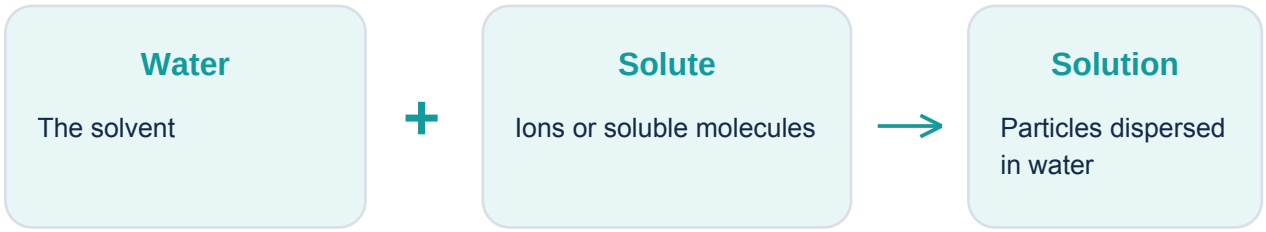
Water carries dissolved substances

Core idea: some mineral ions and organic compounds move within plants dissolved in water. The substance being carried is the solute; water is the solvent.

1. SOLVENT + SOLUTE = SOLUTION



Dissolving does not mean disappearing. The solute remains present as dispersed ions or molecules. This is a relationship diagram, not a chemical reaction.

2. WHY WATER WORKS - SUPPORTING CONTEXT

Water is polar: its molecules have partial positive and negative charges. Water can interact with ions and many polar molecules, helping keep them dispersed in solution.

3. WATER IS NOT A SOLVENT FOR EVERYTHING

The word some matters. Do not claim that every organic compound dissolves readily in water. Oils, for example, do not dissolve well; soluble sugars provide a better transport example.

4. SEPARATE THE MEDIUM FROM ITS CONTENTS

In a solution of sucrose in water, sucrose is the solute and water is the solvent. Calling the whole solution water misses the dissolved substance being transported.

Water polarity, solutes and solutions: OpenStax Biology 2e, section 2.2.

Scope: Cambridge Biology 9700 syllabus, section 7.2, outcome 1, p. 26.

Two important groups of solutes

Mineral ions are inorganic charged particles. Organic solutes include sucrose and amino acids. Both groups can be carried in an aqueous solution: aqueous means water-based.

1. CLASSIFY THE SUBSTANCE

Mineral ions

Examples: nitrate ions and magnesium ions.

Absorbed by roots from the soil solution.

Organic compounds

Examples: sucrose and amino acids.

Made through plant metabolism.

Amino acids contain nitrogen, but they are organic molecules, not nitrate ions. Classification depends on the substance, not just one element it contains.

2. MINERALS PROVIDE MATERIALS - SUPPORTING CONTEXT

Plants need mineral nutrients to build and operate cells. Nitrogen is needed for amino acids and nucleic acids; magnesium is part of chlorophyll. Roots take up dissolved ions, not pieces of soil.

3. MINERALS ARE NOT THE PLANT'S SUGAR SUPPLY

A photosynthetic plant uses light energy to make organic compounds from carbon dioxide and water. Mineral nutrients supply essential elements, but are not a substitute for its carbon or energy supply.

4. USE PRECISE EXAMPLES

For a mineral solute, name nitrate or magnesium ions. For an organic solute, name sucrose or amino acids. Water is the shared solvent, not an example of either solute group.

Mineral nutrients and plant nutrition: OpenStax Biology 2e, section 31.1.

Scope: Cambridge Biology 9700 syllabus, section 7.2, outcome 1, p. 26.

Connect the solute to its pathway

The following overview links this lesson to xylem and phloem. It is supporting context: detailed water movement and phloem transport mechanisms follow in later lessons.

1. TWO WATER-BASED TRANSPORT FLUIDS

XYLEM SAP

Water + mineral ions	→	Roots to stems and leaves

PHLOEM SAP

Water + organic solutes	→	Sites of supply to sites of use

2. XYLEM: WATER WITH DISSOLVED MINERAL IONS

Xylem supplies aerial tissues with water and mineral nutrients taken up by roots. The fluid is a solution, not pure water and not dry mineral particles moving through a tube.

3. PHLOEM: ASSIMILATES DISSOLVED IN WATER

Assimilates such as sucrose and amino acids are carried in phloem sap. They can be delivered to growing or storage tissues. Phloem contains water too; it does not carry dry sugar.

4. THE SENTENCE TO REMEMBER

Some mineral ions and organic compounds are transported within plants dissolved in water. Name the solute, identify water as the solvent, and then connect the solution to the relevant transport tissue.

Xylem and phloem transport: OpenStax Biology 2e, section 30.5.

Scope: Cambridge Biology 9700 syllabus, section 7.2, outcome 1, p. 26.