



### Grade Level

Pre K-Kindergarten

### Lesson Length

30 Minutes

(plus an ongoing 2-3 week experiment)

### STEM Careers

- Gardener/Horticulturist
- Astronomer
- Plant Scientist
- Ag Technician

### Life Skills

- Critical Thinking
- Decision Making

### Related Activities

- Seed Dissection
- Planting a Garden

### Learn More

- Visit Raising Nebraska [raisingnebraska.unl.edu](http://raisingnebraska.unl.edu)
- Visit Hastings Museum [hastingsmuseum.org](http://hastingsmuseum.org)

### Virtual Fun

- <http://solar-center.stanford.edu/activities/>

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# BEND ME YOUR STEM

Plant Science

*This grab and go lesson will focus on how the sun impacts plant growth.*

## LEARNING OBJECTIVES

By the end of the lesson, students should be able to:

- Become familiar with the basic needs of a plant
- Determine how a plant grows in response to light

## EDUCATIONAL STANDARDS SUPPORTED

- NE 2.3.1.b Identify the basic needs of living things (food, water, air, space, shelter)
- NGSS K-LS1-1 Use observations to describe patterns of what plants and animals (including humans) need to survive.

## MATERIALS LIST

- Potting Soil (or garden/field plot)
- Pots (to be placed by the window)
- Sharpie or Tape to Mark on the Pot
- Access to water, watering can
- “What’s Missing” worksheet (end of lesson)
- Crayons/Markers
- Radish, Tomato, Bean or Basil seeds (Seeds that sprout quickly)

## PREPARATION

- Plant a seed in a pot with potting soil. This can be done with students to discuss parts of a seed or by the teacher a few days before the lesson.
- Once the seedling has emerged, you will be ready for this lesson. Put the small seedling in front of a window. After a couple of days, observe where the stem is bending (should be toward towards the sun).

### We want to hear from you!

Let us know what you thought of the lesson  
or send us a picture of youth participating in the lesson.

#NE4HSTEM

#ECLIPSE2017





## INTRODUCTION

Plants are able to sense the environment around them and respond accordingly. In fact, they are in constant motion as they develop, search for light and nutrients and reproduce. Plants have mechanisms that determine up from down to produce shoots and roots in the correct orientation and also have mechanisms to measure time to know when to produce flowers at the right time of the year, become seasonally dormant and even determine night from day. Light is an important environmental cue to which plants are especially sensitive. Different levels of light will stimulate dramatic differences in growth pattern, leaf size and shape.

Plants move through tropisms which are vital to plants' survival. In general, tropisms involved cell elongation on one side of a plant, causing the plant to grow in a particular direction.

### Phototropism

Leaves and stems respond to solar light and grow toward the sunlight (example of phototropism). Phototropism occurs because of plant hormones called auxins react to sunlight. When light is shown on one side of a plant, the auxins will move to the dark side of the plant. The movement of the hormones stimulates those cells to elongate, while the cells on the light side of the plant remain the same. This elongation of cells on one side of the plant and staying the same on the other causes the plant to bend in the direction of the light. Some plant leaves will move so their leaves are perpendicular to the sun in order to maximize photosynthesis (example of solar tracking).

## OPENING QUESTIONS

- What do plants need in order to survive?
- How does the sun impact plants' growth?

Today you are going to be a gardener and explore what plants need in order to survive so you can be successful with your business. You will also be deciding if sunlight impacts plant growth. Let's get started...

### Did You Know?

Seeds can sense gravity and will always grow up.

### Did You Know?

Isaac Newton was the first to truly study gravity in the 1680s. His theory stated that gravity is a force that acts on all matter on Earth. He also noted that the matter's mass and distance played a role in how gravity effected that object.

# ACTIVITY 1: PLANTS HAVE NEEDS TOO!

What do you need in order to live?

- Air
- Water
- Nutrients/Food
- Shelter

*Why do we get thirsty?*

We need water, so we get a drink of water.

*What do we do when we are hungry?*

Eat some food.

Plants have needs in order to live, just as we have needs.

What do plants need in order to grow?

- Air
- Water
- Nutrients
- Sunlight

Explain how each of those needs impacts a plants ability to survive.

Compare and contrast plants and humans.

