Unit 4

Matter Cycling and Photosynthesis:

Where does food come from, and where does it go next?

Student Work Pages

GRADE 7 Core Knowledge Science®

Core Knowledge®

Matter Cycling and Photosynthesis:

Where does food come from, and where does it go next?

Student Work Pages

Core Knowledge Science

Core Knowledge®

*Please see full attribution at the back of this book for credited contributors to the development and field testing of the OpenSciEd unit.

ISBN: 978-1-68380-727-8

Matter Cycling and Photosynthesis:

Where does food come from, and where does it go next?

Table of Contents

Name: _____ Date: _____

What's in the foods we eat that come from plants?

Directions: Write down the foods your small group came up with that you are sure come from plants. Record these in the left column of the table below.

- **Make a prediction:** Check the appropriate boxes if you think that a food has carbohydrates, proteins, and/or fats.
- **Research your foods:** Use nutrition labels to research your foods and then record your findings in the "Results" section of the table.

Foods we eat that come from plants	**Predictions**			**Results**		
	Carbohydrates (Dietary fiber and sugars)	**Proteins**	**Fats**	**Carbohydrates** (Dietary fiber and sugars)	**Proteins**	**Fats**

What were your most surprising noticings and wonderings when looking at our findings? Explain your thinking.

Reading: What do kids around the world eat for breakfast?

Directions:

- Choose one of the readings, which each represent breakfast in a different country.
- Circle the location on the title of the reading you've selected.
- Read the text to learn about the foods in a typical breakfast meal in the country you selected. As you read, take care to highlight each breakfast food that is included.
- Complete the questions based on what you've read.

1. Complete the table based on the location you chose. Write down all of the foods that were mentioned as being a part of the breakfast meal in your selected country, adding them either to the "100% from plants," "Mixture/Not Sure/Other," or "100% from animals" category.

Location:		
100% from plants	**Mixture/Not Sure/Other**	**100% from animals**

2. Choose 2 of the foods from plants from your t-chart, above. For each food, list the food molecules that you predict you would find inside that food.

Name of food (from plants)	**Food molecules you predict you'd find**

3. Look over all of the breakfasts from different countries. Which one do you most connect to and why?

4. Are there any foods that you eat in your family that you think other students might be curious about what food molecules are in them?

Tokyo, Japan: Saki Suzuki, 13 years old

The first time Saki ate the fermented soybean dish called natto, she was 7 months old. She promptly vomited. Her mother, Asaka, thinks that perhaps this was because of the smell, which is vaguely suggestive of canned cat food. But in time, the gooey beans became Saki's favorite food and a constant part of her traditional Japanese breakfasts. Also on the menu are white rice, miso soup, kabocha squash simmered in soy sauce and sweet sake (kabocha no nimono), pickled cucumber (Saki's least favorite dish), rolled egg omelet (tamagoyaki), and grilled salmon.

Istanbul, Turkey: Doga Gunce Gursoy, 12 years old

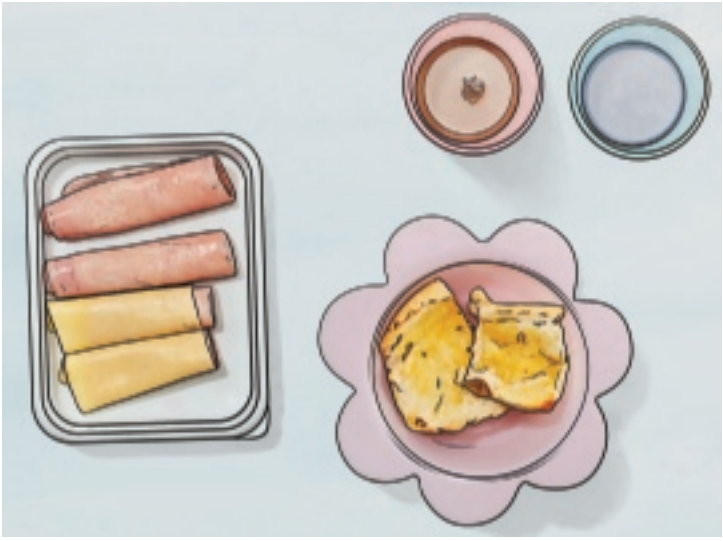
The elaborate Saturday morning spread in front of Doga includes honey and clotted cream, called kaymak, on toasted bread; green and black olives; fried eggs with a spicy sausage called sucuk; butter; hard-boiled eggs; thick grape syrup (pekmez) with tahini on top; an assortment of sheep-, goat-, and cow-milk cheeses; quince and blackberry jams; pastries and bread; tomatoes, cucumbers, white radishes, and other fresh vegetables; kahvaltilik biber salcasi, a paste made of grilled red peppers; hazelnut-flavored halvah, the dense dessert; milk and orange juice. While certainly more elaborate than weekday fare, this Gursoy family meal is in keeping with the hodgepodge that is a typical Turkish breakfast.

Chitedze, Malawi: Emily Kathumba, 9 years old

Emily lives with her grandmother Ethel on the outskirts of Lilongwe, Malawi's capital. Because Ethel works in another family's home—doing cleaning, cooking, and child care—her extended family of nine rises before 6 a.m. to eat breakfast together before they disperse to work and school. Here, Emily is eating cornmeal porridge called phala with soy and groundnut flour; deep-fried fritters made of cornmeal, onions, garlic, and chiles, along with boiled sweet potato and pumpkin; and a dark red juice made from dried hibiscus flowers and sugar. (She is fortunate; half of the children in Malawi are chronically malnourished.) When she can, Emily likes to drink sweet black tea in the mornings, a common beverage for Malawian children.

São Paulo, Brazil: Aricia Domenica Ferreira, 11 years old, and Hakim Jorge Ferreira Gomes, 6 years old

Aricia's pink cup is full of chocolate milk, but her brother Hakim's cup contains coffee (café com leite). For many Brazilian parents, coffee for kids is a cultural tradition that goes right along with tapioca crepes; the taste evokes their own earliest memories. Many also believe that coffee provides vitamins and antioxidants and that a small milky serving in the morning helps their children concentrate in school. Brother and sister are eating ham and cheese as well as pão com manteiga, bread with butter. Another popular breakfast is frozen smoothies made from acai, banana, and guaraná.



Reykjavik, Iceland: Birta Gudrun Brynjarsdottir, 3½ years old

Birta's oatmeal porridge is called hafragrautur, a staple breakfast in Iceland. The oatmeal is cooked in water or milk and often served with brown sugar, maple syrup, butter, fruit, or surmjolk (sour milk). Birta also takes a swig of lysi, or cod liver oil. For part of the year, when the sun barely clears Iceland's horizon, sunlight is a poor source of vitamin D—but the vitamin is plentiful in fish oils. (The word *lysi* is related to the Icelandic verb *lysa*, meaning "illuminate.") Birta's mother, Svana Helgadottir, started giving her four children lysi when each was about 6 months, and now all of them gulp it down without complaint. Many day-care centers and preschools in Iceland dispense cod-liver oil as a regular part of the morning routine.

Name: _____ Date: _____

How Plants Get Food Initial Model

Develop an initial model of the plant system: Choose one plant that you know has food molecules in it (apple, avocado, banana, beans, maple tree, rice, etc.). Make sure to include all the parts of the system and the inputs that you think are necessary to develop an initial model that explains these questions:

- How did this plant get its food molecules?
- Where did the food molecules come from?

Use *pictures, symbols,* and *words* to explain your thinking. Be sure to label any drawings.

Explain your initial model of the plant system in words below:

_____

_____

_____

Which food molecules are in the hydroponic plant food?

Part 1: Preparation Tape this handout into your science notebook.

Which food molecule is your group testing for? _____

Decide what to label each tube, and write that in the "Tube label" row. The first two have been done for you. Then fill out the "Substance tested" and "Indicator added to tube" rows.

Part 2: Data collection

Tube label	(–)	Ex	_____	_____
Tube contains	(–) control group	Experimental group	(+) control group	(+) control group
Substance tested				
Indicator added to tube				
Color prediction				
Results				

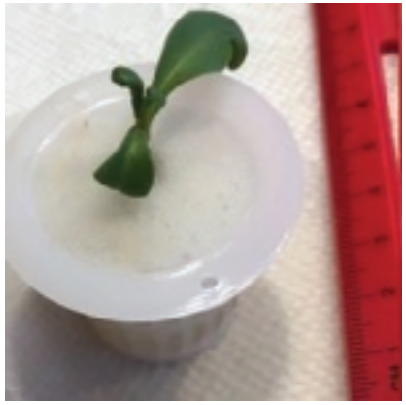
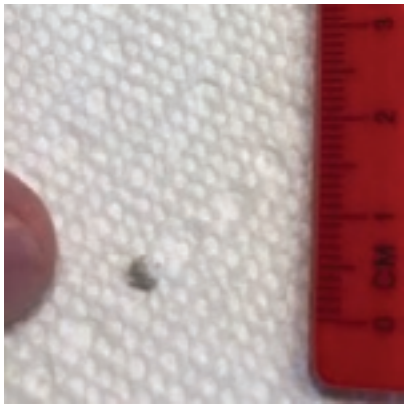
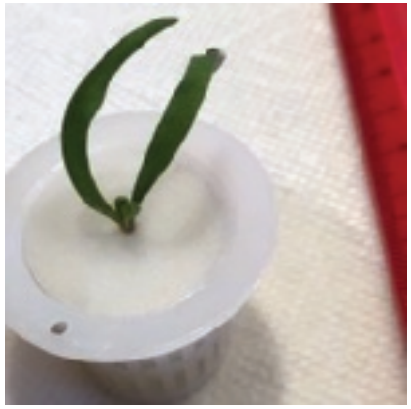
Part 3: Predictions What will you find the next time that you check? Record your predictions in the "Color prediction" row.

