

GCSE Combined Science: Trilogy

Worksheet: Resistant bacteria

TIME 35 min	TOTAL 31 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Resistant bacteria

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

The statements describe how a strain of bacteria that is resistant to an antibiotic can develop and spread. They are in the wrong order.

A The resistant bacteria survive and reproduce.

B A mutation produces a bacterium that is resistant to the antibiotic.

C The antibiotic kills the bacteria that are not resistant.

D The population of the resistant strain rises.

E The resistant strain spreads, because people are not immune to it and there is no effective treatment.

0 1 . 1

Write the letters in the correct order.

.....

.....

.....

.....

[2 marks]

0 1 . 2

Why can bacteria evolve rapidly?

Tick (✓) **one** box.

They reproduce at a fast rate.

☐

They are larger than viruses.

☐

They contain a nucleus.

☐

They are killed by antibiotics.

☐

[1 mark]

0 1 . 3

Give **one** way in which the use of antibiotics in farming could be changed to reduce the development of resistant strains of bacteria.

[1 mark]

0 2

Some strains of bacteria are resistant to antibiotics.

0 2 . 1

Which of these is a strain of bacteria that is resistant to many antibiotics?

Tick (✓) **one** box.

HIV

☐

MRSA

☐

Plasmodium

☐

TMV

☐

[1 mark]

0 2 . 2

Which **two** actions reduce the rate at which antibiotic-resistant strains develop?

Tick (✓) **two** boxes.

Doctors prescribing antibiotics for viral infections

☐

Patients completing their course of antibiotics

☐

Farmers routinely adding antibiotics to animal feed

☐

Restricting the use of antibiotics in agriculture

☐

Patients sharing leftover antibiotics with family members

☐

[2 marks]

0 2 . 3

The development of new antibiotics is unlikely to keep up with the emergence of new resistant strains.

Give **one** reason why.

[1 mark]

0 3

Scientists recorded the percentage of infections caused by one species of bacterium that were resistant to antibiotic Y. Table 1 shows the results.

Table 1

Year	Percentage of infections resistant to antibiotic Y
2010	4
2012	7
2014	12
2016	18
2018	26
2020	33
2022	41

0 3 . 1

Figure 1

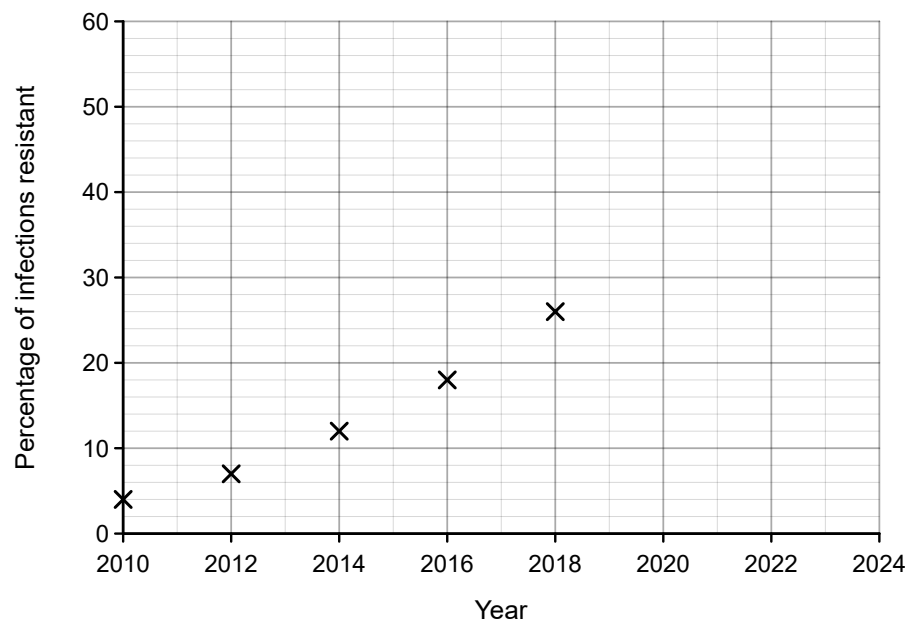


Figure 1 shows some of the data.

Complete Figure 1 by plotting the results for 2020 and 2022.

[2 marks]

0 3 . 2

Draw a line of best fit through the points.

[1 mark]

0 3 . 3

Use your line to predict the percentage of infections that will be resistant to antibiotic Y in 2024.

.....

.....

.....

Percentage = %

[1 mark]

0 3 . 4

Explain why the percentage of resistant infections increased.

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.....

.....

.....

.....

.....

[3 marks]

0 4

In 2015, doctors in one region wrote 780 000 prescriptions for antibiotics. 40% of these prescriptions were for coughs, colds and sore throats, which are usually caused by viruses. After a campaign to reduce the use of antibiotics, the number of prescriptions in 2020 was 664 000.

0 4 . 1

Calculate the number of prescriptions in 2015 that were for coughs, colds and sore throats.

.....

.....

.....

Number of prescriptions =

[1 mark]

0 4 . 2

Calculate the percentage decrease in the number of prescriptions between 2015 and 2020.
Give your answer to 3 significant figures.

.....

.....

.....

.....

Percentage decrease = %

[2 marks]

0 4 . 3

Explain how using fewer antibiotics slows down the development of antibiotic-resistant strains of bacteria.

.....

.....

.....

.....

[2 marks]

0 4 . 4

Give **one** other way to reduce the rate at which antibiotic-resistant strains develop.

.....

.....

[1 mark]

0 5

In 2016, doctors in one region wrote 410 000 prescriptions for antibiotics. 45% of these prescriptions were for coughs, colds and sore throats, which are usually caused by viruses. After a campaign to reduce the use of antibiotics, the number of prescriptions in 2022 was 348 000.