*Have any of you ever helped someone with a garden or have you ever grown a plant before? What happened if the plant didn't have enough water?*

*It wilted, turned brown or died.*

*So, plants need water just like us! Water is taken in through a plant's roots.*

*What would happen if a plant doesn't get enough nutrients (or food)?*

*Plants will have a variety of symptoms when they don't get the right amount of nutrients. For example, if a plant doesn't have enough nitrogen it can turn yellow. If a plant doesn't have enough potassium, it might not flower. There are lots of different symptoms plants show they need a certain nutrient.*

*For us, milk has a lot of a nutrient called calcium. Do you know what calcium does for you? (Helps grow strong bones)*

## Vocabulary

**Air** – Plants use carbon dioxide to make food and release oxygen as a result.

**Water** – Plant roots carry water and nutrients to the plant.

**Nutrients** – Most plants receive nutrients (food) from the soil. Some nutrients come from fertilizers and some are stored in the soil

**Sunlight** – Plants take energy from the sunlight to produce sugars or food.

## Extension

**Photosynthesis** is the transformation of light energy into chemical energy. Green leafy plants contain a light-absorbing pigment called **chlorophyll**.

## Discuss

Plants require different amounts of sunlight. For example, when a plant requires:

**Shade** – around 2 hours of sunlight

**Part Sun** – 3-4 hours of sun

**Full Sun** – 6-8 or more hours of sunlight

## ACTIVITY 2: WHAT IS MISSING

Hand out the “What is Missing” worksheet

Look at the picture. There is something the plant needs in order to survive. What is missing?

Sunlight!

Not only does sunlight help a plant produce their own food, but sunlight helps a plant grown strong and fast.

When plants do not receive enough sunlight, you might notice they become “leggy” and weak. Some plants need very little sunlight, while some plants prefer a lot of sun.

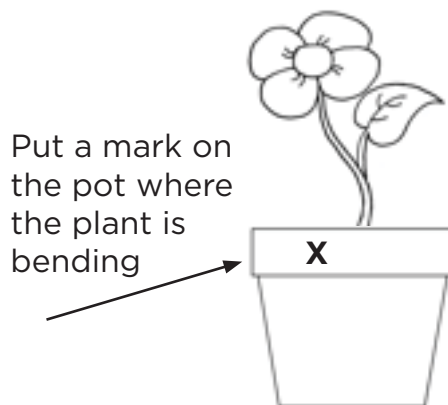
Plants can also show yellowing, have thin stems and small leaves.

Draw in a sun to help this plant grow. (If time allows, let youth color the whole picture.)

## ACTIVITY 3: INTO THE LIGHT

Put a very small seedling in front of a window.

- After a couple of days, observe where the stem is bending (should be toward towards the sun). Make a mark on that side of the pot.
- Turn the pot so the plant is facing away from the window and make another mark on the pot after a couple of days.
- After doing this several times, ask students if they see a pattern. Have youth draw what they observed in their plant science journal.



### Terminology

**Phototropism** – occurs when plant stems grow towards light.

### Facts

Phototropism occurs because of plant hormones called auxins react to sunlight. When light is shown on one side of a plant, the auxins will move to the dark side of the plant. The movement of the hormones stimulates those cells to elongate, while the cells on the light side of the plant remain the same. This elongation of cells on one side of the plant and staying the same on the other causes the plant to bend towards light.

### Extension

Day length is important for flowering plants. Long-day plants need at least 14 hours of sunlight daily to flower; short-day plants need less than 14 hours. It is important to know a plant’s sun requirements before planting.



# REFLECT

Let's review what we have learned...

What do plants need in order to grow?

- Air – Plants use carbon dioxide to make food and release oxygen as a result.
- Water – Plant roots carry water and nutrients to the plant.
- Nutrients – Most plants receive nutrients (food) from the soil. Some nutrients come from fertilizers and some are stored in the soil
- Sunlight – Plants take energy from the sunlight to produce sugars or food.

What does sunlight do for plants?

- Produce their own food and grown strong and fast.

What happened to our plant in the window?

- Plant stem grew towards light

Draw in your journal what you learned today.

This could be a drawing of the plant in the pot or you could guide the youth to draw the four needs of a plant. (Piece of food = nutrients, raindrop = water, bubbles = air, sun = light)



# APPLY

Now that you have successfully identified what plants require. You are on track to being a great gardener or even a plant scientist – someone who studies plants.

What would be an ideal location to have a garden?

- Place that has adequate sunlight, access to water, clean air, and soil with good nutrients

What are specific examples that might limit the amount of sunlight a plant will receive.

- Lots of cloudy days; Total Eclipse, even just for a short amount of time; Length of sunlight in a day, in summer there are more hours of sunlight, etc.

Would it work well to grow lots of plants inside using sunlight through the window? Why or why not?

- You would always have to turn the plants to straighten out their stem; they will usually be stronger if grown outside. We can however use grow lights to raise plants inside or greenhouses.

