Infection and Response part 1 AQA Triple Biology

Name: _____

Class: _____

Date: _____

Time: **66 minutes**

Marks: **62 marks**

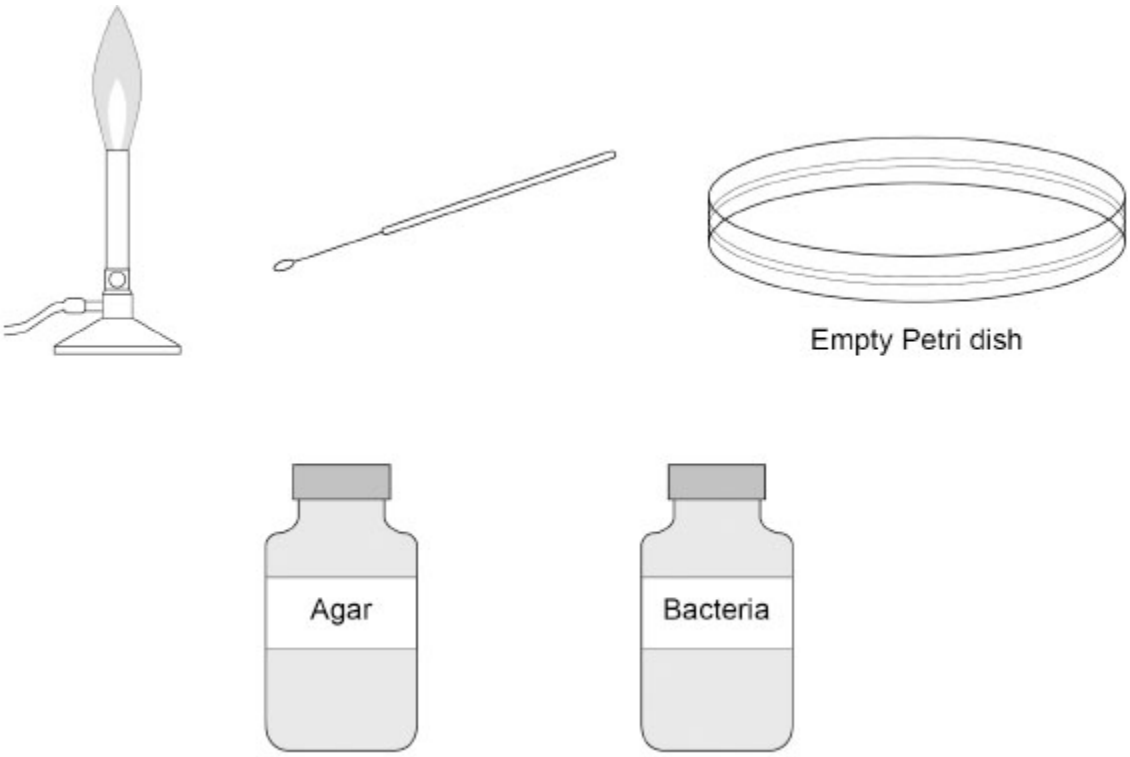
Comments:

1. A student investigated the effect of antibiotics on the growth of bacteria.

The student prepared an agar gel plate.

Figure 1 shows some of the equipment the student used.

Figure 1



(a) Describe a method the student could use to:

- prepare a sterile agar gel plate
- grow an uncontaminated sample of bacteria on the agar gel plate.

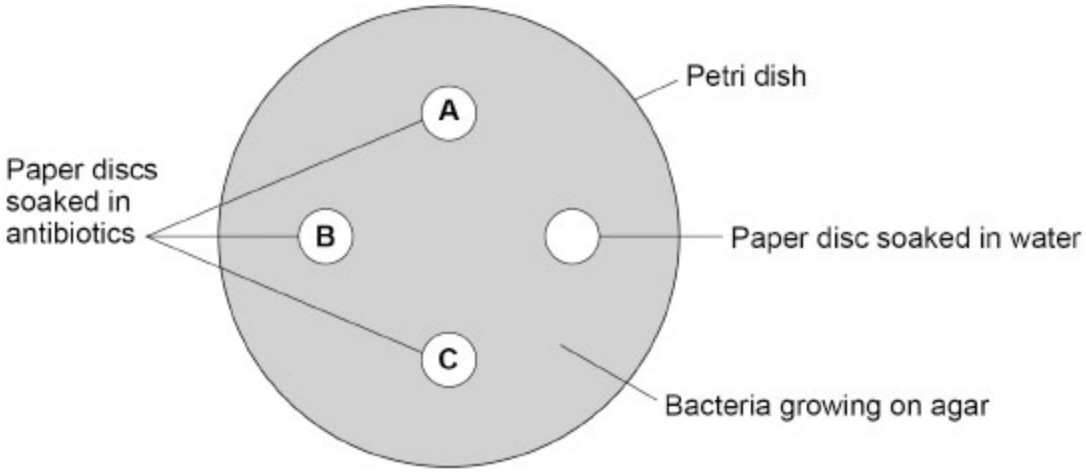
Use the equipment in **Figure 1** in your answer.

