Mark schemes

Q1.
    (a)   pathogens

                    1

    (b)   viruses reproduce inside cells, damaging them
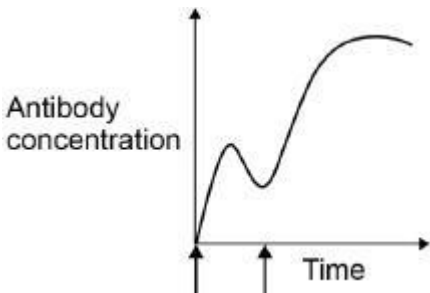
                    1

    (c)   any **one** from:
- they do not have a cell membrane

  *do **not** accept they do not have a cell wall*
- they do not have cytoplasm
- they do not have a nucleus
- they do not have mitochondria (like most eukaryotic cells)
- they do not have ribosomes

  *do **not** accept they do not have chloroplasts / chlorophyll*

  ignore they are not living / alive

  ignore they can only replicate inside cells

  ignore virus has a protein coat

                    1

    (d)   a weakened form of a virus

                    1

    (e)

                    1

    (f)   leaf

                    1

    (g)   y-axis labelled rate of photosynthesis in arbitrary units

                    1

        correct scale

                    1

        all bars plotted correctly

            allow a tolerance of ± ½ small square

            *allow 2 correct bars for **1** mark*

allow bars touching
allow any width of bars

2

all bars correctly labelled
ignore letters

1

(h)   as the level of infection (with TMV) increases, (the rate of)
photosynthesis decreases

*allow as TMV increases, photosynthesis
decreases*

*allow (the rate of) photosynthesis
decreases as the level of infection (with
TMV) increases*

*allow as infection gets worse,
photosynthesis decreases*

allow TMV reduces photosynthesis

1

(i)   less chlorophyll

allow fewer chloroplasts
allow less light absorbed
ignore less photosynthesis

1

(so) less glucose / starch / protein made

1

[14]

Q2.

(a)   any **one** from:
•   bacteria
•   fungi
•   protists

allow singular
*allow names of pathogens
e.g. Salmonella*
ignore virus / germ

1

(b)   hydrochloric acid is produced by the stomach

1

the skin is a barrier covering the whole body

1

(c)   white blood cells engulf the microorganisms.

1

(d)   weakened

1

fast

> *in this order only*

1

(e)   by coughs / sneezes

> *allow 'by droplets in the air'*
>
> *do **not** accept other means of transmission e.g. touch*

1

(f)   (from day) 10 (to day) 18

> *allow (from day) 18 (to day) 10*

1

(g)   14 (days)

> *allow in the range 13 to 15 (days)*

1

(h)   any **one** from:
- they had been vaccinated
- they already had antibodies
- they were immune
  > *ignore they were resistant*
- they had had it before
- they did not get any / enough virus from infected child
  > *ignore they wore a mask unqualified*
- they did not play (much) with the infected child

1

(i)   antibiotics do not kill viruses

> *allow antibiotics do not work on viruses*
>
> *allow antibiotics only kill bacteria*

1

[11]

Q3.

(a)   will stop animals / herbivores eating it

> *allow it will not be eaten*

1

(b)   chemical

1

(c)   thorns / spikes / spines / prickles (to stop animals / herbivores eating it)

1

(d)   for respiration

1

to store as starch

1

(e)   add Benedict's (solution / reagent to the liquid)

1

boil / heat

> *allow any temperature of 65 °C or
> above*

1

(if glucose is present the blue) colour changes to yellow / green / orange / brown / (brick) red

1

(f)   (nitrate ions are needed) to make proteins / amino acids

> *allow to make chlorophyll / DNA / ATP /
> nucleic acid*

1

which are needed for growth / enzymes / new cells

> *allow correct process for named
> molecule in mp1*

1

(g)   in / on the (soil) water

> *allow through air (spaces) in the soil*

1

(h)   dosage

1

toxicity

1

(i)   placebos

1

[14]

Q4.