What is the purpose of vegetables, fruits, and grains?

- Food Production

Who depends on farmers or gardeners?

- All of us

What are other careers that relate to planting seeds other than what we have discussed?

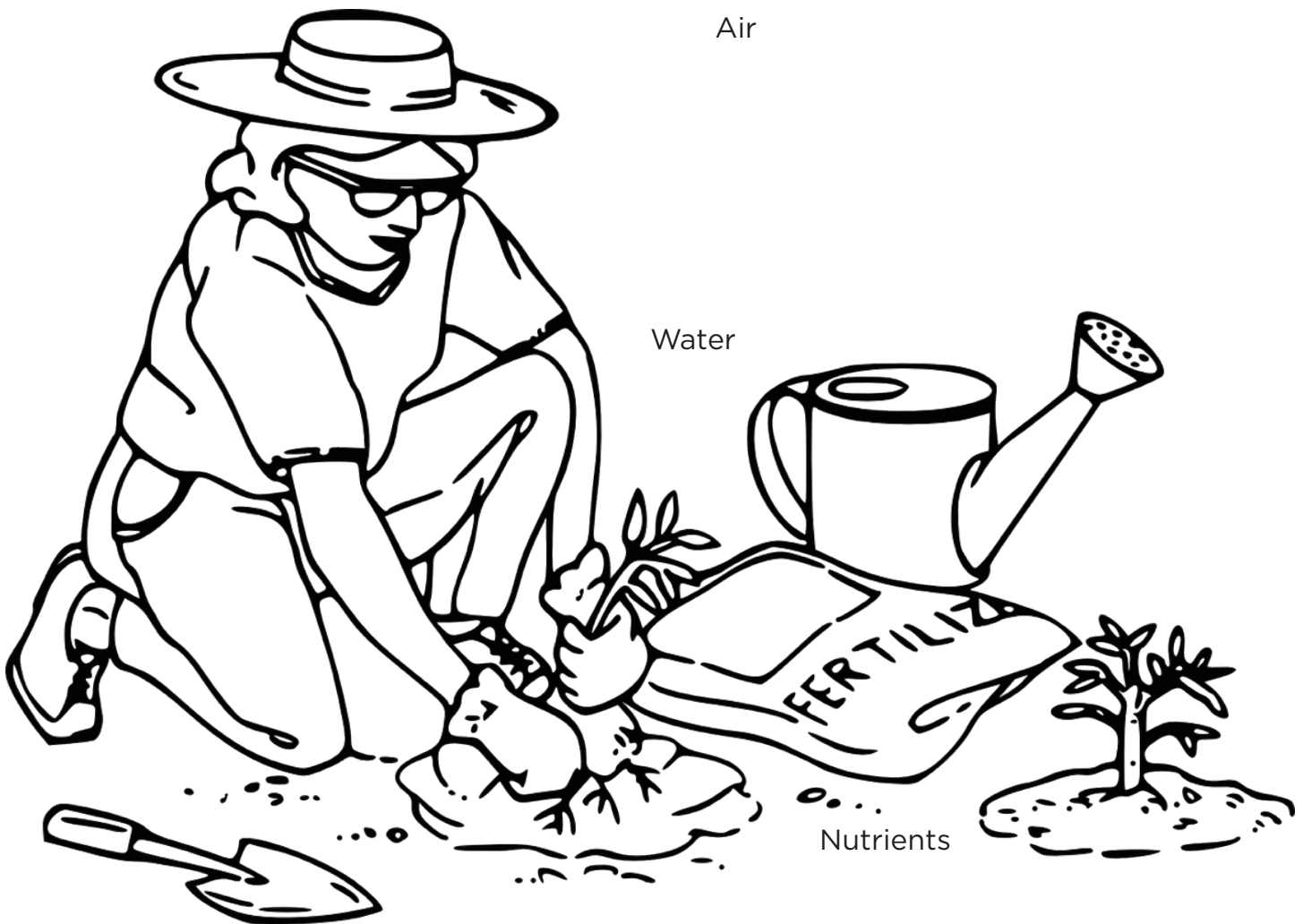
- Plant breeder, geneticist, nursery, soil scientist, agronomist, pathologist, entomologist, etc.

# WHATS MISSING?

Bend Your Stem

NAME \_\_\_\_\_

Plants need water, air, sunlight and nutrients to survive. What is this plant missing? Draw in what is missing and color the rest of the picture.



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# PLANT SCIENCE INVESTIGATION JOURNAL

Bend Your Stem

NAME

DATE



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