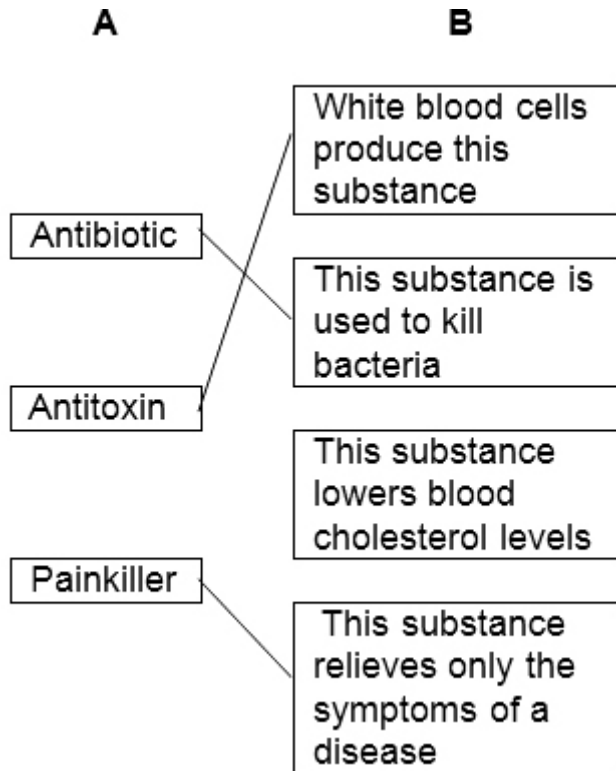
population of resistant pathogens increases  
*allow (resistant pathogens reproduce) rapidly*

1

[10]

**Q4.**

(a)



*1 mark for each correct line  
mark each line from left hand box  
two lines from left hand box cancels mark for that box*

3

(b) inactive

*allow weak / dead / un-living / safe*

1

rubella

*apply list principle, but ignore measles and mumps*

1

**[5]**

**Q5.**

(a) any **two** from:

*ignore eating disorder  
ignore cancer*

- arthritis  
*accept worn joints*
- diabetes  
*accept high blood sugar*
- high blood pressure  
*ignore cholesterol*



- heart disease / heart condition / heart attack / blood vessel disease  
*allow blood clots / strokes*

2

- (b) (i)  $\frac{1}{4}$  or 0.25 or 25%

*correct answer gains 2 marks*

*if answer incorrect, evidence of  $1500 \div 6000$  gains 1 mark*

*25 without % gains 1 mark*

2

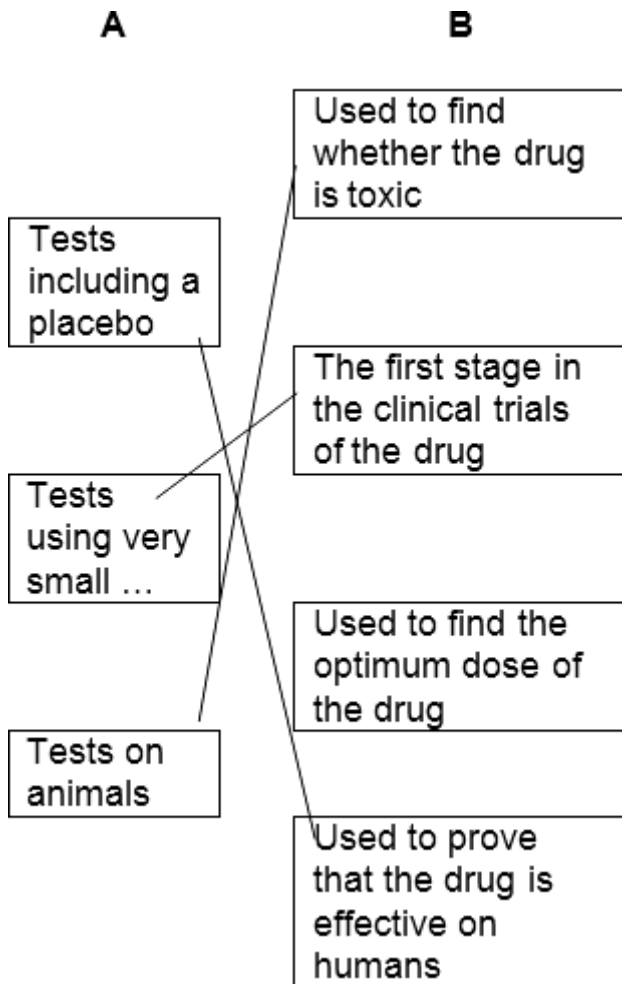
- (ii) majority / most / high proportion of people in trial lost mass / weight  
*ignore good results / it worked*

1

[5]

**Q6.**

(a)



*1 mark for each correct line*

*mark each line from left hand box*

*two lines from left hand box cancels mark for that box*

3

- (b) any **three** from:



