

GCSE Biology B (Twenty First Century Science)
J257/02 Depth in Biology (Foundation)

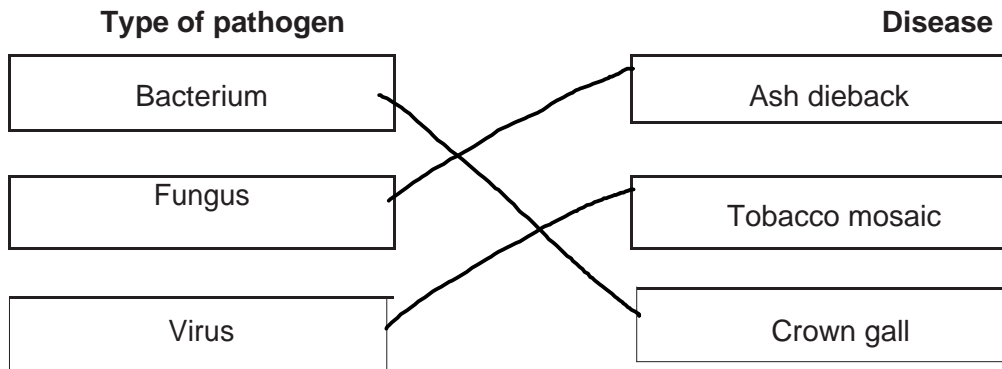
Question Set 3

1

Amir works in a laboratory. His job is to identify the pathogens that cause plant diseases.

(a) Different types of pathogens cause different diseases in plants.

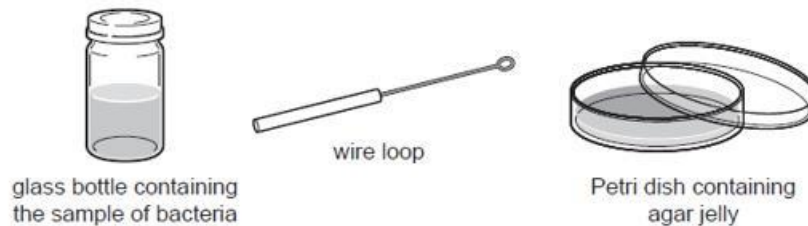
Draw lines to join each **type of pathogen** with the correct **disease** it causes.



[2]

(b) Amir has a sample of bacteria from an infected plant.

He wants to test the effectiveness of different antibiotics against the bacteria. Amir writes a method for transferring bacteria from the sample onto a Petri dish.



Method:

1. Pick up the wire loop from the bench.
2. Open the glass bottle containing the sample of bacteria.
3. Dip the loop in the sample of bacteria
4. Take the lid off the Petri dish.
5. Wipe the loop over the agar jelly in the Petri dish to spread bacteria.
6. Put the lid back on the Petri dish.

(i) Suggest **three** improvements Amir could make to his method to reduce the risk of contaminating the Petri dish with unwanted bacteria.

Use aseptic techniques.
Put on gloves before starting.
Sterilise bench with alcohol before starting.

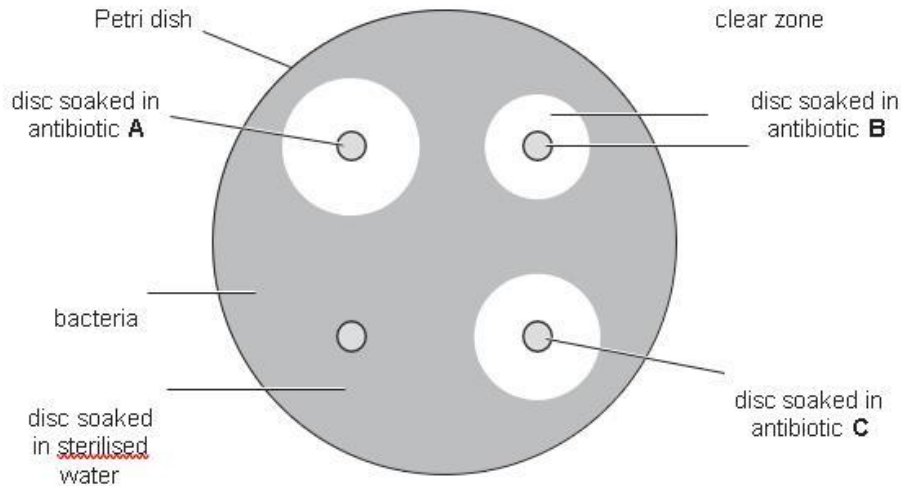
[3]

