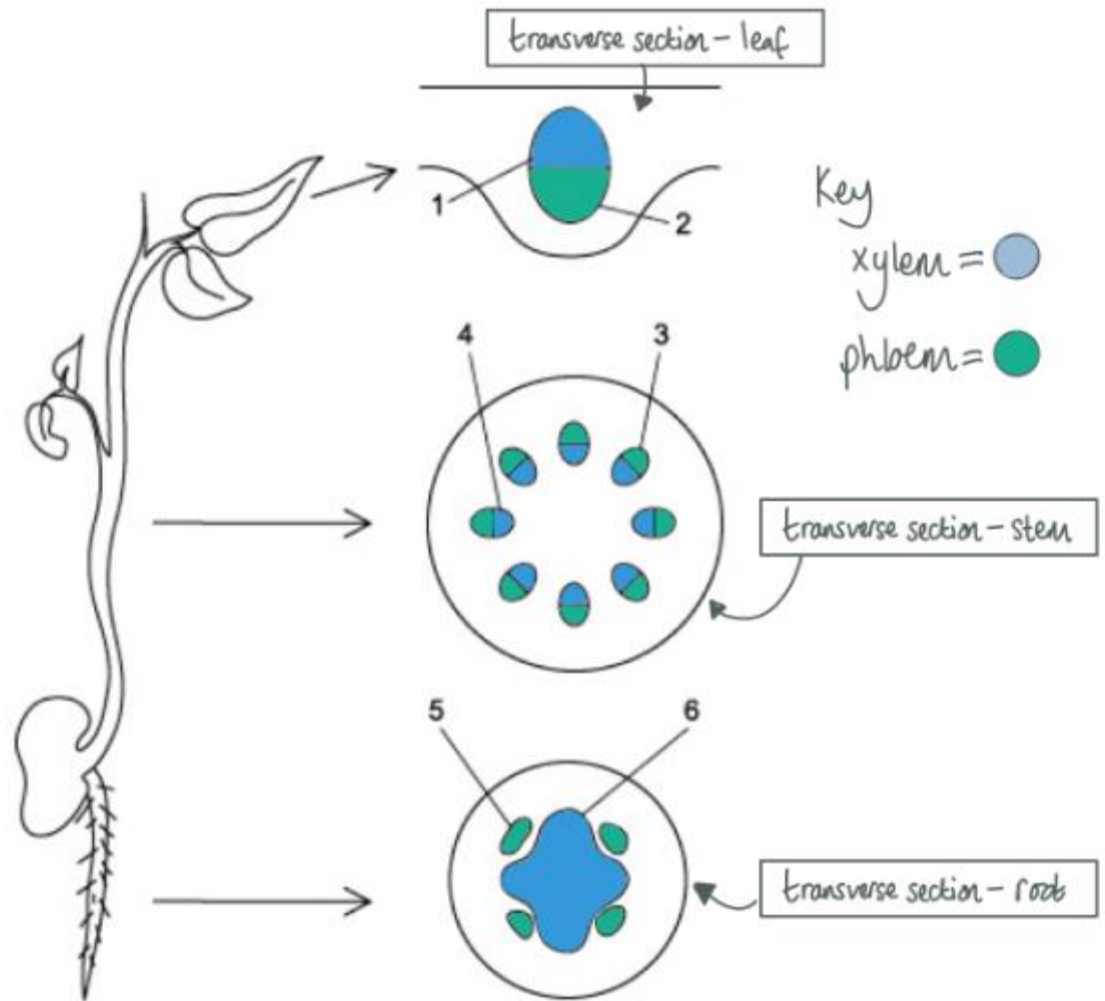


**Model Answers: Easy**

1

The correct answer is **C** because:

- In a **dicotyledonous plant** (which is the only plant type you will be asked about) the xylem and phloem locations in the **root, stem and leaf** always follow the same pattern
- In the **root** the xylem is in the centre in an **X** (or sometimes star) **shape** with the phloem located around the **outside** (in the gaps between the points)
- In the **stem** there are multiple vascular bundles around the outer circumference of the stem – each vascular bundle comprises xylem and phloem tissue with the **xylem tissue on the inside** and the **phloem tissue on the outside**
- In the **leaf** there is a main vascular bundle in the centre with the **phloem located on the bottom** and **xylem on the top** (there may also be smaller vascular bundles shown on the leaf and they follow the same phloem on the bottom and xylem on the top pattern)



2

The correct answer is **B** because:

- The **cortex** is the tissue of a stem or root that lies inward from the **epidermis**, but exterior to the **vascular tissue** (so **X** is cortex)
- **Z** is the epidermis and **Y** is the endodermis
- The root of a **dicotyledonous plant** has no pith (pith is only found in the stem of a dicotyledonous plant) – so A is incorrect

### Pith vs Cortex Recap:

Pith and cortex are commonly mixed up as they are similar tissues (composed mainly of soft, spongy parenchyma cells) with similar functions (storage and transport of water and nutrients throughout the plant). The cortex is located to the outside and/or around the vascular bundles (cortex = outside), while the pith is located in the centre of the stem (pith = inside).