*Students have been informed that the headline is not justified*

- reference to reliability, eg only a small number of mice tested  
**or** trial too short  
**or** investigation not repeated
  - reference to control, eg mice given caffeine not coffee  
**or** 6 cups (equivalence) is more than 1 dose
  - (and) the effect on mice might not be same as on humans  
*allow only tested on mice*
  - (also) text suggests that the treatment improves memory loss (rather than delays it)  
*accept text suggests disease cured*
- or** mice already have memory loss or experiment only showed improvement in memory  
**or** does not show **delays** Alzheimer's  
**or** experiment not done on old mice  
*allow reference to the fact that mice engineered to have it*

3

[6]

**Q7.**

- (a) 18.06 / 18 / 18.1

*correct answer gains 2 marks*  
*if answer incorrect evidence of*  
 $(4131 - 3499) \div 3499 \times 100$   
**or**  $632 \div 3499 \times 100$   
**or**  $((4131 \div 3499) \times 100) - 100$   
**or** 0.18  
*gains 1 mark*

2

- (b) antibiotics kill non-resistant strain  
**or** resistant strain bacteria survive  
*accept resistant strain the successful competitor*  
*do **not** accept intentional adaptation*  
*ignore strongest / fittest survive*  
*ignore mutation*  
*ignore people do not finish antibiotic course*

1

resistant strain bacteria reproduce  
**or** resistant strain bacteria pass on genes

1

population of resistant strain increases **or** proportion of resistant bacteria increases  
*allow high numbers of resistant bacteria*



**or**  
people more likely to be infected by resistant strain (than non-resistant strain)

1

[5]

**Q8.**

- (a) cell division / bacterium divides / multiplies / reproduces  
*allow asexual / mitosis*  
*ignore growth*

1

- (b) 18

1

18 000 /  $18 \times 10^3$  /  $1.8 \times 10^4$   
*do not accept 1.8 /  $1.8^{04}$  /  $1.8^4$*   
*allow ecf from wrong count*

1

- (c) to kill / destroy other microorganisms / named type  
**or** to prevent contamination  
*ignore germs / viruses*

1

to prevent other microorganisms affecting the results  
**or** other microorganisms would be counted  
*allow to give accurate / reliable results*

1

- (d) prevent growth of pathogens / disease-causing microorganisms / dangerous microorganisms  
*do not accept microorganisms become pathogenic*  
*ignore germs / viruses*  
*ignore general safety / biohazards / harmful products produced by bacteria*

1

- (e) to improve the reliability of the investigation / check for anomalies  
*do not accept accuracy / precision / fairness / validity*  
*ignore averages / repeatability / reproducibility*

1

[7]

**Q9.**

- (a) kills / destroys bacteria / MRSA  
*do not allow germs*

1

prevents / reduces transfer  
*allow stops MRSA entering ward*



- (b) mutation  
*do **not** accept antibiotics causes mutation*
- (causes) resistance  
*allow not effective*  
*ignore immunity*
- to antibiotics

1

1

1

1

[5]

**Q10.**

- (a) any **two** from:
- (high) CRP / protein
  - (no) heart condition  
*allow health*
  - (not high) LDL
  - over 50 / age
  - number of tablets (each day)  
*ignore time*  
*ignore placebo / rosuvastatin*  
*ignore number of people*
- (b) any **one** from:
- tablet with no drug  
*allow fake (pill) / dummy (pill) / sugar / chalk (pill)*
  - tablet that has no effect  
*allow drug that has no effect*
  - tablet without chemicals  
*ignore vitamin / mineral pill*
  - tablet that people thought contained statin **or** reference to psychological effect  
*ignore control / different statin*
- (c) 17802 / large number of people **or** enough people  
*ignore control group / fair test / control variables*  
*ignore time / repeats*

2

1

1





- (d) any **one** from:
- ignore cost*
  - placebo group at risk of heart attack **or** to allow statin to be given to everyone
  - statin group 54% less likely to get heart attack **or** showed that statin worked **or** showed trial (very) successful  
*ignore reliable*
  - sufficient information gained / results conclusive  
*ignore got results early*
  - unethical / unfair to carry on trial
- 1
- (e) to avoid bias **or** show impartiality **or** show results independent
- allow manufacturers could cheat*
  - ignore reliability*
  - ignore could be sued / blamed if trial went wrong*
  - ignore manufacturer would know which group got statin / placebo*
- 1
- (f) any **two** from:
- reduction in LDL  
*allow improves LDL:HDL balance **or** LDL and HDL concentrations equal*  
*ignore less cholesterol*  
*ignore more HDL*  
*do **not** accept less HDL*
  - reduction in (saturated) fats
  - reduces deposition of fat / cholesterol / LDL in walls of blood vessels  
**or**  
blood vessels less likely to be blocked with fat / cholesterol / LDL
- 2

