Solutions

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

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

2.1

$10 \times 10 = \mathbf{100}\times$

$10 \times 40 = \mathbf{400}\times$

2.2

fix, dehydrate

clear, embed

cut, stain

2.3

the nucleus is purple: haematoxylin binds the acidic DNA

the cytoplasm is pink: eosin binds proteins

2.4

$d = 0.61 \times 500 \div 1.4 \approx \mathbf{220}$ nm

150 nm is less than 220 nm, so they cannot be seen apart

3.1

(a) 24 mm = 24 000 µm; $24\,000 \div 2000 = \mathbf{12}$ µm

(b) $10 \times 2000 = 20\,000$ µm = **20** mm

(c) electrons have a much shorter wavelength, so resolution is far better (below 1 nm); images are black and white, and samples must be dead and very thin

(d) the beam runs in a vacuum, so samples must be fixed, dried and cut very thin

3.2

(a) dehydration, clearing and embedding in wax are skipped; the frozen tissue is hard enough to cut at once

(b) ice crystals tear the tissue, so details are poorer

(c) once blood supply stops, the cell's own enzymes start to digest it (autolysis); formalin links proteins and stops this

3.3

(a) **PAS**

(b) **trichrome**; collagen shows blue or green

(c) an antibody binds one protein only; it carries an enzyme that makes a brown colour where it binds

(d) a **carcinoma** (a tumour of epithelial cells)

(e) $12 \div 4 = \mathbf{3}$ sections

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