Infection and Response part 2 AQA Triple Biology

Name: _____

Class: _____

Date: _____

Time: **85 minutes**

Marks: **79 marks**

Comments:

1. Measles is caused by a virus.

(a) The measles vaccine is given to children to prevent them becoming ill with measles.

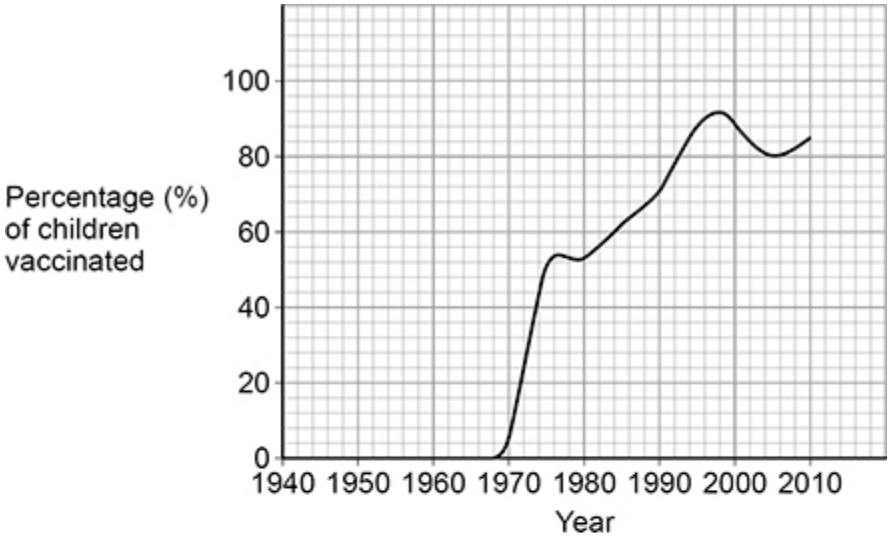
Draw **one** line from each blood component to its function when someone is vaccinated against measles.

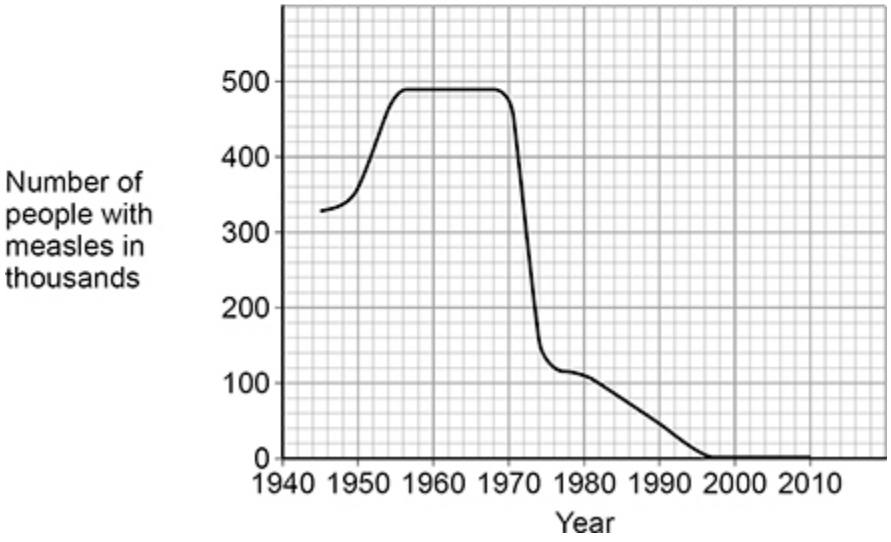
Blood component	Function
Platelets	Help clot the blood where the vaccine was injected
	Produce antibodies to the measles virus
White blood cells	Produce the measles skin rash
	Transport oxygen to the measles virus

(2)

The figure below shows information about trends in the UK for:

- percentage of children vaccinated
- the number of people with measles.





(b) What year was the measles vaccine first used?

Use the figure above.

_____

(1)

(c) Describe the trend in the **number of people with measles** from 1945 to 1975.

Use the figure above.

