

Living Systems

INVESTIGATIONS GUIDE



Full Option Science System
Developed at the Lawrence Hall of Science, University of California, Berkeley
Published and Distributed by Delta Education



Investigation 2 – Nutrient Systems

PART 2: Plant Nutrition

NGSS Standards:

5-PS3.D

5-LS1.C

5-LS2.B

6 sessions



How do plants get the food they need?

In Part 1, you investigated how a single-cell organism (yeast) transferred food. In Part 2 you will be working with a more complex organism.

You will be using WHEAT SEEDS.

Like yeast, these wheat seeds are in a dormant, resting state.

Let's see if we can design a plan to break these seed out of their dormancy.



TURN & TALK:

1. How can we activate these seeds?
2. What evidence will tell us that the seeds have become active? What variables do we need to consider?



How do plants get the food they need?



Materials available for this Investigation:

- ½ L containers
- Potting soil
- Wheat seeds
- 5 mL spoons
- Water
- Beakers
- Plastic bags (to prevent evaporation)





What do you think would happen to seeds planted in the dark?



Investigation Set-up:

In your groups, follow these procedures

1. Fill four ½ L containers almost full with soil.
2. Sprinkle one 5 mL spoon of wheat seeds over the surface of the soil.
3. Pour 100 ML of water carefully over the planted seeds.
4. Close two of the planters in **clear plastic bags**, using binder clips. Label the bag with the date and the group names.
5. Close the other two planters in **black plastic bags**. Label them.
6. Place the four bagged planters in a **warm lighted location**.





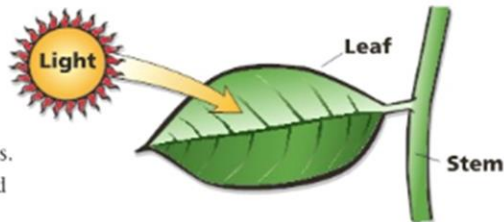
Producers

Plants produce their own food. The food is sugar. The sugar is used by all plant cells. The cells use the energy in the sugar for growth.

Plants use a process called **photosynthesis** to make sugar for growth. The raw materials that plants use to make the sugar are water and carbon dioxide (CO₂). Water from the soil and carbon dioxide from the air combine with light energy from the Sun. Sugar, oxygen, and water are the products.

Most plants are green. Or at least they have a lot of green leaves. Leaves look green because the leaf cells have **chlorophyll**. Chlorophyll can absorb blue and red light. It reflects green light. That's why chlorophyll looks green.

The important part is that chlorophyll absorbs blue and red light. The energy from the absorbed blue and red light is then used to make the sugar molecules during photosynthesis. Sugar is the energy nutrient used by the plant cells to perform their life functions.



TIME TO READ

Partner read “Producers” on pages 23 – 26.

Complete “**Thinking about Photosynthesis**” questions in your notebooks.

Write all **bold vocabulary words** in your notebook.



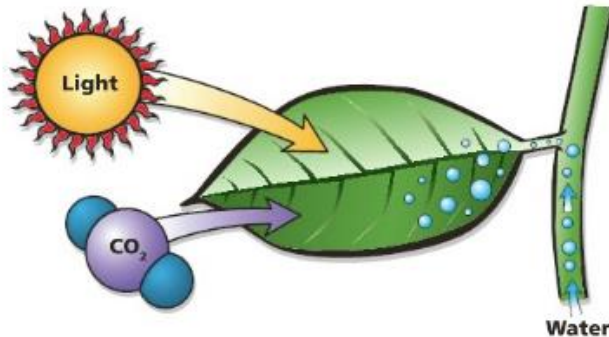
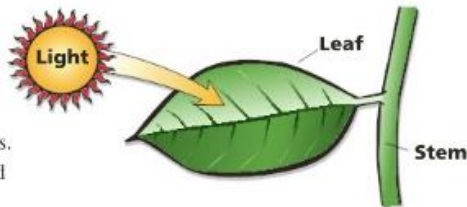
Producers

Plants produce their own food. The food is sugar. The sugar is used by all plant cells. The cells use the energy in the sugar for growth.

