

10.2 Antibiotics

Name: _____ Class: _____ Date: _____

Total: 14 marks

KEY WORDS resistance 耐药性 • penicillin 青霉素 • antibiotic resistance 抗生素耐药性
• antibiotic 抗生素 • cell wall 细胞壁

Objective

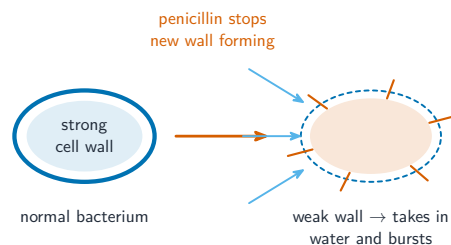
Build the skills to answer exam questions on **antibiotics** — how **penicillin** 青霉素 acts, why antibiotics do not affect viruses, and **antibiotic resistance** 抗生素耐药性.

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 Worked examples

■ How penicillin works

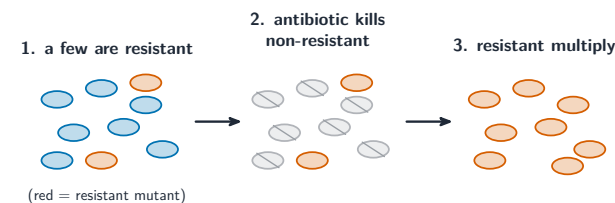


Penicillin stops new cell wall forming, so the bacterium takes in water and bursts

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

■ Antibiotic resistance



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

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 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

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.