Part 4: Results Record your results in the "Results" row.

Part 5: Making sense of your data

1. What does your data tell you? Are food molecules found inside hydroponic plant food (HPF)? What is your evidence?
2. Could the HPF be the source of food molecules for the plants? Why or why not?

Photos of Plants Growing in Class

Plant	Seeds	Sprouting (at 10 days)	At 5 weeks	Nutrition Label
Radish	 **Less than 0.01 g**		 **7.23 g**	Radishes **Nutrition Facts** Serving Size: 1 cup, slices Amount Per Serving Calories 18 % Daily Value* Total Fat 0.1g 0% Saturated Fat 0g 0% Trans Fat 0g Cholesterol 0mg 0% Sodium 45mg 2% Total Carbohydrate 3.9g 1% Dietary Fiber 1.9g 7% Sugars 2.5g Protein 0.8g
Spinach	 **Less than 0.01 g**		 **2.55 g**	Spinach **Nutrition Facts** Serving Size: 1 cup (30g) Amount Per Serving Calories 7 % Daily Value* Total Fat 0.1g 0% Saturated Fat 0g 0% Trans Fat 0g Cholesterol 0mg 0% Sodium 24mg 1% Total Carbohydrate 1.1g 0% Dietary Fiber 0.7g 3% Sugars 0.1g Protein 0.9g

1. Which types of food molecules does each plant have?
   a. Radish:

   b. Spinach:

2. How does the amount of matter in a single seed compare to the amount of matter in the plant that has grown for five weeks? How does the size of each compare?

Name: _____ Date: _____

Self-Assessment for Classroom Discussions

1. Read each statement and mark YES or NO for whole-class discussions and/or small-group discussions.

Today, I. . .	In Whole-Class Discussions?		In Small-Group or Partner Discussions?	
	YES	NO	YES	NO
Shared my thinking by sharing new ideas, asking new questions, or asking for clarification from others.				
Listened actively to others by rephrasing, repeating and/or reusing the ideas of others, and/or by asking others to repeat their statements or to clarify ideas when they are difficult to hear or understand.				
Respectfully gave critiques to others about their explanations, models, investigation plans, or questions by using observations, data, or evidence and asking questions.				
Invited others to share their thinking.				

2. Choose one statement that you checked NO for or that you think you can improve on, and write down two ideas for what you can do to improve in the next discussion.

_____

_____

_____

_____

_____

Investigating Above the Surface Inputs

Substance	Part A. What do we predict will happen to the amount of this substance in the system? Why?	Amount of this substance measured in the closed system		Part D. What happened to the amount of this substance in the system?
		Part B. Starting time	Part C. Ending time	

Making sense of our results

1. Are any ***parts*** that make up food molecules going into the plant from above the surface? What claims can you make based on evidence from this experiment?

2. What are you unsure of or what new questions does this raise for you?

Data from Leaves in the Light

Data produced every second for the first 30 seconds

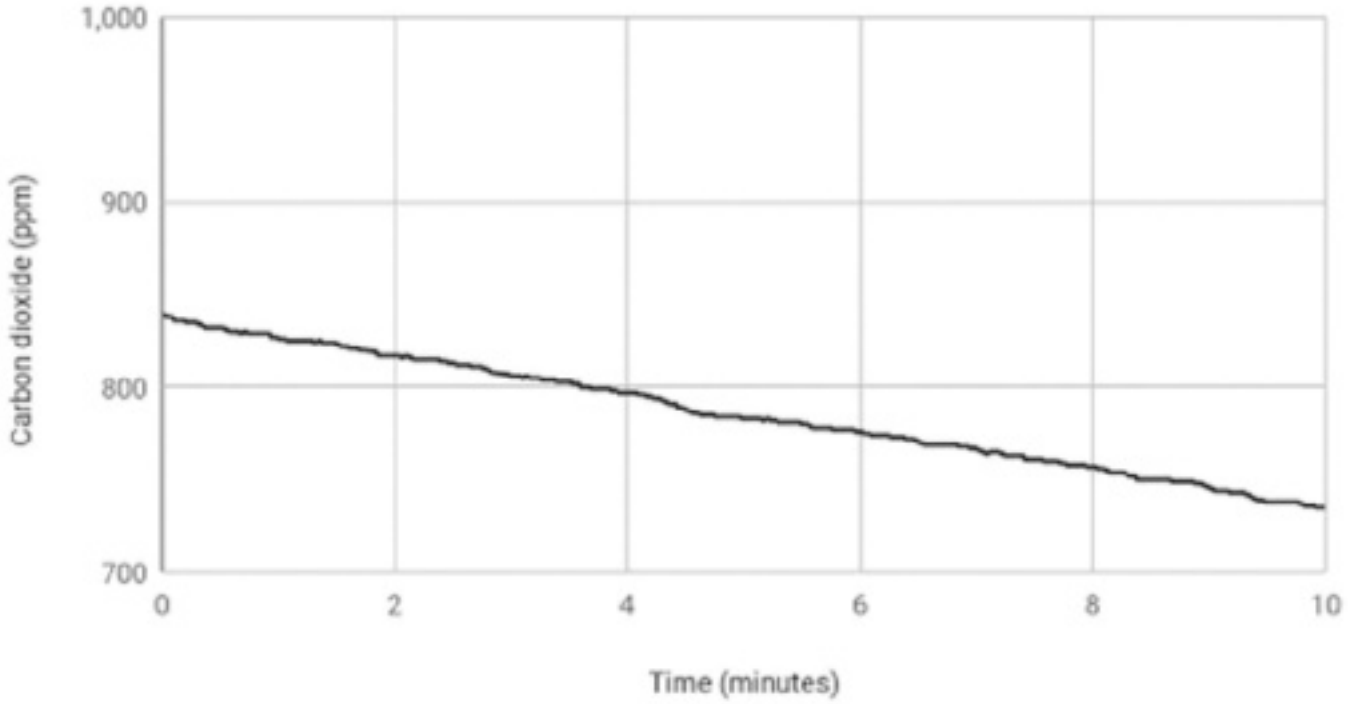
	A	C	E	I	J	L
1	Date 10/8/2018	Seconds	CO2 (PPM)	Humidity (%)	Light (Lux)	O2 (PPM)
2	10/8/2018, 3:07:08 PM	0	839	56	1,065	199,500
3	10/8/2018, 3:07:09 PM	1	839	56	1,065	199,500
4	10/8/2018, 3:07:10 PM	2	838	56	1,065	199,500
5	10/8/2018, 3:07:11 PM	3	838	56	1,065	199,500
6	10/8/2018, 3:07:12 PM	4	838	56	1,065	199,500
7	10/8/2018, 3:07:13 PM	5	838	56	1,065	199,600
8	10/8/2018, 3:07:14 PM	6	836	56	1,065	199,500
9	10/8/2018, 3:07:15 PM	7	836	56	1,065	199,600
10	10/8/2018, 3:07:16 PM	8	836	56	1,065	199,600
11	10/8/2018, 3:07:17 PM	9	836	56	1,065	199,600
12	10/8/2018, 3:07:18 PM	10	836	56	1,065	199,600
13	10/8/2018, 3:07:19 PM	11	836	56	1,065	199,500
14	10/8/2018, 3:07:20 PM	12	835	56	1,065	199,800
15	10/8/2018, 3:07:21 PM	13	835	56	1,065	199,500
16	10/8/2018, 3:07:22 PM	14	835	57	1,065	199,600
17	10/8/2018, 3:07:23 PM	15	835	57	1,065	199,600
18	10/8/2018, 3:07:24 PM	16	835	57	1,065	199,600
19	10/8/2018, 3:07:25 PM	17	835	57	1,065	199,600
20	10/8/2018, 3:07:26 PM	18	834	57	1,065	199,600
21	10/8/2018, 3:07:27 PM	19	834	57	1,065	199,600
22	10/8/2018, 3:07:28 PM	20	833	57	1,065	199,600
23	10/8/2018, 3:07:29 PM	21	833	57	1,065	199,600
24	10/8/2018, 3:07:30 PM	22	832	57	1,065	199,600
25	10/8/2018, 3:07:31 PM	23	832	57	1,065	199,600
26	10/8/2018, 3:07:32 PM	24	832	57	1,065	199,700
27	10/8/2018, 3:07:33 PM	25	832	57	1,067	199,700
28	10/8/2018, 3:07:34 PM	26	832	58	1,067	199,600
29	10/8/2018, 3:07:35 PM	27	832	58	1,065	199,600
30	10/8/2018, 3:07:36 PM	28	832	58	1,065	199,600
31	10/8/2018, 3:07:37 PM	29	832	58	1,065	199,600
32	10/8/2018, 3:07:38 PM	30	832	58	1,065	199,600