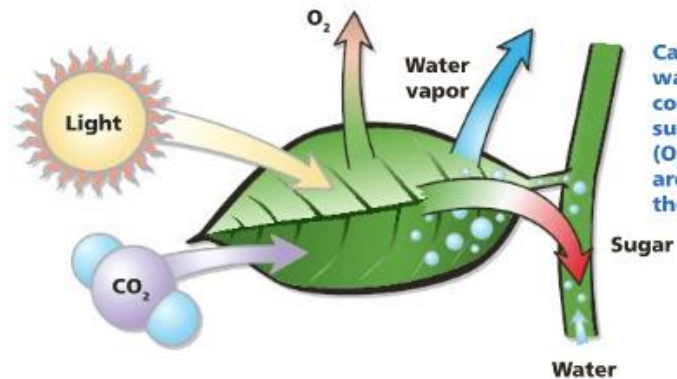
Plants use a process called **photosynthesis** to make sugar for growth. The raw materials that plants use to make the sugar are water and carbon dioxide (CO_2). Water from the soil and carbon dioxide from the air combine with light energy from the Sun. Sugar, oxygen, and water are the products.

Most plants are green. Or at least they have a lot of green leaves. Leaves look green because the leaf cells have **chlorophyll**. Chlorophyll can absorb blue and red light. It reflects green light. That's why chlorophyll looks green.

The important part is that chlorophyll absorbs blue and red light. The energy from the absorbed blue and red light is then used to make the sugar molecules during photosynthesis. Sugar is the energy nutrient used by the plant cells to perform their life functions.



Water from the roots, carbon dioxide from the air, and light from the Sun enter the cells.

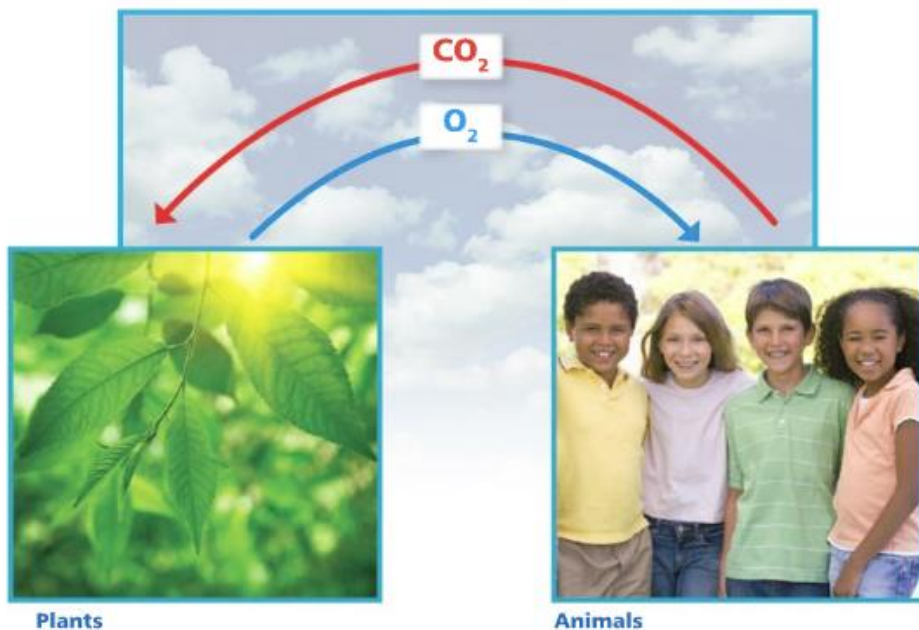


Carbon dioxide, water, and light combine to make sugar. Oxygen (O_2) and water are released into the air.



The Carbon Dioxide-Oxygen Cycle

Through the process of photosynthesis, producers release oxygen to the air. This is very important to the biosphere. Animals and most other living things need oxygen to live. Even plants need oxygen for their life functions. Producers release more oxygen than they use. Carbon dioxide is released as a waste gas by animals and other living things. Producers use that gas to produce more oxygen. This carbon dioxide-oxygen cycle is very important to the health of the biosphere.



Food production doesn't stop there. Plants use the sugar to produce a lot of other molecules. They produce other kinds of sugars with names like sucrose, dextrose, and fructose. They produce starches, which store energy in potatoes and grains like wheat. They produce vegetable oils, such as corn oil, sunflower oil, and olive oil.

Plants store energy as sugars, starches, and oils. When the plant needs them, it pulls them out of storage, turns them back into **glucose**, and sends the glucose to the cells. That's how plants survive at night and during winter. They use stored energy to do whatever they need to do.

Other organisms use the energy stored by plants to live and survive. That includes humans. When you eat a slice of bread or a baked potato, you are eating energy stored by a plant. When you eat lettuce and carrots, you are eating sugars, starches, and all the cells made by plants. And when you eat food to nourish your cells, remember where the food came from. It started as carbon dioxide, water, and sunlight. It's really quite amazing when you stop to think about it. You are running on solar energy.



The Sun's energy is used by producers to make their own food. Then, that energy is transferred to you when you eat a plant.

