

GROW YOUR PALS PROGRAM GUIDE



THE NATIONAL FFA MENTORING PROGRAM

Sponsored by



LESSON 1.7

The Amazing Potato Race!

Unit:
PLANTS AND GARDENING

PRECEPTS

- J. Mental Growth
- J2. Think creatively

NATIONAL STANDARDS

- NL-ENG.K-12.12 - Applying Language Skills
- NS.K-4.3 Life Science



Lesson Type:
Small Group

STUDENT LEARNING OBJECTIVES

As a result of this lesson, the student will ...

- Define *phototropism*.
- Explain the importance of light in plant growth.





TIME

Instruction time for this lesson: **50 minutes.**



RESOURCES

Hangarter, R. (2000). Plant Trophic Responses. Retrieved February 8, 2010, from Indiana University. Website: <http://plantsinmotion.bio.indiana.edu/plantmotion/movements/tropism/tropisms.html>

National FFA Organization. (2003). LifeKnowledge Precepts and Signs of Success.



TOOLS, EQUIPMENT AND SUPPLIES

- ✓ PALS1.7.SG.AS.A - one per student
- ✓ PALS1.7.SG.TM.A - one per group
- ✓ Piece of white computer paper- one per student
- ✓ Colored pencils/markers/paint/crayons - enough for entire group

The following materials will be needed for every two students:

- ✓ A shoebox with a lid; a hole of about 1.5 inches in diameter should be cut out of one end of the box.
- ✓ Several pieces of cardboard small enough to fit into the shoebox
- ✓ A sprouting potato

KEY TERMS



The following term is presented in this lesson and appears in ***bold italics***:

Phototropism



CONTENT OUTLINE

Objective 1. Define ***phototropism***

I. Define ***phototropism***

A. ***Phototropism*** is the growth or movement of a plant toward light

II. Activity: Make a Potato Maze

A. Materials Needed:

1. A shoebox with a lid; a hole of about 1.5 inches in diameter should be cut out of one end of the box
2. Several pieces of cardboard small enough to fit into the shoebox
3. A sprouting potato

B. Procedures:

1. Take the shoebox with the hole and place several pieces of cardboard inside to create a 'maze'
2. Place the sprouting potato at the end of the shoebox farthest away from the hole
3. Put the lid on the box
4. Place in a sunny location so light gets into the box through the hole
5. After three to four days, take the lid off the shoebox
6. The potato plant should be finding its way through the maze toward the light
7. Eventually the plant will grow through the hole in the shoebox

LESSON PREP-WORK

There are two ways that the content in this lesson can be delivered. The majority of the groups will only have the ability to visit a PALS group once a week or month, therefore this lesson will be taught from that perspective. If groups have the ability to meet more than once a week, this lesson can be divided and the results from the activity the students put together themselves can be viewed on the second meeting. For more direction, see the 'Extended Classroom Activities' section.

*In order to properly prepare for this lesson, there are several items that should be accomplished before beginning the lesson. Because it will take several days for the potato to 'travel' through the maze, gather the following materials at least three to four days prior to meeting with the group: A shoebox with a lid, several pieces of cardboard small enough to fit in the shoebox, a sprouting potato and scissors. The activity that will be set up will illustrate **phototropism** and the importance of light to growing plants. Complete the following procedures, which should take around 10 minutes, at least three to four days prior to meeting:*

1. With the scissors, cut a hole about 1.5 inches in diameter in one end of the shoebox
2. Use several pieces of cardboard to create a maze inside the shoebox
3. Place the sprouting potato at the end of the shoebox farthest away from the hole
4. Put the lid on the box
5. Keep it in a sunny location so light gets into the box through the hole.
6. After a few days, take the lid off the box
7. The potato plant should be finding its way through the maze toward the light.
8. Eventually the plant will grow through the hole in the box

Make sure to gather all materials up and carefully transport them to the location on the day of the PALS activity.

INTEREST APPROACH

As students arrive, pass out one PALS1.7.SG.AS.A to each student along with a writing utensil. If possible, arrive to the classroom early and setup the materials at each desk location. If quantities are limited, have students partner up with their materials to complete this activity. Once all students arrive, welcome them and introduce the group if necessary.



