Infection and Response part 3 AQA Triple Biology

Name: _____

Class: _____

Date: _____

Time: **88 minutes**

Marks: **83 marks**

Comments:

1. Human immunodeficiency virus (HIV) is a pathogen.

(a) Give **one** way HIV can spread from one person to another person.

_____

_____

(1)

The table below shows information about new cases of HIV diagnosed in the UK.

Year	Number of new HIV cases in women	Number of new HIV cases in men
2010	376	2266
2012	361	2310
2014	397	2370
2016	298	1886
2018	242	1288

(b) Describe the trends shown in the table above between 2010 and 2018.

_____

_____

_____

_____

(2)

(c) Suggest **one** reason for the change in the number of new HIV cases between 2014 and 2018.

_____

_____

(1)

(d) Calculate the ratio of new cases of HIV in women to new cases of HIV in men in 2018.

Give your answer to 3 significant figures.

Ratio (3 significant figures) = _____**:** 1

(3)

(e) In the UK population the total number of women is greater than the total number of men.

The data in the table in part (a) is used to compare the proportions of new cases of HIV in the population for men and women.

Suggest how the data could be presented differently so that a more valid comparison can be made.

(1)

Scientists have been working to produce a vaccine for HIV for many years.

(f) Explain how a vaccine for HIV could work to prevent a person developing HIV infection.

(4)

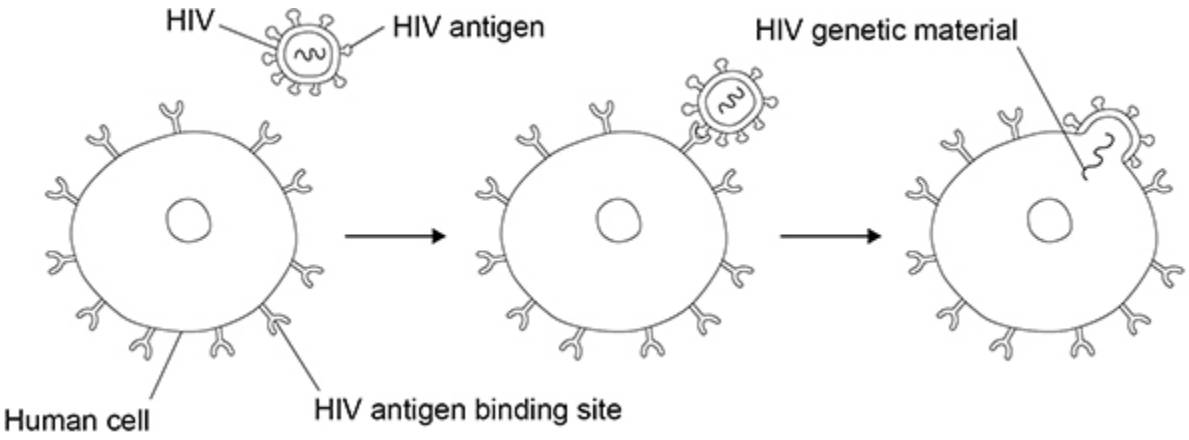
A person with late stage HIV infection has AIDS.

Scientists have produced monoclonal antibodies for HIV.
The monoclonal antibodies can prevent a person infected with HIV developing AIDS.

(g) Describe how the monoclonal antibody for HIV can be produced.

(4)

(h) The figure below shows how HIV enters a human cell.



Suggest how the monoclonal antibody for HIV helps to prevent a person infected with HIV developing AIDS.

Use information from the figure above.

_____

_____

_____

_____

_____

_____

(3)

(Total 19 marks)

2. Monoclonal antibodies (mAbs) are usually made using mouse lymphocytes.

Candida albicans infection produces serious symptoms in patients with a poor immune system.

Recently scientists have produced mAbs to *Candida albicans* using human lymphocytes produced naturally after an infection.

