4-3 Infection and Response – Biology

1.1 Pathogens are disease causing microorganisms.

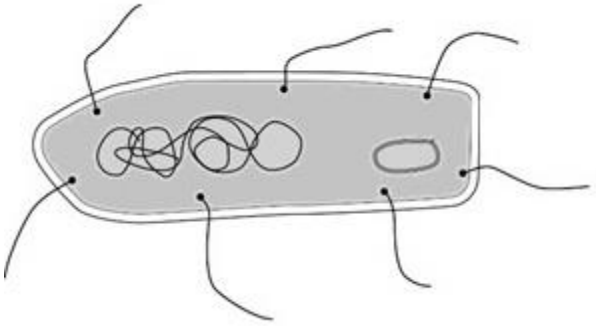
Draw **one** line from each disease to the correct disease-causing microorganism.

[3 marks]

Disease	Microorganism
Measles	Virus
Rose black spot	Bacterium
Salmonella	Fungi
	Protists

Figure 1 shows the image of a bacterial cell.

Figure 1



1.2 Measure the length of the image of the cell in mm.

[1 mark]

Length of image = _____ mm

1.3 The bacterial cell has been magnified 15 000 times.

Calculate the real length of the bacterial cell using your answer in 1.2.

[1 mark]

Real length of cell = _____ µm

1.4 Plants can be infected with pathogens.

Plants are also damaged by ion deficiencies.

Chlorosis (yellow leaves) is caused by an ion deficiency.

Lack of which ion causes chlorosis?

[1 mark]

Tick **one** box.

Chloride ☐

Hydrogen ☐

Magnesium ☐

Nitrate ☐

2.0 Drugs affect the human body.

New drugs must be tested and trialled before being used.

2.1 New drugs are tested in a laboratory before they are trialled on people.

In a laboratory, what are new drugs tested on?

[1 mark]

_____

2.2 Why is it important that drugs are trialled before doctors give them to patients?

[2 marks]

Tick **two** boxes.

- To check that the drug works ☐
- To check the cost of the drug ☐
- To find out if the drug is legal ☐
- To find the best dose to use ☐

2.3 In a double blind drug trial, only some people know which patients have been given the drug.

Who knows which patients have been given the drug?

[1 mark]

Tick **one or more** boxes.

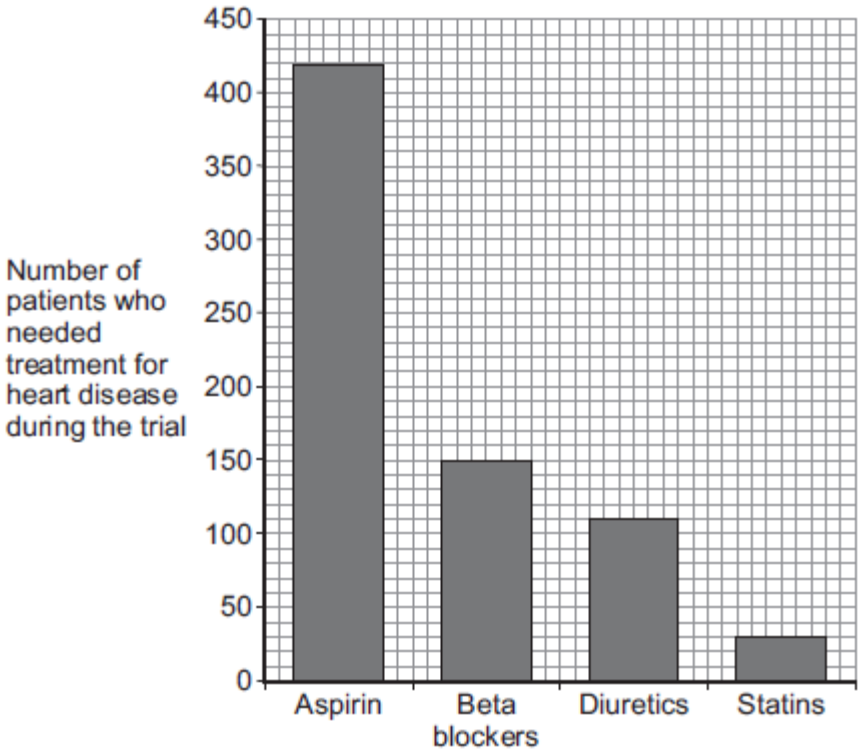
- The patient ☐
- The doctor ☐
- The scientists at the drug company ☐

Doctors trialled four different treatments for reducing the risk of heart disease.

The patients did **not** have heart disease at the start of the trial.

The **Figure 2** below shows the results.