**[8]****Q11.**

- (wbc) ingest / digest pathogens / bacteria / viruses
- allow eat germs*
  - ignore swallow germs*
  - ignore ingest the disease*
  - ignore attack / kill the disease*

1

(wbc) produce antibodies

1

(wbc) produce antitoxins

1



any **one** from:

- (antibodies) destroy or kill pathogens / bacteria / viruses / germs  
*ignore destroy / kill disease*  
*ignore attack / fight pathogens*
- (antitoxins) counteract / destroy / neutralise toxins / poisons  
*ignore attack / killing toxins*
- reasonable reference to memory cells **or** rapid production of antibodies upon re-infection

1

**[4]****Q12.**

(a) measles

1

mumps

1

rubella

1

(b) antibodies

1

(c) (i) any **two** from:

- fell
- then rose
- any reasonable amplification eg until 2004 / to 80%
- flattens off (between 1999–2000)

2

(ii) eg fear of side effects

**or**

cost of vaccine

**or**

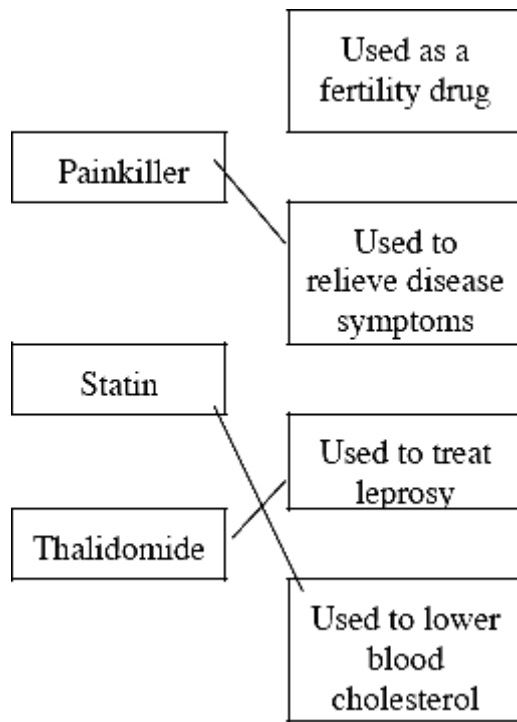
lack of vaccine

**or**

complacency / disease less common

1

**[7]****Q13.**



(a)

*all three correct = 3 marks  
two correct = 2 marks  
one correct = 1 mark  
extra line from a statement cancels the mark*

3

(b) (i) 8

1

(ii) 3210

1

(c) (i) if it is toxic

1

(ii) if it has side effects

1

[7]

**Q14.**

(a) testing for toxicity / see if it is safe / see if it is dangerous / to see if it works  
*ignore side effects unqualified*

1

(b) (i) testing for side effects / testing for reactions (to drug)  
*ignore to see if it works  
do **not** accept dosage*

1

(ii) any **one** from  
*ignore immune system*



- dose too low to help patient
  - higher risk for patient
  - might conflict with patient's treatment / patient on other drug
  - effect might be masked by patient's symptoms / side effects clearer
- (c) to find optimum dose
- allow testing on larger sample or it makes results more reliable*
- allow to find out if drug is effective / find out if drug works on ill people (not just if drug works)*
- (d) (i) (tablet / drug / injection) that does not contain drug
- allow control / fake / false*
- allow tablet / injection that does not affect body*
- do **not** accept drug that does not affect body*
- (ii) neither patients nor doctors

1

1

1

1

[6]

**Q15.**

- (a) produces toxins / damage cells / reproduce rapidly **or** reproduce in cells
- ignore invade cells*
- (b) any **three** from:
- TV crew immune / Indians not immune / Indians have weak(er) immune system
  - ignore resistant*
  - TV crew had / produced antibodies / Indians had no antibodies **or** antibody production faster in TV crew
  - TV crew had previous exposure to flu / had been vaccinated **or** Indian tribe had no previous exposure to flu / had not been vaccinated
  - allow immunised*
  - Indians caught disease from TV crew **or** TV crew were carriers (of the virus)

1

3

[4]

**Q16.**

- (a) (i) inoculating loop



		1
(ii)	V	1
	W	
	<i>either order</i>	1
(iii)	Z	1
(b)	carbohydrates	1

[5]

**Q17.**(a) any **two** from:

- arthritis  
*allow damaged joints*
- diabetes  
*accept high blood sugar*
- high blood pressure
- strokes  
*allow blocked blood vessels / thrombosis*
- allow breathing difficulties  
*ignore cancer*  
*ignore high cholesterol*

2

(b) (i) any **two** from:

*to gain marks there must be a comparison*  
*ignore comparison at single age*

- lower number of women deaths up to age of 75-80
- higher number of women deaths after 80  
*ignore women die older or men die younger*
- men's peak higher
- men's peak at an earlier age
- men's death start earlier than women
- more men than women die of heart disease

