

Exercise walk-through

Antibiotics ■ 10.2

eXercise

You must be able to

- outline how penicillin acts on bacteria and why antibiotics do not affect viruses
- explain how antibiotic resistance arises and spreads
- state steps to reduce the impact of resistance

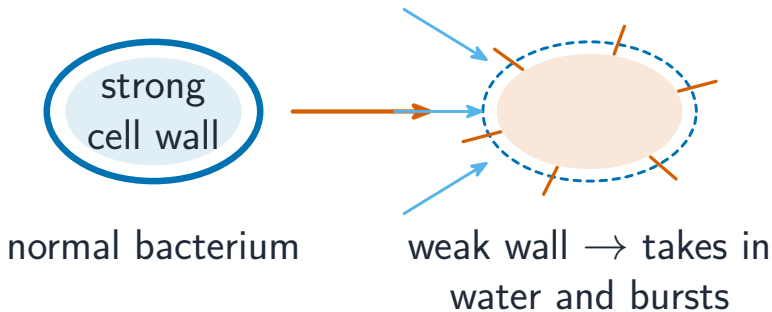
Method — How penicillin works

Penicillin stops bacteria building their **cell walls** 细胞壁. As the bacterium grows, its weak wall cannot hold it, so water enters by osmosis and the cell bursts.

Antibiotics do **not** work on **viruses** 病毒: a virus has no cell wall and no reactions of its own to attack — it uses the host cell's machinery, so there is no antibiotic target.

Method — How penicillin works

penicillin stops
new wall forming

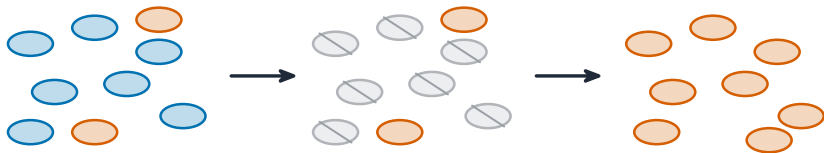


Method — Antibiotic resistance

A chance **mutation** 突变 can make a bacterium **resistant**. When the antibiotic is used, non-resistant bacteria die but resistant ones survive and multiply, so resistance spreads. **Steps to slow it:** use antibiotics only when needed (not for colds), finish the full course, use the correct antibiotic, and reduce use in farming.

2. antibiotic kills

1. a few are resistant non-resistant 3. resistant multiply



(red = resistant mutant)

Practice 2.1 ■ 2 marks

Explain why penicillin causes a growing bacterium to burst.

Solution 2.1

Method: How penicillin works

Worked steps

penicillin prevents the bacterium making/repairing its cell wall **M1**; so as it grows, water enters by osmosis and the weak wall lets the cell burst **A1**.

Practice 2.2 ■ 2 marks

State **two** steps that help slow the spread of antibiotic resistance.

Solution 2.2

Method: Antibiotic resistance

Worked steps

any two: only use antibiotics when needed; finish the full course; use the correct antibiotic; reduce use in farming **B1** *each, max 2*.

Exam-style 3.1 ■ 1 mark

Why do antibiotics **not** kill viruses?

- A** viruses are too small
- B** viruses have no cell wall or metabolism of their own to target
- C** viruses live outside cells
- D** viruses reproduce too quickly

Solution 3.1

Method: How penicillin works

- A viruses are too small
- B viruses have no cell wall or metabolism of their own to target 
- C viruses live outside cells
- D viruses reproduce too quickly

Worked steps

- B. Viruses have no cell wall or metabolism of their own, so there is no antibiotic target.

Exam-style 3.2 ■ 1 mark

Antibiotic resistance spreads in a bacterial population because:

- A** the antibiotic causes the mutations
- B** resistant bacteria survive treatment and reproduce
- C** all bacteria become resistant at once
- D** antibiotics make bacteria grow faster

Solution 3.2

Method: Antibiotic resistance

- A the antibiotic causes the mutations
- B resistant bacteria survive treatment and reproduce** 
- C all bacteria become resistant at once
- D antibiotics make bacteria grow faster

Worked steps

- B. Resistant bacteria survive treatment and reproduce, passing on the resistance.**

Exam-style 3.3 ■ 4 marks

Explain, using the idea of natural selection, how a population of bacteria can become resistant to an antibiotic.

Solution 3.3

Method: Antibiotic resistance

Worked steps

there is variation in the population — a chance mutation makes some bacteria resistant **B1**; when the antibiotic is used, the non-resistant bacteria die **B1**; the resistant ones survive and reproduce **B1**; so the proportion of resistant bacteria increases over generations **B1**.

Exam-style 3.4 ■ 2 marks

In a sample of 800 bacteria, 12 survived treatment with an antibiotic.

- (a) Calculate the percentage of bacteria that were resistant.
- (b) Explain why finishing the full course of an antibiotic helps prevent resistance.

Solution 3.4

Method: Antibiotic resistance

Worked steps

(a) $\frac{12}{800} \times 100 = 1.5\%$ **M1** **A1**.

(b) finishing the course kills all the bacteria, including any that are slightly less susceptible **M1**, so none survive to reproduce and spread resistance **A1**.