(a) *Candida albicans* lives in the throat of infected patients.

A sample is taken from the throat of a patient with a suspected *Candida albicans* infection.

The sample is transferred onto a microscope slide.

Describe how the mAbs and a fluorescent dye could be used to see any *Candida albicans* pathogens on the slide.

(3)

In a laboratory the human lymphocyte mAbs were injected into animals infected with *Candida albicans*.

The mAbs caused increased phagocytosis of the *Candida albicans* pathogens.

Doctors intend to start a trial to give the mAbs to patients severely ill with *Candida albicans.*

(b) Explain how increased phagocytosis of the *Candida albicans* pathogen will help the patient.

(2)

(c) It has been shown that this mAbs treatment is effective in the laboratory using both:

- infected tissue culture cells
- infected live animals.

The mAbs treatment for *Candida albicans* is now ready for clinical trials on people.

Describe how the clinical trials should be carried out.

(6)

(d) Scientists have also used human lymphocytes to make mAbs to other pathogens and to some types of cancer cells.

Suggest **one** reason why these new mAbs have been more successful in treating diseases in humans than mAbs made using mice.

(1)

(Total 12 marks)

3. The human body can defend itself against microorganisms that cause disease.

Viruses are one type of microorganism that cause disease.

(a) Name **one** type of microorganism that causes disease in humans.

Do **not** refer to viruses in your answer.

_____

(1)

(b) Which **two** defence systems prevent microorganisms infecting the human body?

Tick (✓) **two** boxes.

Air is warmed as it is breathed into the lungs. ☐

Hairs on the skin trap microorganisms. ☐

Hydrochloric acid is produced by the stomach. ☐

Teeth in the mouth crush and kill microorganisms. ☐

The skin is a barrier covering the whole body. ☐

(2)

(c) If microorganisms enter the human body the immune system can destroy the microorganisms.

How does the immune system destroy microorganisms?

Tick (✓) **one** box.

Platelets kill the microorganisms. ☐

Red blood cells stick to the microorganisms. ☐

White blood cells engulf the microorganisms. ☐

(1)

(d) Vaccinations prevent people becoming ill with diseases such as measles.

Complete the sentences.

Choose answers from the box.

active	**fast**	**resistant**	**slow**	**weakened**

In a vaccine the measles virus is _____.

If the measles virus enters the body after vaccination the immune system reaction will be _____.

(2)

(e) How is the measles virus spread from one person to another?

_____

_____

(1)

Doctors investigated the spread of the virus that causes chickenpox.

The first symptom of chickenpox after exposure to the virus is spots on the body.

23 children were playing together at a party.

On the day of the party one of the children developed chickenpox spots.

Every two days after the party, the doctors recorded when the other 22 children first showed chickenpox spots.

The table below shows the results.

Day when chickenpox spots first showed	Number of children
2	0
4	0
6	0
8	0
10	1
12	1
14	6
16	4
18	2
20	0
Total	**14**

(f) What was the range for the days on which children first showed chickenpox spots?

Use the table above.

From day _____ to day _____

(1)

(g) Incubation time is the usual time from exposure to a pathogen until the first symptoms appear.

Suggest the most likely incubation time for chickenpox.

Incubation time = _____ days

(1)

(h) Suggest **one** reason why some of the children did **not** develop chickenpox.

_____

_____

(1)

(i) One mother gave antibiotics to her child who had chickenpox.

Suggest why this child did **not** recover more quickly than the other children who had chickenpox.

_____

_____

(1)

(Total 11 marks)

4. Many diseases can be treated using drugs.

(a) Which type of pathogen can be killed by antibiotics?

Tick **one** box.

Bacteria ☐

Fungi ☐

Protists ☐

Viruses ☐

(1)

(b) Some drugs were originally extracted from living organisms.

Draw **one** line from each drug to the organism it was originally extracted from.

