Water at Work

How water helps a plant's cells function

FB.2.5 "Investigate how the properties of water (e.g., cohesion, adhesion, heat capacity, solvent properties) contribute to the maintenance of living cells and organisms."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Circle four water properties in the passage, then underline one effect each property has on the tomato plant. Give each property and its matching effect the same number.

A Tomato Plant at Noon

(1) At noon in a school greenhouse, a tomato plant lifts water from damp soil to leaves above the bench. Water enters roots and moves through narrow tubes called xylem. As water evaporates from leaf surfaces, it pulls on the water below. Water molecules stick to one another, a property called cohesion, so this pull can move a continuous column upward. Water also sticks to xylem walls, a property called adhesion. Adhesion helps the column stay against the tube walls as it rises. Together, these properties keep water reaching leaf cells, which need it to remain firm.

(2) The greenhouse roof traps sunlight, and the air grows warm during the afternoon. The water inside the tomato plant's cells does not heat up as quickly as many other substances would. Water has a high heat capacity: it takes a lot of energy to raise its temperature. As a result, water helps slow temperature changes inside cells when sunlight warms the leaves. This matters because the proteins that carry out cell processes work best within a limited temperature range. Water cannot prevent all overheating, but its heat capacity gives cells more time to cope with a rising temperature.

(3) Inside a tomato leaf cell, water does more than fill space. Because water is a good solvent for many substances, dissolved minerals from the roots can travel in watery fluids to cells that need them. In the cell's watery interior, dissolved materials can move and take part in chemical reactions that build and maintain living tissue. Water also presses the cell's contents against its firm cell wall, helping the leaf stay upright. If the roots cannot replace water lost by the leaves, the cells lose this pressure and the plant wilts. Each effect depends on water being present where cells function.

2 ANSWER WITH EVIDENCE

Use the passage

1. How does cohesion help water reach the tomato plant's leaf cells?

2. How does adhesion help water move through the xylem?

3. Why does water's heat capacity matter to cells on a warm afternoon?

4. How does water's solvent property help the plant build and maintain living tissue?

3 YOUR TURN

Your own words

A sunflower seedling grows in a windy, sunny yard, but its soil is drying out. In four sentences, explain how two different water properties would help its cells on this day and predict one effect if its roots cannot replace water lost from its leaves.

Water at Work

PART 1 · READ AND MARK

Circle four water properties in the passage, then underline one effect each property has on the tomato plant. Give each property and its matching effect the same number. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How does cohesion help water reach the tomato plant's leaf cells?	**Cohesion keeps water molecules together, allowing the pull from evaporation to move a continuous column of water up the xylem.**
2	How does adhesion help water move through the xylem?	**Adhesion makes water stick to the xylem walls, helping the water column stay against the walls as it rises.**
3	Why does water's heat capacity matter to cells on a warm afternoon?	**Water's high heat capacity slows temperature changes inside cells, helping keep conditions within the range where cell proteins work best.**
4	How does water's solvent property help the plant build and maintain living tissue?	**Water carries dissolved minerals to cells and lets dissolved materials move in cells and take part in chemical reactions.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Cohesion helps water molecules stay together as water is pulled up toward the sunflower's leaves. The wind can increase water loss from the leaves, so this supply matters. Water's high heat capacity slows temperature changes inside the sunlit leaf cells. If the roots cannot replace lost water, the cells lose pressure against their walls and the seedling wilts.

For Part 3, accept any two distinct, accurately explained water properties linked to the sunflower's cells. The prediction should follow from the roots' inability to replace lost water.