2

(ii) any **two** from:



- men smoke more (cigarettes)  
*ignore alcohol*
- more men smoke
- men under more stress
- men less active
- more men overweight / eat more / less diet conscious **or** different fat distribution  
*ignore reference to body size*
- genetic factors
- men might have lower metabolic rate  
*ignore references to hormones*
- men less likely to visit doctor even though they have symptoms

2

(c) *points can be in any order*

laboratory tests / tests on tissues

**or**

tests on animals

**or**

tests for toxicity

*ignore computer simulations*

1

tests for side effects on volunteers / healthy people / small numbers

1

widespread testing

**or**

testing for optimum dose

**or**

test on patients / sick people

**or**

test to see if it is effective

*accept use of placebo*

1

**[9]****Q18.**

(a) antibodies

*allow antitoxins / memory cells*

*do **not** allow antigens*

1

immune

*ignore protection*

*allow resistant*



- (b) (i) fell 1
- numerical qualification to zero / nothing / by 100%  
*allow stopped in 1995* 1
- (ii) (no) 1
- ignore circle*
- % vaccination fell **or** when no vaccination  
but autism numbers did not fall / stayed high / increased  
**or**  
'(yes) might support it if time lag between vaccination and autism symptoms' / 'time lag for diagnosis' (1)  
6 year time lag quantified (1) 1

[6]

**Q19.**

- (a) any **two** from:
- sterilise / kill microorganisms  
*ignore 'cleaning' / 'disinfect'*  
*ignore 'germs'*
  - method of sterilisation eg apparatus / media sterilised in oven / autoclave  
*allow pressure cooker / boiling water*
  - pass flask mouth / pipette tip / loop / test tube mouth through flame
  - work near a flame
  - minimise opening of flask / test tube **or** hold non-vertical  
*allow idea of sealing / covering or prevent entry of air*
- (b) any **two** from:
- temperature  
*ignore references to time / type of bacterium*
  - concentration / amount of nutrients / ions
  - type of nutrient
  - volume / amount of solution



- amount of bacteria added
  - agitation **or** amount of oxygen
- (c) (i) 7.5  
*accept in range 7.4 – 7.6*
- (ii) use more pH values around / close to pH 7.5 / between 7 and 8

2

1

1

**[6]****Q20.**

- (a) (i) 12  
*correct answer with **or** without working  
if answer incorrect evidence of (number of deaths) × 6 **or** 2  
seen gains 1 mark*
- (ii) (ward 2)  
more deaths / infections on ward 1  
**or**  
less deaths / infections on ward 2
- (b) (i) **both** bars correctly plotted  
*ie plots in spaces between 2.8 and 3.2 **and** 0.8 and 1.2  
ignore width and shading*
- (ii) less deaths / infections
- (iii) bacteria / germs / microbes / infection killed / washed off  
*accept less infections passed on*

2

1

1

1

1

**[6]****Q21.**

- (a) any **two** from
- live inside / infect body cells
  - difficult for drugs to enter (body) cells / drug would kill (body) cell
  - antibiotics ineffective against viruses
  - viruses mutate **frequently**

2





(b) (i) 420

*correct answer with **or** without working*

*if answer incorrect evidence of 'number of deaths'  $\times 7$  **or** 60  
seen gains **1** mark*

*ignore 6 000 000*

2

(ii) any **three** from:

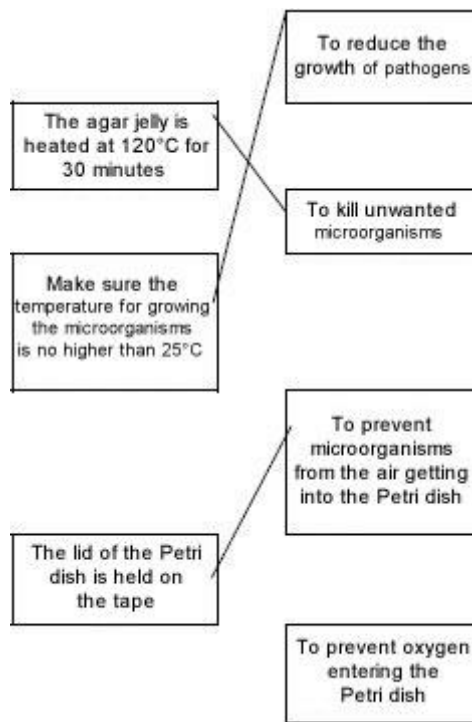
- virus / flu mutates
- people no longer / not immune  
*ignore resistance*
- white blood cells / memory cells / immune system do not recognise virus
- relevant reference to antibodies / antigens
- current vaccine ineffective **or** no vaccine available then **or** takes time to develop new vaccine  
*allow no tamiflu / anti-viral drugs*
- conditions less hygienic / lack of hygiene
- people in poor health (following world wars)  
*allow people had 'weak' immune system*

3

[7]

