Solutions

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

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

2.1

systolic pressure rises; diastolic pressure stays about the same (or falls slightly)

2.2

arterioles supplying working muscles dilate (vasodilation); arterioles supplying the gut and kidneys constrict (vasoconstriction); so a much larger share of a larger cardiac output goes to the muscles, up to about 80%

2.3

central fatigue starts in the brain and spinal cord: less drive to the muscles, e.g. low motivation, changes in brain chemicals, high core temperature; peripheral fatigue happens in the muscle itself; e.g. phosphocreatine or glycogen depletion, build-up of H^+ or phosphate

2.4

downhill running uses many eccentric contractions of the quadriceps; these cause small tears in muscle fibres and connective tissue; inflammation follows and soreness (DOMS) peaks about 24–72 hours later

3.1

(a) heart rate rises slightly before the start (anticipatory rise); it rises quickly in the first minutes; then it levels off at a steady state

(b) it falls quickly at first and then more slowly back towards resting level

3.2

(a) rest: $20 - 15 = \mathbf{5}$ ml per 100 ml; exercise: $20 - 5 = \mathbf{15}$ ml per 100 ml

(b) working muscles use more oxygen, so the oxygen level in the muscle falls and the gradient rises; higher temperature, CO_2 and acidity make haemoglobin release more oxygen (Bohr shift); more capillaries open, giving more surface area and slower flow past the fibres

3.3

any two causes, each [2]: H^+ builds up from anaerobic glycolysis, lowering pH, which slows enzymes and interferes with calcium and the contraction process; phosphocreatine runs out, so ATP cannot be resynthesized fast enough; inorganic phosphate builds up, which reduces the force of cross-bridges

3.4

award up to [6]: cold-water immersion: reduces perceived soreness and swelling, and feels good, so useful between close matches; but evidence for faster recovery of performance is mixed, and regular use may reduce strength and muscle gains from training; sleep: needed for muscle repair, hormone release and mental recovery; poor sleep lowers performance and raises injury and illness risk; conclusion: prioritize sleep for everyone, use cold water selectively in congested match periods

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