Data table from data produced every 2 minutes for 10 minutes

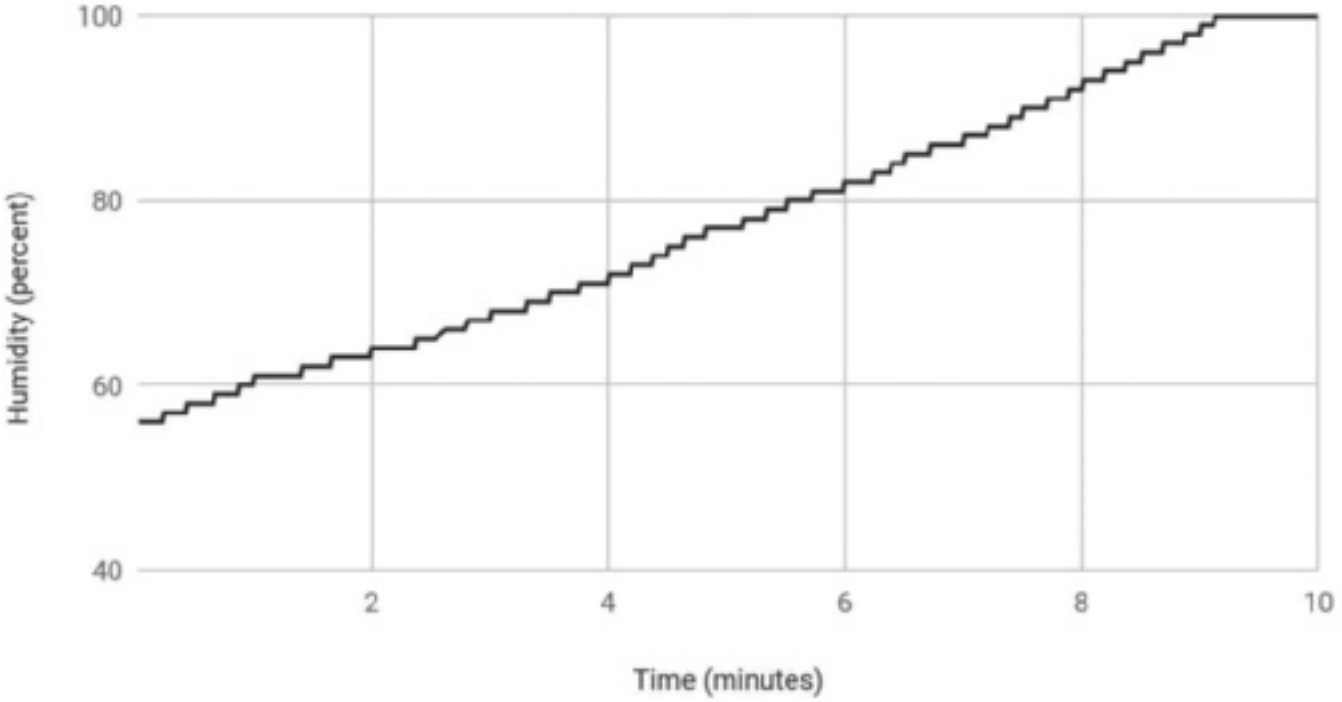
Time (minutes)	Carbon dioxide (ppm)	Humidity (%)	Oxygen (ppm)	Light (lux)
0	839	56	199,500	1,065
2	816	64	199,700	1,063
4	797	72	199,900	1,067
6	775	82	200,000	1,067
8	756	93	200,100	1,067
10	735	100	200,200	1,067

Note: “ppm” means “parts per million.”

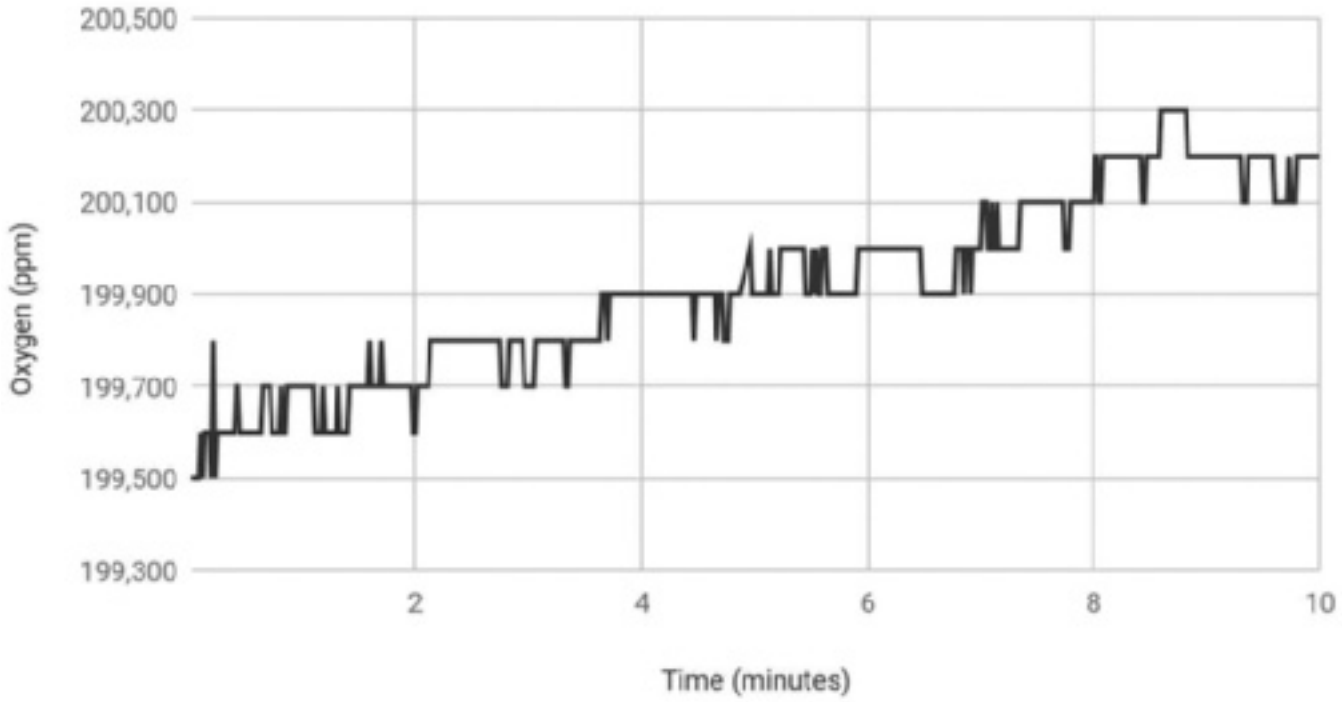
Carbon dioxide level



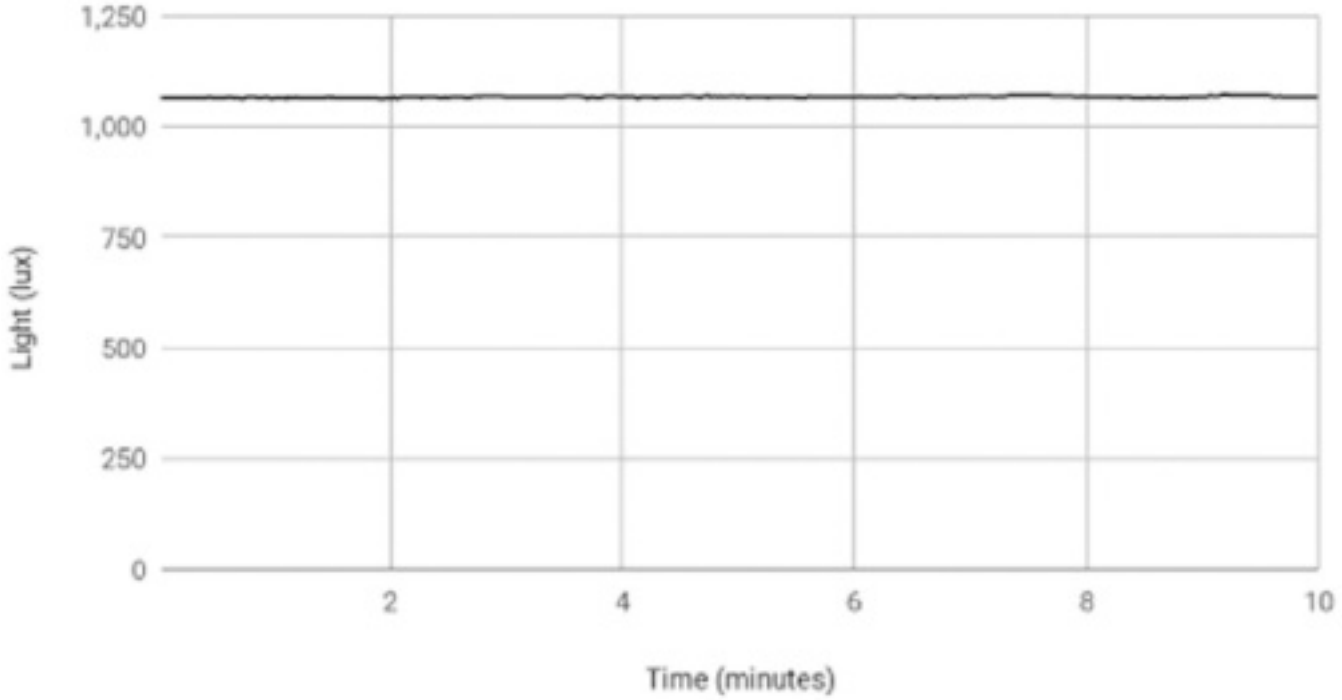
Humidity level



Oxygen level



Light level



Leaf Observations

Does the structure of the leaf provide any evidence for how carbon dioxide gets into a leaf, how oxygen gets out, or what is happening inside the leaf?