## Q22.

(a) **List A – Action      List B – Effect**



*1 mark per correct line  
each extra line cancels 1 mark*

3

- (b) (i) dish 2 has (colonies of) microorganisms / bacteria / (but there are none in dish 1)

*allow fungi / pathogens / microbes / germs  
allow more microorganisms in dish 2*

1

- (ii) untreated milk contains living microorganisms

**or**

microorganisms killed by UHT

**or**

no living microorganisms in UHT milk

*ignore microorganisms enter from the air*

1

- (iii) dish 3 was not opened

*do **not** allow no growth of microorganisms because of lack of air / oxygen*

**or**

it was sterilised

*ignore microorganisms cannot enter from the air*

**or**



nothing / no milk was added

1

[6]

**Q23.**

(a) (i) lives inside cells

1

(ii) inactive

1

(iii) antibodies

1

(b) (i) 1950

1

(ii) 8 (years)

1

(iii) any **one** from: eg

- disease could be reintroduced (from abroad)  
*disease might come back insufficient*
- disease would spread if it came back
- protection on holiday abroad
- high proportion of immune people needed to prevent epidemic

1

[6]

**Q24.**

(a) any **three** from:

- vaccine is inactive / dead form of (pathogen)  
*allow antigens*
- stimulates antibody production
- stimulates antitoxin production
- by white cells
- antibodies kill (pathogen)
- antitoxins neutralise poisons
- antibodies quickly produced on reinfection  
*ignore antibodies remain in blood*
- reference to ingestion by white cells

3



(b) (i) (no)

any **two** from

- sample size small / only 12
- conclusion based on hearsay from parents
- only 8 parents linked autism to MMR
- no control used

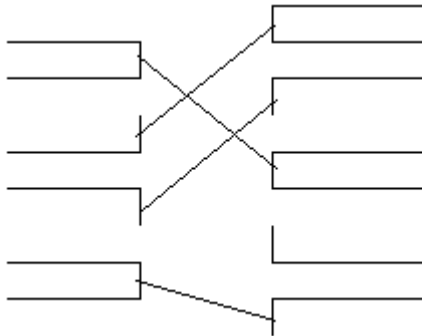
2

(ii) (yes)  
being paid by parents / lawyers

1

[6]

**Q25.**



*1 mark for each line  
extra line from List A Action cancels the mark*

[4]

**Q26.**

(a) (i) antibiotic or named antibiotic  
*ignore antibodies  
accept antiseptic  
do **not** accept disinfectant*

1

(ii) painkillers  
*accept named painkillers eg aspirin*

1

(b) (i) 5.5 / 5 ½ weeks

1

(ii) rose gains **1** mark  
rose, then fell then rose again gains **2** marks



a further **1** mark for **one** quantitative statement eg

- rose for 3 weeks / to 14–15 units
- dropped to 4 weeks / 9 units
- rose to 7 weeks / 64–65 units

3

(iii) (no)

level begins to fall / is falling (after 7 weeks)

1

**[7]****Q27.**

(a) (bacteria) produce toxins / poisons

1

(viruses) damage / kills cells **or** toxins released from cell

1

(b) any **two** from:

- viruses live inside cells
- viruses inaccessible to drug
- drug would damage body cells / tissue

2

(c) any **four** from:

- overuse of antibiotics
- bacteria mutate  
*do **not** allow antibiotic causes mutation*
- antibiotics kill non-resistant strains **or** idea of selection
- reduced competition
- resistant bacteria reproduce

4

**[8]****Q28.**

(a) antibodies

1

antitoxins

1

antibiotics

1



- (b) any **two** from:
- measles
  - mumps
  - rubella / German measles
- 2
- (c) less / low / no chance of getting named / all condition(s) if vaccinated
- 1
- quantitative figure(s) e.g. 5 times less likely to get convulsions  
*must be comparative*
- 1
- (d) enzymes
- 1
- genes
- 1

[9]

**Q29.**

- (a) any **two** from:
- virus is neutral*
- resistant to (most) antibiotics
  - contagious **or** easily passed on **or** reference to open wounds
  - patients ill therefore less able to combat disease
- 2
- (b) (i) chloride of lime / hand washing killed bacteria (picked up from corpses)  
*allow disease / germs / infection / disinfectants*
- 1
- (ii) people to wash hands after contact with patient
- 1
- so bacteria / pathogen / MRSA not transferred to other patient
- 1

[5]

**Q30.**

- (a) (i) 56
- accept 54 – 58*
- 1
- (ii) increased
- 1
- reasonable qualification eg slowly then more quickly  
**or**



to 174 / 176

**or**

by 138 / 140

1

(b) any **two** from:

- no immunity **or** antibodies ineffective  
*accept no resistance*
- no vaccines **or** humans not immunised
- idea of large scale contact **or** large scale travel  
*do **not** accept passed on*  
*ignore no cure*

2

[5]