_____

_____

_____

_____

_____

_____

(3)

In **1998**, a scientific paper was published suggesting a link between condition **X** and one type of measles vaccine.

(d) What happened to the **percentage of children vaccinated** against measles after the scientific paper was published in 1998?

Use the figure above.

_____

_____

(1)

(e) Why might the claims made in the scientific paper have affected the percentage of children vaccinated?

Tick (✓) **one** box.

The measles pathogen did not exist in the UK anymore. ☐

Parents were worried their children would get condition **X**. ☐

The health service in the UK did not have any vaccines. ☐

(1)

(f) In 2010, the scientific paper linking condition **X** and the measles vaccine was shown to be based on false claims.

What should scientists do with scientific research to help detect false claims?

Tick (✓) **one** box.

Have the research peer reviewed. ☐

Publish the research on the internet. ☐

Send a research questionnaire to the public. ☐

(1)

(g) The person who wrote the scientific paper was paid to research the link between condition **X** and the measles vaccine.

Why are the claims in the scientific paper likely to be considered **not** valid?

_____

_____

(1)

(Total 10 marks)

2. Viruses cause disease.

(a) What name is given to microorganisms that cause disease?

Tick (✓) **one** box.

Pathogens ☐

Predators ☐

Producers ☐

(1)

(b) The body has defences to stop viruses entering.

Draw **one** line from each defence to the part of the body that provides the defence.

Defence	**Part of the body that provides the defence**
A physical barrier that stops viruses entering	Brain
	Heart
Mucus that traps viruses	Nose
	Skin

(2)

Some viruses can cause tumours to develop.

(c) Complete the sentence.

Choose the answer from the box.

digestion	**division**	**metabolism**

A tumour can form when changes to cells cause uncontrolled

cell _____.

(1)

(d) Malignant tumours are cancers.

Which **two** sentences describe malignant tumours?

Tick (✓) **two** boxes.

Malignant tumours are only found in the reproductive system. ☐

Malignant tumours contain digestive enzymes. ☐

Malignant tumours do not change in size. ☐

Malignant tumours have cells that can spread to other parts of the body. ☐

Malignant tumours may form secondary tumours. ☐

(2)

HPV is a virus that can cause one type of cancer in females.

In the UK since 2008, most 12 to 13-year-old females have been vaccinated against HPV.

Scientists investigated the percentage of 16 to 18-year-old females with HPV.

The table below shows the results.

Year	**Percentage (%) of 16 to 18-year-old females with HPV**
2010	8.2
2012	3.2
2014	2.0
2016	1.6

(e) What does the table above show about the percentage of females with HPV from 2010 to 2016?

_____

_____

(1)

(f) Suggest the reason for the change you described in part (e).

_____

_____

(1)

The HPV vaccine contains an inactive form of the virus.

The inactive form of the virus is injected into the body.

(g) Which part of the blood responds to the inactive virus?

Tick (✓) **one** box.

Platelets ☐

Red blood cells ☐

White blood cells ☐

(1)

(h) What is produced by the body in response to the inactive virus?

Tick (✓) **one** box.

Antibiotics ☐

Antibodies ☐

Antiseptics ☐

(1)

(i) Suggest **one** reason why some **parents** refuse to allow their children to have the HPV vaccine.

Do **not** refer to the pain of the injection in your answer.

_____

_____

(1)

(Total 11 marks)

3. Malaria is caused by a protist.

The protist is passed from one person to another person by mosquitos.

(a) Which term describes the mosquito?

Tick (✓) **one** box.

Bacterium ☐

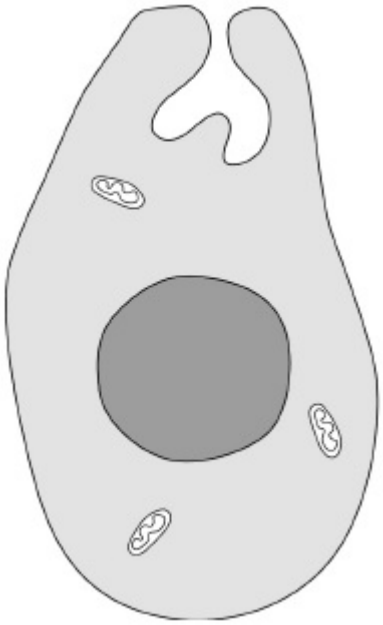
Gene ☐

Vector ☐

(1)

(b) The malarial protist is a eukaryotic cell.

