10.2 Antibiotics

Name: _____ Class: _____ Date: _____ **Total: 14 marks**

KEY WORDS resistance • penicillin • antibiotic resistance • antibiotic • cell wall

Objective

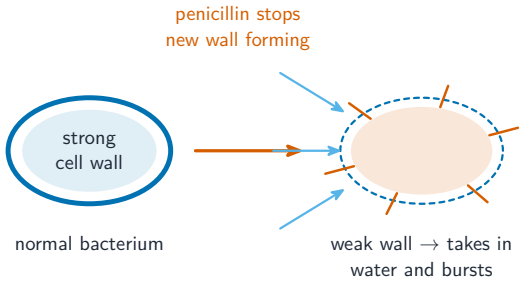
Build the skills to answer exam questions on **antibiotics** – how **penicillin** acts, why antibiotics do not affect viruses, and **antibiotic resistance** .

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

1 Key knowledge and worked examples

How penicillin works

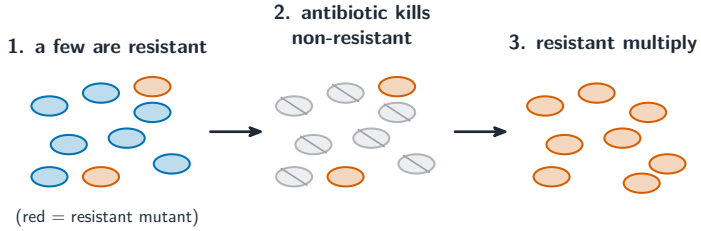


Penicillin stops new cell wall forming, so the bacterium takes in water and bursts

Penicillin stops bacteria building their **cell walls** . 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** : 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.

Antibiotic resistance



Resistance spreads by natural selection: the antibiotic kills the rest, so resistant survivors take over

A chance **mutation** 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 Practice

2.1 Explain why penicillin causes a growing bacterium to burst. [2]

2.2 State **two** steps that help slow the spread of antibiotic resistance. [2]

3 Exam-style questions

3.1 Why do antibiotics **not** kill viruses? [1]

☐ **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

3.2 Antibiotic resistance spreads in a bacterial population because: [1]

- ☐ **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

3.3 Explain, using the idea of natural selection, how a population of bacteria can become resistant to an antibiotic. [4]

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

(a) Calculate the percentage of bacteria that were resistant. [2]

(b) Explain why finishing the full course of an antibiotic helps prevent resistance. [2]

Solutions

Each answer shows the steps, then the **result**.

2.1

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

2.2

- any two: only use antibiotics when needed; finish the full course; use the correct antibiotic; reduce use in farming

3.1 B

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

3.2 B

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

3.3

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

3.4

(a)

- $\frac{12}{800} \times 100 = 1.5\%$

(b)

- finishing the course kills all the bacteria, including any that are slightly less susceptible, so none survive to reproduce and spread resistance