Solutions

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

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

2.1

- ADH (antidiuretic hormone)
- the pituitary gland

2.2

- in a healthy person all the filtered glucose is reabsorbed in the first coiled tubule
- in diabetes the blood glucose is so high that not all of it can be reabsorbed

2.3

- iris: controls how much light enters the eye (the size of the pupil)
- retina: contains receptor cells (rods and cones) that detect light

2.4

- auxin collects on the shaded side of the shoot
- cells on the shaded side elongate more, so the shoot bends towards the light (positive phototropism)

3.1

- a receptor in the skin detects heat and starts an impulse in a sensory neurone
- the impulse passes to a relay neurone in the spinal cord
- then along a motor neurone to the effector, a muscle that contracts

3.2

- high pressure in the glomerulus forces small molecules (water, glucose, urea, salts) into the Bowman's capsule: ultrafiltration
- all the glucose is reabsorbed into the blood in the first coiled tubule: selective reabsorption
- water is reabsorbed in the loop and collecting duct; what is left (urea, excess water and salts) is urine

3.3

(a) decrease $1.5 - 0.6 = 0.9$ dm^3; $0.9 \div 1.5 \times 100 = \mathbf{60}\%$

(b) sweating lowers the water content of the blood; the hypothalamus detects this, and the pituitary releases more ADH; ADH makes the collecting ducts more permeable to water; more water is reabsorbed into the blood, so a small volume of concentrated urine is made

(c) out: $0.6 + 2.3 + 0.4 = 3.3$ dm^3; balance $3.0 - 3.3 = \mathbf{-0.3}$ dm^3; she is losing more water than she takes in, so she becomes dehydrated unless she drinks more

(d) points to include:

- the hypothalamus detects the rise in blood temperature (K)
- sweat glands release more sweat; water evaporates from the skin, taking heat energy away (K)
- arterioles near the skin surface widen (vasodilation) (K)
- more blood flows near the surface, so more heat is lost by radiation (An)
- hairs lie flat, so less air is trapped as insulation (K)
- this is negative feedback: the response brings the temperature back towards 37 °C (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.