The figure below shows a malarial protist.



Give **two** features of the malarial protist that show the cell is eukaryotic and **not** prokaryotic.

1 _____

_____

2 _____

_____

(2)

(c) Which organism is prokaryotic?

Tick (✓) **one** box.

Cow ☐

Grass ☐

Salmonella ☐

(1)

(d) The malarial protist reproduces asexually.

What is a feature of asexual reproduction?

Tick (✓) **one** box.

Only one parent is involved. ☐

The offspring show genetic variation. ☐

Two gametes fuse. ☐

(1)

(e) Mitosis occurs in the malarial protist during asexual reproduction.

The protist has 14 chromosomes.

How many chromosomes will each new protist cell have after mitosis?

Tick (✓) **one** box.

7 ☐ 14 ☐ 21 ☐ 28 ☐

(1)

(f) When a person has malaria, the protists destroy red blood cells.

What change would happen in the blood of a person with malaria?

Tick (✓) **one** box.

Decreased antibodies	☐
Decreased haemoglobin	☐
Increased plasma	☐
Increased platelets	☐

(1)

(g) It is estimated that 210 million people are infected with malaria every year.
Half of these infected people survive the disease.

Calculate how many people would survive the disease in 3 years if the estimate is correct.

Give your answer in standard form.

Number of people (in standard form) = _____

(4)

(h) The spread of malaria can be controlled by using mosquito nets to avoid being bitten.

Describe **two** other ways that people can reduce the chance of being bitten by mosquitos.

Do **not** refer to mosquito nets in your answer.

1 _____

_____

2 _____

_____

(2)

(i) Different types of disease may interact.

Scientists studied how having disorder **S** interacts with malaria.

The scientists calculated the chance of children with disorder **S** getting malaria.

The table below shows the results.

Age in years	**Percentage (%) chance of children with disorder S getting malaria**
2	70
4	65
6	50
8	45

Describe the trend shown in the table.

Use data from the table above.

_____

_____

_____

_____

(2)

(Total 15 marks)

4. *Salmonella* bacteria cause outbreaks of food poisoning in humans.

To prevent food poisoning in humans, farmers vaccinate their animals against *Salmonella* bacteria.

(a) How do *Salmonella* bacteria in food cause the symptoms of vomiting and diarrhoea?

_____

_____

(1)

During a food poisoning outbreak, scientists identified the farm where the food came from.

The farmer had **not** vaccinated the farm animals against *Salmonella* bacteria.

(b) The food poisoning outbreak could have been prevented if the farm animals had been vaccinated.

Explain how:

- the immune systems of animals respond to a vaccination
- the immune response in farm animals prevents an outbreak of food poisoning in humans.

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

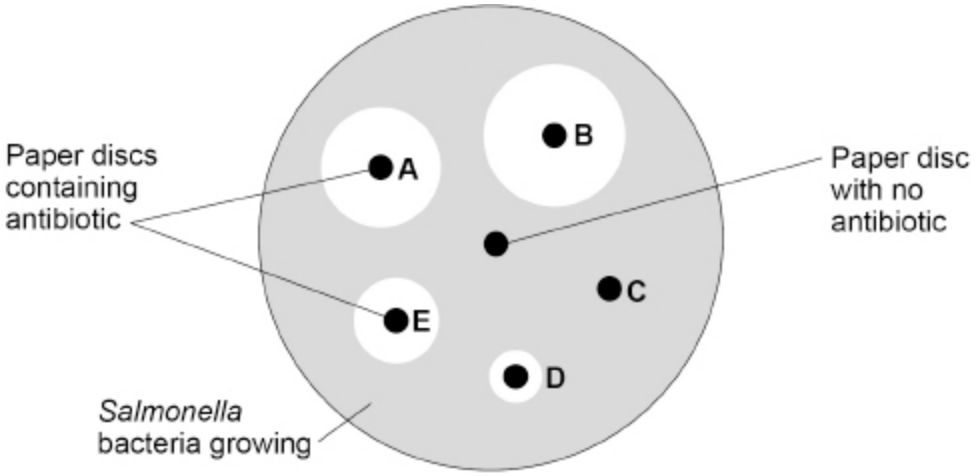
Most cases of food poisoning do **not** need to be treated with antibiotics.

