Solutions

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

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

2.1

(i) ATP–PC system; (ii) aerobic system

2.2

muscles store only a small amount of phosphocreatine; in maximal work it is used very quickly to resynthesize ATP, so it runs out in about 10 s; rebuilding PC needs energy from the aerobic system during recovery, which takes minutes

2.3

anaerobic glycolysis does not need oxygen and happens in the cytoplasm; the aerobic system needs oxygen and happens mainly in mitochondria; anaerobic glycolysis supplies ATP faster but yields only 2 ATP per glucose; aerobic yields about 30 or more; anaerobic produces lactate (and acidity); aerobic produces CO_2 and water and can also use fat

3.1

(a) about 1–2 minutes (accept 60–120 s)

(b) the ATP–PC system supplies ATP in the first seconds, at the start and in the final sprint; anaerobic glycolysis supplies much ATP at high intensity in the middle of the race, producing lactate; the aerobic system rises as oxygen supply increases and gives about half the energy over two minutes

3.2

(a) A: $45 \div 60 \times 100 = \mathbf{75}\%$; B: $50 \div 60 \times 100 \approx \mathbf{83}\%$

(b) runner A, because A is more economical; A works at a lower percentage of maximum at the same speed, so A can sustain a higher speed before fatigue

(c) any two: good technique (less vertical bounce); strength and plyometric training (stiffer tendons); lighter shoes or body mass; experience and training volume

3.3

(a) above the lactate threshold, lactate is produced faster than it is removed; because more fast-twitch fibres are recruited and glycolysis is faster than the aerobic system can use pyruvate

(b) fast component: lasts a few minutes; restores phosphocreatine and re-oxygenates myoglobin; slow component: can last much longer; used for removing lactate, and for raised body temperature, heart rate, breathing and hormone levels

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