### Q31.

(a) (i) viruses live inside cells

1

viruses inaccessible to antibiotic

*allow drug / antibiotic (if used) would (have to) kill cell*

1

(ii) mutation

*ignore mutation caused by antibiotic*

1

natural selection **or** no longer recognised by antibiotics

*accept description of natural selection*

1

(b) (stimulate) antibody production

*ignore antitoxin*

1

(by) white cells

1

rapidly produce antibody on re-infection

*ignore antibodies remain in blood*

1

[7]

### Q32.

(a) dirty clothes/equipment/hands passed bacteria

*allow bacteria from any sensible source e.g. surgeon, floor*

**OR**

ease of entry of bacteria (during operations)



	<i>do not accept germs</i>	1	
(b)	fewer died	1	
	indication of reduced number <b>or</b> proportion <i>e.g. 3000 → 600</i> <i>down by 2400</i> <i>20% of previous deaths</i>	1	
			<b>[3]</b>
<b>Q33.</b>			
(i)	kills / destroys <u>bacteria</u> <b>or</b> prevents growth of <u>bacteria</u> <i>do not allow germs</i> <i>do not allow fights or gets rid of</i>	1	
(ii)	any <b>two</b> from:  bacteria may be resistant / immune (treatment futile) <b>or</b> bacteria would not be killed <i>accept descriptions from table</i> <i>accept "fights" here</i> <i>do not accept people resistant</i>  may select for resistant type  may cause increased incidence of resistance or Penicillin less effective in future  sore throat might be due to a virus – Penicillin would not work	2	
			<b>[3]</b>
<b>Q34.</b>			
(a)	measles  <i>ignore mumps</i>	1	
	rubella  <i>accept German measles</i>	1	
(b)	viruses are 'dead'  <i>accept other viral treatments</i> <i>accept 'non-virulent'</i> <i>mild' must be qualified</i> <i>do not accept 'small dose'</i>	1	





- (c) *The answer to this question requires good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.*

*Maximum of 4 marks if ideas not well expressed*

any **five** from:

contains antigens or proteins

*accept reference to immunological  
memory or memory cells'*

white cells (accept lymphocytes)

*do not accept phagocytes*

idea of specificity in antibodies or antigens

antibody production

*ignore engulfing*

antigens destroyed / virus destroyed

rapid antibody production if infected

max 5

- (d) antibiotics do not kill / affect viruses

1

[9]

**Q35.**

- (a) (i) diagram shows extensions of intact cell membrane around viruses

1

- (ii) antibodies

*allow enzymes re (ii)*

*allow interferon*

*ignore antitoxins / proteins*

1

- (b) virus is transferred

1

(virus in) blood / body fluids – transfer (via needles)

1

[4]

**Q1.**

- (a) antibiotics diffuse / pass (into agar)  
*do **not** allow into dish* 1
- kill / prevent growth of bacteria or destroy cell wall / bacteria  
*accept bacteria are dead* 1
- (b) it / higher concentration kills more bacteria **or** causes less growth  
*do **not** accept anything referring to size of circle* 1



levels off (at 6 units)

*accept above 4 units*

1

(c) **Quality of written communication:**

for correct sequencing or linking of ideas or points

*this mark can only be awarded for a plausible attempt (not necessarily biologically correct) to link a precaution to a purpose*

*Q ✓ or Q ✗*

1

Loop flamed

to sterilise it / kill unwanted microorganisms

*accept so no bacteria present do **not** accept to clean it*

1

Lid taped

prevent bacteria getting in / out **or** prevent someone touching bacteria

*accept microorganisms/fungi for bacteria*

*do **not** accept viruses or germs*

1

25°C

prevents / reduces growth of / reproduction

1

harmful bacteria / microorganisms or pathogens

1

(d) any **two** from:

- to avoid over-use of antibiotics **or** use no / less / low concentration antibiotics
- select antibiotic that is most effective
- finish the course
- don't give or use for animals
- develop new antibiotics **or** alternatives

2

[11]

**Q2.**

(a) decrease in number of deaths (after vaccination started)

1

(b) in correct sequence:

bacteria

1



white blood cells

1

antibodies

1

[4]

### Q3.

#### Quality of written communication

*for correct use of at least **two** scientific terms eg mutation, resistant (**not** just 'antibiotic-resistant', **not** 'immune') / selection / natural selection / survival / reproduction / gene / allele / DNA*

1

any **two** from:

mutation occurs in bacteria or change in DNA / gene occurs  
*cancel if mutation 'caused by' antibiotic*

(when antibiotic used) only resistant bacteria survive **or** non-resistant bacteria are killed **or** reference to 'natural selection'

resistant bacteria pass on the gene / allele  
*allow pass on the mutation*  
*do **not** accept just 'pass on resistance'*

2

[3]

### Q4.

(a) measles mumps rubella / German measles  
*any order*

1

(b) **Quality of written communication:**  
*for giving at least **two** statements linked to vaccination*

