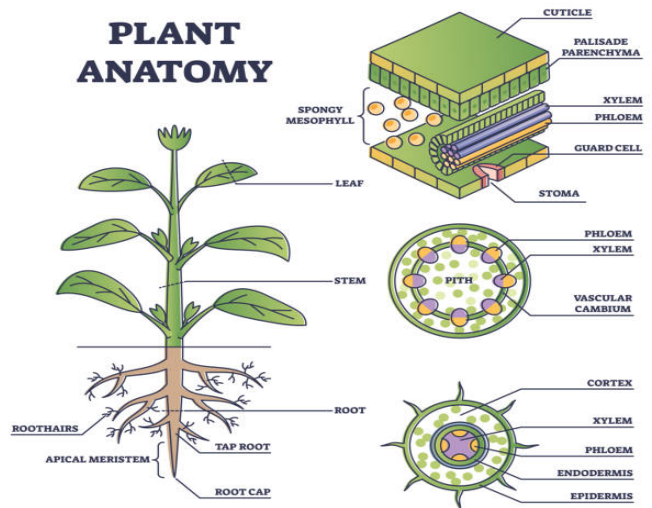


Capillary Action: Water Movement in Plants

Capillary action is a process where liquids move by being “pulled” through small spaces. This movement, which can overcome the resistive force of gravity, is due to adhesive forces between the liquid and a surface, and the cohesive force of the liquid itself.

Capillary action is how plants move water and nutrients up from the soil and through the rest of the plant. Water will move up the plant through tiny tubes called xylem. Water will enter the roots of a plant and get pulled up through the xylem tubes by capillary action. This happens because water molecules are attracted to each other (cohesion) and to the walls of the xylem tubes (adhesion). Together, these two forces help water move up the plant through the xylem.



Flowers such as carnation are an excellent way for students to see how water is able to move through xylem due to capillary action.

Grade level: Middle School (6th-8th grade)

Time frame: 90 minutes

US Next Generation Science Standards (NGSS)

PS1.A: Structure and Properties of Matter

LS2.B: Cycling of Matter and Flow of Energy in Ecosystems

ETS1.A: Defining and Delimiting Engineering Problems

ETS1.B: Developing Possible Solutions

ETS1.C: Optimizing the Design Solution

Objective:

To demonstrate the process of capillary action in plants

To understand that capillary movement is due to adhesive and cohesive forces

To understand that capillary force is independent of, and resistant to, gravitational force

To understand that capillary force is a natural phenomenon, and can be a useful tool for moving liquids

Engage

1. At the beginning of class, fill three plastic cups with water.
2. Add food coloring to each cup.
3. Cut three strips of paper towel that are about 2-cm wide and 15 cm long.
4. Place one end of each paper towel strip in a cup of water, making sure the other end is hanging over the edge of the cup.
5. After 15 minutes, discuss how the water is able to move from one glass to another. Leave overnight.



Procedure:

1. Fill several cups with different colored water.
2. Cut the bottom of each flower stem at an angle and place one or two stems in each cup of water.
3. Cover each cup with plastic wrap to create a closed environment.
4. Record observations after 24 hours



Assessment:

- What is capillary force?
- Define adhesion and give an example
- Define cohesion and give an example
- Explain how capillary action helps plants grow and survive.

- Diagram and label the parts of a plant involved in water and nutrient transport.

- How do you think gravity influences capillary movement of water through the plant? Explain.

- Describe how water uptake in plants would be different on the moon? In microgravity? Use Newton's Laws and balanced/unbalanced forces in your explanation.

Extensions:

- Conduct a similar experiment with different types of plants or materials to compare capillary action
- Research and discuss how humans can use the concept of capillary action to design more efficient systems for transporting fluid from one area to another.

Are capillary forces influenced by gravity?

Design a small apparatus for flight on board G-Force One to investigate how reduced gravity changes water movement. Data must be measurable, and captured within 20 seconds!

Volume: no greater than 10 cm³

Water: Max volume 30 mL

Must be sealed and leak-proof

Resources

Demonstration: Adhesion and Cohesion in Microgravity:

[Adhesion and Cohesion in Zero-G](#)

Experiment: Water Diffusion in Regolith in Lunar Gravity and Microgravity

[Water diffusion in Lunar Regolith in Zero-G](#)

Article: Adhesion and Cohesion

[Khan Academy Structure of Water](#)