Data source	Observations of the leaf structure	Ideas about function
Source A:		
Source B:		
Source C:		
Source D:		
Source E:		

Reading: Plant Cells

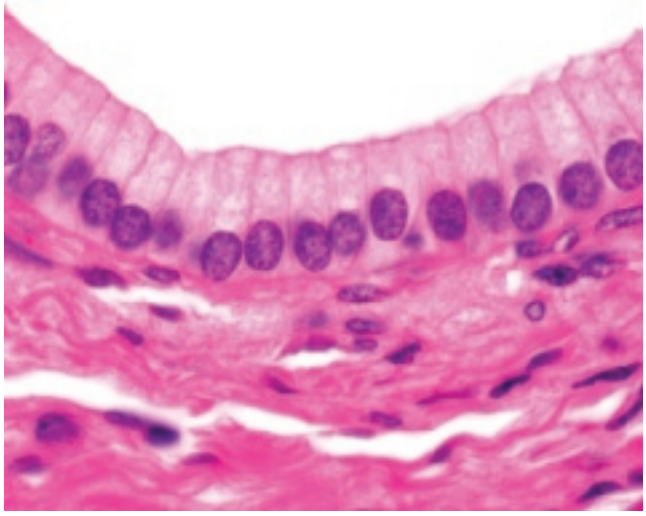
All living things, including plants, are made up of **cells**, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular).

Discussion question

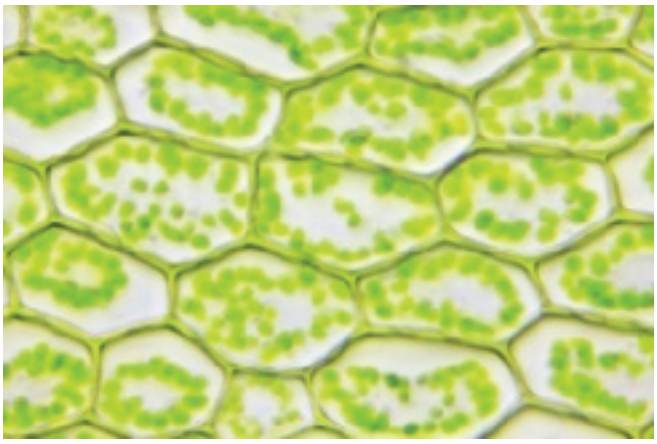
What do you know about animal cells?

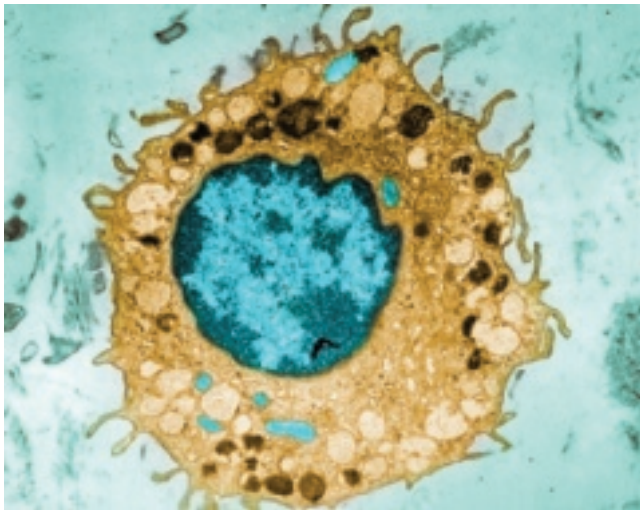
You observed plant cells under the microscope at 400×. Plant cells are similar to and different from animal cells. Compare the structures in a plant cell and animal cell.

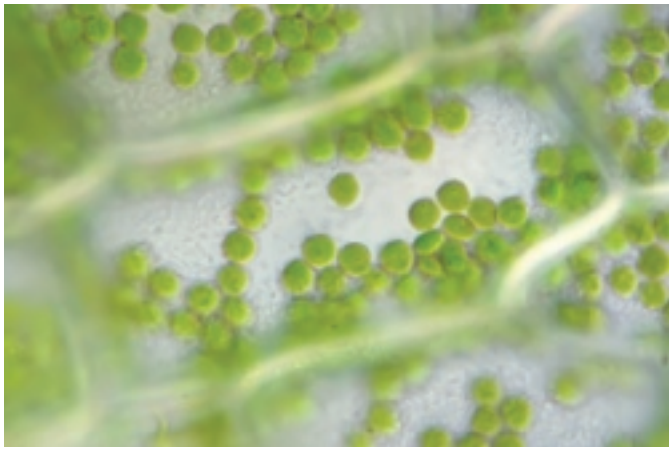
Animal cells
Human pancreas cells



Plant cells
Leaf cells







Discussion questions

- How are plant and animal cells similar?
- How are plant and animal cells different?

What are the green circles in plant cells and why do they move?

Both plant and animal cells have similar structures that perform different functions for the organism. In the *Inside our Bodies Unit,* you figured out that animal cells do chemical reactions to release energy from food. These reactions take place in tiny structures called *mitochondria.* Like animal cells, plant cells' structures are not static. The structures inside the cells can help plants do things. One major difference you may have noticed is that plant cells have many small green circles and animal cells do not. These structures are called *chloroplasts* and are only found in plant cells.

In the video, we observed a pattern of movement by these chloroplasts in the cell. Scientists who have observed this movement wondered whether the chloroplasts were moving in response to something. They hypothesized that the movement may have been in response to sunlight hitting the plant leaf, and to test this idea they placed plant leaves in low light conditions. Scientists also placed plant leaves in very intense light conditions to compare the movement of chloroplasts in the plant cells.

Scientists observed that the chloroplasts move differently in response to different light conditions. In the low light conditions, chloroplasts moved to a place within the cell where they could absorb the most light. However, in the intense light conditions, the chloroplasts moved within the cell to avoid the light. Scientists later learned that too much sunlight can damage chloroplasts, explaining the movement pattern.

Reflection Questions:

1. **What pattern did scientists observe in plant cells in different light conditions?**
2. **Think about what you know about light and energy. What do you think the light is doing in the plant cells?**
3. **Do you think plants need light? Why or why not?**

Name: _____ Date: _____

Planning and Carrying Out Investigations

Investigation B plan	
What is the independent variable you will be changing?	
What different values do you plan to try for this?	
Do you plan to do repeated trials for each value? If so, how many?	
What will you record for your dependent variable(s) to measure the output? Will you record oxygen produced, sugar produced, or both?	
In investigation A you ran the simulation for 2,000 units of simulation time. What length of time do you plan to run the simulation in investigation B, before pausing it to record your data, to ensure a fair test/comparison of what is produced?	

Data table Create a data table for recording the values of the independent variable and dependent variables for each simulation run you plan to do.

Making sense

1. What claim can you now make about how changing the amount of your independent variable affected the outputs of the plant cell?

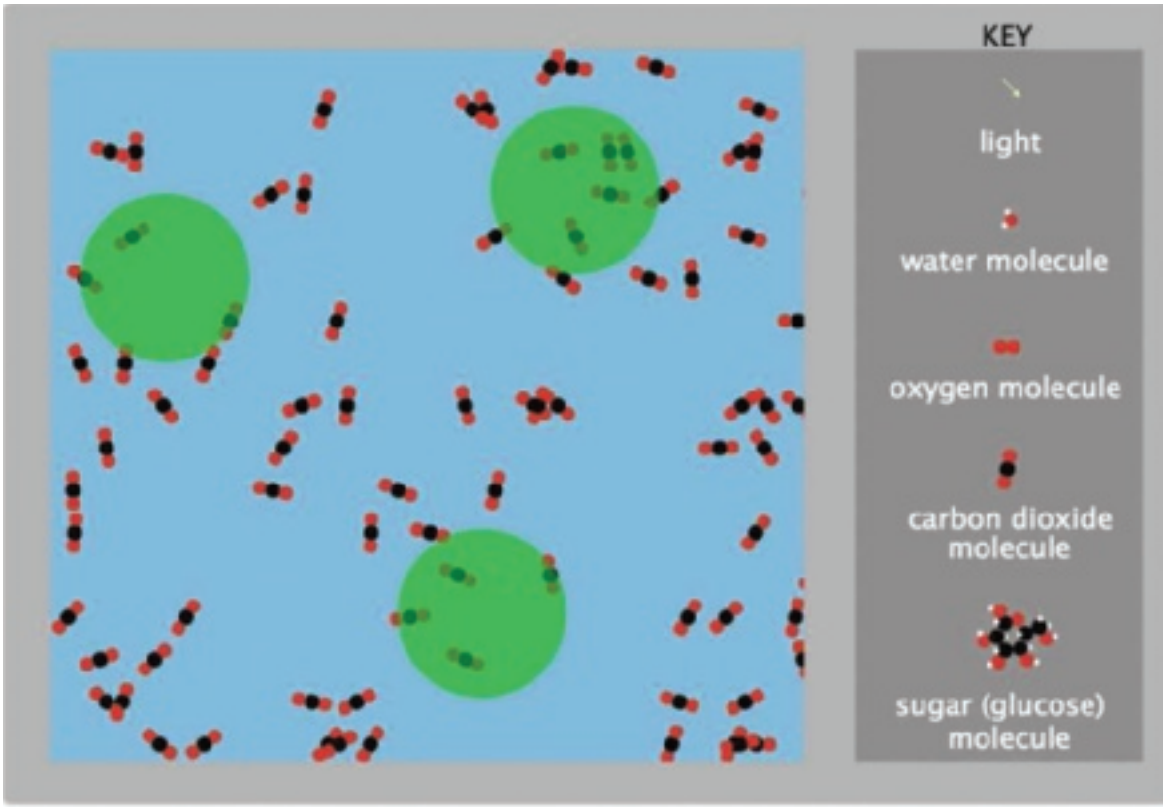
2. If you tried completely removing your input, how did that affect the outputs of the plant cell?