1

any **four** from:

*NB max **3** marks for only one side of argument*  
*do **not** accept economic argument*

a valid reference to pain  
*eg pain of vaccination / disease*

should

protect against diseases

measles / mumps / rubella are dangerous diseases / can cause lasting harm / death

cannot be treated by antibiotics



problem of epidemics

should not

may suffer autism / damage to mental / social development

may suffer large intestine disorders

separate vaccines available that cause no / less problems

4

[6]

**Q5.**

(i) the loop is sterilised

*accept to kill anything on the loop*

**or**

to kill any bacteria on it;

*do not credit to clean the loop*

1

(ii) if hot it would kill bacteria picked up (from culture);

*accept 'microorganisms' or 'microbes'*

*accept entry of contaminated air but reject entry of air unqualified*

1

(iii) to prevent entry (from the air) of unwanted bacteria or bacterial spores or fungal spores;

*accept so can't breath on it*

*accept 'microorganisms' or 'microbes'*

1

(iv) so that the (petri) dish is not opened (after bacteria are cultured)

**or** to reduce evaporation

**or** drying of the agar,

*accept 'microorganisms' or 'microbes'*

*accept to prevent anything relevant getting in/out*

*reject references to spillage*

1

[4]

**Q6.**

(a) antibodies;

*if incorrect term used then penalise in (a) then regard as continuous error for rest of question*

1

(b) antibodies remain (for several years)

**or** are not removed

*accept last a long time **or** not destroyed*

***or** continues to make antibodies*



- or causes increased number of antibodies or more antibodies  
or stays in body or person has made own antibodies  
or if memory cells named must link to antibody production*
- 1
- (c) antibodies removed (from blood);  
*accept destroyed or  
unable to make or  
replace antibodies or  
they are not human antibodies or  
person has not made own antibodies*
- 1
- (d) so more antibodies made;  
*accept so enough antibodies made  
or so correct amount of antibodies present or to keep antibodies high  
or so body keeps making antibodies*
- 1
- (e) any **two** from
- already has tetanus bacteria in body;  
*accept could boost infection or make it worse*
- would take too long **or**  
a long time for antibodies to be made;  
*accept too slow forming antibodies  
or cannot form correct amount of antibodies*
- disease would have effect before  
antibodies made;  
*accept antibodies are specific  
or will work for one disease but not another*
- 2 max
- (f) injection of ready made antibodies;  
*accept does not have to wait for antibody formation or has large amount of antibodies quickly  
or has enough antibodies quickly  
or antibodies start working straight away*
- 1
- Q7.**
- (a) shape of antibody is not complementary;  
*accept shapes of antibody and antigen do not match or antibody does not correspond to antigen Y or is not the same shape as antigen Y or antibody different shape*

[7]



		1	
	so unable to attach or join to antigen Y <i>accept they do not fit</i>	1	
(b)	(i) <u>antibodies</u> in blood or in skin or in body; <i>accept already have the antibodies</i>	1	
	<u>react</u> with (injected) antigens or bacteria; <i>accept skin affected by antigen-antibody complex or blood vessels in skin enlarge or dilate</i> <i>do not accept attack instead of react</i>	1	
	(ii) any <b>three</b> from  bacteria weak so do not cause disease <i>accept not harmful</i> <i>do not accept bacteria are dead</i>  cause antibody production;  memory cells remain; <i>accept a suitable description</i>  so body can quickly produce more antibodies in a real infection; <i>accept antibodies remain in blood or in body</i>	3	[7]
<b>Q8.</b>	mutation or description of mutation (gives resistance to penicillin)	1	
	<u>some</u> survive (penicillin)	1	
	(survivors) reproduce <b>or</b> multiply	1	
	asexual reproduction <b>or</b> binary fission <b>or</b> cloning <i>accept mitosis</i>	1	
	<u>gene</u> for resistance <b>or</b> the mutation is passed on (to offspring) <i>allow reference to bacteria being immune</i> <i>ignore reference to survival of fittest</i>	1	[5]

**Q9.**



- (a) droplet infection **or** aerosol infection  
*do not accept airborne*  
*accept airborne droplets*  
1
- (b) so there is no large group which could catch the infection/pass on the infection  
*converse – if large numbers can't pass it on the virus is less likely to reach those few who are susceptible*  
1
- (c) (i) any **four** of the following points:-  
*example of a 3 mark answer: Lymphocytes produce specific antibodies.....*
- comment on specificity applied to antibodies or lymphocytes
- (recognition by) lymphocytes;
- (white cells) make antibodies;
- antibodies destroy/neutralise the virus/antigen/protein subunit;  
*do not accept antibodies KILL viruses*  
*accept white blood cells replicate*  
*accept some white cells form memory cells/live a long time;*  
*accept subsequent infection results in very rapid antibody production;*  
max 4
- (ii) active;  
1
- (d) any **three** of the following points
- Structure change in:*  
protein for binding to host cell;  
*accept changes in surface proteins (of protein coat)*
- spike containing enzyme;  
*changes in antigen*
- Fit:* existing/circulating/old antibodies don't match new virus strain shape/new antigen/new binding protein;
- Wrong antibodies:* injection does not stimulate antibodies against all strains/different antigens;  
*accept wrong antibodies for 1 mark*  
max 3