(6)

The student used an agar gel plate to test three antibiotics, **A**, **B** and **C**.

Figure 2 shows how the agar gel plate was set up.

Figure 2



(b) The student incubated the agar gel plate at 25 °C.

Why should the temperature **not** be higher than 25 °C?

_____

_____

(1)

(c) What was the purpose of the paper disc soaked in water?

Tick (✓) **one** box.

To check the bacteria were uncontaminated. ☐

To make the investigation more accurate. ☐

To show the effect of no antibiotics. ☐

(1)

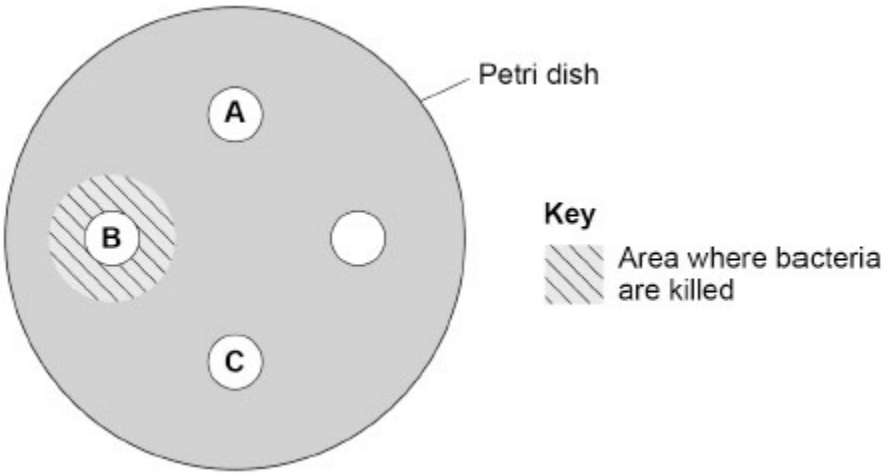
(d) The student removed the agar gel plate from the incubator after 48 hours.

Antibiotic **A** was the **most** effective at killing the bacteria.

Antibiotic **C** was the **least** effective at killing the bacteria.

Figure 3 shows the results for the disc soaked in antibiotic **B**.

Figure 3



Complete **Figure 3** to show the results you would expect.

You should:

- draw a ring around the disc soaked in antibiotic **A**
- draw a ring around the disc soaked in antibiotic **C**.

(2)

(e) The student repeated the investigation with antibiotic **D**.

The bacteria were resistant to antibiotic **D**.

What effect would antibiotic **D** have had on the bacteria?

Tick (✓) **one** box.

All of the bacteria would have been killed. ☐

Some of the bacteria would have been killed. ☐

None of the bacteria would have been killed. ☐

(1)

(Total 11 marks)

2. Blood contains different types of cell.

(a) Complete the sentences.

Choose answers from the box.

antibiotics	**antitoxins**	**painkillers**	**pathogens**

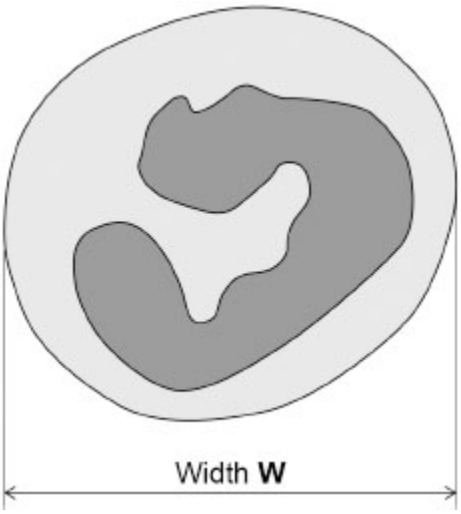
White blood cells defend the body against _____.

