Solutions

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

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

2.1

- glucose →
- lactic acid

2.2

- bubble the air through limewater (or hydrogencarbonate indicator)
- limewater turns milky (indicator turns from red to yellow)

2.3

Any two (1 mark each):

- a large surface area (many alveoli)
- thin walls, one cell thick, so a short diffusion distance
- a good blood supply keeps a steep concentration gradient
- a moist lining for gases to dissolve

3.1

- the external intercostal muscles contract, moving the ribs up and out
- the diaphragm contracts and flattens
- the volume of the thorax increases, so the pressure falls below air pressure and air moves in

3.2

Any three (1 mark each):

- tar can cause lung cancer
- smoke damages the cilia, so mucus and bacteria collect: bronchitis
- alveolus walls break down (emphysema), giving a smaller surface area
- carbon monoxide joins to haemoglobin, so the blood carries less oxygen

3.3

(a) rest: $14 \times 0.5 = 7.0$ dm^3; after: $30 \times 1.5 = 45$ dm^3; $45 \div 7.0 = \mathbf{6.4}$ times

(b) during the run some respiration was anaerobic, making lactic acid; extra oxygen is needed to break down the lactic acid (the oxygen debt); fast breathing also removes the extra carbon dioxide

(c) $(30 - 14) \div 14 \times 100 = \mathbf{114}\%$; 5 minutes

(d) points to include:

- aerobic respiration uses oxygen; anaerobic does not (K)
- aerobic: glucose + oxygen → carbon dioxide + water; anaerobic: glucose → lactic acid (K)
- aerobic releases much more energy from each glucose molecule (K)
- during hard running the blood cannot supply oxygen fast enough, so anaerobic respiration adds energy (An)
- anaerobic respiration makes lactic acid, which causes muscle fatigue (An)
- lactic acid must later be broken down with oxygen, but carbon dioxide and water from aerobic respiration are simply removed (An)

Levels: **5–6** a full, logical answer with correct biology and correct terms; **3–4** several correct points, partly linked; **1–2** one or two relevant points.