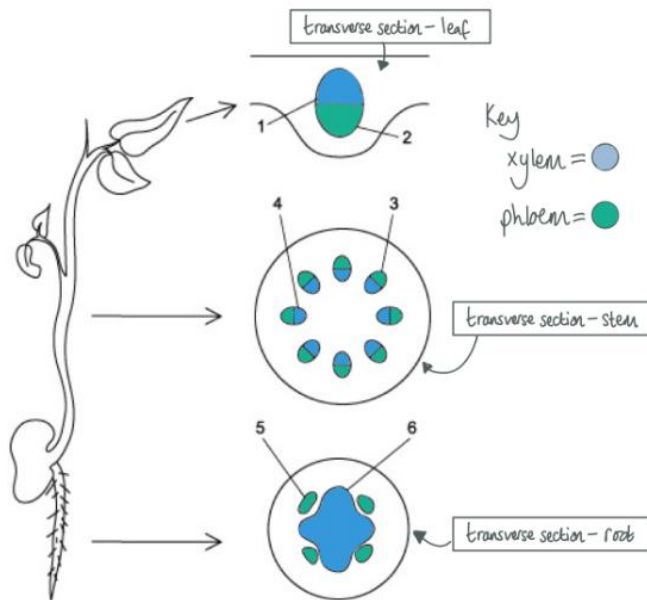


Model Answers: Hard

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)

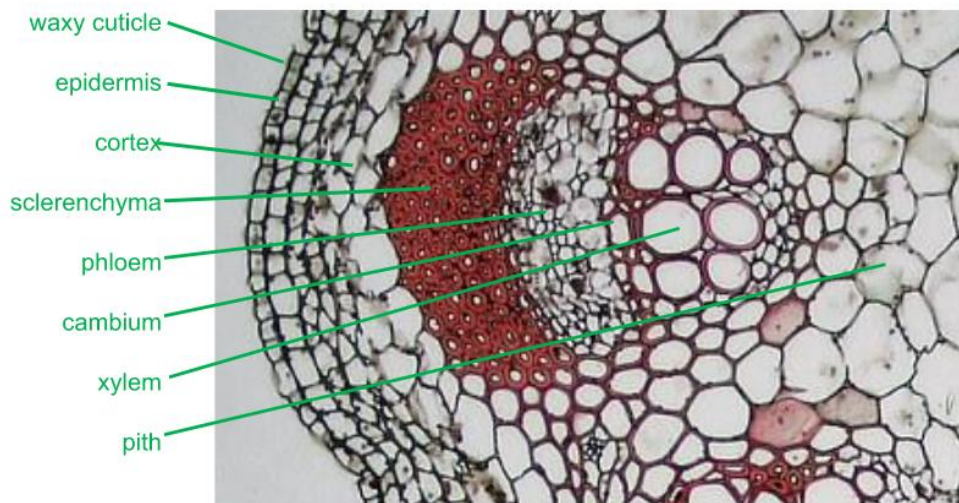


2

The correct answer is **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 **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**
- The next layer outside of the phloem is the **sclerenchyma cells** (i.e. the dark cells represented by **B**) – these are heavily **lignified, dead** cells that provide structural support to the plant
- Between the xylem and phloem is the **cambium** (an area

of **undifferentiated cells** used for growth of new tissue)



3

The correct answer is **D** because:

- **Both** companion cells and sieve tube elements have **endoplasmic reticulum** (ER is one of the few organelles that sieve tube elements have)
- **Neither** sieve tube elements nor xylem vessel elements have **nuclei**

A and **B** are incorrect as companion cells do not have lignified tissue

C is incorrect as xylem vessel elements do **not** have nuclei

4

The correct answer is **B** because:

- The purpose of a plan diagram is to show the distribution of the **main tissues** within an organ (in this case a dicotyledonous root)
- The aim is to identify the tissues and to delimit these different tissues with boundary lines – **crucially, no individual cells should be drawn!**
- **A, C and D** are all incorrect as they include individual cells, or organelles (which should not be included in a plan diagram)
- **B** is correct as all the labels refer to **tissues** (which should be included in a plan diagram)

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 **A** because:

- **X** is the cortex; **Y** is the endodermis and **Z** is the epidermis
- Either option would be correct for **X** as storage of carbohydrates and providing a pathway for the movement of water from the root hairs to vascular system are both functions of the **cortex**
- The **endodermis** contains the **Casparian strip** therefore plays a role in regulating the **movement of water** into and out of the vascular system (the Casparian strip blocks water travelling via the apoplast pathway forcing it into the **symplast** pathway)

so necessitates the crossing of a **cell membrane**) - the endodermis does **not** play a significant role in structural support

- As the outermost layer, the **epidermis** is the first line of **defence** against infection, providing a physical barrier to pathogens.
- Plant roots have root hairs and the main role of root hairs is to **absorb water** and nutrients, consequently there is **no** waxy cuticle on the root because if there was, it will be impossible for roots to absorb water and nutrients from the soil

6

The correct answer is **D** because:

- The purpose of a plan diagram is to show the distribution of the **main tissues** within an organ (in this case a dicotyledonous leaf)
- The aim is to identify the tissues and to delimit these different tissues with boundary lines – **crucially, no individual cells should be drawn!**
- **4** is incorrect as it refers to individual cells (which should not be included in a plan diagram)
- The rest are correct as they all refer to tissues (which should be included in a plan diagram)

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)

7

The correct answer is **C** because:

- Xylem vessel elements have **neither** cytoplasm nor nuclei
- Sieve tube elements have cytoplasm but **no** nuclei
- Companion cells have **both** cytoplasm and nuclei

8

The correct answer is **C** because:

- **Without** this cytoplasmic contact, the rate that sucrose could be transported into the sieve tube element would be far **slower**
- **Less** sucrose in the sieve tube element would mean that there is a **higher** water potential on the sieve tube element
- A higher water potential in the sieve tube element would result in **less** water moving into the **sieve tube element** from the **xylem** (as there is less of a concentration gradient)
- **Less** water moving in would result in a **lower hydrostatic pressure** in the sieve tube element
- As mass flow is driven by pressure gradients, a **lower** hydrostatic pressure in the sieve tube element would mean the **rate of translocation** would **decrease**

A is incorrect as the companion cell does **not** provide much structural support (due to an absence of **lignin**).

B is incorrect as the source of sugars is either from the **leaves** or a **starch storage area**.

D is incorrect as once they have reached maturity, sieve tube elements simply divide **without** undergoing **mitosis** (mitosis is nuclear division – mature sieve tube cells don't have nuclei so don't need to undergo mitosis to carryout **cytokinesis**).

9

The correct answer is **B** because:

- **Plasmodesmata** are narrow threads of cytoplasm that pass through the cell walls of **adjacent** plant cells
- Plasmodesmata allow:
 - **Communication** between cells
 - Cytoplasmic **movement of nutrients** between cells
 - **Symplastic** movement of **water**

The **communication** between neighbouring cells via the plasmodesmata is achieved by the **cytoplasmic movement** of substances between cells

10

The correct answer is **D** because:

- **X + Z = xylem** **Y + W = phloem**
- The phloem does not have **lignified** tissue – so **1** is incorrect
- The cells in phloem are **living** – so **2** is incorrect
- The xylem transports water and mineral ions – so **3** is incorrect
- The xylem is **not** made up of companion cells or sieve tube elements – so **4** is incorrect
- The movement in the phloem occurs in two directions – so **5** is incorrect