Thinking about Photosynthesis

1. What is sugar?
2. What raw materials do plants need for growth? Where do those materials come from?
3. What is the role played by chlorophyll?
4. What are the products of photosynthesis? Where do they go?
5. Where do plants produce food?
6. Explain how the Sun's energy is transferred through a simple food chain.



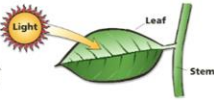
Producers

Plants produce their own food. The food is sugar. The sugar is used by all plant cells. The cells use the energy in the sugar for growth.

Plants use a process called **photosynthesis** to make sugar for growth. The raw materials that plants use to make the sugar are water and carbon dioxide (CO₂). Water from the soil and carbon dioxide from the air combine with light energy from the Sun. Sugar, oxygen, and water are the products.

Most plants are green. Or at least they have a lot of green leaves. Leaves look green because the leaf cells have **chlorophyll**. Chlorophyll can absorb blue and red light. It reflects green light. That's why chlorophyll looks green.

The important part is that chlorophyll absorbs blue and red light. The energy from the absorbed blue and red light is then used to make the sugar molecules during photosynthesis. Sugar is the energy nutrient used by the plant cells to perform their life functions.



23



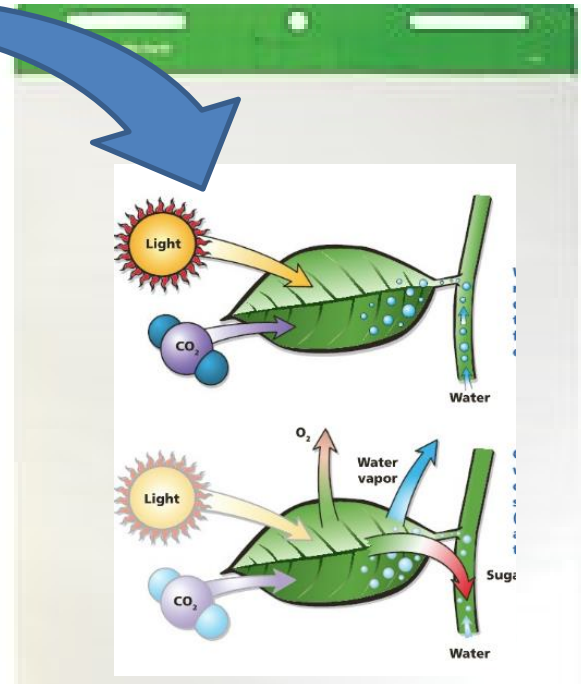
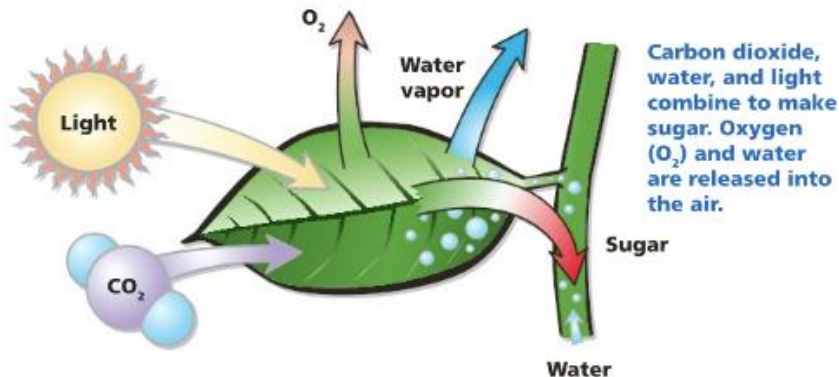
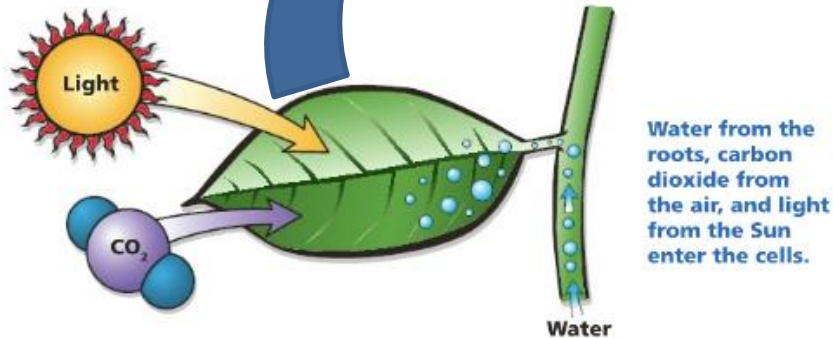
Review the questions from “*Thinking about Photosynthesis*”:

