

Exercise walk-through

2.5

Plant cell structure, xylem and phloem (statements 4.1–4.6, core practicals 7–8)

Pearson Edexcel · International A-Level · Biology

A eukaryotic cell is a set of compartments

Structure	Function
Nucleus	stores DNA behind a double membrane
Rough ER	folds and transports proteins from its ribosomes
Golgi	modifies, packages and exports proteins
Mitochondrion	aerobic respiration and ATP

Mitosis preserves chromosome number

Prophase : chromosomes condense, spindle forms



Metaphase : chromosomes line up on the equator



Anaphase : chromatids pulled to opposite poles



Telophase : nuclear membranes reform

Check yourself

Your turn

A pond sample has counts 60, 20, 15 and 5. What is the index of diversity?

- A. $N(N-1)$ over the sum of $n(n-1)$: 9900 over $4150 = 2.39$
- B. add the species counts first, then divide by four
- C. the largest count over the smallest count
- D. species richness times total individuals

Exercises 2.1·2.3

2.1 Explain how cellulose microfibrils give a plant cell wall its strength. [2]

2.2 State two structural differences between xylem vessels and phloem sieve tubes. [2]

2.3 Name the tissue between the xylem and the root's outer layers that transports sugars. [1]

Exercises 2.1·2.3

2.1 Explain how cellulose microfibrils give a plant cell wall its strength. [2]

2.1 Many cellulose chains lie parallel, cross-linked by hydrogen bonds, bundling into microfibrils layered in different directions, which resists stretching in every direction.

2.2 State two structural differences between xylem vessels and phloem sieve tubes. [2]

2.2 Any two: xylem cells are dead with no cytoplasm, phloem's are living; xylem walls lignified, phloem's cellulose with sieve plates; xylem hollow continuous tubes, phloem has pores in sieve plates.

2.3 Name the tissue between the xylem and the root's outer layers that transports sugars. [1]

2.3 Phloem.

Exercises 3.1·3.2

3.1 Explain how the structure of xylem vessels suits the transport of water from root to leaf, referring to four structural features and the function each serves. [4]

3.2 The photograph shows a transverse section of a sunflower stem stained to show lignin. Describe where you would find the xylem and phloem in this section, and explain why lignin is absent from the walls of companion cells. [4]

Exercises 3.1·3.2

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3.1 Any four pairs: dead hollow cells form a continuous low-resistance tube; lignified walls waterproof and stop collapse under tension; loss of end walls removes barriers; pits allow lateral water movement into surrounding tissue; narrow bore holds the water column by cohesion.

3.2 The photograph shows a transverse section of a sunflower stem stained to show lignin. Describe where you would find the xylem and phloem in this section, and explain why lignin is absent from the walls of companion cells. [4]

3.2 Xylem inside each vascular bundle toward the centre, stained red by lignin; phloem outside the xylem toward the epidermis. Companion cells are metabolically active cells of the phloem that load sugars into sieve tubes; lignin would kill them and block the plasmodesmata they use – lignified cells are dead.

Exercise 3.3

3.3 A student uses a potometer to compare water uptake of a plant in still air and in a fan's airflow. The bubble moves 12 mm in 5 minutes in still air and 46 mm in 5 minutes in the fan. Calculate the ratio of uptake rates, suggest why the fan increases uptake, and state one variable that must be kept the same for the comparison to be valid. [5]

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3.3 Ratio $46/12 \approx 3.8 : 1$. The airflow removes the humid boundary layer around the leaves, steepening the water-vapour gradient and raising transpiration. Keep the same plant, temperature/light and water temperature (any one, B1).