Some white blood cells release chemicals that neutralise toxins. These chemicals are called _____.

(2)

(b) **Figure 1** shows a white blood cell.

Figure 1



The image of the white blood cell in **Figure 1** is magnified 4000 times.

Calculate the real width of the white blood cell.

Complete the following steps.

Measure width **W** in millimetres (mm).

Width **W** = _____ mm

Convert your measurement to micrometres (µm).

1 millimetre (mm) = 1000 micrometres (µm).

_____

_____

Width **W** in micrometres = _____ µm

Calculate the real width of the white blood cell.

Use the equation:

$$\text{real width} = \frac{\text{width W (µm)}}{\text{magnification}}$$

_____

_____

_____

Real width = _____ µm

(4)

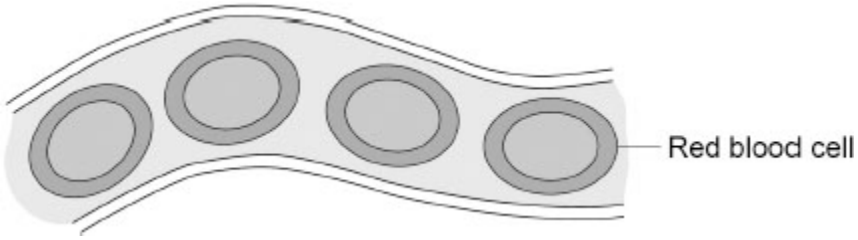
The table below shows information about different types of blood vessel.

Blood vessel	**Width of blood vessel in micrometres (µm)**	**Pressure of blood travelling through the blood vessel**
Artery	10 000	High
Capillary	10	Low
Vein	20 000	Very low

(c) The width of a red blood cell is 8 µm.

Figure 2 shows red blood cells in one type of blood vessel.

Figure 2



Which type of blood vessel is shown in **Figure 2**?

Use the table above.

Tick (✓) **one** box.

Artery ☐

Capillary ☐

Vein ☐

(1)

(d) Explain why arteries need to have thick walls.

Use the table above.

_____

_____

_____

_____

(2)

Coronary arteries in the heart can become narrowed.

(e) What happens inside coronary arteries to cause them to become narrowed?

_____

_____

(1)

(f) Explain why narrowed coronary arteries can be dangerous.

_____

_____

_____

_____

(2)

(g) Treatments are available for some cardiovascular diseases.

Draw **one** line from each cardiovascular disease to a treatment for the disease.

Cardiovascular disease	Treatment
A blocked coronary artery	Antibiotics
Heart failure	Heart transplant
High blood cholesterol	Statins
	Stent

(3)

(h) Why is coronary heart disease described as a 'non-communicable disease'?

_____

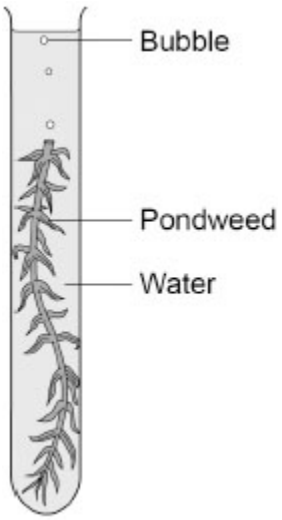
_____

(1)

(Total 16 marks)

3. A student investigated the effect of temperature on the rate of photosynthesis in pondweed.

The figure below shows how the student set up the apparatus.



This is the method used.

1. Prepare five tubes of pondweed as shown in the figure above.
2. Place one tube into each of five water baths set at different temperatures.
3. Wait two minutes.
4. Measure the time taken for each piece of pondweed to release 10 bubbles.

(a) What is the independent variable in the investigation?

_____

(1)

The table below shows the results.

Temperature in °C	**Time taken for pondweed to release 10 bubbles in seconds**
10	84
20	43
30	27
40	25
50	33

(b) Calculate the rate of photosynthesis at **20 °C**.

