

inkBiology

ANSWER BOOK

Plan diagrams and tissue sections

Cells, microscopy and biological organisation · Unit B01

OCR A 3.1.3, 4.1.1 · Edexcel B 2.1 vii, 4.4 vi · CAIE 7.1, 8.1, 9.1

14 questions · 44 marks

NAVY EDITION

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SECTION A · Short, 1 to 2 marks

- A1** PDR-Q6 **B1** any two of: tissue boundaries only with no individual cells, no shading, sharp unbroken lines, regions in correct proportion, ruled label lines touching the structure, magnification or scale bar stated. **B1** it records the positions and proportions of whole tissues within the organ, rather than the detail of any cell. [2]
- A2** PDR-Q14 **B1** the gap faces the oesophagus, which lies immediately behind the trachea. [2]
B1 leaving the ring incomplete, with smooth muscle spanning the gap, allows the oesophagus room to bulge as swallowed food passes down it.
- A3** PDR-Q15 **B1** roughly 700 erythrocytes for every 1 white blood cell. **B1** the biconcave disc is thinner in the middle, so that part of the cell stains more palely and the cell appears as a ring with a paler centre. [2]

SECTION B · Standard, 3 to 5 marks

- B1** PDR-Q7 **B1** ciliated epithelium, with goblet cells among it, lining the lumen. **B1** loose tissue beneath it, containing mucous glands and blood vessels. **B1** smooth muscle and elastic fibres. **B1** cartilage, as an incomplete C-shaped ring. **B1** an outer layer of connective tissue, attaching the trachea to its neighbours. [5]
- B2** PDR-Q1 **B1** in the root the vascular tissue forms a single central stele. **B1** the root's xylem forms a central star, with the phloem in separate patches between the arms. **B1** in the stem the vascular tissue is split into discrete bundles arranged in a ring near the outside. **B1** within each stem bundle the xylem lies on the inner side and the phloem on the outer side. [4]
- B3** PDR-Q8 **M1** magnification = size of drawing ÷ actual size, both in millimetres: $120 \div 4.0$. [4]
A1 $\times 30$, written on the plan with no unit, because a plan diagram must state its magnification or carry a scale bar. **A1** $0.50 \text{ mm} \times 30 = 15 \text{ mm}$ in from the outer line of the drawing. **B1** the tissues of a plan diagram must be drawn in their correct proportions, so the position of each boundary is measured, with an eyepiece graticule where needed, and scaled rather than estimated.
- B4** PDR-Q9 **B1** erythrocyte, about $7 \mu\text{m}$. **B1** lymphocyte, about $9 \mu\text{m}$. **B1** neutrophil, about $12 \mu\text{m}$. **B1** monocyte, up to about $18 \mu\text{m}$. [4]

- B5** **B1** a root is loaded in tension, pulled by the shoot it anchors and by wind [3]
PDR-Q2 acting on the plant above. **B1** a central column resists pulling in the way a rope does, so strength down the middle suits the root. **B1** a stem is loaded in bending, and a hollow cylinder of strong material near the outside resists bending far better than the same material in the centre.
- B6** **B1** A is a neutrophil, because no other cell you have to name has a lobed [3]
PDR-Q3 nucleus. **B1** B is a monocyte, the largest cell on a smear, with the kidney-shaped nucleus that separates it from a lymphocyte. **B1** C is an erythrocyte, because mature erythrocytes are the only blood cells with no nucleus.
- B7** **B1** the trachea shows a single C-shaped ring of cartilage, incomplete at the [3]
PDR-Q5 back where smooth muscle spans the gap. **B1** a bronchus shows cartilage broken into separate curved plates with gaps between them. **B1** a bronchiole shows no cartilage at all, only epithelium, smooth muscle and elastic fibres.
- B8** **B1** the xylem lies on the upper side of the vein and the phloem on the lower [3]
PDR-Q10 side. **B1** this is the same vascular bundle that ran through the stem, carried out sideways into the leaf. **B1** what was the inner face of the bundle in the stem, the xylem, becomes the upper face in the leaf, so the orientation is continuous rather than newly determined.
- B9** **B1** the vascular bundles are discrete and lie in a ring near the edge of the [3]
PDR-Q11 stem, rather than filling the whole cross-section. **B1** a longitudinal cut straight through the centre of the stem can pass entirely between two bundles, showing only pith and cortex. **B1** the transverse section already showed the ring of bundles, so the correct conclusion is that one section plane is insufficient on its own, not that the tissue is absent.
- B10** **B1** a plan diagram records the positions, boundaries and proportions of whole [3]
PDR-Q12 tissues without drawing any individual cell, whereas a high-power drawing records the structure of a small number of representative cells in detail. **B1** a plan diagram is drawn at low magnification so a whole organ or section fits in view, whereas a high-power drawing is made at a magnification high enough to show detail within one or a few cells. **B1** combining the two, drawing cellular detail inside a plan diagram, breaks the convention, because a plan diagram's purpose is the tissue map rather than cell structure.

B11 [3]
PDR-Q13 **B1** away from the midrib a vein is much smaller, with the xylem and phloem forming only a tiny bundle among the mesophyll, difficult to make out clearly. **B1** a section between two small veins might miss the vascular tissue almost entirely, showing mostly mesophyll and epidermis. **B1** the midrib is a fixed, predictable location carrying the largest vein, where the tissues are clearly separated and the upper-xylem, lower-phloem arrangement is easy to see.

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