1. What is sugar? **Food made by green plants.**
2. What raw materials do plants need to build sugar molecules? Where do these materials come from?
Carbon dioxide from the air. Water from the soil through plant roots, and energy from the Sun in the form of light.
3. What is the role played by chlorophyll?
It reflects green light and absorbs red and blue light. This light is used by plants to make food (sugar).
4. What are the products of photosynthesis? Where do they go?
The products are oxygen and water which are released into the air. The sugar is transported to other parts of the plant for food.
5. Where do plants produce food?
In green leaves.
6. Explain how the Sun's energy is transferred through a simple food chain?

The Sun's energy and light are used by producers to make food. Other organisms eat the plants and the energy is transferred to them.

The green leaf cells make sugar out of carbon dioxide (CO_2) and water (H_2O). Carbon dioxide comes from the air. Water comes from the soil, up through the roots. The carbon dioxide and water meet in the green cells.

The carbon dioxide, water, and energy from the Sun combine to make sugar molecules in the plant cells. The cells also produce oxygen and water molecules. The oxygen is released into the air. The plant uses water or releases it into the air as water vapor (gas). So where is food produced? Food is produced in the green parts of the plant. Every cell that contains chloroplasts is making sugar.



Team Activity:

Recreate the diagram on page 24 on anchor chart paper.

Be sure to label the raw materials that plants use to make nutrients.

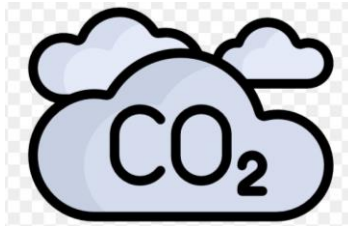
Also label the flow or direction of by-products produced.



How do plants get the food they need?



Water from the soil through plant roots.



Carbon dioxide from the air.



And energy from the Sun in the form of light.



What do you think would happen to seeds planted in the dark?



Let's share out some of our predictions.

DAY
3

CHECK-IN

Wheat Plant Environment Check-in

In your notebooks, make the following observations about both of your wheat plant environments.

- Approximately how many seeds are growing in each environment? **Count them.** (all, most, some, a few?)
- What is their average height? (measure the height of all the stems in centimeters, add up all the heights, divide by the number of stems)
- What color are the plants in each environment? Be specific (**draw it in your notebook or take a digit photo**)



Conclusion:

- Do wheat plants grow in the light AND dark environments?
- How are the plants different in the light and dark environments?
- What difference does the color suggest? Infer here, why?



DAY
6

CHECK-IN

In your notebooks, make the following observations about both of your wheat plant environments



- What is their average height? (measure the height of all the stems, add up all the heights, divide by the number of stems)
- What does chlorophyll do for plants?
- Where does energy that the wheat plants need to grow in the dark environment come from?
- What do you think will happen to plants in the dark after they use up all the food stored in the seed?
- How do the wheat plants and yeast differ in how they get their food?

FOCUS

How do plants get the food they need?

What happens if

What will happen to a plant that is moved from a light environment into a *dark* environment?

What will happen to a plant that is moved from a dark environment into a *light* environment?

Set up this investigation, changing the environment of one dark planter and one light planter and labeling the containers.

Keep one original light planter in the light and one original dark planter in the dark as controls

After one day and again after four days, we will make observations and record the results



**Change one
black bag to a
clear bag.**

**Change one
clear bag to a
black bag.**





Living Systems: Investigation 2 (Nutrient Systems) Part 1 & 2



Player vs Player
1:1 Devices

Classic



Team vs Team
Shared Devices

Team mode

Game options



Loaded 100%

A black smartphone with a blue border is shown. The screen displays the Kahoot! login interface. At the top is the Kahoot! logo in white on an orange background. Below it is a white input field labeled 'Game PIN'. Underneath the input field is a dark grey button with the word 'Enter' in white. At the bottom of the screen, in smaller white text, it says 'Create your own kahoot for FREE at kahoot.com' and 'Terms | Privacy'. The phone has a home button at the bottom.

Kahoot!

Game PIN

Enter

Create your own kahoot for
FREE at kahoot.com

[Terms](#) | [Privacy](#)

<https://create.kahoot.it/share/living-systems-investigation-2-nutrient-systems-part-1-2/763bd7ce-5a62-4641-a47c-f337719d154b>

Investigation 2 – Nutrient Systems

Short Answer Response Quiz Prep - Be prepared to answer the questions below. The quiz will be any of the questions below.