Give your answer to 3 significant figures.

Give the unit.

Rate (3 significant figures) = _____

Unit = _____

(4)

(c) Explain the difference in the rate of photosynthesis at 40 °C compared with the rate of photosynthesis at 10 °C.

(3)

(d) Give **two** other factors that affect the rate of photosynthesis.

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

1 _____

2 _____

(2)

(e) Describe **one** way the method could be changed to obtain more accurate results for the rate of photosynthesis.

_____

_____

_____

(1)

A gardener noticed that some plants were not growing as well as usual.

(f) Describe **two** ways the gardener could identify a plant disease.

1 _____

_____

2 _____

_____

(2)

(g) One of the plants had purple spots on its leaves and the leaves fell off.

What disease is the plant most likely to have?

_____

(1)

(h) A different plant had yellow leaves, but no spots.

Explain why plants may develop yellow leaves.

_____

_____

_____

_____

_____

(2)

(Total 16 marks)

4. Measles is an infectious disease caused by a pathogen.

(a) What type of pathogen causes measles?

_____

(1)

(b) Give **one** way measles is spread from one person to another person.

_____

_____

(1)

(c) One symptom of measles is pain.

In adults, aspirin can be used to treat the pain.

Which plant did aspirin originate from?

_____

(1)

(d) Give **one** other symptom of measles.

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

_____

(1)

The spread of measles can be reduced by vaccination.

(e) Explain why vaccinating large numbers of children helps to reduce the spread of the measles pathogen in the population.