Figure 2



Each treatment was trialed on the same number of patients for 5 years.

2.4 How many patients who took aspirin needed treatment for heart disease during the trial?

[1 mark]

Number of patients = _____

2.5 Based **only** on the evidence in the graph, which would be the best treatment to reduce the risk of developing heart disease?

[1 mark]

_____

2.6 Suggest **one** other factor that a doctor might consider before deciding which treatment to use for a patient.

[1 mark]

_____

3.0 Some forms of the Human Papilloma Virus (HPV) have been shown to cause cervical cancer.

Girls aged 11 to 14 now receive a vaccine for HPV.

Explain how the HPV vaccine could reduce the incidence of cancer.

Include in your answer:

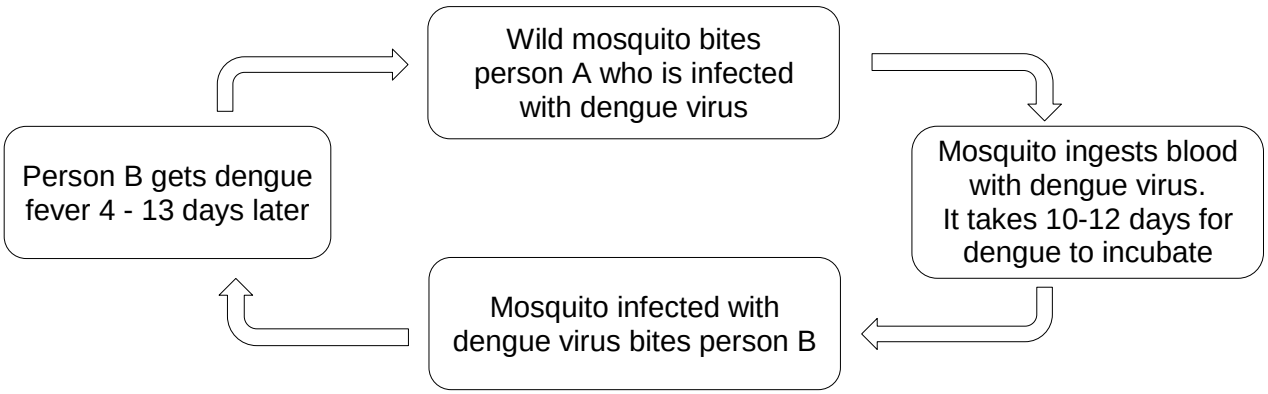
- How the immune system responds to vaccines
- How giving girls the vaccine could reduce the number who get cervical cancer.

[6 marks]

4.0 Dengue fever is a viral disease that affects up to 100 million people each year.

The lifecycle of the dengue virus can be summarised as:

Figure 3



4.1 The mosquito passes the virus from person to person.

What type of organism is the mosquito in this case?

[1 mark]

Tick **one** box.

Fungus ☐

Parasite ☐

Protist ☐

Vector ☐

4.2 Brazil is a country with high levels of the dengue virus in the population.

Give **two** ways in which people in Brazil can help prevent infection with dengue virus.

[2 marks]

_____

_____

4.3 What is the minimum incubation time from person **A** being bitten to person **B** getting dengue fever?

Use information in **Figure 3**

[1 mark]

_____

5.0 Pneumonia is a condition that causes severe breathing difficulties and can lead to death. It is usually caused by a viral or bacterial infection.

The incidence of pneumonia in people with HIV has been five to ten times higher than in people without HIV.

5.1 Suggest why the incidence of pneumonia is higher in people with HIV.

[2 marks]

5.2 Atazanavir is a drug used to treat people with HIV.

Suggest what type of drug Atazanavir is.

[1 mark]

5.3 Scientists are trying to make a vaccine against HIV.

A vaccine to protect against HIV could be made using only a small part of the virus rather than a weakened form of the whole virus.

There would be **no** whole virus in the vaccine.

Suggest **two** advantages of using this type of vaccine.

[2 marks]

5.4 Tobacco Mosaic Virus affects plants.

Plants infected with Tobacco Mosaic Virus are often smaller than healthy plants.

Explain why.

[4 marks]

6.0 A student is given a tube containing a liquid nutrient medium.

The medium contains *E. coli* bacteria.

6.1 The student is told to grow some of the *E. coli* on agar jelly in a Petri dish.

Describe how the student should prepare an uncontaminated culture of *E.coli* in the Petri dish.