<u>Question:</u>	<u>Possible Response:</u>
<ul style="list-style-type: none">What kind of organism is yeast?	<i>Yeast is a single-celled fungus.</i>
<ul style="list-style-type: none">What does yeast need to break out of a dormant state?	<i>Sugar</i>
<ul style="list-style-type: none">How do yeast organisms get their nutrients?	<i>They absorb them through their cell membrane.</i>
<ul style="list-style-type: none">Where did the carbon-dioxide gas come from in the yeast experiment?	<i>When the yeast breaks sugar down for energy, the gas is given off as a waste product.</i>
<ul style="list-style-type: none">What raw materials do plants need to build sugar molecules? Where do those materials come from?	<i>Carbon-dioxide from the air, water from the soil through its roots, and energy from the Sun in the form of light.</i>
<ul style="list-style-type: none">What is the role played by chlorophyll?	<i>It reflects green light and absorbs red and blue light. This light is used by the plant to make food (sugar) through a process called photosynthesis.</i>
<ul style="list-style-type: none">What are the products of photosynthesis? Where do they go?	<i>The products are oxygen and water which are released into the air. The sugar is transported to other parts of the plant as food for the plant's cells.</i>
<ul style="list-style-type: none">How are plants different in light and dark environments?	<i>Plants growing in light environments are green; plants growing in dark environments are yellow.</i>
<ul style="list-style-type: none">What does the color difference suggest?	<i>The cells of the plants in the light environment contain chlorophyll that is why they are green ; the cells in the dark environment do not contain chlorophyll, that is why they are yellow.</i>

Investigation 2 – Nutrient Systems

Short Answer Response Quiz Prep - Be prepared to answer the questions below. The quiz will be any of the questions below.

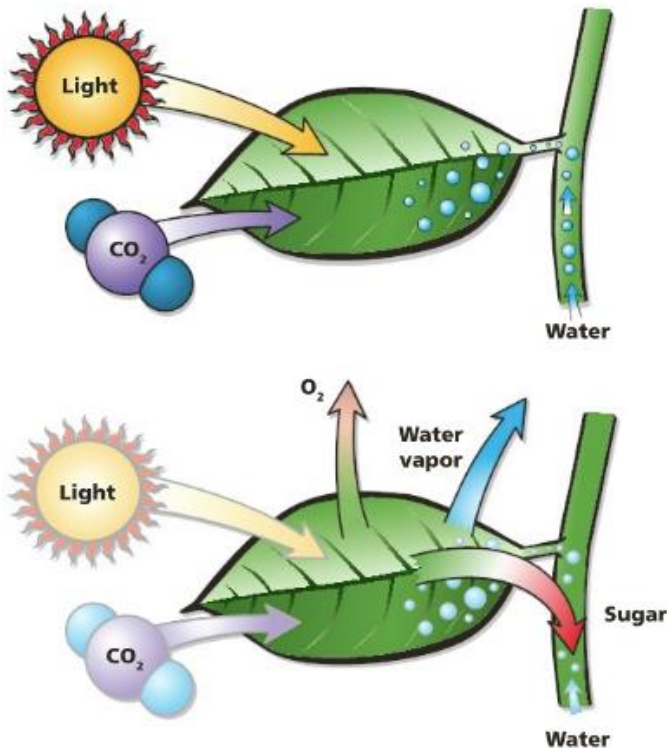
Question:

- Plants need energy to grow. Where does energy that the wheat plants need to grow in dark environments come from?
- How do plants and yeast differ in how they get their food?

Possible Response:

From energy nutrients stored in the seed in the form of starch.

Yeast gets food (sugar) produced by other organisms and absorbs it; green plants make their own food from air, water, and light.



- Describe what this diagram shows.

The process of photosynthesis. Water from the roots, carbon dioxide from the air, and light from the Sun enter plant cells. They all combine to make sugar that feeds the plant. Plants give off oxygen and water vapor as waste products into the air.

Short-Answer Response Quiz:

- *What raw materials do plants need to build sugar molecules? Where do those materials come from?*
- *What is the role played by chlorophyll?*
- *How do plants and yeast differ in how they get their food?*
- *Where did the carbon-dioxide gas come from in the yeast experiment?*
- *What are the products of photosynthesis? Where do they go?*
- *What kind of organism is yeast?*
- *How do yeast organisms get their nutrients?*

photosynthesis –

a process used by plants and algae to make sugar (food) out of light, carbon dioxide, and water.

chlorophyll –

a molecule that absorbs red and blue light and reflects green light.

glucose –

The sugar broken down in cells that releases energy.