However, some patients may need to take antibiotics to recover.

Scientists investigated the effectiveness of five different antibiotics on the *Salmonella* bacteria in the outbreak.

Antibiotics **A**, **B**, **C**, **D** and **E** were used in the investigation.

The figure below shows the results.



(c) Describe **two** aseptic techniques the scientists should have used in the investigation.

1 _____

_____

2 _____

_____

(2)

(d) The scientists incubated the bacteria at 37 °C.
Students in school laboratories incubate bacteria at 25 °C.

Explain why scientists use 37 °C but students must use 25 °C to incubate bacteria.

_____

_____

_____

_____

_____

_____

(3)

(e) What is the purpose of the paper disc with no antibiotic in the figure above?

_____

_____

(1)

(f) The scientists concluded that either antibiotic **A** or antibiotic **B** should be prescribed to patients with food poisoning.

Why should antibiotic **A** or antibiotic **B** be prescribed?

_____

_____

(1)

(g) The scientists wanted to be more certain about which antibiotic should be prescribed.

Describe how the results in the figure above could be used to obtain a **quantitative** comparison of antibiotics **A** and **B**.

_____

_____

(1)

(h) One year later, there was another outbreak at the farm involving *Salmonella* bacteria.

Antibiotic **B** did **not** have an effect.

Suggest why antibiotic **B** no longer had an effect.

_____

_____

(1)

(i) Antibiotics treat food poisoning because they kill *Salmonella* bacteria inside the human body.

Some antibiotics work because they damage the bacterial cell wall.

The bacteria die because the cells burst.

Explain why the cells burst.

_____

_____

_____

_____

_____

_____

(3)

(Total 17 marks)

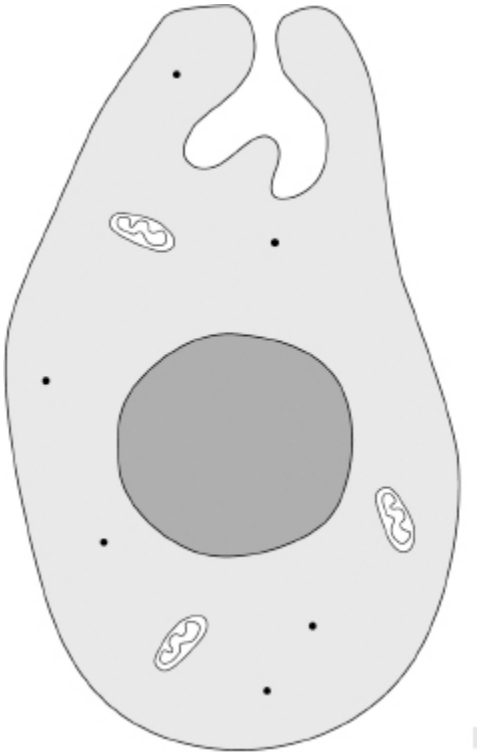
5. The protist that causes malaria is passed from one person to another person by mosquitos.

(a) What term describes an organism that passes a pathogen from one person to another person?

_____

(1)

(b) The figure below shows the malarial protist.



The malarial protist is a eukaryotic cell.

Describe **three** ways the structure of the malarial protist is different from the structure of a prokaryotic cell.

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

1 _____

_____

2 _____

_____

3 _____

_____

(3)

(c) During one stage of malaria infection, the malarial protists enter red blood cells and cause them to burst.

Explain why the bursting of red blood cells causes tiredness.

