

**RELAX!
HERE'S A LESSON
WORTH TEACHING.**

NutrientMovement

Appropriate for Middle & High School



RESOURCES AVAILABLE TO TEACHERS

Other teaching aides are also available including:

- Videos
- Posters
- PowerPoint Presentations
- Visual Aids
- Full Curriculum for Teachers
- Activities

Visit our website to order your support materials today. The time you invest in our cause will come back to you many times over as you see the eyes of both young and old audiences respond to the information you share.

www.nutrientsforlife.org

YOUR VOICE OUR RESOURCES

Nutrients for Life is a nonprofit organization that provides information and resources to educators and individuals like you, to help inform the public about the vital role that fertilizer plays in feeding the world.

The information we have compiled is science-based and user-friendly.

It has been successfully implemented by educators across the country.

Through a grassroots effort, we can spread the word about soil health to students of all ages and to adult organizations that are always looking

for programs. Our story is not only important, but it is interesting and serves a vital role in educating consumers and decision-makers

in the future.

**IF YOU
DON'T TELL
YOUR STORY,
WHO WILL?**

**Your story matters.
Soil science matters.**



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Investigating Nutrient Movement

Here is a quick, but effective lesson that you can use at a moments notice.

Visual aids: Paper or disposable coffee cups, water, food coloring, larger container for the cup to sit in.

Optional: Nutrients for Life NPK poster.

This lesson is found in NFLF’s curriculum, *Nourishing the Planet in the 21st Century*.

When going to the classroom, bring a copy of the curriculum and accompanying poster to gift to the teacher.

All NFLF resources are free.

PROCEDURE



1) Ask students, “How do nutrients in the soil water get into the plants root hairs?”
a. Accept all answers at this time.

2) Explain that there are two ways water and nutrients move into plants’ root system. One is active transport, and the other is diffusion. In diffusion, molecules move randomly due to their kinetic energy. This movement causes molecules to intermingle. The net movement of molecules is from an area of high concentration to one of lower concentration. The net movement stops when the concentration of the molecules is the same everywhere. The movement comes from their kinetic energy and does not need additional energy (unlike active transport).



STEP 1: Pass out a container, water, food coloring and cup (with 2 holes opposite each other towards the base of the cup to each group.) The water level in the larger container must be higher than where the holes on the cup will be.

STEP 2: Fill the cup about ½ full of water. Have someone hold the holes closed.

STEP 3: Place the cup of water into the center of the larger container.

STEP 4: Fill the larger container with the water until it is level with the amount of water placed into the cup.

STEP 5: Add several drops of food coloring to the water in the larger container and gently mix the water until the color is evenly distributed. Do not add coloring inside of the cup!

STEP 6: Watch the water in the cup for 5 minutes and record observations.



OVERVIEW

Plants remove water and nutrients from the soil through the plant’s root system. Some nutrients move into root cells from the soil by diffusion and others by an energy-requiring process (active transport). This diffusion activity represents one way nutrients are moved into the plant by using a simple visual.

MAJOR CONCEPTS

- Diffusion is the movement of a nutrient ion from an area of high concentration to an area of lower concentration.
- In a soil system, the surface of the root is usually considered to be the area of lower concentration. The surface of the clays in the soil aggregates is thought to be the area of high concentration. Therefore, the positively charged nutrient ions diffuse from the surface of clays in the soil to the surface of the root. Nutrient uptake by plants keeps the concentration at the root surface low.
- Diffusion is slow but continuous as long as the plants are growing.

NUTRIENTS

FOR LIFE

Humans and plants need many of the same nutrients to grow big and strong.

Humans need a variety of proteins, carbohydrates, minerals, and vitamins to stay healthy. Besides the primary nutrients NPK, plants need small amounts of secondary nutrients, such as calcium and sulfur, and micronutrients, like iron and zinc.

N
NITROGEN EQUALS STRONG PLANTS
Nitrogen makes plants grow strong and healthy.