Drug	Organism the drug was originally extracted from
Aspirin	A mould
Digitalis	A virus
	Foxglove
	Rose
	Willow Tree

(2)

(c) New drugs must be tested before they can be used.

Give **one** reason why drugs should be tested.

_____

_____

(1)

(d) Doctors have developed a new drug.

The new drug has been tested on live animals.

What is the next stage in testing the new drug?

Tick **one** box.

Testing on animal tissues in a laboratory	☐
Testing on healthy volunteers	☐
Testing on patients with the disease	☐
Testing on the whole human population	☐

(1)

(e) Vaccination can be used to prevent an illness in a person.

Explain how a vaccination can prevent an illness.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 9 marks)

5. Rose black spot is a disease of roses.

(a) What type of microorganism causes rose black spot?

Tick **one** box.

A bacterium ☐

A fungus ☐

A protist ☐

A virus ☐

(1)

(b) Explain how different **types of organism** defend themselves against microorganisms.

_____

_____

_____

_____

_____

_____

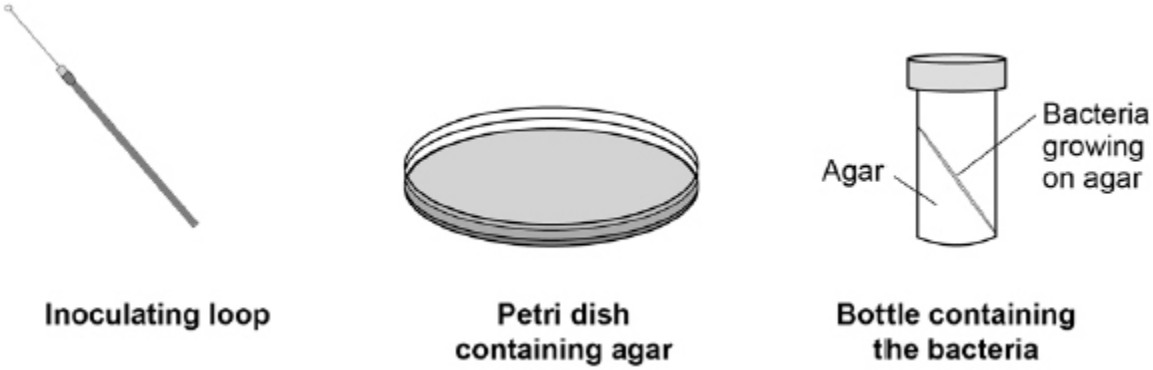
_____

_____

(6)

(c) A student tried to grow some bacteria in the laboratory.

The diagram shows some of the apparatus used.



Inoculating loop | **Petri dish containing agar** | **Bottle containing the bacteria**

This is the method used.

1. Remove the lid of the Petri dish.
2. Remove the lid of the bottle containing the bacteria.
3. Use the inoculating loop to remove some of the bacteria from the bottle.
4. Spread the bacteria over the agar using the inoculating loop.
5. Put the lid back on the Petri dish.
6. Put the Petri dish into an incubator at 25 °C for 24 hours.

Steps 1−5 could cause the sample of the bacteria on the petri dish to be contaminated.

Give **three** improvements to the method to prevent contamination.

1. _____

_____

2. _____

_____

3. _____

_____

(3)

(d) Why did the student grow the bacteria at 25 °C rather than at 40 °C?

Tick **one** box.

So the bacteria grew more quickly ☐

So the bacteria grew more slowly ☐

To prevent the growth of a harmful pathogen ☐

To save money ☐

(1)

(Total 11 marks)

6. Microorganisms can cause disease.

(a) Draw **one** line from each disease to the correct description.

HIV	Can be spread by not washing hands thoroughly.
	Can increase the chance of infection such as pneumonia.
Malaria	Part of the life cycle includes an insect.
	spread by cough and sneezes.
Salmonella	Treated with stem cell.
	Treated with fungicides.