_____

_____

_____

_____

(2)

(d) The malarial protist reproduces sexually and asexually during a life cycle.

Complete **Table 1** to give **three** differences between sexual reproduction and asexual reproduction.

One difference has been completed for you.

Table 1

	Sexual reproduction	**Asexual reproduction**
	Involves two parents	Involves one parent
1		
2		
3		

(3)

(e) One drug for treating malaria prevents mitosis occurring in the malarial protist.

The drug stops the synthesis of new DNA bases in the cell.

Suggest how the drug prevents mitosis occurring.

_____

_____

(1)

(f) Describe the process of cell division by mitosis.

_____

_____

_____

_____

_____

_____

(3)

(g) Different types of disease may interact.

Scientists studied the incidence of malaria infections in children:

- with disorder **S**
- without disorder **S**.

The incidence of malaria in children with disorder **S** was calculated as a percentage of the incidence in children without disorder **S**.

Table 2 shows the results.

Table 2

Age in years	**Calculated percentage (%) incidence of malaria in children with disorder S**
2 to < 4	69
4 to < 6	63
6 to < 8	50
8 to 10	45
> 10	73

Describe what the results in **Table 2** show about the interaction between disorder **S** and malaria.

(2)

(Total 15 marks)

6. HIV (Human Immunodeficiency Virus) is a pathogen.

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

Year	Number of new HIV cases
2010	2642
2014	2767
2018	1530

(a) Describe what happened to the number of new cases of HIV from 2010 to 2018.

(2)

(b) What could cause a **decrease** in the number of new HIV cases in the future?

Tick (✓) **one** box.

A higher population of people in the UK	☐
A lower number of trained HIV nurses	☐
Better education on how to prevent the spread of HIV	☐

(1)

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

How could a vaccine work to prevent a person being infected with HIV?

Write the stages **A**, **B**, **C**, **D** and **E** in the correct order.

The first stage has been completed for you.

A Antibodies attach to the inactive virus.

B Antibodies destroy the inactive virus.

C An inactive form of the virus is injected into the body.

D If the active virus enters the body, antibodies are produced quickly.

E White blood cells produce antibodies to the inactive virus.

C ⟶ _____ ⟶ _____ ⟶ _____ ⟶ _____

(3)

(d) When scientists produce a vaccine for a disease the vaccine is tested on live animals.

What is the next stage in testing the vaccine?

Tick (✓) **one** box.

Testing on cells in a laboratory ☐

Testing on healthy volunteers ☐

Testing on the whole human population ☐

(1)

(e) A vaccine for HIV is important because it is difficult to develop safe drugs to destroy viruses.

Why is it difficult to develop safe drugs to destroy viruses?

Tick (✓) **one** box.

Drugs that destroy viruses also damage body tissues. ☐

There are too many viruses for the drugs to destroy. ☐

Viruses are too big for the drugs to destroy. ☐

(1)

(f) Some drugs originated from plants.

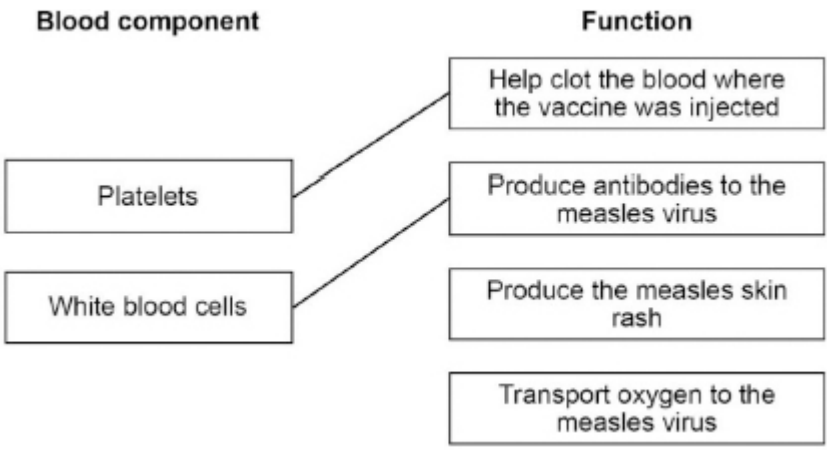
Draw **one** line from each drug to the plant the drug originated from.

