Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

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

2.1

amoxicillin: **cell wall** (penicillin-binding proteins)

gentamicin: **30S ribosome** (protein synthesis)

ciprofloxacin: **DNA gyrase**

2.2

vancomycin is a very large molecule

it cannot pass through the outer membrane to reach the wall

2.3

clavulanic acid blocks β-lactamase

so the enzyme cannot break down amoxicillin

2.4

gentamicin kills best with a high peak (concentration-dependent), so one big dose

penicillin kills best with time above the MIC (time-dependent)

so penicillin is given often to stay above the MIC

3.1

(a) it has the *mecA* gene, which makes an altered penicillin-binding protein (PBP2a) that β-lactams cannot bind

(b) **vancomycin** (or teicoplanin, linezolid)

(c) the level is too high, risking kidney damage: hold or reduce the dose and recheck

(d) genes are carried on plasmids, passed from one bacterium to another by conjugation

(e) to clear MRSA from his skin and nose, so it does not spread or come back

3.2

(a) $7 \times 70 = \mathbf{490\ mg}$

(b) it can damage the kidneys and the ear; a high trough shows it is building up, as kidney function falls

(c) it kills by a high peak (concentration-dependent), and its effect lasts after the level falls (post-antibiotic effect)

3.3

(a) $30 \div 40 = \mathbf{75\%}$

(b) $12 \div 40 = \mathbf{30\%}$

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(c) any two of: resistance; *C. difficile* infection; side effects such as rash or kidney damage; cost

(d) a few bacteria are resistant by chance; the drug kills the sensitive ones, so the resistant ones survive and multiply

(e) improving, with no fever for 24–48 hours; able to swallow and absorb, with a working gut