

Model Answers: Medium

1

The correct answer is **D** because:

- **1** could be either cuticle or epidermis (it is not possible to ascertain which from the diagram)
- **2** is the phloem and **3** is the xylem as, in a **root**, the xylem is in the centre in an X shape and the phloem located around the outside of the xylem
- **4** is the cortex, there is no pith in a dicot (dicotyledonous) root as the vascular bundle is in the centre of the root

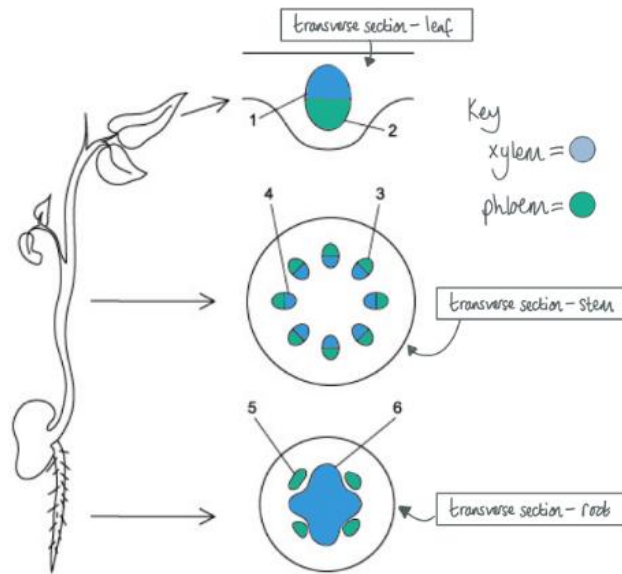
Pith vs Cortex Recap:

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**).

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 **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)



3

The correct answer is **A** because:

- **Xylem** vessel elements have heavily **lignified** walls (which adds structural strength and helps to prevent the xylem from collapsing under **negative pressure** from transpiration pull)
- **Companion cells** have **nuclei** and are therefore able to undergo cell division

B is incorrect as xylem vessel elements do **not** have nuclei as they are dead cells

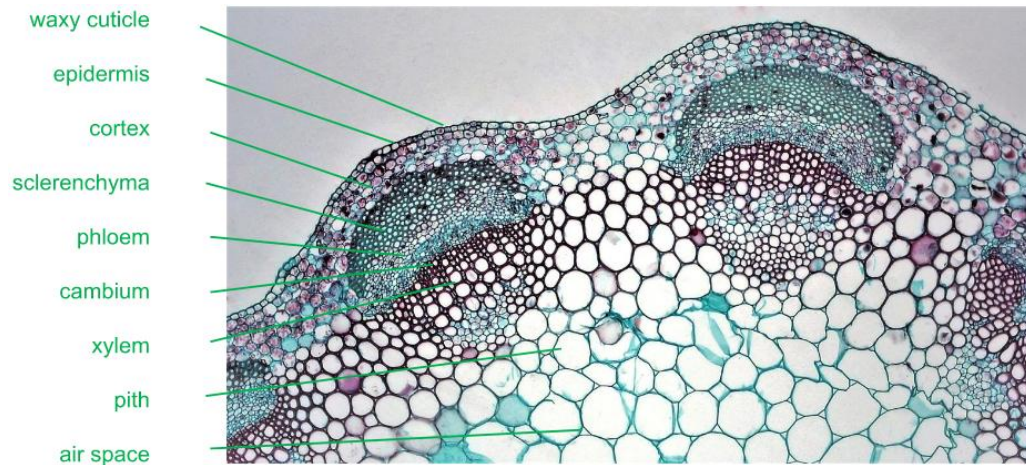
C is incorrect as companion cells have **cytoplasm**

D is incorrect as on both accounts as xylem vessel elements do **not** have mitochondria and companion cells do **not** have lignified walls

4

The correct answer is **B** because:

- **X** is in the **xylem**, therefore must be a xylem vessel element (rather than a sieve tube element)
- **Y** is in the **phloem**, therefore must be a sieve tube element (rather than a cortex, epidermal or xylem vessel element)
- **Z** is located in the **pith**, but is specifically pointing at a gap between cells, therefore it must be an **airspace**



5

The correct answer is **C** because:

2 and **4** are **xylem** which does the following:

- Transports water
- Transports in one direction
- Transports ions and minerals

1 and **3** are the **phloem** which does the following:

- Transports sugars
- Transports in two directions
- Transports products of photosynthesis

6

The correct answer is **A** because:

- Xylem vessel elements (xylem cells) have no **nucleus, cytoplasm** or **end walls**
- Sieve tube elements (phloem cells) have **no** nucleus, but **do** have cytoplasm and end walls

7

The correct answer is **D** because:

- The xylem contains **elongated** cells with **no** end walls
- Xylem vessels are located in **vascular bundles** on the outside of the stem and in the middle of the roots

A is incorrect as xylem vessels **not** contain peripheral cytoplasm and are located to the **inside** of phloem in vascular bundles

B is incorrect as it is describing a sieve tube element.

C is incorrect as xylem vessels are never associated with companion cells.

8

The correct answer is **B** because:

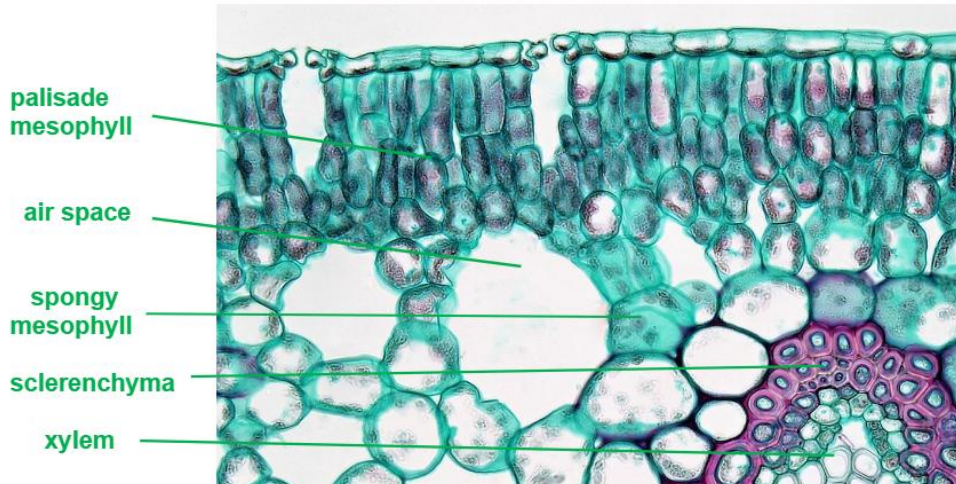
- **X** is the cortex – the cortex is the area in the root found between the epidermis (**Z**) and the endodermis (**Y**) and is made up of **parenchyma** cells which play a role in **storage** of nutrients
- **Y** is the endodermis - the endodermis is located between the cortex and the vascular bundle in roots and contains the **Casparian strip** (which forces water from

the **apoplast** into the **symplast** pathway)

- **Z** is the epidermis – the epidermis is the outermost layer in the root (there is **no cuticle** in roots to allow maximum **water absorption**)

9

The correct answer is **D** because:



Z is **xylem** and not phloem because in **leaves**, the xylem is located **on top** of the phloem in the vascular bundle. This image only shows the top half of a vascular bundle therefore **Z** must be xylem (the phloem is not shown in the image). The darker band of cells above the xylem is **sclerenchyma cells**. Sclerenchyma cells are **highly lignified** and provide **structural** support to the plant

10

The correct answer is **A** because,

- **Plasmodesmata** are narrow threads of cytoplasm that pass through the cell walls of **adjacent** plant cells and allows **communication** between them
- Communication between neighbouring cells via the plasmodesmata is achieved by the **symplastic** movement of substances between cells