Tracing water through xylem

Student activity • practical and reasoning

YEAR 10 / LESSON 39 / BIOLOGY + SCIENCE (DOUBLE AWARD)

The question

Which tissues carry a visible water-borne dye?

Observe a water-borne tracer and prepared stem sections, keeping the visible evidence separate from the full transport mechanism.

Equipment

- Teacher-prepared dyed and plain-water stems
- Microscope, slides, coverslips, forceps/soft brush and water
- Permanent xylem reference slide, pencil and booklet

Staff alone use the cutting blade on a stable tile. Handle coverslips and slides carefully, avoid dye and plant sap contact, and do not taste any material. Wash hands after the activity.

Course coverage: Shared Biology / Double Award: 2.54. Xylem transport of water and minerals.

Plan, model or apparatus sketch

Draw and label the apparatus or biological model; identify one limitation.

Method and reasoning

Read the whole sequence before starting

YEAR 10 / LESSON 39 / BIOLOGY + SCIENCE (DOUBLE AWARD)

1. Observe teacher-prepared leafy stems standing in food-coloured water and a matched stem in plain water. Record start time, dye identity and treatment duration.

2. Compare the visible colour pattern in stems and leaves. Do not assume every coloured region is a xylem vessel without structural evidence.

3. The teacher cuts thin transverse stem sections on a stable tile. Use forceps or a soft brush to transfer a prepared section onto a slide with water.

4. Lower a coverslip carefully and observe at low power. Draw the dye distribution and identify vascular regions with a reference cross-section.

5. Compare with a permanent xylem slide to describe hollow conducting vessels and supporting walls, labelling observed features separately from reference information.

6. Explain that the dye traces a pathway but does not by itself measure total water flow or prove the complete mechanism of upward transport.

Cleanup

- Staff secure the cutting blade and collect cut stems and sections through the school’s designated plant-waste route.
- Return permanent slides to labelled boxes; collect used wet slides and coverslips in the designated tray, without handling broken glass.
- Switch off and cover microscopes as directed, clean dye spills and wash hands.

Record your evidence

Blank spaces are for your own work

YEAR 10 / LESSON 39 / BIOLOGY + SCIENCE (DOUBLE AWARD)

Reference and task data

Xylem conducts water and dissolved mineral ions from roots to other plant parts. Dye distribution can reveal conducting pathways, but dye may bind to tissue or spread and need not move exactly like every water molecule. A cut stem bypasses the root, so this setup does not demonstrate root uptake.

Example / trial	Observation / evidence	Explanation / limit
Whole-stem observations		
Section drawing / reference comparison		
Conclusion / limitation		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

YEAR 10 / LESSON 39 / BIOLOGY + SCIENCE (DOUBLE AWARD)

1. What does xylem transport?

2. Why include a plain-water stem?

3. Why use a thin section?

4. What is bypassed when a cut stem stands directly in dye?

5. Does the highest visible dye mark equal total water uptake?

6. Give one limitation of the demonstration.