_____

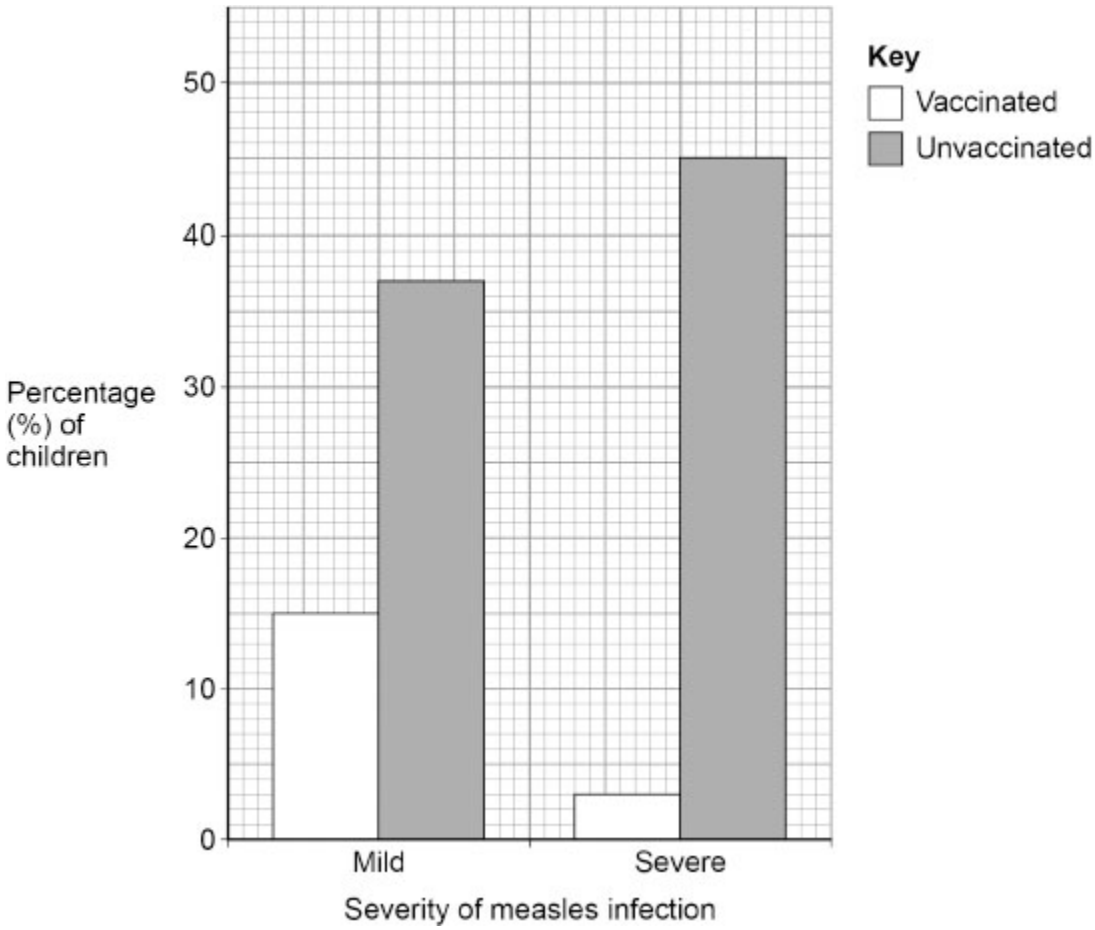
_____

_____

_____

(2)

The figure below shows information about the severity of measles infection in vaccinated and unvaccinated children.



(f) There were 240 children in the survey.

Calculate how many **unvaccinated** children had a severe measles infection.

Use the figure above.

Number of unvaccinated children = _____

(3)

(g) It is recommended that all children are given a measles vaccination.

Give evidence from the figure above to support the recommendation.

Include data from the figure above in your answer.

_____

_____

_____

_____

(2)

(Total 11 marks)

5. Pathogens cause disease.

(a) How does the skin defend the human body against pathogens?

_____

_____

(1)

The stomach contains acid to kill pathogens.

A scientist investigated the effect of acid on the survival of bacteria.

This is the method used.

1. Prepare four test tubes each with 10 cm^3 of culture solution.

2. Use acid to adjust the pH of the solutions to be pH1, pH2, pH3 and pH5

3. Add 1 cm^3 of bacteria mixture to each test tube.

4. Take a 0.1 cm^3 sample from each test tube and record the number of live bacteria.

5. Keep the test tubes at 37 °C for 24 hours.

6. Repeat step 4.

The table below shows some of the results.

Time in hours	**Number of live bacteria**			
	pH1	**pH2**	**pH3**	**pH5**
0	210	210	210	216
24	23	**X**	63	185

(b) What fraction of the bacteria present at 0 hours for **pH3** survived for 24 hours?

Give your answer in its simplest form.

_____

_____

_____

Fraction surviving = _____

(2)

(c) How many more bacteria were killed at pH1 than at pH5 in 24 hours?

Complete the following steps.

Calculate the number of bacteria killed at pH1

_____

Calculate the number of bacteria killed at pH5

_____

Calculate how many more bacteria were killed at pH1 than at pH5

_____

_____

Number = _____

(3)

(d) A student calculated value **X** in above table to be 43

Suggest how the student calculated this value.

_____

_____

_____

_____

(2)

(Total 8 marks)

1. (a) **Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.

5-6

Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.

3-4

Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1-2

No relevant content.

0

Indicative content

preparation of agar plate

- melt agar
- pour agar into Petri dish
- allow agar to cool / set

transfer of bacteria

- transfer bacteria to agar / Petri dish **or** spread bacteria on agar / Petri dish
- transfer bacteria using (inoculating) loop **or** by pouring (liquid) bacterial culture

techniques to ensure sterile conditions (aseptic technique)

- wipe table with a disinfectant / antibacterial solution
  or
  sanitise hands using sanitiser gel
- sterilise agar by heating **or** using autoclave / UV **or** pressure cooker
- sterilise Petri dish by heating **or** using autoclave / UV **or** pressure cooker **or** ethanol
- sterilise neck of agar / bacteria bottle by passing through a flame
- only open lid of agar bottle minimally **or** only lift lid of Petri dish minimally
- work next to a Bunsen flame
- sterilise inoculating loop before use by dipping in alcohol / ethanol
- sterilise inoculating loop before use by passing through a flame

growth of bacteria

- incubate Petri dish upside down
- tape lid (correctly)
- incubate at 25 °C **or** leave bacteria to grow

For **Level 3**, a valid method must include preparation of the agar plate and transfer of the bacteria using sterile techniques.

For **Level 2**, a method must include preparation of the agar plate and transfer of the bacteria.