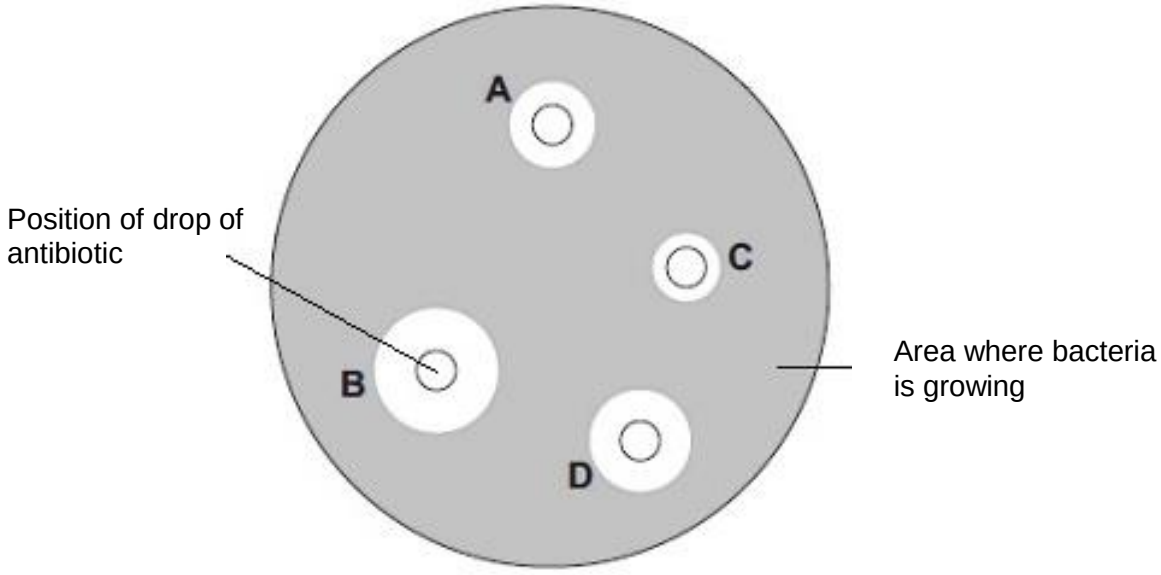
You should explain the reasons for each of the steps you describe.

[4 marks]

After the culture had been prepared, the student added one drop of each of five antibiotics, **A**, **B**, **C**, and **D**, onto the culture.

Figure 4 shows the appearance of the petri dish 3 days later.

Figure 3



6.2 Which was the most effective antibiotic?

For this antibiotic, calculate the area in which bacteria did not grow.
Show your working.

[2 marks]

Most effective disc_____

Area_____mm^2

6.3 Explain whether the antibiotic use identified in **6.3** will be the best one to use for gonorrhea infections.

[2 marks]

_____

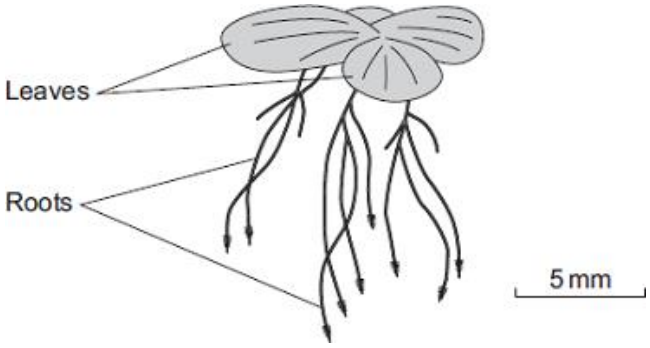
_____

7.0 Duckweed is a plant that grows in ponds.

The leaves of duckweed float on the surface of the water and its roots hang down in the water

Figure 5 shows a duckweed plant.

Figure 5



7.1 Duckweed roots absorb nitrate ions from the water.

What do duckweed plants make with the nitrate ions?

[1 mark]

Some students grew duckweed plants in three different solutions of mineral ions, **A**, **B** and **C**, and in distilled water (**D**).

Table 1 shows the concentrations of mineral ions in each of **A**, **B**, **C** and **D** at the start of the investigation.

Table 1

Mineral ion	**Concentration of mineral ions in mg per dm^3 at the start of the investigation**			
	A	**B**	**C**	**D**
Nitrate	1000	4	4	0
Phosphate	300	0	0	0
Magnesium	200	84	24	0

The students counted the number of duckweed leaves in **A**, **B**, **C** and **D** at the start of the investigation and after 28 days.

Table 2 shows their results.

Table 2

	A	**B**	**C**	**D**
Number of leaves at start	4	4	4	4
Number of leaves after 28 days	50	27	14	6

7.2 Describe the effect of magnesium ions on the growth of duckweed.

Use **Table 1** and **Table 2**.