0 5 . 1

Calculate the number of prescriptions in 2016 that were for coughs, colds and sore throats.

.....

.....

.....

Number of prescriptions =

[1 mark]

0 5 . 2

Calculate the percentage decrease in the number of prescriptions between 2016 and 2022.

Give your answer to 3 significant figures.

.....

.....

.....

.....

Percentage decrease = %

[2 marks]

0 5 . 3

Explain how using fewer antibiotics slows down the development of antibiotic-resistant strains of bacteria.

.....

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.....

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[2 marks]

0 5 . 4

Give **one** other way to reduce the rate at which antibiotic-resistant strains develop.

.....

.....

[1 mark]

0 6

A scientist tested bacteria from a throat infection with four antibiotics, A, B, C and D. The bacteria were spread on an agar plate, and a paper disc soaked in each antibiotic was placed on the agar. Each paper disc has a diameter of 6 mm. After incubation, the scientist measured the diameter of the clear zone around each disc.

Table 2 shows the results.

Table 2

Antibiotic	Diameter of clear zone in mm
A	8
B	11
C	21
D	7

0 6 . 1

Which antibiotic was most effective against these bacteria? Give a reason for your answer.

.....

.....

[1 mark]

0 6 . 2

Calculate the area of the clear zone around disc C.
Use the equation: $\text{area} = \pi r^2$, where r is the radius of the clear zone.
Give your answer to 3 significant figures.

.....

.....

.....

.....

Area = mm²
[2 marks]

0 6 . 3

Suggest what the result for antibiotic D shows about the bacteria.

.....

.....

[1 mark]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Resistant bacteria · 31 marks

Question 1 (4 marks)

01.1 [2 marks]

Answer: B, C, A, D, E

- B first and E last (1)
- C, A, D in that order between them: B, C, A, D, E (1)

Notes: B, C, A, D, E scores 2 marks.

01.2 [1 mark]

Correct: They reproduce at a fast rate.

01.3 [1 mark]

- restrict / reduce the use of antibiotics in agriculture (1)
- stop adding antibiotics to animal feed routinely, e.g. to increase growth (1)
- use antibiotics only to treat animals that are ill (1)

Any 1 of the points above.

Question 2 (4 marks)

02.1 [1 mark]

Correct: MRSA

02.2 [2 marks]

Correct: Patients completing their course of antibiotics; Restricting the use of antibiotics in agriculture

02.3 [1 mark]

- developing new antibiotics is costly / expensive (1)
- developing new antibiotics is slow / takes many years (1)
- bacteria reproduce / evolve quickly (1)

Any 1 of the points above.

Question 3 (7 marks)

03.1 [2 marks]

- 2020 plotted at 33% ($\pm$ half a small square) (1)
- 2022 plotted at 41% ($\pm$ half a small square) (1)

03.2 [1 mark]

- a smooth line of best fit (curve or straight line) passing through or close to all the points (1)

03.3 [1 mark]

Answer: 49%

- 49 (%) (allow 46–52 or a value consistent with the student's line) (1)

03.4 [3 marks]

- mutations produced resistant bacteria (1)
- antibiotic Y killed non-resistant bacteria, but resistant bacteria survived and reproduced (1)
- the resistant strain spread, because people are not immune to it and there is no effective treatment (1)
- antibiotic Y may have been used inappropriately, e.g. for viral or non-serious infections, or courses were not completed (1)

Any 3 of the points above.

Question 4 (6 marks)

04.1 [1 mark]

Answer: 312 000

- $780\,000 \times 0.4 = 312\,000$ (1)

04.2 [2 marks]

Answer: 14.9%

- $(780\,000 - 664\,000) \div 780\,000 \times 100$ (1)
- 14.9 (%) (1)

Notes: An answer of 14.87 (not given to 3 significant figures) scores 1 mark.

04.3 [2 marks]

- fewer bacteria are exposed to antibiotics, so fewer non-resistant bacteria are killed (1)
- so resistant bacteria have less of an advantage: they are less likely to survive and reproduce while the others die, so the resistant strain spreads more slowly (1)

04.4 [1 mark]

- patients should complete their course of antibiotics (1)
- restrict the use of antibiotics in farming / agriculture (1)

Any 1 of the points above.

Question 5 (6 marks)

05.1 [1 mark]

Answer: 184 500

- $410\,000 \times 0.45 = 184\,500$ (1)

05.2 [2 marks]

Answer: 15.1%

- $(410\,000 - 348\,000) \div 410\,000 \times 100$ (1)
- 15.1 (%) (1)

Notes: An answer of 15.12 (not given to 3 significant figures) scores 1 mark.

05.3 [2 marks]

- fewer bacteria are exposed to antibiotics, so fewer non-resistant bacteria are killed (1)
- so resistant bacteria have less of an advantage: they are less likely to survive and reproduce while the others die, so the resistant strain spreads more slowly (1)

05.4 [1 mark]

- patients should complete their course of antibiotics (1)
- restrict the use of antibiotics in farming / agriculture (1)

Any 1 of the points above.

Question 6 (4 marks)

06.1 [1 mark]

Answer: C

- C, because it produced the largest clear zone (1)

06.2 [2 marks]

Answer: 346 mm^2

- $r = 10.5$ (mm) (1)
- 346 (mm^2) (1)

Notes: An answer of 346.4 (not given to 3 significant figures) scores 1 mark. An answer of 1390 (diameter used as the radius) scores 1 mark.

06.3 [1 mark]

- the bacteria are partly resistant to antibiotic D / it is the least effective antibiotic, so it should not be used (1)
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