3

The correct answer is **D** because:

- Sieve tube elements have end walls – so **1** is incorrect
- **Neither** sieve tube elements nor xylem vessel elements have nuclei (to allow more space for flow of liquids) - so **2** is correct
- Although xylem vessel elements do not have cytoplasm, sieve tube elements still have a small amount – so **3** is incorrect
- Only the sieve tube elements are dependent on **companion cells** for certain functions – so **4** is incorrect

The end walls of sieve tube elements (called **sieve plates**) are permeated with many openings to allow flow of sap between adjacent sieve tube elements

### Companion Cell Recap:

The companion cells are specialized **parenchyma** cells found in the phloem tissue. They are **living** cells with relatively large nuclei and abundant mitochondria (indicating that they are metabolically active). Companion cells are closely associated with sieve tube elements (connected to them via numerous plasmodesmata) and **provide energy** to the sieve tube elements during translocation.

4

The correct answer is **C** because:

- The purpose of a plan diagram is to show the distribution of the **main tissues** within an organ (in this case of the stem)
- The aim is to identify the tissues and to delimit these different tissues with boundary lines – **crucially, no individual cells should be drawn!**
- **Companion cell** should not be included in a plan diagram as it is an individual cell (whereas the rest are all tissues, so should be included)

**Important:** xylem is allowed (as it refers to a tissue) but xylem vessel element is not (as it refers to a cell). Likewise, phloem is allowed (as it refers to a tissue) but sieve tube element is not (as it refers to a cell).

5

The correct answer is **B** because:

- **Y = xylem** and **X = phloem**
- The xylem transports **water** and minerals not the phloem – so **1** is incorrect
- The xylem only transports substances in only **one** direction – so **2** is correct
- The xylem and phloem (plus the cambium located between them) comprise a **vascular bundle** – so **3** is correct
- The phloem transports products of photosynthesis – so **4** is correct

6

The correct answer is **B** because:

- The **xylem** is made of **dead tissue** and the **phloem** is made of **living tissue**
- As the **xylem** tissue is already dead its functioning will be **unaffected** by the addition of the poison
- Transport in the **phloem** is dependent on **actively loading sucrose** into the sieve tube elements - this process will no longer occur after the cells in the vascular bundle have been poisoned, so transport in the phloem will stop

7

The correct answer is **A** because:

- One of the most important roles in companion cells is the **active loading** of sucrose into the **phloem**
- **Active** loading is an **energy** requiring process, therefore the companion cells need to synthesis large quantities of **ATP**
- To make all this ATP the companion cells have large numbers of **mitochondria**

**Starch grains** are found in all living plant cells (to provide a source of glucose) but are not found in an unusually high abundance in companion cells (parenchymal cells in the cortex and pith of roots and stems do have a higher than normal starch grain abundance though)

**Chloroplasts** are found in highest concentrations in the palisade mesophyll cells (and to a smaller extent in the spongy mesophyll cells) which is where photosynthesis takes place, but companion cells do not have an unusually high abundance of chloroplasts

**Lysosomes** are found in all living plant cells (they are used to break down organelles, pathogens and biomolecules), but they are not found in an unusually high abundance in companion cells

8

The correct answer is **C** because:

- Root hairs do **not** have cuticles, as this would **prevent** water absorption – so **1** is correct
- Root hairs have a **large surface area** to speed up the intake of water by osmosis – so **2** is correct
- Root hairs have **thin walls** to speed up the intake of water by osmosis – so **3** is correct
- Root hairs maintain a **low water potential** by **actively** pumping minerals and ions from the soil (against their concentration gradients),

these minerals are stored in the large vacuoles in the root hair cells and **speed up** the absorption of water via osmosis – so **4** is correct

9

The correct answer is **B** because:

- Sieve tube elements have a vastly reduced cell content to **maximise space** for the movement of **sap**
- Organelles that are missing include the cytoskeleton, ribosomes, tonoplast and the **nucleus**
- Mature sieve elements still contain structural phloem specific proteins, mitochondria, ER and strands of cytoplasm
- Due to their vastly **reduced cell contents**, sieve tube elements rely on companion cells for many metabolic processes

### Companion Cell Recap:

The companion cells are specialized parenchyma cells found in the phloem tissue. They are living cells with relatively large nuclei and abundant mitochondria (indicating that they are metabolically active). Companion cells are closely associated with sieve tube elements (connected to them via numerous plasmodesmata) and provide energy to them during translocation.

10

The correct answer is **D** because:

- The diagram shows the cross-section of a dicot (dicotyledonous) root, recognisable by the characteristic '**X**' shape of the xylem tissue in the middle
- Cell W is within this X shape, therefore must be a **xylem vessel element**