- (ii) After transferring bacteria from the sample onto a Petri dish, Amir adds four different paper discs to the agar.

Three of the discs have been soaked in solutions of different antibiotics, **A**, **B** and **C**. One disc has been soaked in sterilised water.

Amir places the dish in an incubator overnight. The bacteria grow to cover the surface of the agar jelly.

The diagram shows what he sees after the dish has been incubated.



not to scale

The radius (r) of the clear zone around the disc soaked in antibiotic **A** is 11 mm.

Calculate the area of this clear zone.

Use the equation: area of clear zone = $3.14 \times r^2$

Give your answer to 3 significant figures.

$$\underline{r = 11 \text{ mm}} \quad 3.14 \times (11)^2 = 379.94 = \underline{\underline{380}}$$

[3]

Area of clear zone =380..... mm^2

- (iii) Amir sets up three more Petri dishes in the same way as the first.

Disc	Soaked in	Area of clear zone (mm^2)			
		Petri dish 1	Petri dish 2	Petri dish 3	Petri dish 4
1	Antibiotic A		363	346	346
2	Antibiotic B	227	363	227	214
3	Antibiotic C	314	283	298	314
4	Sterilised water	0	0	0	0

The table shows his results for all four dishes.

Amir thinks one of the discs was soaked in the wrong solution.

Suggest which disc may have been soaked in the wrong solution.

Give a reason for your answer.

[2]

Disc 2 in Petri dish 2. As the area in the clear zone is in the range of results for disc 1 in the other dishes.

(c) Plant cells make their own antimicrobial substances.

Explain how antimicrobial substances help plants to survive and why this is essential for **human** survival. [3]

Antimicrobial substances kill pathogens and that is important for humans as we depend on plants for food. Plants are also an essential part of the ecosystem.

(d) Amir plans to look at a sample of infected plant tissue using a light microscope. The table shows some information about the cells in the sample.

Cell type	Diameter (μm)	Diameter (m)
Plant cell		8×10^{-5}
Bacterium	2	

[1]

(i) What is the diameter of the bacterium, in m, in standard form? Put a ring around the correct answer.

$2 \times 10^6 \text{ m}$ 20^6 m $2 \times 10^{-6} \text{ m}$ 20^{-6} m

[1]

(ii) What is the diameter of the plant cell, in μm ?

Put a ring around the correct answer.

$80^{-6} \mu\text{m}$ $80 \mu\text{m}$ $75 \mu\text{m}$ $40 \mu\text{m}$ $0.00008 \mu\text{m}$

(iii) Amir knows that:

- most viruses measure less than 250 nm in diameter
- his light microscope will not allow him to see objects smaller than 1 μm in diameter.

[2]

Can Amir use his light microscope to see viruses in the sample of infected plant cells?

Explain your answer.

No, because $250 \text{ nm} = 0.25 \mu\text{m}$ which is smaller than $1 \mu\text{m}$ so viruses are too small for his microscope to see.

(iv) Suggest a piece of apparatus that Amir could use to see viruses in the infected plant cells. [2]

Explain your answer.

Electron microscope because it provides greater magnification. He will be able to see things smaller than $1 \mu\text{m}$.

[2]

- (e) Humans can be vaccinated to protect them from pathogens. However, plants cannot be protected in the same way.

[3]

Explain why vaccination cannot work in plants in the same way as it works in humans

Plants do not have white blood cells and can't make antibodies. Therefore plants cannot develop immunity against a specific pathogen.

Total Marks for Question Set 3: 22

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