(3)

(b) Gonorrhoea is a sexually transmitted disease.

A bacterium causes gonorrhoea.

What are the symptoms of gonorrhoea?

Tick **two** boxes.

- Headache ☐
- Pain when urinating ☐
- Rash ☐
- Vomiting ☐
- Yellow discharge ☐

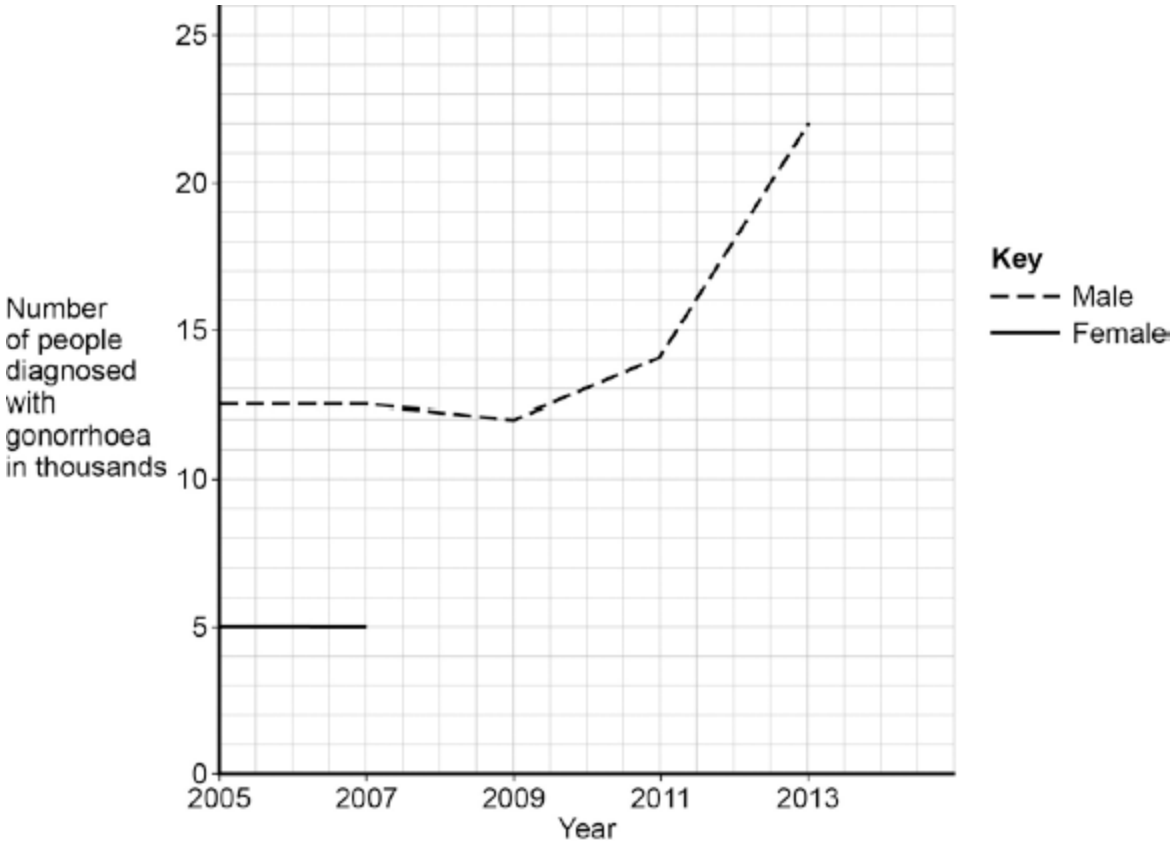
(2)

(c) The table below shows the number of people in the UK diagnosed with gonorrhoea in different years.

	Number of people diagnosed with gonorrhoea in thousands	
Year	**Female**	**Male**
2005	5.0	12.5
2007	5.0	12.5
2009	5.5	12.0
2011	6.0	14.0
2013	7.5	22.0

Use the data in the table to complete the graph below.