(a)   a protist

1

(b)   lower percentage of people with malaria when using (mosquito) nets

> *allow converse if clearly describing
> people who do not use (mosquito) nets
> allow fewer people with malaria when
> using (mosquito) nets
> allow **only** 1.2% of people with malaria
> when using (mosquito) nets
> ignore reference to data from table
> unqualified
> do **not** accept incorrectly calculated
> figures*

1

(c)   any **one** from:
  •   some people who use (mosquito) nets have malaria

> *allow people can get malaria when they
> are not sleeping*

- • data from only one area / part of Africa
- • size of group too small **or** sample size too small **or** only 476 people

    allow correlation does not imply causation
- • only 50 people did not use (mosquito) nets

    or

    uneven group sizes (nets vs. no nets)
- • no other information about people considered

    allow examples of information not considered e.g. age, other medical issues such as sickle cell, whether taking anti-malarial medication, vaccination

    ignore ref to other factors unqualified
- • people may have lied about using (mosquito) nets

1

(d) any value between 88 - 91

    allow decimal values

1

(e) any **one** from:
- • improved health care

    *allow examples of improved health care such as **more** / **cheaper** / **new** treatments / vaccinations / antibiotics*
- • use of mosquito control methods

    *allow descriptions such as spraying of insecticides / repellent **or** draining water holes **or** preventing mosquitoes from breeding*
- • changing behaviour to avoid being bitten (by mosquitoes)

    *allow descriptions such as wear long clothing **or** avoid going out at dusk*

1

(f)   **Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

4–6

Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.

1–3

No relevant content

0

Indicative content

prevents pathogens from entering
skin
- • tough / dry / dead outer layer
- • skin acts as a <u>barrier</u>
- • sebum / oil on (surface of) skin
- • sebum / oil repels pathogens

- scabs form over cuts **or** scabs form a barrier
- platelets are involved in forming clots / scab

stomach
- contains (hydrochloric) acid
- (HCl) kills bacteria
- in food **or** in swallowed mucus

eyes
- produce tears
- contains enzymes to kill bacteria
- tears are antiseptic

breathing system
- trachea / bronchi / nose produce mucus
- mucus is sticky
- (mucus) traps bacteria
- (mucus) carried away by cilia

defends itself against pathogens inside the body
- immune system / white blood cells (WBCs)
- WBCs engulf pathogens
- antitoxins are produced
- (antitoxins) neutralise toxins / poisons (produced by pathogen)
- antibodies are produced
- (antibodies) help destroy pathogens
- memory cells (are formed)
- (memory cells give a) more rapid response if pathogen re-enters

a **level 2** response should refer to body defence **and** the immune system

[11]

Q5.

(a)   gonorrhoea

1

(b)   the bacteria are resistant to the antibiotics

1

(c)   abstain from sex(ual intercourse)
           allow abstinence
    or
    wash hands after touching penis / urinating / using the toilet
           ignore wash hands unqualified

1

(d)   **Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted.

4–6

    Level 1: Relevant features are identified and differences noted.

1–3

No relevant content

0

Indicative content:
qualitative statements
*   **3** works best on **A**
*   **1** works best on **B**
*   **2** works best on **C**

*   **1** is least effective on **A**
*   **3** is least effective on **B**
*   **3** is least effective
    or has no effect on **C**

quantitative statements
*   **1** kills more of **B** and **C** compared to **A**
*   **2** kills more of **C** than **A** / **B**
*   **3** kills more of **A** than **B** and **C**
*   **2** kills the same amount of **A** and **B**
*   **2** and **3** killed similar amounts of **B**
*   **C** are resistant to **3**
*   only **2** worked well on all of the bacteria
*   for **A**, **3** works best, **2** is next and **1** is least effective
*   for **B**, **1** works best, **2** is next and **3** is least effective
*   for **C**, **2** works best, **1** is next and **3** is least effective

for **level 2** reference to qualitative and quantitative statements is
required

(e)   sample **E**

1

(f)

*an answer of 14 scores **2** marks*

$\dfrac{15 + 12 + 13 + 16}{4}$

1

or

$\dfrac{56}{4}$

14

1

(g)

*an answer of 140 000 scores **3** marks*
an incorrect answer for one step does
not prevent allocation of marks for
subsequent steps

(area = 0.1 × 0.1 =) 0.01
allow 1 × 10⁻²

1

(volume = 0.01 × 0.01 =) 0.0001
allow 1 × 10⁻⁴

1

(number = 14 =) 140 000
       0.0001
allow ecf from part (f)
allow 1.4 × 10⁵
*do **not** accept 14 × 10⁴*

1

(h)   Q

1

(i)

1

allow reverse argument

(bacteria) could make humans ill
*allow (bacteria) cause infection /
disease*
or
(bacteria) could kill humans
*allow (bacteria) cause appropriately
named disease*
or
(bacteria) could release toxins
ignore harmful

1

[17]

Q6.
(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 πr² 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
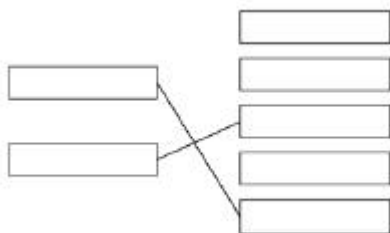　　　　　　*ignore environmental effects / flammability*

1

[11]

Q7.