[1 mark]

_____

7.3 Solution **A** contained the highest concentration of nitrate ions.

One student concluded, 'The results show that nitrate ions are needed for the growth of duckweed.

What evidence in **Table 2** supports the student's conclusion?

[1 mark]

_____

7.4 The students measured the growth of the duckweed by counting the number of leaves.

Suggest a better method of measuring the growth of the duckweed.

[1 mark]

_____

7.5 Explain why your method is better than the students' method.

[1 mark]

_____

MARK SCHEME

Qu No.		Extra Information	Marks
1.1	Measles – virus Rose black spot – fungi Salmonella - bacterium	One mark per disease correctly matched	3
1.2	60 (mm)		1
1.3	4 (µm)	allow ecf using candidates answer to 1.2	1
1.4	Magnesium		1

Qu No.		Extra Information	Marks
2.1	any one from, (live) animals cells tissues	ignore people / volunteers allow named examples, e.g. mice do not allow plants	1
2.2	to check that the drug works to find the best dose to use		1 1
2.3	scientists at the drug company		1
2.4	420		1
2.5	Statins		1
2.6	any one from: • side effects • other medication (they are taking) • other medical conditions	allow family history / age allow patient choice	1

Qu No.	3	Extra Information	Marks
Level 3	A detailed and coherent explanation is given. The student links the details of the immune response to the prevention of spread of cervical cancer. Logical links are made and scientific terms are used accurately.		5-6
Level 2	A logical description is given of most of the stages of the immune response to HPV. The answer is not linked to the prevention of the spread of disease.		3-4
Level 1	Some relevant points made which do not cover the entire process. The logic may be unclear and links may not be made.		1-2
	No relevant content		0

Indicative content	Extra Information
Vaccination involves introducing small quantities of dead or inactive forms of HPV	do not allow small amount of HPV
Stimulate the white blood cells	allow lymphocytes / B-cells
To produce antibodies against HPV	allow immunoglobulins
Memory cells for the HPV (antigen) is produced	
If infected, antibodies against HPV are produced faster	
Stops infection with the virus / HPV	
Girls who get the vaccine less likely to get cancer	allow kill / destroy virus

Lower likelihood that virus spread via sexual contact and so prevent spread cervical cancer even to those who haven't received the vaccine	

Qu No.		Extra Information	Marks
4.1	Vector		1
4.2	destroy the mosquitos		1
	prevent the mosquitos from biting people	allow use mosquito repellent / nets	1
4.3	14 days		1

Qu No.		Extra Information	Marks
5.1	immune system becomes severely damaged		1
	so white blood cells can no longer destroy the pathogen (unlike a person without HIV)		1
5.2	Antiretroviral		1
5.3	safer/ no risk of getting the disease		1
	it can't reproduce		1
5.4	parts of the leaf have no chlorophyll / chloroplasts		1
	(so) less light is absorbed for photosynthesis		1
	(therefore) less glucose made from photosynthesis		1
	(and so) less proteins made (from glucose) for growth		1

Question 6.1		Marks
Level 2	A detailed and logical description is given of the stages involved in preparing an agar plate. Logical links are made and scientific terms are used accurately.	3-4
Level 1	Discrete, relevant statements are made. The logic may be unclear and links may not be made.	1-2
	No relevant content	0

Indicative content	**Extra Information**
Indicative content ***Pre-inoculation*** • Petri dish and agar sterilised before use • to kill unwanted bacteria • inoculating loop passed through flame / sterile swab • to sterilise / kill (other) bacteria ***Inoculation*** • loop/swab used to spread/streak bacterium onto agar • lid of Petri dish opened as little as possible • to prevent microbes from air entering ***Post-inoculation*** • sealed with tape • to prevent microbes from air entering • incubate • to allow growth of bacteria	*Allow other correct methods, eg bacterial lawns*

6.2	(disc) B 314.16 / 314.2	 allow ecf for disc identified by candidate	1 1
6.3	some bacteria may be antibiotic resistant may work differently on different bacteria	 allow E.coli don't cause gonorrhoea	1 1

Qu No.		Extra Information	Marks
7.1	protein		1
7.2	(more) magnesium gives more growth / leaves / duckweed	allow less magnesium leads to less growth / leaves / duckweed	1
7.3	A gave highest number of leaves / plants **or** A gave most growth / duckweed	allow faster / better growth allow more growth with nitrate **or** less growth without nitrate **do not allow** 'no' growth without nitrate	1
7.4	Measuring mass. weight or area of <u>all</u> leaves	ignore dry or fresh allow measure length of roots.	1
7.5	Correct explanation for method given, e.g. includes roots / whole plant **or** leaves vary in size		1