Raise your hand if you have seen one of these before

Point to PALS1.7.SG.AS.A - the maze.



Great! Who can tell me what this is? *Allow students to answer a maze.*

That's right. When I say MAZE, take your writing utensil and work your way through the maze on your sheet of paper. If you get stuck, work back and see if you can find the exit! When you are done, put your writing utensil down and your hand up. What questions are there? *Answer any questions. Great!*

MAZE!

Circulate around the room as students work on the maze. If students get stuck, help on an as-needed basis. If a few students struggle, try to get either another instructor to assist one-on-one or have another student that finishes help them out. Once all students finish, refocus the group's attention.



Great job working your way through that maze! How did you know which way to turn?

Allow students to say that they turned so that they could reach the exit.



So you knew that the only way out of the maze was to find the exit, correct?

Allow students to say yes.

Has anyone heard the phrase 'a light at the end of the tunnel?'

Allow students to respond. Some may have and others may not.



Who will share with us what it is like to travel through a tunnel?

Allow students to describe how it feels to travel through a tunnel.



Whenever we travel in a tunnel, we are in the dark. When we get closer to the exit we see light that lets us know we're getting close to being at the end of the tunnel. Think of our maze – when we were getting closer to the exit, you were almost seeing the 'light at the end of the tunnel.' It became easier for you to find your way out because the exit was so near.

Awesome job working your way through those mazes. Today, let's investigate to see how important light is to plants and learn about the a-MAZ-ing concept of **phototropism**. Say it with me **phototropism**! Put those thinking caps on and let's get started!

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Make sure to prepare PALS1.7.SG.TM.A prior to beginning the content lesson. If an overhead or technology is not available, have the content on posters that can be displayed large enough in the room for all students to see.

For the activity, students will need to be divided into pairs. If the number of students is known prior to arriving, divide all the materials needed for the activities into enough groups so they will be easy to distribute when ready. One set of demo materials will help demonstrate the procedures of the activity during explanation. Also, make sure to have the activity that was prepared three to four days prior to show the end results if necessary.



Did you know that a plant can actually move depending on the location of light?

Allow students to respond.



When a plant grows or moves toward light, we call this **phototropism**. It's a big word, so let's break it down.

Display PALS1.7.SG.TM.A. or write it on a surface large enough for the group to see.



The word **phototropism** can be broken down into two words joined together. Refer to PALS1.7.SG.TM.A. The word 'photo' means light. We see this term used a lot of different places; what are some words or phrases you can think of that have photo in them?

Listen for words such as photograph or photo finish or photosynthesis.



In all of these cases, we are talking about capturing that light to do something.

The second half of the word **phototropism**, is ‘tropism.’ This word means the movement of an organism or plant in this case. If we take those two meanings and put them together, what would **phototropism** mean?

Allow students to think about it. They may have difficulty, but if the word is broken down for them to see walk them through, step by step again what the two words mean and what it would mean to combine them.



This is really making our brains work today! So, if we are talking about a plant, **phototropism** is the movement of a plant toward light. It’s a big word, but the meaning is pretty simple.

Let’s watch a video that will help us understand a little better what **phototropism** looks like. *If technology is not available, skip this illustration. If it is available, go on the Internet and visit: <http://plantsinmotion.bio.indiana.edu/plantmotion/movements/tropism/tropisms.html>. This is a non-profit educational website through Indiana University that has several different videos of time lapse photography illustrating **phototropism** in plants. The video illustration will help students better see an example of a plant ‘moving’ toward light.*

OBJECTIVE 1. | Define **phototropism**.



I. Define **phototropism**.

A. **Phototropism** is the growth, or movement, of a plant toward light



Have you ever seen a plant move before?

Allow most students to say no.



Well, let’s put together an activity that will help us see **phototropism** taking place. Are you ready to build a maze? *Allow students to respond.*

Great! Let’s put together our experiment that will help illustrate **phototropism**.

Hold up the shoebox.



For this activity, we are going to take this shoebox and the extra pieces of cardboard to make a maze for our potato plant to travel through.

Hold up the extra pieces of cardboard



Does anyone remember the phrase we talked about at the beginning of our time together today?

