Solutions

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

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

2.1

progressive overload: gradually increasing the training load so the body keeps adapting; reversibility: fitness gains are lost when training stops or is reduced

2.2

$\mathrm{HR}_{\max} = 220 - 18 = 202$; $(202 - 60) \times 0.70 + 60 \approx \mathbf{159}$ beats min^{-1}

2.3

strength rises before muscles get noticeably bigger; the nervous system learns to recruit more motor units and fire them faster and more together; antagonist muscles relax more, so more force is produced; hypertrophy adds strength only later

2.4

$2400 \div 1600 = \mathbf{1.5}$; a sudden rise above about 1.3 is linked with a higher injury risk, so the load should be increased more gradually

3.1

(a) the heart muscle (left ventricle) gets larger and stronger, so stroke volume rises; the same resting cardiac output is reached with fewer beats

(b) any two: more capillaries; more mitochondria; more myoglobin; higher $\dot{V}\mathrm{O}_2\mathrm{max}$; higher lactate threshold; more blood plasma and haemoglobin

3.2

(a) training volume is reduced before a main competition while intensity is kept; so the body recovers fully and performance peaks on the day

(b) it plans hard and easy periods, so load rises gradually; recovery weeks and a transition phase allow adaptation (supercompensation); load can be monitored and adjusted, so fatigue does not build up over many weeks

3.3

any two, each with a justification: include balance and strength exercises, because falls are a major risk and muscle mass declines with age; include weight-bearing or loading exercise, to slow bone loss; longer warm-up and recovery, lower starting intensity and slower progression, because of a lower $\mathrm{HR}_{\max}$, slower recovery and more chronic conditions

3.4

award up to [6]: HIIT: short, intense intervals improve $\dot{V}\mathrm{O}_2\mathrm{max}$ in less total time, so it fits a busy week; but it feels hard, needs good motivation, and has a higher injury risk for untrained people; continuous: easier to start and keep doing, builds an aerobic base and fat use; but needs more time for similar gains; conclusion: a mix, e.g. two short HIIT sessions plus one longer easy session, with gradual progression