P
PHOSPHORUS MOVES ENERGY
Phosphorus helps plants with photosynthesis. It stores and moves energy around the plant.

K
WATER IS POTASSIUM'S FRIEND
Potassium helps plants control and use water efficiently.

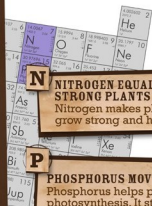
NUTRIENTS COME FROM THE SOIL THAT HELP THE PLANT GROW AND PRODUCE FOOD

NUTRIENTS COME FROM FOOD GROWN IN THE SOIL

K
POTASSIUM HELPS THE HEART
Humans need potassium, like plants do. Potassium helps control muscles and the rhythm of the heart.

Fe
IRON HELPS MOVE OXYGEN
Iron helps the body make hemoglobin that moves oxygen and hemoglobin through the blood. This is similar to phosphorus moving energy around the plant.

Ca
CALCIUM EQUALS STRONG BONES
Calcium helps humans have strong bones, like nitrogen helps plants have strong stalks.





NUTRIENTS FOR LIFE

FOUNDATION

Diffusion Lesson

Plants remove water and nutrients from the soil through the plant's root system. Some nutrients move into root cells from the soil by diffusion and others by an energy-requiring process (active transport). This diffusion activity represents one way nutrients are moved into the plant by using a simple visual.

Visual Aids: Paper or disposable coffee cups, water, food coloring, larger container for the cup to sit in.

Time: 10-15 minutes

- 1) Ask students, "How do nutrients in the soil water get into the plants root hairs?"
 - a. Accept all answers at this time.
- 2) Explain that there are two ways water and nutrients move into plants' root system. One is active transport, and the other is diffusion. In diffusion, molecules move randomly due to their kinetic energy. This movement causes molecules to intermingle. The net movement of molecules is from an area of high concentration to one of lower concentration. The net movement stops when the concentration of the molecules is the same everywhere. The movement comes from their kinetic energy and does not need additional energy (unlike active transport).

Activity: Students will now investigate the process by which water enters the root hair. Divide classroom into groups.

STEP 1: Pass out a container, water, food coloring and cup with 2 holes opposite each other towards the base of the cup to each group. The water level in the larger container must be higher than the holes on the cup.

STEP 2: Fill the cup about $\frac{1}{2}$ full of water. Have someone hold the holes closed.

STEP 3: Place the cup of water into the center of the larger container.

STEP 4: Fill the larger container with the water until it is level with the amount of water placed into the cup.

STEP 5: Add several drops of food coloring to the water in the larger container and gently mix the water until the color is evenly distributed. Do not add coloring inside of the cup!

STEP 6: Poke 2 holes in the cup, opposite of each other.**

****You may find it easier to prep holes in the cups ahead of time. If doing so, pour the water in the larger container first. Then have one student hold the holes closed with their fingers, while another student pours water into the cup.**

STEP 7: Watch the water in the cup for 5 minutes and record observations.

Review:

- 1) Ask students, “Why did the colored water enter the cup?”
 - a. Guide the discussion to bring out that although the concentration of water was the same on both sides of the cup, the concentration of the food coloring was higher outside of the cup compared to inside the cup.
- 2) Ask the students to determine if the following statements are true or false:
 - a. Plant Roots have tiny hairs that absorb water. (TRUE)
 - b. Plants roots use energy to pump water into the plant. (FALSE)
 - i. As shown in this experiment, water enters the root hairs by the passive process of diffusion. When root hairs contact the water, the water flows from a high concentration in the soil toward a lower concentration in the root cells.
 - c. Nutrients enter root cells through the process of diffusion. (TRUE)
 - d. Nutrients enter root cells through the process of active transport. (TRUE)
 - e. Plant roots grow until they find water. (False)
 - i. Roots can only grow where water is already present. As the surface of the soil dries out, roots near the surface may die while roots further down are in contact with water and can grow deeper.