**M1.**          (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]**

**M2.**          (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)

*do* ***not*** *accept germs*

**1**

(b)     fewer died

**1**

          indication of reduced number **or** proportion

*e.g. 3000→ 600*

*down by 2400*

*20% of previous deaths*

**1**

**[3]**

**M3.**          (a)     (i)      38.84

*correct answer with or without working gains* ***2*** *marks*

*(691 × 1000) / 17 791 gains* ***1*** *mark*

**2**

(ii)     women in Ward 1 infected

**1**

by pathogens / bacteria / viruses passed on by doctors  
(who have been in contact with dead bodies)

**1**

(b)     medicine / drug

**1**

that kills bacteria

**1**

(c)     resistant to / not killed by antibiotics

**1**

(d)     Semmelweiss showed that infection could be passed on via  
touch and so hand washing by doctors / nurses / patients /  
visitors reduces the risk of infection

**1**

**[8]**

**M4.**          (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

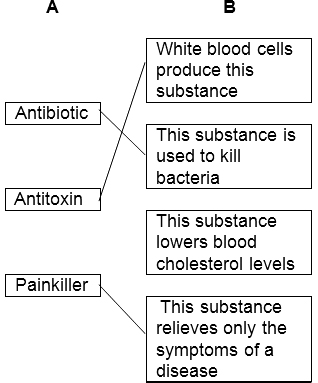
**3**

(iii)     (no)

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

**1**

**[7]**

**M5.**          (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]**

﻿

**M6.**          (a)     cell division / bacterium divides / multiplies / reproduces

*allow asexual / mitosis*

*ignore growth*

**1**

(b)     18

**1**

18 000 / 18 × 103 / 1.8 × 104

*do* ***not*** *accept 1.8 / 1.8 04 / 1.84*

*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]**

**M7.**          (a)     (i)      12

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

*if answer incorrect evidence of (number of deaths) × 6* ***or*** *2 seen gains* ***1*** *mark*

**2**

(ii)     (ward 2)

         more deaths / infections on ward 1

**or**

         less deaths / infections on ward 2

**1**

(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*

**1**

(ii)     less deaths / infections

**1**

(iii)     bacteria / germs / microbes / infection killed / washed off

*accept less infections passed on*

**1**

**[6]**

**M8.**(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**

*in this order*

**[7]**

**M9.**          (a)     kills / destroys bacteria / MRSA

*do* ***not*** *allow germs*

**1**

prevents / reduces transfer

*allow stops MRSA entering ward*

**1**

(b)     mutation

*do* ***not*** *accept antibiotics causes mutation*

**1**

(causes) resistance

*allow not effective*

*ignore immunity*

**1**

to antibiotics

**1**

**[5]**

**M10.** blood clots to seal cuts;  
kills microbes which enter

*each for 1 mark  
(allow higher level answers)*

**[2]**

**M11.**          (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]**

**M12.**          (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]**

**M13.**          (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]**

**M14.**          (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]**

**M15.**          (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]**

**M16.**          (a)     worldwide **or** several countries (outbreak)

*ignore affects large numbers of people*

**1**

(b)     any **three** from

•        new strain of flu / virus changes / virus different

*ignore mutation*

•        vaccination not effective **or** new vaccine not yet developed

*allow resistant / immune to vaccine*

•        antiviral drugs not effective / not yet developed

*allow drugs / treatment not effective*

*do* ***not*** *allow antibiotics not effective*

•        people not immune to it

*allow people not resistant*

•        virus not recognised by white blood cells / antibodies **or** antibodies / antitoxins not effective

*accept no antibodies / antitoxins*

*ignore white blood cells / antibodies fighting off*

•        people / animals travel between countries / abroad spreading infection

**3**

**[4]**

**M17.**(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]**

**M18.**         (a)     produces toxins / damage cells / reproduce rapidly **or** reproduce in cells

*ignore invade cells*

**1**

(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)

**3**

**[4]**

**M19.**(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]**

**M20.**          (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]**

**M21.**(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

•        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’*

**2**

(b)     (stimulate) antibody production

*ignore antitoxin*

**1**

(by) white cells

**1**

rapidly produce antibody on re-infection

*ignore antibodies remain in blood*

**1**

**[7]**

**M22.**          (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]**

##

          (a)     (i)      white blood cells

*for 1 mark*

**1**

(ii)     e.g. contact with infected person unhygienic conditions

*for 1 mark each*

**2**

(iii)     broken down, by enzymes into amino acids

*any  2 for 1 mark each*

**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]**

**M24.**          (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*

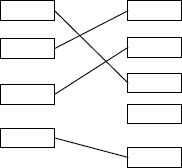
*Fit:* existing/circulating/old antibodies don’t match new virus strain shape/new antigen/new binding protein;

*Wrong antibodies:* injection does not stimulate antibodies against all strains/different antigens;

*accept wrong antibodies for 1 mark*

**max 3**

**[10]**

**M25.**          (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*

**4**

(b)     (i)     because antibiotics diffuse / pass (into agar)

**1**

where they kill bacteria

**1**

(ii)     as a control

**1**

(iii)    as the concentration increases more bacteria are killed  
**or**causes less growth

**1**

levels off (at 6 units)  
**or**the greatest effect is when the concentration is increased from 4 to 6 units

**1**

(iv)     repeat experiment with more concentrations of antibiotic

**1**

between 4 and 6 units

**1**

(c)     (i)     MRSA

*accept Clostridium*

**1**

(ii)     mutation

**1**

(iii)    overuse / inappropriate use of antibiotics

**1**

**[14]**

**M26.**(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]**