Drug	**Plant the drug originated from**
Aspirin	Foxglove
Digitalis	Rose
	Tobacco
	Willow

(2)

(Total 11 marks)

1. (a)



1

do **not** accept more than one line from a box on the left

1

(b) 1968

allow 1969

1

(c) increases

1

(then) levels off / plateaus

allow (then) stays the same

allow reaches a maximum

between 1956 and 1968

1

(then) decreases

ignore use of numbers of people

*if no other mark awarded allow **1** mark for (overall) decrease*

1

(d) (the percentage) decreased

allow (the percentage)

decreased then increased

allow (the percentage) changed from 92% to 80%

1

(e) parents were worried their children would get condition **X**

1

(f) have the research peer reviewed

1

(g) any **one** from:

- (the author was) biased
- (the author was influenced by money
- because the research was not peer reviewed
- there was not enough evidence
- small sample size

ignore (the author) was paid

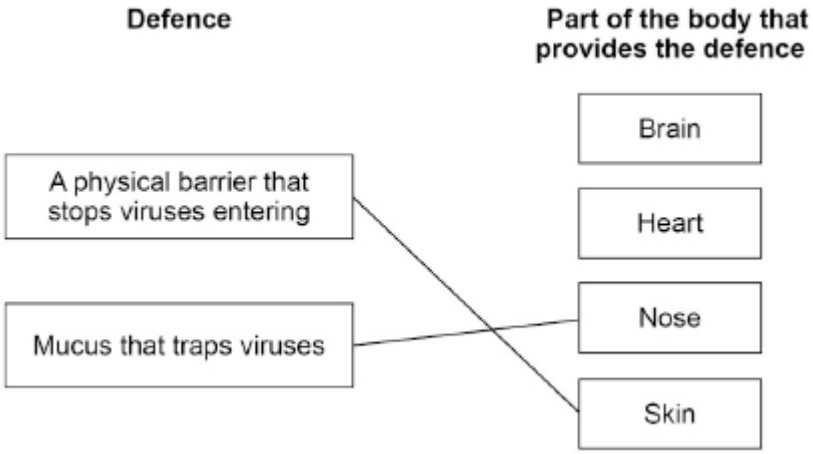
1

[10]

2. (a) pathogens

1

(b)



do **not** accept more than one line from a box on the left

2

(c) division

1

(d) malignant tumours have cells that can spread to other parts of the body

1

malignant tumours may form secondary tumours

1

(e) (percentage) decreases

1

(f) more females were vaccinated (over time)

allow males may also be vaccinated

allow more people were vaccinated

allow increased use of (named) barrier methods of contraception

allow more awareness / education (about HPV)

1

(g) white blood cells

1

(h) antibodies

1

(i) any **one** from:

- people are afraid of side / unknown effects
  allow there are side effects
  allow people think they cause (named) disease
- religious / cultural objections
  ignore religion unqualified ignore moral / ethical objections
- (some people) believe they don't work
- some people think (HPV) vaccine encourages sexual activity
  ignore pain of injection

1

[11]

3. (a) vector

1

(b) any **two** from:

- (it has) mitochondria
- (it has a) nucleus
  *if neither mark awarded, allow **1** mark for protist has membrane-bound structures*
  allow it does not have a loop of DNA
- (it has) no plasmids
  allow other appropriate features
  *do **not** accept (it has) cytoplasm*
  *do **not** accept (it has) a (cell) membrane*
  *do **not** accept it has no cell wall*

2

(c) Salmonella

1

(d) only one parent is involved

1

(e) 14

1

(f) decreased haemoglobin

1

(g) $\frac{210\ 000\ 000}{2}$

or

105 000 000

allow alternative route

allow correct conversion to standard form at any stage

allow $\frac{210 \text{ million}}{2}$

or

105 million

1

105 000 000 × 3

allow 105 million × 3

1

315 000 000

allow 315 million

1

3.15×10^8

1

(h) any **two** from:

- wear long(er) sleeves / clothes

  allow reduce bare skin exposure

- use insect repellent or insecticides

  allow insect repellent methods such as citronella candles

- don't go out in the evening

  allow close doors / windows in the evening

- avoid going to countries / places with malaria / mosquitos

- destroy breeding grounds

  allow methods of destroying breeding grounds such as drain water holes

- release sterile male mosquitos

2

ignore vaccination / anti-malarial drugs

allow other correct suggestions

(i) percentage / chance (of getting malaria) decreases (with age)

*do **not** accept percentage / chance of having disorder **S***

decreases with age

1

correct use of data such as two pairs of data from the table

allow use of processed data

1

[15]

4.

(a) (bacteria) release / produce toxins

allow (bacteria) release / produce poisons

ignore toxins unqualified

1

(b) **Level 2**: Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

3–4

Level 1: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

1–2

No relevant content

0

Indicative content:

Vaccination of animal

- (animal's) white blood cells / lymphocytes produce antibodies (against *Salmonella* / vaccine / antigens)
- antibodies are specific / complementary / correct to *Salmonella* / antigens
- (specific) antibodies bind to *Salmonella* / antigens

Secondary response in animal

- if infected (specific) antibodies are produced quickly **or** in large numbers
- (so) white blood cells **or** antibodies would kill (live) *Salmonella*
- (so) fewer / no bacteria / pathogens / *Salmonella* in animals **or** in animal products (meat / milk / eggs)

Prevention of food poisoning in humans

- (so) fewer / no bacteria / pathogens / *Salmonella* eaten **or** in (named) food
- (so) number of bacteria never reaches a high enough level for infection to develop
- (so) fewer toxins produced (in humans).

For **Level 2** students must link immune response in animals to prevention of an outbreak in humans.

(c) any **two** from:

allow alternative descriptions of sterilising equipment such as UV light

ignore clean / wash surfaces / hands / equipment

- disinfect hands / work surface
- sterilise Petri dish **or** culture medium (before use)
- pass inoculating loop / forceps through a flame (before use)

  allow sterilise agar (before use)

  ignore sterilise equipment
- work near a flame
  or
  work in a fume cupboard
- tilt lid (of Petri dish) when placing discs on agar (to minimise contact with air / breath)

  allow example of other method to minimise contact with air / breath
- secure lid of Petri dish with adhesive tape

  ignore store dish upside-down

2

(d) (37 °C)

37 °C is human / body temperature

1

Salmonella / bacteria grows best / better at 37 °C

allow (so) bacteria grow best / better at human body temperature

1

(25 °C)

25 °C reduces / prevents the growth of bacteria that are harmful to humans / students

allow because it is too low for growth of human pathogens

1

(e) (acts as a) control

allow for comparison

allow to show that the results are not due to the paper disc

allow to show that the results are due to the antibiotic

ignore to show the effect / effectiveness of the antibiotic

*do **not** accept as a control variable*

1

(f) (they) killed the most bacteria

allow prevented most bacteria growing / replicating

allow largest zone of inhibition (of bacteria)

ignore largest clear area unqualified

*ignore antibiotic **B** killed the most bacteria*

1

(g) measure the diameter / radius of each clear area

allow measure the diameter / radius of each region where the bacteria are killed

or

calculate / measure the area of each clear area

allow calculate the area of each region where the bacteria are killed

1

(h) bacteria must be resistant (to antibiotic **B**)

*do **not** accept bacteria must be immune*

1

(i) water enters the (bacterial) cell

1

(water enters) by osmosis

allow (water enters) by diffusion through a partially / selectively / semi permeable membrane

*do **not** accept if description of concentrations is incorrect*

1

(so) damaged / incomplete / no cell wall cannot withstand pressure (of water)

allow (so remaining) cell membrane cannot stretch further

1

[17]

5. (a) vector

1

(b) any **three** from:

allow converse for prokaryotic cells

allow eukaryotic for protist

- protist / it has mitochondria
- protist / it has (a) nucleus **or** protist DNA / genetic material is not free in the cytoplasm