Name: _____ Date: _____

Making Sense of the Computer Simulation

Evaluating Different Models

The chemical processes you saw occurring in the computer simulation are referred to as photosynthesis. Below is a screenshot from the simulation.



A diagram similar to the one below was created in class to represent the inputs and outputs of that process.

What was in the plant cell at the start? **(Inputs)**	**Interactions** <--- Between these ---> and the chloroplasts	What was in the plant cell at the end? **(Outputs)**

1. How do the inputs shown on the left side of the diagram and the outputs shown on the right side of the diagram your class created compare to what you identified as inputs and outputs in the simulation?

2. What advantages does each model provide in helping you understand where plants get one of their food molecules (sugar) from?

Advantages of the computer simulation	Advantages of the diagram above

Reading: How do scientists measure energy in food?

You've probably heard before that the food we eat provides energy for our bodies, but what exactly does that mean? Remember from the Inside our Bodies unit that when we eat food, it gets broken down in our bodies, and the chemical reactions that happen inside our cells provide energy that our body can use. But how much energy is in the food we eat that can be used by our bodies?

Remember back in Lesson 1, we looked at food labels to see what our breakfast foods were made of?

Food labels also provide information about how much energy a serving of that food can provide our bodies. Look at the food labels below.

Maple Syrup

Nutrition Facts

Serving Size 4 tbsp (60mL)
Servings 32

Amount Per Serving	
Calories 200	
	% Daily Value
Total Fat 0g	0%
Sodium 7mg	0%
Total Carbohydrate 53g	18%
Sugars 53g	
Protein 0g	0%

INGREDIENT: 100% Pure Maple Syrup. Maple Syrup is a natural sweetener made by boiling the sap of a maple tree, nothing is added and only water is boiled off.

Maple Drink

Nutrition Facts

Serving Size 1 Bottle

Amount Per Serving	
Calories 30	
	% Daily Value*
Total Fat 0g	0%
Sodium 0g	0%
Potassium 35mg	1%
Total Carbohydrate 8g	2%
Protein 0g	
Calcium 4% • Iron 0%	
Manganese 50%	

INGREDIENT: Organic maple water

Natto

Nutrition Facts

Serving Size: 1 oz (28g)
Servings Per Container 3.5

Amount Per Serving	
Calories 60	
	% Daily Value*
Total Fat 3g	5%
Saturated Fat 1g	1%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 2mg	0%
Total Carbohydrate 4g	1%
Dietary Fiber 2g	6%
Sugars 1g	
No Added Sugars	
Protein 5g	
Vitamin D 0 mcg • *Iron 2mg 13%	
Calcium 60mg 6% • *Potassium 204mg 5%	

*The % Daily Values (DV) tells you how much a nutrient in serving of food contributes to a daily diet. 2,000 calorie a day is used for general nutrition advice.

As you can see, these labels have a categorization of different food molecules such as fat, carbohydrates, fiber, protein, and sugar. But in order to determine the total amount of energy that can be used in our bodies, we have to look at the measure of calories.

The number of calories on a food label indicates the number of units of usable energy we can get from the food we eat. You figured out in the Inside our Bodies unit that to get energy out of food, our bodies must break food molecules down small enough to be absorbed out of the digestive system and into the circulatory system and transported to the cells of our body. The cells of our body are where food reacts with oxygen to provide those cells and the tissues and organs they make up the energy to do things. We figured out that the process is called cellular respiration.

All foods contain different amounts of calories depending upon the molecules that make them up. Fats, proteins, and carbohydrates (fiber, starch, and sugar) in food all contribute to the total number of calories or energy units our body can use.

Source:

- Adapted from: How Do Food Manufacturers Calculate the Calorie Count of Packaged Foods? (2006, July 31). Retrieved October 27, 2019, from https://www.scientificamerican.com/article/how-do-food-manufacturers/

Making sense

1. Make a claim about which of the food servings shown in the article would provide our bodies the most energy through cellular respiration.

2. If a food label measured zero calories, what claim could you make about how much energy this food would provide our body?

3. In many systems that we have studied before, we have kept track of how energy is transferred into and out of that system, such as a cup warming up or cooling down or how the ground heats the air above it. Thinking back to the maple tree, we know the sugar in maple syrup can provide us energy. Where did that energy come from? Brainstorm below some possible inputs that the tree may have received this energy from. Where do you think plants are getting the energy to make these food molecules that can provide energy to our bodies?

4. Consider what you have just read and observed in the text and food labels. Which source of information—the text or the food label images—was most helpful in adding (integrating) this scientific information into your current thinking?

Name: _____ Date: _____

How many calories are in each input and output for plants making food?

Inputs		
	Source	**Calories**
Water (H_2O)		
Carbon dioxide (CO_2)		
Patterns:		

Outputs		
	Source	**Calories**
Glucose (Cs, Hs, and Os)		
Oxygen (O_2)		
Patterns:		

Making sense of our results

1. What do you notice when you compare the calories for the inputs and outputs?

_____

_____

2. What are you unsure of or what new questions does this raise for you?

_____

_____

Name: _____ Date: _____

Obtaining Information from Scientific Text Checklist

Obtaining Information	
• Read for the gist—skim the title, headings, images.	What is the central idea or claim?
• Mark up the text.	Select methods for marking the text. For example: • Keep track of questions you have in the margins. • Circle key words. • Put question marks by words you want to learn more about. • Underline main ideas.
• Examine any images, graphs, or tables.	Write one sentence about the central point of each image, graph, or table.
• Examine where the authors obtained their information.	What sources did the authors cite?

Name: _____ Date: _____

Lesson 8: Gotta-Have-It Checklist

Instructions: Use your Progress Tracker and your science notebook to make a checklist of the most important ideas you need to make a new model to explain these questions:

- How do plants get their food molecules?
- Where do the food molecules come from?

What our model needs to have to answer the questions *How do plants get their food molecules? Where do the food molecules come from?*	**Check off pieces of the model as you use them.**	
	Used	*Not used*

You will use your checklist to make a new model for answering the questions. As you use ideas from your checklist, put a check in the "Used" column and label the concept on your model with its row number from the checklist. If you do not use an idea, place a check in the "Not used" column.

Data Table for Leaves in the Dark

Substance	Part A. What do we predict will happen to the amount of this substance in the system? Why?	Amount of this substance measured in the closed system		Part D. What happened to the amount of this substance in the system?
		Part B. Starting time	Part C. Ending time	

Making sense of our results

1. What is happening with photosynthesis in the dark? What claims can you make based on evidence from this investigation and our previous investigation in Lesson 4?

2. What are you unsure of or what new questions does this raise for you?

Secondhand Data for Leaves in the Dark

Data produced every second for the first 30 seconds

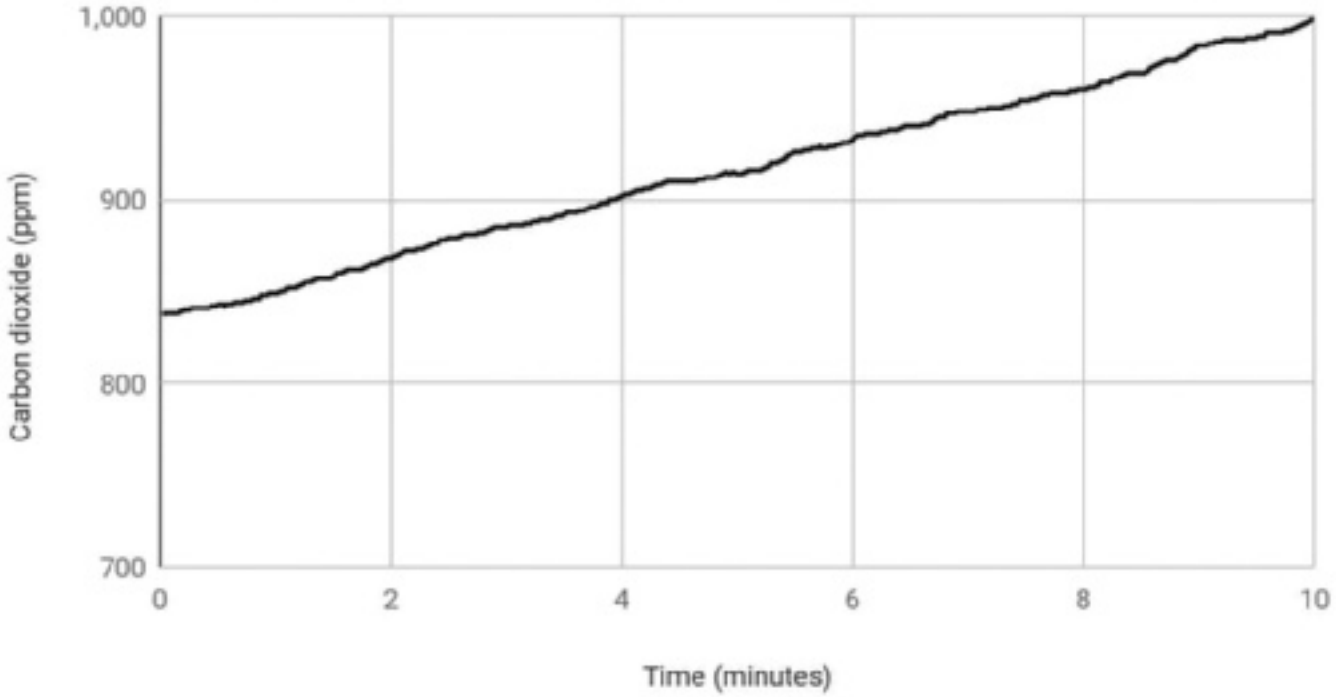
	A	C	F	H	K	M
1	Date	Seconds	CO2 (PPM)	Humidity (%)	Light (Lux)	O2 (PPM)
2	10/8/2018, 5:47:31 PM	0	838	56	6	202,600
3	10/8/2018, 5:47:32 PM	1	838	56	6	202,600
4	10/8/2018, 5:47:33 PM	2	838	56	6	202,600
5	10/8/2018, 5:47:34 PM	3	838	56	6	202,600
6	10/8/2018, 5:47:35 PM	4	838	56	6	202,600
7	10/8/2018, 5:47:36 PM	5	838	56	6	202,600
8	10/8/2018, 5:47:37 PM	6	838	56	6	202,600
9	10/8/2018, 5:47:38 PM	7	838	56	6	202,600
10	10/8/2018, 5:47:39 PM	8	838	56	6	202,600
11	10/8/2018, 5:47:40 PM	9	838	56	6	202,600
12	10/8/2018, 5:47:41 PM	10	838	56	6	202,600
13	10/8/2018, 5:47:42 PM	11	839	56	6	202,600
14	10/8/2018, 5:47:43 PM	12	839	56	6	202,600
15	10/8/2018, 5:47:44 PM	13	840	56	6	202,600
16	10/8/2018, 5:47:45 PM	14	840	56	6	202,600
17	10/8/2018, 5:47:46 PM	15	840	56	6	202,600
18	10/8/2018, 5:47:47 PM	16	840	56	6	202,600
19	10/8/2018, 5:47:48 PM	17	841	57	6	202,600
20	10/8/2018, 5:47:49 PM	18	841	57	6	202,600
21	10/8/2018, 5:47:50 PM	19	841	57	6	202,600
22	10/8/2018, 5:47:51 PM	20	841	57	6	202,600
23	10/8/2018, 5:47:52 PM	21	841	57	6	202,600
24	10/8/2018, 5:47:53 PM	22	841	57	6	202,600
25	10/8/2018, 5:47:54 PM	23	841	57	6	202,600
26	10/8/2018, 5:47:55 PM	24	841	57	6	202,500
27	10/8/2018, 5:47:56 PM	25	841	57	6	202,500
28	10/8/2018, 5:47:57 PM	26	841	57	6	202,500
29	10/8/2018, 5:47:58 PM	27	842	57	6	202,500
30	10/8/2018, 5:47:59 PM	28	842	57	6	202,500
31	10/8/2018, 5:48:00 PM	29	842	58	6	202,500
32	10/8/2018, 5:48:01 PM	30	842	58	6	202,500