(b) to prevent growth of pathogens

allow to prevent growth of harmful bacteria / fungi / microorganisms

1

(c) to show the effect of no antibiotics

1

(d) larger ring drawn around antibiotic **A** than **B**

ignore ring drawn around blank / water disc

ignore shading / hatching within rings

1

smaller ring drawn around antibiotic **C** than **B**

*ignore no ring drawn around antibiotic **C***

1

(e) none of the bacteria would have been killed

1

[11]

2. (a) pathogens

1

antitoxins

in this order only

1

(b) *measurement*

60 (mm)

allow measurement in the range 59 (mm) to 61 (mm)

1

conversion

60 000 (µm)

allow correct conversion from incorrect measurement

1

substitution

$= \frac{60\,000}{4\,000}$

allow correct substitution using incorrect conversion

1

real width

15 (µm)

allow correct calculation using incorrectly converted value

1

(c) capillary

1

(d) (blood in arteries) has high pressure

1

(so need thick walls) to withstand / maintain the pressure
or
(so need thick walls) to prevent bursting

ignore to increase the pressure

*allow **2** marks for to withstand / maintain high pressure*

1

(e) deposits / build-up / increase of fat(ty material)

allow deposits / build-up / increase of cholesterol

allow deposits / build-up / increase of plaque

1

(f) less / no blood flow

1

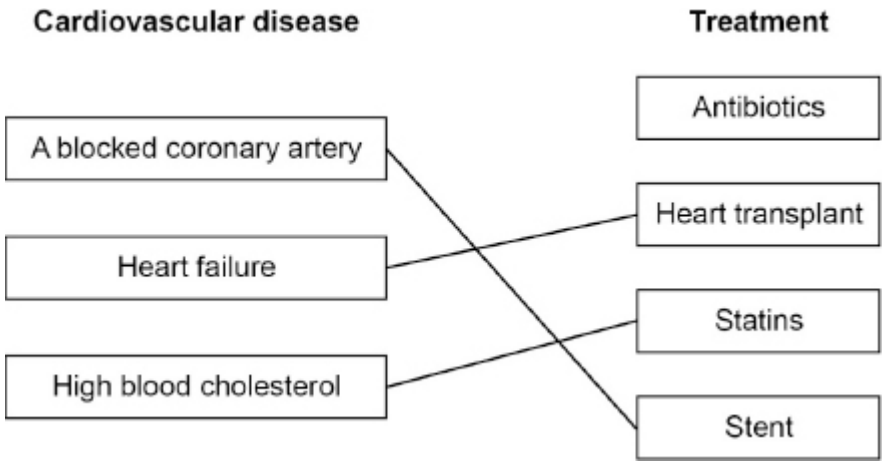
(so) less / no oxygen / glucose transported (to heart / body)

*allow **2** marks for less oxygenated blood flows*

*if no other marks awarded allow **1** mark for idea that it will lead to a heart attack*

1

(g)



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

3

(h) because it cannot be spread / passed on (from one person to another)
or
because it is not caused by a pathogen / bacterium / virus / fungus / protist / microorganism / microbe

allow not contagious / infectious

ignore because it is a lifestyle disease

1

[16]

3. (a) temperature

1

(b) $\frac{10}{43}$ **or** $\frac{1}{43} \times 10$

allow correct calculation in other units eg bubbles per minute / hour

1

0.23255…

1

0.233

(unit) bubbles per second

allow student's incorrectly calculated value to 3 significant figures

allow use of other values for time from the table

1

unit must be consistent with student's answer for MP3

1

(c) rate / photosynthesis is faster / higher (at 40°C)

allow converse for 10°C if clearly stated

allow as the temperature increases, the rate (of photosynthesis) increases

1

reactants / particles / molecules / enzymes have greater (kinetic) energy

allow reactants / particles / molecules / enzymes move faster

1

(so) collide more frequently

allow (so) more collisions in a given time allow more <u>successful</u> collisions

1

(d) any **two** from:

- light intensity / level
- colour / wavelength of light

*if neither point awarded allow **1** mark for light unqualified*

- carbon dioxide (concentration)
- (mass of) chlorophyll

allow number of chloroplasts

ignore water / humidity

*do **not** accept wind*

2

(e) collect gas / oxygen in a (gas) syringe

or

collect gas / oxygen in an inverted measuring cylinder

*allow bubbles for gas / oxygen do **not** accept incorrect gas*

allow measure the volume of gas / oxygen in a (gas) syringe ignore use a gas syringe

allow measure the volume of gas / oxygen in an inverted measuring cylinder

ignore collect gas / oxygen in a measuring cylinder

ignore use an inverted

measuring cylinder

allow other correct methods

1

(f) any **two** from:

