Solutions

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

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

2.1

a change from the set point is detected; the response reverses the change, bringing the value back to the set point

2.2

β cells in the pancreas detect the high glucose concentration; they release insulin; insulin makes cells take up glucose, and the liver and muscles convert it to glycogen

2.3

arterioles in the skin dilate (vasodilation); more blood flows near the surface and more heat is lost by radiation; sweat glands release sweat, and its evaporation removes heat

2.4

the efferent arteriole is narrower than the afferent, so blood pressure in the glomerulus is high; the capillary walls have pores and the basement membrane acts as a filter; small molecules such as water, glucose and urea pass into the capsule, while proteins and blood cells stay

2.5

the hypothalamus detects the concentrated blood and the pituitary releases ADH; ADH makes the collecting duct more permeable to water by adding aquaporins; more water is reabsorbed into the blood, so a small volume of concentrated urine is made

3.1

(a) 15 mmol dm^{-3}

(b) rises from 5 to a peak of about 8 mmol dm^{-3} at about 0.5 h; falls back to 5 mmol dm^{-3} by about 2 h

(c) B, because glucose rises much higher and stays high / does not return to normal

(d) type 1: β cells are destroyed, so little or no insulin is made; type 2: insulin is made but target cells respond less to it

3.2

(a) $37.0 - 36.2 = \mathbf{0.8}$ °C

(b) hypothalamus

(c) any two, each response with its explanation: vasoconstriction of skin arterioles, so less blood reaches the surface and less heat is lost; shivering, rapid muscle contractions whose respiration releases heat; more thyroxine raises the metabolic rate; hair erection traps air as insulation