- The numbers for males have already been plotted.
- Only some of the numbers for females have been plotted.



(3)

(d) Describe the patterns in the numbers of males and females with gonorrhoea from 2005 to 2013.

Use the data in the graph.

_____

_____

_____

_____

_____

(3)

(e) Gonorrhoea is treated with an antibiotic.

HIV is another sexually transmitted disease.

Explain why prescribing an antibiotic will **not** cure HIV.

_____

_____

_____

_____

(2)

(Total 13 marks)

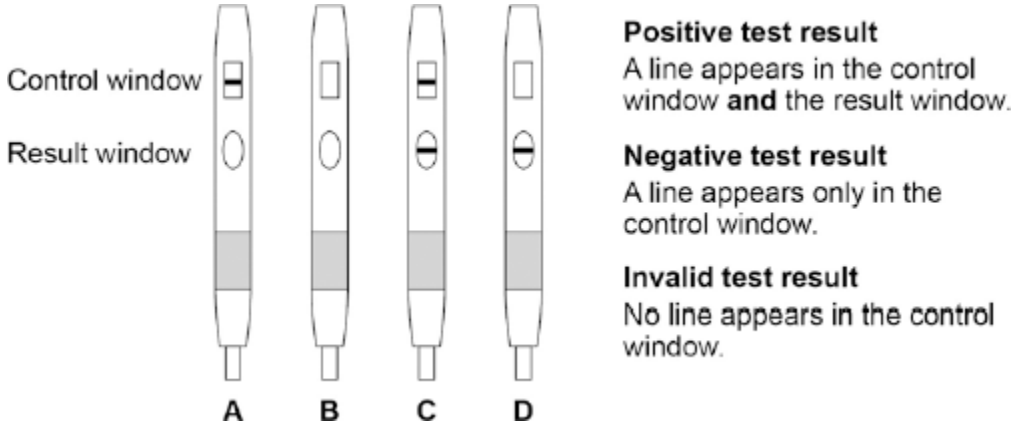
7. Monoclonal antibodies are used to measure the levels of hormones in the blood.

Pregnant women produce the hormone HCG.

HCG is excreted in urine.

Figure 1 shows four pregnancy test strips.

Figure 1



(a) Which test strip shows a negative test result?

Tick **one** box.

A ☐ B ☐ C ☐ D ☐

(1)

(b) Monoclonal antibodies are used for pregnancy testing.

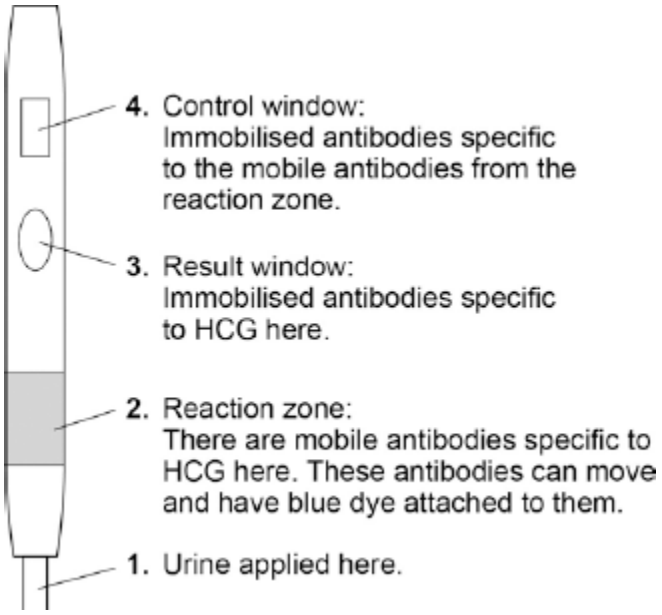
Give **one other** use of monoclonal antibodies.