Data table from data produced every 2 minutes for 10 minutes

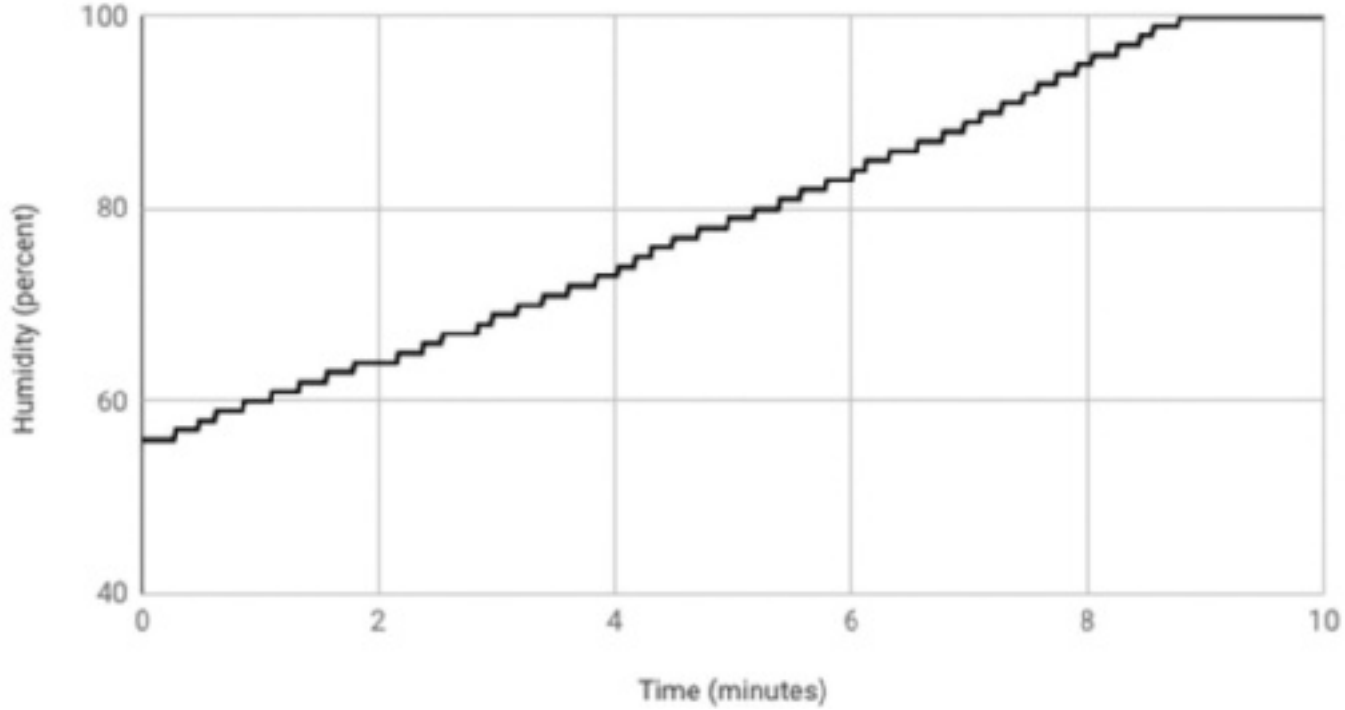
Time (minutes)	CO_2 (ppm)	Oxygen (ppm)	Humidity (%)	Light (lux)
0	838	202,600	56	6
2	868	202,400	64	6
4	902	202,300	73	8
6	932	202,200	83	6
8	960	202,100	95	0
10	998	202,100	100	0

Note: “ppm” means “parts per million.”