*Allow students to think about it. Some may say **phototropism**, but refer to the original mazes they worked through and steer them towards the 'light at the end of the tunnel.'*



That's right. We are going to create a maze that our potatoes will have to travel through to get to the 'light at the end of the tunnel'. When I say PONDER, think quietly to yourself whether or not the potato plant will be able to find the light. Remember, it has to travel through your maze in order to reach the hole at the end where the light is. You will have twenty seconds to ponder.

Allow a student to explain that they should be deciding whether or not their potato will reach the light. Great. What questions are there?

PONDER

*As the students think quietly, begin to gather materials for the following activity. This activity will help illustrate **phototropism** in potato plants as well as the importance of light to the growth of a plant. At the conclusion of 20 seconds, refocus the attention of the group.*

II. Activity: Make a Potato Maze

A. Materials Needed:

1. A shoebox with a lid; a hole of about 1.5 inches in diameter should be cut out of one end of the box.
2. Several pieces of cardboard small enough to fit into the shoebox
3. A sprouting potato

B. Procedures:

1. Take the shoebox with the hole and place several pieces of cardboard inside to create a 'maze'
2. Place the sprouting potato at the end of the shoebox farthest away from the hole
3. Put the lid on the box
4. Place in a sunny location so light gets into the box through the hole.
5. After three to four days take the lid off the box
6. The potato plant should be finding its way through the maze toward the light. Eventually, the plant will grow through the hole in the box



Thank you for thinking quietly! How many of you think that the potato plant will make it through the maze to find the light?

Allow students to raise their hands.



OK - how many of you think that the potato plant will not be able to make it through the maze to find the light?

Allow students to raise their hands.



Well, I'm eager to find out what happens! Let's pair up and put together our experiment on **phototropism**!

At this point, divide students into pairs. Pass out the materials needed for 'Make a Potato Maze' activity. Place the demo materials at the front of the group for all students to see. For each step, demonstrate what to do while talking through the procedures. This will allow students to see exactly what they should be doing.



For each group, you should have a shoebox with a lid, some extra pieces of cardboard and a sprouting potato. Does everyone have all the supplies needed?

Work through any issues here with supplies and make sure that all students are ready to start the first step of the activity.



Listen carefully as we work together to setup our experiments! As we work through the activity, we will demonstrate the steps for everyone to see. As questions come to mind, please raise a hand so we can make sure that we are all still together!

During the activity, go through each step with the demo materials so students understand what is expected of them.



When you hear the word MAZE, take three minutes, take the shoebox and create a maze with the extra pieces of cardboard

Hold up the shoebox. Hold up the extra pieces of cardboard.



Carefully arrange the cardboard in the box to resemble a maze.

Hold up the box and demonstrate adding the extra pieces of cardboard to make walls that will form the maze.



Everyone's box will look different from one another. When your group has finished this step, put your box on your table. How long do we have to complete this step?

Allow students to respond for three minutes.



What questions are there? While you work, if you have a question, raise your hand and someone will be around to help.

MAZE

It is a good idea to check on all groups to make sure the walls of the maze are sturdy and will not fall over. If needed, tape can be applied to the walls to make sure they will not fall over. Give two-minute and one-minute reminders as students put together their mazes to encourage them to keep moving. Remind students when they have finished creating their maze to put their shoebox down on the table. At the completion of three minutes, refocus the group.



Thank you for taking such care to make your mazes! Next, place your sprouting potato at the end of the shoebox farthest away from the hole.

Hold up sprouting potato and demonstrate where the potato should be positioned.



When you have completed this step, raise your hand.

Wait for all groups to finish this step. Assist where necessary.



Place the lid on top of the box.

Demonstrate this step. Make sure all groups get the lids on the boxes.



Let's move our boxes to a sunny location in the room so that we can create that 'light at the end of the tunnel' for our plant!

Depending on the room, find an area that will be best to store the boxes for a few days. If a window is not available, try a grow lab or any other strong source of light that can be left on for a few days. After students have moved their boxes, have them return to their seats.



Great job putting together our potato mazes! In a few days, we will get to see if **phototropism** has taken place and if our plant has grown toward the light. Are you curious to see if the plant will make it through the maze? Well, you're in luck! A few days ago, we put together this same experiment so we could show you what will happen!