- reference to a gardening manual / website / app
- take (infected plants) to a laboratory / scientist / expert
- use testing kits that contain monoclonal antibodies

ignore use / search the internet unqualified

2

(g) (rose) black spot

allow other correct diseases such as rust

*do **not** accept nitrate / magnesium deficiency*

*do **not** accept tobacco mosaic virus **or** TMV*

1

(h) a shortage of magnesium (ions)

allow a shortage of nitrate / iron (ions)

1

which causes chlorosis
or
(so) less chlorophyll
or
(magnesium is needed) to make chlorophyll

OR

lack of light (1)

causes chlorosis **or** causes chlorophyll to break down (1)

ignore chlorosis unqualified

ignore fewer chloroplasts

allow (nitrate / iron is needed) to make chlorophyll

1

[16]

4. (a) virus

1

(b) any **one** from:

- (transfer of) droplets / saliva / mucus
- sneezes
- coughs

ignore other methods of transferring pathogens, unqualified such as touch or direct contact

*do **not** accept transfer through sexual intercourse*

1

(c) willow

ignore parts of willow such as bark / leaves

1

(d) fever

or

(red skin) rash

allow high temperature

allow (increased) sweating

allow (red) spots / lumps / boils

allow red / itchy skin

allow cough / sneeze

allow runny / blocked nose

allow sore throat

allow red / watery / sore eyes

allow headache

ignore flu-like symptoms

unqualified

ignore pain unqualified

*do **not** accept nausea / diarrhoea*

1

(e) **few(er)** people (in population) with pathogen / measles / disease (due to vaccination)

allow named types of pathogen

allow (provides) herd immunity

1

(so) **less likely** for pathogen / measles / disease to be passed on

or

(so) **less likely** for pathogen / measles / disease to be spread / caught

*allow **less likely** to come into contact with a person with pathogen / measles / disease*

ignore (so) spread of disease is reduced

*allow **2** marks for fewer people with measles, so **less likely** to spread*

1

(f) (graph reading) = 45

1

$\frac{45}{100} \times 240$

allow 0.45 × 240

1

108

*allow for **1** mark an answer of 7 / 7.2 with evidence of having used 3(%) from the graph*

or

*allow for **1** mark an answer of 88 / 88.8 / 89 with evidence of having used 37(%) from the graph*

1

(g) a lower percentage of vaccinated children have severe measles / infection / disease

or

a higher percentage of unvaccinated children have severe measles / infection / disease

or

vaccination reduces severity of measles / infection / disease

allow answers in terms of numbers of children or likelihood of getting disease

allow converse

1

correct use of supporting comparative data from the figure

*allow examples such as (severe disease is) 42% higher (in unvaccinated) **or** 15 times higher (than in vaccinated)*

or

allow correct use of raw data used in a comparative way

1

[11]

5. (a) (physical) barrier
or
stops pathogens entering (blood / body)

allow named pathogen throughout
allow produces antimicrobial secretions
allow produces oil / sebum / sweat
ignore reference to scabs / clots

1

(b) $\frac{63}{210}$

1

$\frac{3}{10}$

allow 0.3
ignore 30%
if neither mark awarded allow $\frac{210}{63} = \frac{10}{3}$ *for* ***1*** *mark*

1

(c) *(at pH1)* 187 (killed)

ignore negative symbol throughout

1

(at pH5) 31 (killed)

1

(187 – 31) = 156
(more bacteria killed)

allow correct subtraction using incorrect calculation at pH1 and/or pH5

1

(d) (the student) calculated the midpoint

1

(between) 23 and 63

OR

any **two** from:

- $\frac{63 - 23}{2} = 20$
- 20 + 23 = 43
- 63 – 20 = 43

allow (between values at) pH1 and pH3

allow $\frac{23 + 63}{2}$ *= 43 for **2** marks*

allow plot data from the table on graph (1) then read off value for pH2 (1)

*allow other correct methods for up to **2** marks*

1

[8]