# 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.

| Type of pathogen | Disease |
|---|---|
| Bacterium | Ash dieback |
| Fungus | Tobacco mosaic |
| Virus | Crown gall |

[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.



glass bottle containing the sample of bacteria

wire loop

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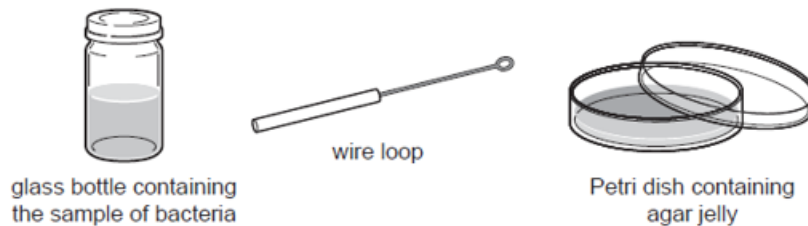
Method:
1. Pick up the wire loop from the bench.
2. Open the glass bottle containing the sample of bacteria.
3. Dip the loop in the sample of bacteria
4. Take the lid off the Petri dish.
5. Wipe the loop over the agar jelly in the Petri dish to spread bacteria.
6. Put the lid back on the Petri dish.

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

[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.
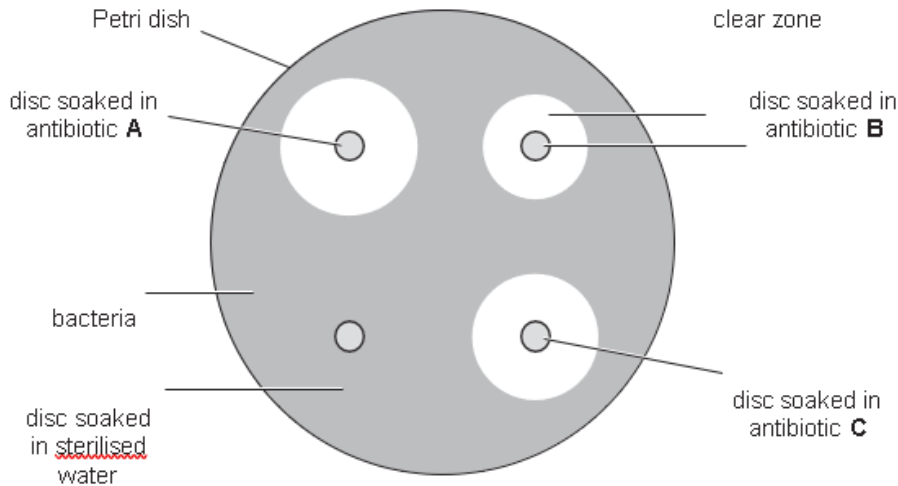


not to scale

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.

**[3]**

Area of clear zone =   ………………… 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]**

**(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]**

**(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 | | $8 \times 10^{-5}$ |
| Bacterium | 2 | |

**(i)** What is the diameter of the bacterium, in m, in standard form?

Put a ring around the correct answer.

**[1]**

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

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

Put a ring around the correct answer.

**[1]**

$80^{-6}\,μm$          $80\,μm$          $75\,μm$          $4\,0\,μm$          $0.00008\,μm$

**(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.

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

Explain your answer. **[2]**

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

Explain your answer. **[2]**

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

Explain why vaccination cannot work in plants in the same way as it works in humans **[3]**

# Total Marks for Question Set 3: 22