  *if neither mark awarded, allow **1** mark for protist has membrane-bound*

  structures

  ignore genetic information

- protist / it does not have a single loop of DNA / genetic material

  ignore genetic information

- protist / it does not have plasmids

- protist / it does not have a cell wall

  *do **not** accept eukaryotic cell does not have a cell wall*

  allow protist / it does not have a slime capsule

  ignore cilia / flagellae / ribosomes

  ignore size / shape

3

(c) less oxygen carried (in blood)

allow less oxygen carried (to cells)

ignore reference to number of red blood cells unqualified

*do **not** accept no oxygen carried*

1

less energy released from respiration

*do **not** accept energy produced / made / created*

1

(d) any **three** pairs from:

Sexual reproduction	Asexual reproduction
involves two parents	involves one parent
involves gametes joining / fusing **or** involves fertilisation	involves no (fusion of) gametes **or** does not involve fertilisation
there is mixing of genetic material / information **or** there is genetic variation **or** offspring are genetically different	there is no mixing of genetic material / information **or** there is no genetic variation **or** offspring are genetically identical ignore reference to clones
involves (only) meiosis	involves mitosis **or** does not involve meiosis
more energy required	less energy required
slower	faster

*if no other mark awarded allow **1** mark for asexual reproduction produces many offspring*

pairs of answers can be in any order

3

(e) (no bases so) DNA replication cannot occur

allow copying / duplicating / doubling for replication

ignore cannot make DNA unqualified

1

(f) (after DNA replication) one set of chromosomes is pulled to each end of the cell

allow one (member) of each pair of chromosomes is pulled to each end of the cell

ignore (half the) chromosomes are pulled to each end of the cell

1

nucleus divides

allow two (new) nuclei form

1

cytoplasm **or** cell membrane divides to form two cells

allow cytokinesis

1

(g) having disorder **S** reduces incidence / percentage of malaria

*allow having disorder **S** reduces chance of getting malaria*

*allow having disorder **S** protects against malaria*

1

as age increases a lower percentage of children with disorder **S** get malaria until age 10, then the percentage increases

allow protection against malaria increases with (increasing) age until age 10, then it decreases

1

[15]

6. (a) increased (at first)

1

(then) decreased

ignore numbers unqualified

*do **not** accept an implication of an overall increase*

*if no other mark awarded allow (overall) decrease for **1** mark*

1

(b) better education on how to prevent the spread of HIV

1

(c) (C) → E → A → B → D

*allow **1** mark for E → A link*

*allow **1** mark for A → B link*

*allow **1** mark for B → D link*

*if no other mark awarded allow **1** mark for an answer of (C) → E → B → A → D*

3

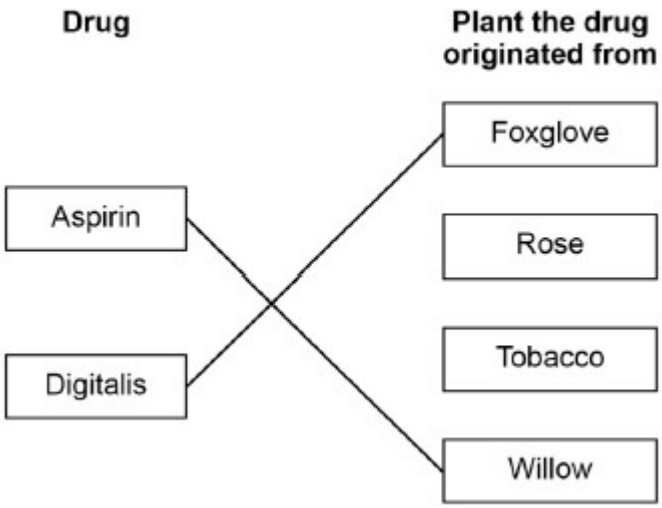
(d) testing on healthy volunteers

1

(e) drugs that destroy viruses also damage body tissues

1

(f)



*do **not** accept more than one line from a box on the left*

2

[11]