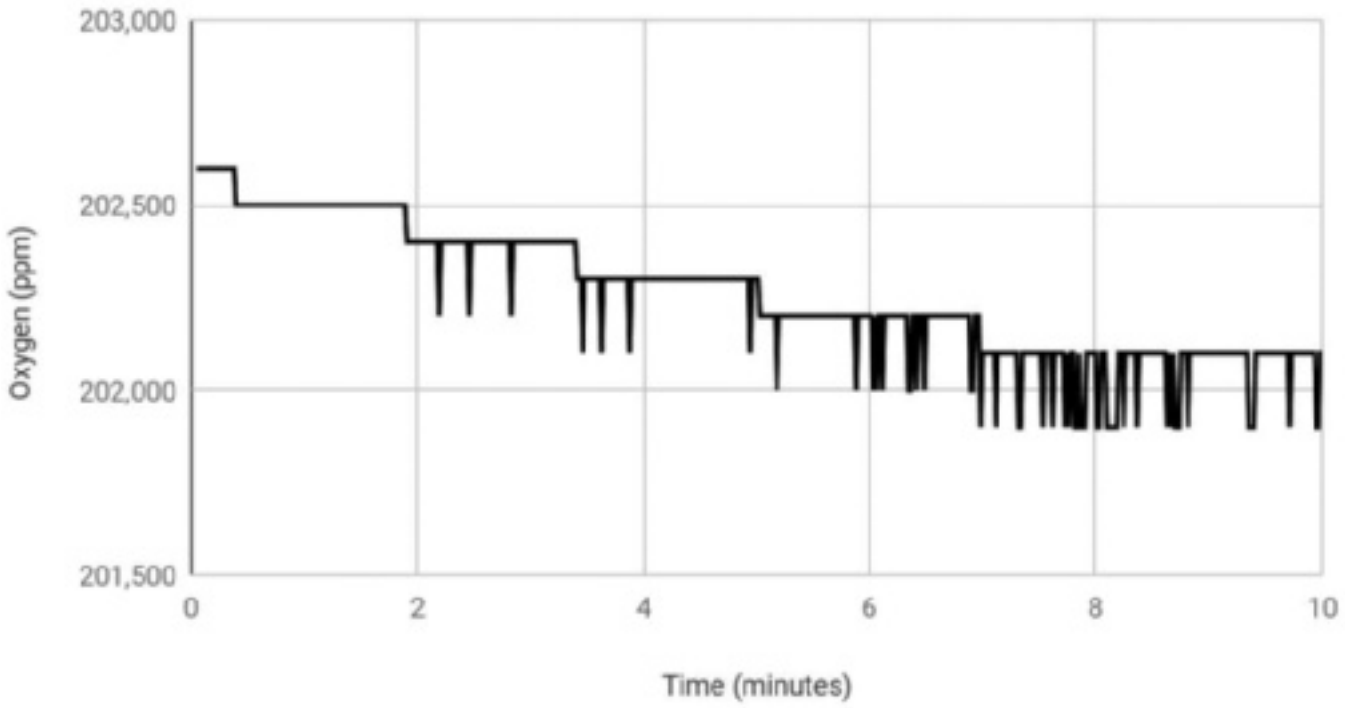
Carbon dioxide level



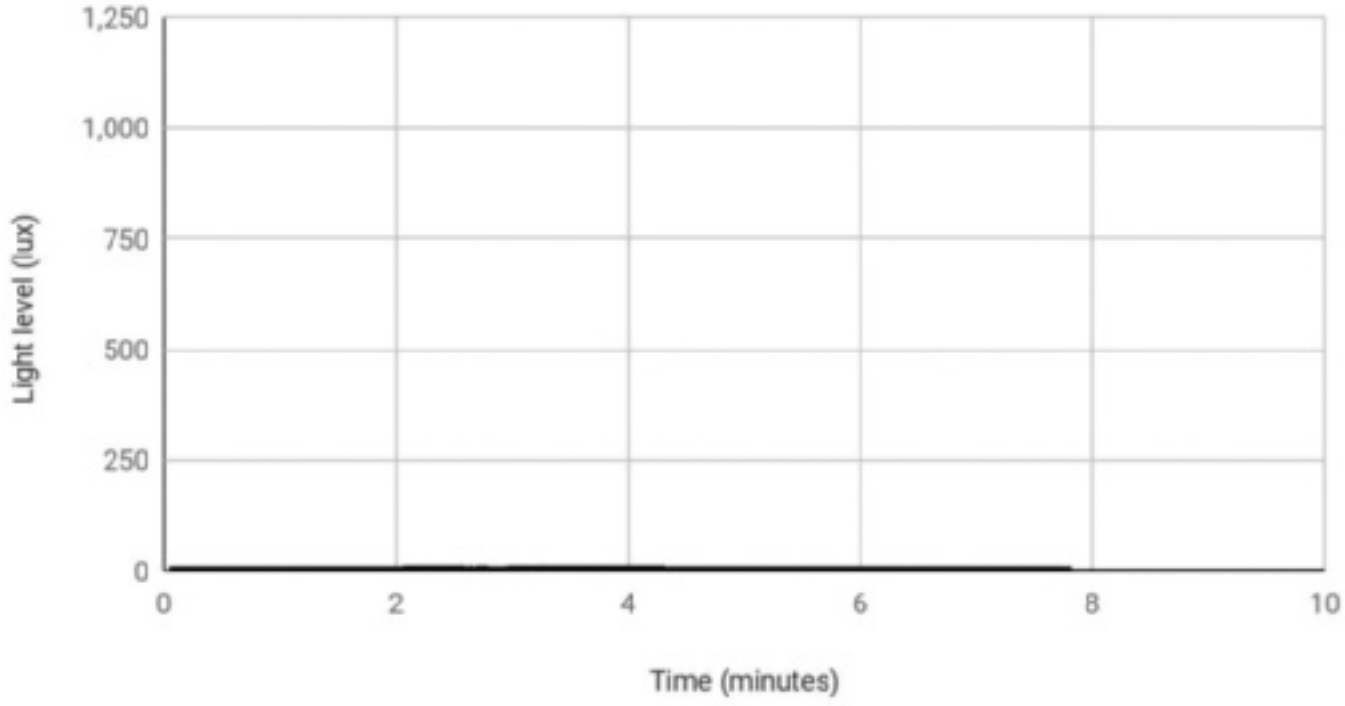
Humidity level



Oxygen level



Light level



Communicating Information from Scientific Text Checklist

Every time. . .	
• Identify the audience you are communicating with	Who is your audience?
• Clarify your purpose	What is the purpose of your scientific communication?
• Identify the constraints of your communication	What constraints are there for your communication? Does it need to be written, oral, a poster?
• Use text, images, tables, diagrams, graphs, equations	Which kinds of communicating will you use? What is each medium communicating to your audience?

When appropriate. . .	
• Get feedback	Who will you get feedback from on your scientific communication?
• Engage in conversation	Who will you talk to about what you figured out? What is the purpose of this conversation?
• Ask questions	What questions do you have about your work or the work of others?

Name: _____ Date: _____

Beans and BTB Investigation Data Table

	Bag A: Classroom air	Bag B: Exhaled air	Bag C: Beans in classroom air
Color of BTB in the beginning			
Predict: What color will the BTB be at the end?			
Observations Day 1: What did you see?			
Observations Day 2: What did you see?			
What does the final color of BTB tell you?			

Name: _____ Date: _____

What changes are happening around food that does not get eaten?

Using words or pictures, record what you noticed from observing the images of bread over 7 days.

Noticings from Bread	
In the dark	**In the light**

Draw an ↑ (increase), ↓ (decrease), or = (stays the same) for the change in each input or output in the light and dark.

Input/Output	In the dark	In the light
Carbon dioxide		
Oxygen		
Humidity (water)		

Making sense of our results

1. Using words, describe what happened to each input/output during this process.
   a. Carbon dioxide

   b. Oxygen

   c. Humidity (water)

2. Write an initial explanation of what you think could be happening to cause these changes in the inputs/outputs.

Obtaining and Communicating Information from Scientific Text Checklist

Obtaining Information	
• Read for the gist — skim the title, headings, images.	What is the central idea or claim?
• Mark up the text.	Select methods for marking the text. For example: • Keep track of questions you have in the margins. • Circle key words. • Put question marks by words you want to learn more about. • Underline main ideas.
• Examine any images, graphs, or tables.	Write one sentence about the central point of each image, graph, or table.
• Examine where the authors obtained their information.	What sources did the authors cite?
• Identify the ideas from the text that support what you've figured out so far.	What are the supporting ideas?

Communicating Information	
• Identify the audience you are communicating with.	Who is your audience?
• Clarify your purpose.	What is the purpose of your scientific communication?
• Identify the constraints of your communication.	What constraints are there for your communication? Does it need to be written, oral, a poster?
• Use text, images, tables, diagrams, graphs, equations.	Which kinds of communicating will you use? What is each medium communicating to your audience?
• Engage in conversation.	Who will you talk to about what you figured out? What is the purpose of this conversation?
• Prepare to communicate.	What will you say? What is your evidence? Include any images, diagrams, or words you will use when you communicate the information you obtained.

Lesson 14 Gotta-Have-It Checklist

Instructions: Use your Progress Tracker and your science notebook to make a checklist of the most important ideas you need for a model to explain these new questions:

- Where does all of our food come from?
- Where does it go next? Where do the atoms that make up living and nonliving things go next in our world?

* *You do not need to repeat ideas already in your checklist from Lesson 8.*

What our model needs to have to answer the questions, "Where does all of our food come from?" and "Where do the atoms that make up living and nonliving things go next in our world?"	***Check off pieces of the model as you use them.***	
	Used	*Not used*

Use your checklist to add to your model. As you use ideas from your checklist, put a check in the "Used" column for the idea and label the concept on your model with its row number from the checklist.

Name: _____ Date: _____

Self-Assessment

Giving Feedback: How well did you give feedback today?

Today, I. . .	YES	NO
Gave feedback that was **specific** and about **science ideas**.		
Shared a suggestion to help improve my peer's work.		
Used evidence from investigations, observations, activities, or readings to support the feedback or suggestions I gave.		

One thing I can do better next time when I give feedback is:

_____

_____

Receiving Feedback: How well did you receive feedback today?

Today, I. . .	YES	NO
Read the feedback I received carefully.		
Asked follow-up questions to better understand the feedback I received.		
Said or wrote why I agreed or disagreed with the feedback.		
Revised my work based on the feedback.		

What is one piece of feedback you received?

_____

_____

What did you add or change to address this feedback?

_____

Name: _____ Date: _____

Reviewing Our Driving Question Board

Instructions: Below is a list of questions from our Driving Question Board (DQB). Mark questions you think the class has answered by putting different symbols next to each question:

- We did not answer this question or any parts of it yet: **O**
- Our class answered some parts of this question, or the ideas we developed helped me see how I could now answer some parts of this question: ✓
- Our class answered this question, or the ideas we developed helped me see how I could now answer this question: ✓ +

Questions from the DQB:

Question from Driving Question Board	Mark

Name: _____ Date: _____

Roadmap for Reading

This week's reading collection focuses on the variety of plants in the world and their uses as nutrients for humans. The selections include diagrams, graphs, and tables for you to analyze and interpret.

Collection 1: "Plants, Food, and Plants' Food" consists of four selections.

1 Plant Gallery
2 Plants That Feed the World
3 All That in One Avocado?
4 Sugar

As you read:

- Consider the general purpose of each part: is it a description, an explanation, a procedure, or an attempt to persuade?
- Consider how data and graphics support the narrative text and how narrative text clarifies the data and graphics.
- Consider how each reading builds on knowledge you gained from the previous readings.

Written Response

Your writing exercise is to create a meme that responds to one or more big ideas from this collection and would be enjoyed by other students.

- Compose your meme on a separate sheet of paper; attach this page to the front of it when you turn it in.
- Think about what struck you as interesting, odd, amazing, or inspiring in these readings.
- Draw or print a rectangle-shaped picture.
- Write some amusing or inspiring text about plants and food in bold lettering—no more than a couple of lines.
- Refer to at least one main idea from this collection.
- Make sure your meme meets your school rules and is not offensive.
- Before you begin, review the criteria in the Evaluation Guidelines that follow to help you clearly understand the expectations of the exercise.

Evaluation Guidelines

Element	1	2	3	Feedback
Content	The meme has an image and text, but the point is not clear. The science idea seems inaccurate or unclear. The image and text seem unconnected.	The meme's point is not particularly amazing, amusing, or inspiring, but the science idea is accurate. The image and text work together fairly well.	The meme is amazing, amusing, or inspiring. The image and text refer to scientific ideas about plants and nutrients. The two work together effectively.	
Design	The image is not on a rectangle. The text is too light, unreadable, or not present.	The image is a rectangle. The text is bold and fairly readable but could be better positioned.	The image fills a rectangle. The text is bold, easy to read, and well positioned related to the image.	
Grammar and mechanics	There are two or more errors that were not intentional for comedy's sake or space reasons.	There is at least one error that is not intentional for comedy's sake or space reasons.	Any errors are intentional text language for comedy's sake or space reasons.	