_____

(1)

(c) **Figure 2** shows the parts of a pregnancy test strip.

Figure 2



The pregnancy test strip will show a positive test result when a woman is pregnant.

Explain how the pregnancy test strip works to show a positive result.

(6)

(Total 8 marks)

1.

(a) any **one** from:

- sexual contact / intercourse

  allow intercourse unqualified

  ignore kissing

- exchange of body fluids

  *allow example of exchange such as (drug) users sharing needles **or** blood transfusion **or** passage from mother to foetus in uterus*

1

(b) (number of cases) in women decreases then increases, then decreases

1

(number of cases) in men increases then decreases

1

*allow **total** numbers (of men and women together) increase then decrease*

ignore reference to differences between men and women

*if no other marks awarded allow overall trend decreases in **both** for **1** mark*

ignore use of figures

(c) any **one** from:

- better education (into prevention of spread of HIV)

  allow increased awareness about HIV

- condoms more widely available **or** condoms easier to source **or** condoms cheaper

  ignore contraception / protection unqualified

- new / better drugs (to prevent HIV infection / spread)

  allow PrEP / anti-retrovirals stop the virus being passed on

  ignore new treatments

  *do **not** accept antibiotics*

- better / more testing / identification (of people with HIV)

  allow less promiscuity

  ignore vaccination

1

(d) $\frac{242}{1288}$

1

0.1878…

allow a rounded answer

1

0.188 (:1)

allow a correctly rounded answer from student's incorrect division using numbers from the table

*do **not** accept if a unit is given*

1

(e) any **one** from:

- calculate as a percentage
- give the numbers per 100 000 people

ignore calculate as a proportion allow any standard number eg 10 000 / 1000

1

(f) inactive HIV / virus is injected (into bloodstream / muscle / body)

allow dead HIV / virus is injected (into bloodstream / muscle / body)

allow (named) part of HIV / virus is injected (into bloodstream / muscle / body)

1

white bloods cells produce antibodies (against inactive virus)

allow lymphocytes produce antibodies (against inactive virus)

*do **not** accept phagocytes produce antibodies (against inactive virus)*

1

(if infected with HIV) correct / specific antibodies are produced quickly

1

antibodies destroy the (active) virus / HIV

allow antibodies 'kill' the (active) virus / HIV

1

ignore reference to WBC unqualified

(g) HIV / antigen / protein injected into mouse

1

extract / collect (mouse) lymphocytes that make a specific antibody to HIV / antigen / protein

1

allow other correct small mammals eg rat

*allow extract specific lymphocytes from someone with HIV for **2** marks*

lymphocytes are combined with tumour cell to create a hybridoma

allow lymphocytes are combined with a myeloma / cancer cell to create a hybridoma

1

(hybridoma) cloned to create many cells that produce the antibody

1

alternative route

HIV / antigen / protein injected into mouse (1)

lymphocytes from mouse are combined with a tumour cell to create a hybridoma (1)

the hybridoma that makes the specific / correct antibody is isolated (1)

(hybridoma) cloned to create many cells that produce the antibody (1)

(h) monoclonal antibody is complementary / specific to HIV antigen

allow correct description of complementarity

1

monoclonal antibodies attaches to (all the) HIV antigens

1

(so) HIV cannot bind to (human) cell
or
(so) HIV genetic material cannot enter (human) cell

*allow white blood cells **or** phagocytes identify (monoclonal) antibodies and engulf / destroy (antibody bound) HIV*

1

alternative route

monoclonal antibody is complementary / specific to HIV antigen (1)

monoclonal antibody with (anti-retroviral) drug attached attaches to the HIV antigens (1)

*drug destroys the virus **or** drug destroys genetic material (1)*

allow 'the virus' for HIV throughout

[19]

2. (a) bind fluorescent dye to mAbs

1

put (bound) fluorescent mAbs on the slide (and rinse off)

ignore add mAbs and dye to slide (unbound)

