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

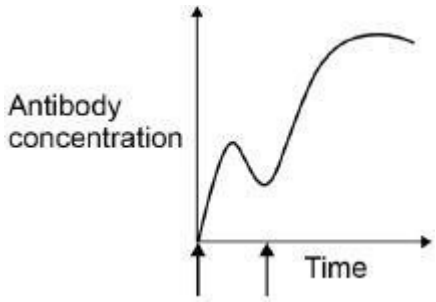
ignore virus has a protein coat

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 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 barrier
- 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 A and B
- 3 same amount of A than B and C
- 2 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*

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

1

or

$$\frac{56}{4}$$

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 = $\frac{14}{0.0001}$ =) 140 000
allow ecf from part (f)
allow 1.4 × 105
do not accept 14 × 104

1

(h) Q

1

(i)
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

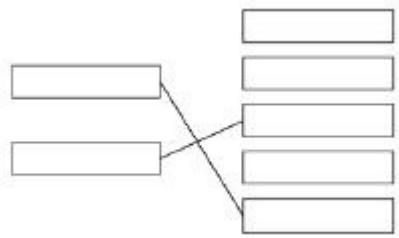
[11]

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 mucus traps microbes
	trachea / bronchi	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

[11]

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

2

(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

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

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

other factors may have affected those admitted to hospital

or

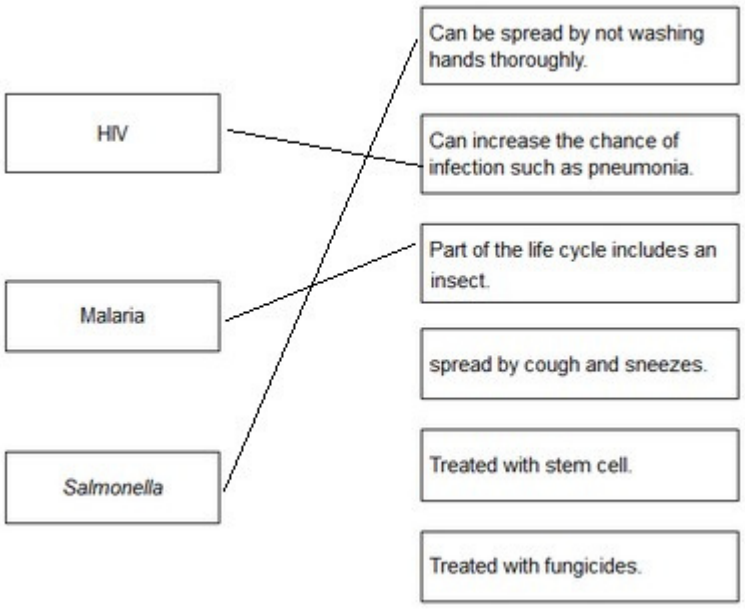
don't know if it was a double blind trial

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 only 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]

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]