[10]

**Q10.**

- blood clots to seal cuts;  
kills microbes which enter  
*each for 1 mark*





(allow higher level answers)

[2]

**Q11.**

- (i) 2 of:  
 ingest microbes; )allow higher level answers  
 produce antibodies; )allow cause and effect  
 produce antitoxins )eg antitoxins neutralise poisons = 2  
*each for 1 mark*

2

- (ii) injection of dead/weak microbes;  
 stimulates antibody production;  
 these can be produced again quickly on new infection  
**or** remain for long time to 'combat' new infection  
*each for 1 mark*

3

[5]

**Q12.**

- (a) use antibiotics; or named one to kill bacteria; (not microbes)  
*each for 1 mark*

2

- (b) some ingest/digest bacteria (not microbes) OWTTE  
 some produce antibodies;  
 which destroy bacteria/viruses;  
 some produce antitoxins;  
 which counteract poisons released by bacteria  
*each for 1 mark*

5

[7]

**Q13.**

- (a) engulf bacteria  
 produce antibodies  
 produce antitoxins  
 effect of antibodies/antitoxins  
*for 1 mark each*

4

- (b) method must be related to disease  
 dead/weakened microbes (as appropriate)  
 stimulate antibody production  
 antibody production rapid if microbe enters again  
*for 1 mark each*

3

[7]

**Q14.**



- (a) virus  
bacteria (allow fungi, protozoa) 2
- (b) reference to poisons/toxins produced by microbes 1
- (c) 2 of e.g.  
engulf microbes  
produce antibodies  
produce antitoxins 2
- (d) dead/weakened microbes (relevant to named disease)  
method e.g. injection/ swallowed (relevant to named disease)  
body responds by producing antibodies 3

**[8]****Q15.**

- (a) lungs  
*for 1 mark* 1
- (b) microbes reproduce rapidly produce poisons  
*for 1 mark each* 2
- (c) viruses/fungi/protozoa  
*for 1 mark* 1
- (d) more likely to come into contact with infected people/more TB bacteria in air  
*for 1 mark* 1
- (e) white cells ingest bacteria  
produce antibodies which destroy bacteria  
produce antitoxins which counteract poisons produced by bacteria  
*for 1 mark each* 3

**[8]****Q16.**

- (a) white cells ingest bacteria  
produce antibodies which destroy bacteria  
produce antitoxins which counteract poisons produced by bacteria  
*for 1 mark each* 3
- (b) dead/mild microbes  
stimulate antibody production  
white cells can quickly produce these again  
*for 1 mark each*



- (c) adds more bacteria (mild)  
does not affect TB bacteria  
*for 1 mark each*

3

2

**[8]****Q17.**

- (a) microbes entered body,  
multiplied rapidly,  
made poisons  
*any 2 for 1 mark each*

2

- (b) contact with infected people  
*for 1 mark*

1

- (c) the body kills the microbes  
*for 1 mark*

1

**[4]****Q18.**

- (a) (i) white blood cells  
*for 1 mark*
- (ii) e.g. contact with infected person unhygienic conditions  
*for 1 mark each*
- (iii) broken down, by enzymes into amino acids  
*any 2 for 1 mark each*

1

2

2

- (b) reproduce rapidly produce toxins  
*for 1 mark each*

2

- (c) antibiotic or named  
*for 1 mark*

1

- (d) mild or deal microbes introduced white cells produce antibodies  
which can destroy disease microbes  
idea of memory cells  
idea that injecting antibodies give immediate production  
*any 3 for 1 mark each*

3

**[11]**

**Q19.**

bacteria reproduce rapidly / increase rapidly in numbers produce poisons / toxins  
each for 1 mark

2

[2]

**Q20.**

bacteria reproduce rapidly / increase rapidly in numbers  
produce poisons / toxins  
each for 1 mark

[2]

**Q21.****(a) Quality of written communication**

*The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme*

idea of mutation **or** variation

*do **not** allow 'bacteria get used to antibiotics' **or** idea that antibiotics change the bacteria **or** 'bacteria become immune' **or** references to adaptation or evolution*

1

(resistant cells) survive antibiotic

1

(resistant cells) breed

1

**(b) EITHER (yes)**

keep animals disease free (1) so grow faster (1 mark) **or** live longer

**OR (no)**

resistant bacteria may develop (1)  
risk to human **or** animal health (1)

*allow bacteria become resistant / immune*

2

[5]