1

mAbs will bind to Candida albicans / pathogens and show up under the microscope

allow mAbs will bind to Candida albicans / pathogens and show up under UV (lamp)

1

(b) more Candida albicans / pathogens will be engulfed / killed by phagocytes / white blood cells

allow Candida albicans / pathogens will be engulfed / killed by phagocytes / white blood cells more quickly

*do **not** accept white blood cells produce antibodies*

*do **not** accept lymphocytes engulf Candida albicans*

1

therefore less damage to cells / tissues / organs

ignore less toxin released (by Candida albicans)

1

(c) **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

- given first to healthy volunteers
  - at (very) low dose
  - to test it is safe **or** to test for toxicity **or** to check for any side effects
- then to some patients (with the disease) **or** people with the disease
  - to test for the correct / optimum dose
  - to check for any side effects
  - to test for efficacy **or** to test if it works
  - in a double blind trial
  - where neither patients nor doctors know who has the mAbs and who has a placebo (or alternative treatment)
- reference to large trial **or** long duration **or** control variables

(d) any **one** from:

- (the body will) not reject the mAbs
  or (the body is) less likely to reject the mAbs

  *do **not** accept idea of rejection of cells*

- mouse mAbs are (more likely to be) rejected

- the human lymphocytes have already responded to that infection / cancer cell so they are known to work against the disease

1

[12]

3.

(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

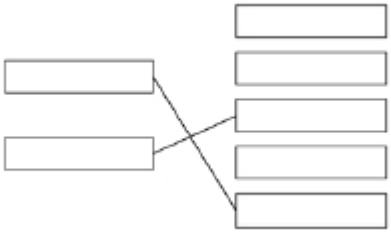
1

[11]

4. (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]

5. (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

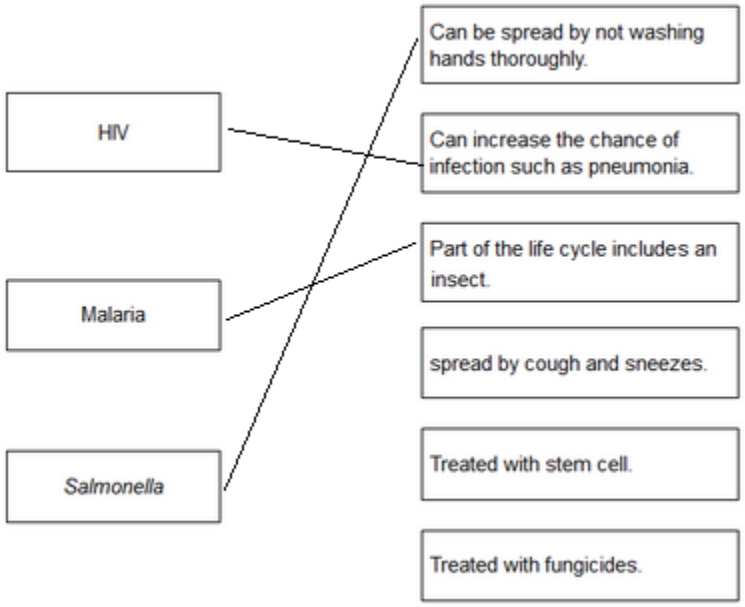
(d) to prevent the growth of a harmful pathogen

1

[11]

6.

(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]

7. (a) **A**

1

(b) any **one** from:
- identify / locate specific molecules / other hormones
- locate blood clots
- diagnose / treat some cancers

1

(c) (as) urine passes through reaction zone

1

HCG hormone binds to the mobile HCG antibody (in the reaction zone)

1

(passes up the stick) HCG hormone binds to the immobilised HCG antibodies in the results zone

1

(the other) antibodies which do not attach to HCG

1

bind to antibodies in control zone

1

blue dye appears in both control and results zones (to show positive result)

1

[8]