At this point, make sure all students in the group can see the results of the pre-assembled activity.



Remember, everyone's maze looked differently, so even the one we put together a few days ago could be completely different than yours!

Raise your hand again if you think the potato will make it through the maze to reach the light?

Allow students to raise their hands.



OK - raise your hand if you think the potato will not make it through the maze to reach the light?

Allow students to raise their hands.



Well, the wait is over! Let's see the results that we came up with in our experiment.

Carefully take lid off of the pre-assembled activity. Hold the maze so that students can see that the potato plant had traveled through the maze. Depending on the amount of light, the number of days, and the maze structure could have had an affect on how much the potato plant actually grew. Some potatoes may have traveled quickly and actually reached the hole on the end.



What happened in this maze? *Allow a student to say that the potato traveled through the maze.*

That's right. This potato traveled through the maze. Why did the potato travel through the maze? *Allow a student to say to reach the light or to reach the light at the end of the tunnel.*

Excellent! This potato started off at one end of the box and grew toward the light. If it was dark at that end of the box, do you think the potato still would have traveled through the maze?

Allow students to say no. If they are unsure, direct them toward answering no.



Actually, if we were to place this box in a closet for the same amount of time, the plant would not have traveled through the maze. What does this tell us about the importance of light to a plant?

Allow students to say that it is very important. If they struggle, have them think again, if the plant was in darkness it would not have traveled. If it is in light, it will travel.

OBJECTIVE 2. Explain the importance of light in plant growth.



I. Plants need light to survive



That's right. Light is important to plants. It's so important that if a plant does not have light it will not survive. That's why this potato plant worked so hard so that it could receive the light it needed in order to live.



We have discovered from our experiment that **phototropism** really happens. If a plant sees light, it will grow and move toward the light because it is important to its survival. In a few days you will be able to look at your experiment and see how far your potato plants made it through your maze. You might even make a little race out of it! Great job today! Let's review what we just learned.



REVIEW / SUMMARY

*For the review activity, a source of colored pencils/markers/paint/crayons will need to be available to assist students in illustrating **phototropism**. Each student will need one piece of plain computer paper to complete this activity as well.*



We talked a lot today about **phototropism** and the importance of light to plant growth.

Picasso e-Moment®

A great way to remember things is through drawing. If you had to illustrate what **phototropism** is, how could you do it? When I say DRAW, take the plain piece of paper that was just passed out and draw a picture of what **phototropism** means. Imagine if you had to tell a friend about **phototropism** and they could not understand words - what would it look like? We talked about **phototropism** today and also saw a few different illustrations. Can you think of anywhere else you might see **phototropism**? Make your illustration different and unique. Who will repeat for the class what we are about to draw?

*Allow a student to say they will illustrate **phototropism**.*



Great. What questions do you have?

Answer any questions that might come up.



If you think of a question, raise your hand.



Are you ready? *Allow students to say yes.*

DRAW!

*As students illustrate **phototropism**, circulate around the room and help where needed. As students finish up, refocus the group's attention.*



Thank you for being so creative with your illustrations. Who will share what they drew today? Tell us a little about what you drew and why.

Allow students to share. Depending on time, this can include a few to all students.



Thanks for sharing! Those were great illustrations of **phototropism**!

We learned today that plants have the ability to move toward something that is important to them: light. In a few days, you will be able to discover again that plants' ability to be phototropic shows us that they are alive and amazing creatures!

APPLICATION



Large Group Idea

Groups creating the boxes can be larger and challenge the groups to make a maze that will allow their potato plant to reach the hole first. Make it a competition to see whose plant will make it to the light first.

To further enforce the importance of light, after the initial evaluation of the mazes, students could divide the boxes up, placing half in a dark closet and the rest remaining at the source of light. In a few days, they can then see that the boxes in the dark failed to grow any further, where the ones with the light sources continued to grow.



One-on-One Idea

Read with your PALS From Seed to Plant, by Gail Gibbons.

If this lesson is stretched over two meetings, students will be able to complete the last portion of it by viewing their own mazes and not the pre-assembled maze.