(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]

Q8.

(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
animals	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
plants	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
fungi	antibiotic production	kill bacteria

6

(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*

3

(d)   to prevent the growth of a harmful pathogen

1

<div align="right">**[11]**</div>

Q9.

   (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

<div align="right">**2**</div>

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

<div align="right">**3**</div>

   (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)

<div align="right">**2**</div>

   (d)   as a control
or
to see / compare the effects of the treatment (vs. no treatment)

<div align="right">**1**</div>

   (e) $(4.8 + 10.4) \div 2 \div 100 \times 1500$
or
$(4.8 \div 100 \times 750) + (10.4 \div 100 \times 750)$

<div align="right">**1**</div>

        114
*an answer of 114 scores **2** marks*
*allow 228 for **1** mark*

<div align="right">**1**</div>

   (f)   **(supports the conclusion because)**
over double the number / % of patients (in the trial) were hospitalised with

<div align="center">Page 14 of 18</div>

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
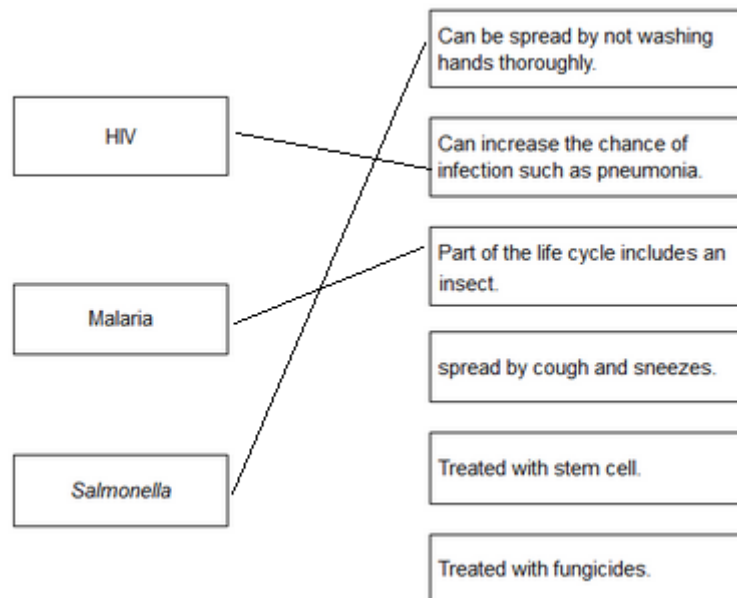> *allow correct named factor e.g. age / gender / other illness*

or
don't know if it was a double blind trial

1

[12]

Q10.

(a)

each extra line negates a mark

4

(b)   pain when urinating

1

yellow discharge

1

(c)   three correct plots
> *allow **1** mark for two correct plots*

2

correctly drawn line

1

(d)   any **three** from:

- (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)*

3

(e)   HIV is a virus

1

(and) antibiotics are <u>only</u> effective against bacteria
or
antibiotics do not kill viruses
        allow viruses live inside cells

1

[13]

Q11.

(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]

Q13.

Q12.

(a)   vector

1

(b)   any **three** from:
• destroy the snails
• isolate infected dogs
• treat infected dogs
    allow vaccination
• educate owners about picking up dog faeces

3

(c)   stop mosquitoes breeding
        allow correct description

1

use mosquito nets
        allow use of insect repellent

1

[6]

Q13.

(a)   (i)   small amounts of dead pathogens

1

(ii)   decrease

1

by 60 (%)
    allow from 70(%) to 10(%)
    allow other correct data treatment

1

(b)   (i)   penicillin

1

(ii)   any **two** from:
• antibiotics only kill bacteria
    allow antibiotics do not kill viruses
• some bacteria are resistant (to antibiotics)
    allow MRSA not killed by antibiotics
• (correct) antibiotics not always used
    allow course not completed
• deficiency disease(s) not caused by bacteria **or** cannot be treated by antibiotics
• inherited disease(s) not caused by bacteria **or** cannot be treated by antibiotics
• 'lifestyle' diseases not caused by bacteria **or** cannot be treated

by antibiotics
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]