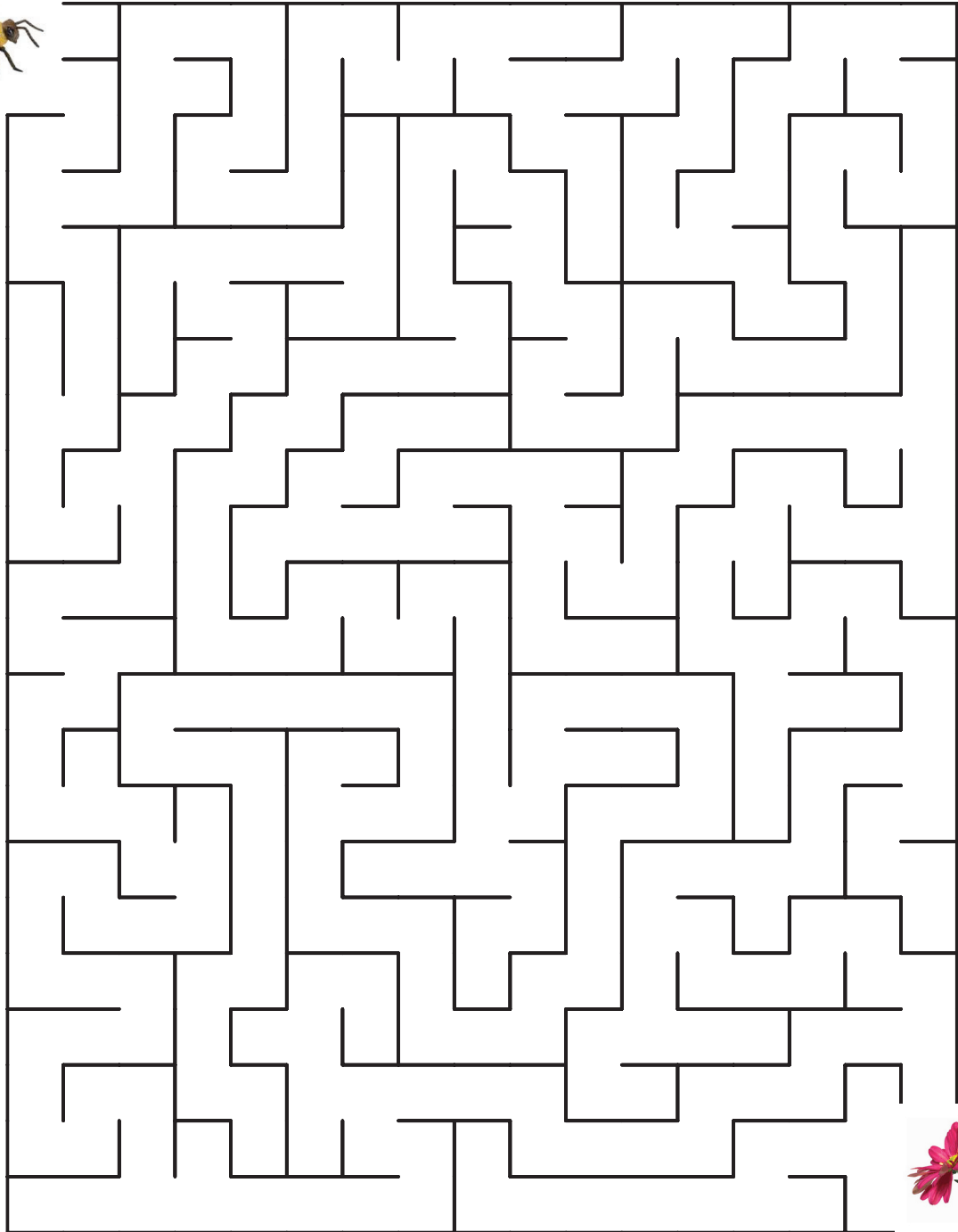
EVALUATION

Collect Picasso e-Moment® drawings and evaluate for completeness.

PALS1.7.SG.AS.A

It's A-MAZ-ING!

Can you get to the end? Complete the following maze and see if you can reach the exit without turning around!





PALS.1.7.SG.TM.A

What is PHOTOTROPISM?

PHOTO + **TROPISM**
(Light) (Movement)