Additional Feedback Notes:

Name: _____ Date: _____

Science Literacy Exercise Page 2 Use with Reading Collection 2

Roadmap for Reading

This week's reading collection focuses on the elements and compounds that cycle into and out of plants. The selections support understanding that in any chemical reaction—including in Earth systems—matter is conserved as it moves into and out of living things.

Collection 2: "Plants and Chemistry" consists of five selections.

1 All-Star Building Blocks of Food
2 Photosynthesis
3 More than Glucose
4 Fertilizers
5 Plants in Water, Water in Plants

As you read:

- Consider the general purpose of each part: is it a description, an explanation, a procedure, or an attempt to persuade?
- Use resources available to you, including the glossary at the end of the Reader, to define unfamiliar words.
- Consider how each reading helps you build on the knowledge you gained from the previous reading.

Written Response

Your writing exercise is to complete a set of "MVP* Compounds" trading cards modeled on those in the first reading selection.

- The outlines of the cards for you to write on are on the next page.
- The first card has been done for you. To complete the other five, choose five other important compounds discussed in the collection, and write their names on the fronts of the cards.
- Make sure your choices come from at least two reading selections.
- List one or two important facts about each compound on the back of each card, such as where it can be found and what plants do with it.
- Use your well-chosen facts to highlight how matter changes.
- Remember to check your spelling and grammar.
- Before you begin, ask your teacher questions to help you clearly understand the expectations of the exercise.

* Most Valuable Player

MVP Compounds in Plants

Glucose	• A sugar • Made by plants during photosynthesis
front	back

Additional Feedback Notes:

Name: _____ Date: _____

Science Literacy Exercise Page 3 Use with Reading Collection 3

Roadmap for Reading

This week's reading collection focuses on several kinds of matter related to plant life. The selections include a social media discussion, and you'll have to decide which person is the most credible.

Collection 3: "Our Changing Planet" consists of three selections.

1 Plant Sap and Resin Products
2 Dissolved Oxygen and Aquatic Life
3 Will a Greening Earth Slow Global Warming?

As you read:

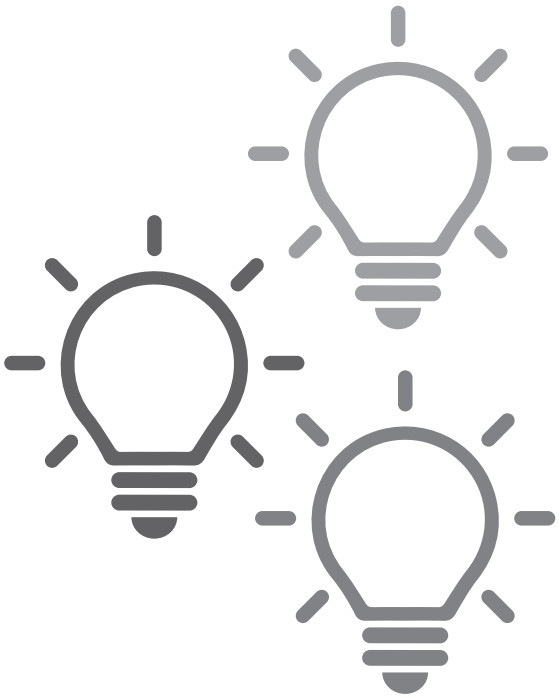
- Consider the general purpose of each part: is it a description, an explanation, a procedure, or an attempt to persuade?
- Consider how subheadings organize the parts of the text and guide the reader.
- Look for contextual clues to the meanings of words or phrases that are unfamiliar to you.

Written Response

Your writing exercise is to draw and label a graphic organizer highlighting three important science ideas in the reading collection.

- Draw your graphic organizer on a separate sheet of paper; attach this page to the front of it when you turn it in.
- Choose an image to represent an idea. It can be a lightbulb, as in the sample shown, a leaf, a sun, or some other related object.
- Write the heading "I didn't know that . . ." at the top of the page.
- For each of the three readings, complete the sentence inside one of the images, sharing one scientific idea that surprised you.
- Use color to make the organizer attractive and easier to understand.
- Before you begin, review the criteria in the Evaluation Guidelines that follow to help you clearly understand the expectations of the exercise.

I Didn't Know That . . .



Evaluation Guidelines

Element	1	2	3	Feedback
Content	There are fewer than three surprising ideas, or the statements are either unclear or scientifically inaccurate.	There are three surprising ideas, but not all selections are represented; statements are generally scientifically accurate, but the words are slightly unclear.	There is one surprising idea from each of the three selections; all statements are scientifically accurate.	
Design and graphic elements	The drawing is messy, and the text is difficult to read in several places; color is absent or detracts from the overall design.	The design is mostly neat and legible; it is somewhat easy to read; color is used but contributes little to the overall design.	The design is neat and legible; it is easy to read; color is used effectively.	
Grammar and mechanics	There are six or more errors in punctuation, capitalization, and spelling.	There are three to five errors in punctuation, capitalization, and spelling.	There are fewer than three errors in punctuation, capitalization, and spelling.	

Additional Feedback Notes:

Name: _____ Date: _____

Science Literacy Exercise Page 4 Use with Reading Collection 4

Roadmap for Reading

This week's reading collection focuses on how plants and other photosynthetic organisms provide food for consumers, including humans. The selections include a number of maps revealing patterns over time and a model showing relationships as a pyramid.

Collection 4: "Producers and Consumers" consists of five selections.

1 Plants Need Oxygen, Too
2 Sugar Storage Strategies of Plants
3 Seasonal Primary Productivity
4 Tasting the Other Kingdoms
5 Producers and Pyramids

As you read:

- Consider the general purpose of each part: is it a description, an explanation, a procedure, or an attempt to persuade?
- Consider how data and graphics support the narrative text and how narrative text clarifies the data and graphics.
- Consider how each part of the reading relates to knowledge you gained from your investigations and activities.

Written Response

Your writing exercise is to create a handmade thank-you card for producers that shows your understanding of some of the key points in this collection about producers and you as a consumer.

- Fold a separate sheet of paper in half to make your card; you can hold the card so the fold is on the left or on the top. Attach your card to the front of this sheet when you turn it in.
- Use the cover of the card to name the organism(s) you want to thank.
- Use the inside of the card to write a thank-you message that is about 50 words long. Use details from the readings to tell the producer how they help you and how you feel about it.
- You can write your message in sentences or as poetry that rhymes or doesn't rhyme.
- On the back of your card, write your name.
- Before you begin, review the criteria in the Evaluation Guidelines that follow to help you clearly understand the expectations of the exercise.

Evaluation Guidelines

Element	1	2	3	Feedback
Content	Recipient is unclear or not appropriate; inside text shows limited or incorrect understanding of human interactions with plants and other photosynthetic organisms; the connection to any specific readings is unclear.	Recipient is named on the cover fairly clearly; inside text shows some understanding of human interactions with plants and other photosynthetic organisms made in one reading.	Recipient is clearly named on the cover; inside text shows understanding of points about human interactions with plants and other photosynthetic organisms made in two or more readings.	
Appearance	It is messy and difficult to read; design elements are missing or sloppy.	It is difficult to read in one or two places; design is basic with limited use of color or other elements.	It is very neatly written; design uses color and other elements to make an attractive presentation.	
Style of writing	Order of ideas is haphazard; chosen style is not apparent.	Order of ideas is somewhat confusing; chosen style is unevenly applied.	Ideas are in an order that make sense; chosen style is consistently applied.	
Grammar and mechanics	There are six or more errors in punctuation, capitalization, and spelling.	There are three to five errors in punctuation, capitalization, and spelling.	There are fewer than three errors in punctuation, capitalization, and spelling.	

Additional Feedback Notes:

Name: _____ Date: _____

Science Literacy Exercise Page 5 Use with Reading Collection 5

Roadmap for Reading

This week's reading collection focuses on how food and particles that make up food are transformed and move through various systems on Earth. The selections include a mock debate about the best way to deal with foods people don't eat, and you'll get to decide which of two solutions is best.

Collection 5: "Connected Lives" consists of four selections.

1. Food Chains and Webs
2. Decomposition Diaries
3. The Life of a Carbon Atom
4. Debate Transcript

As you read:

- Consider the general purpose of each part: is it a description, an explanation, a procedure, or an attempt to persuade?
- Analyze the point of view of the "author." Is it written in the first person but from a fictitious character? Or are there two people speaking to one another?
- Consider how each part of the reading relates to knowledge you gained from the previous part.

Written Response

Your writing exercise is to complete a thoughtful paragraph that evaluates two arguments presented in the reading and, possibly, offers your own.

- Compose your paragraph on a separate sheet of paper; attach this page to the front of it when you turn it in.
- Choose one of the following claims as your topic sentence.
  - *Sending food waste to a composting facility is a better way to deal with uneaten cafeteria foods than sending the waste to hog farms.*
  - *Sending food waste to hog farms is a better way to deal with uneaten cafeteria foods than sending the waste to composting facilities.*
  - *Getting students to reduce their food waste is better than sending off loads of waste to be processed.*
  - *Convincing President Simon to change how food is offered in the cafeteria is better than sending off loads of waste to be processed.*
- Build on the topic sentence to complete a well-constructed paragraph that argues in support of your claim. Use clear and scientific reasoning about the flow of matter and energy among your paragraph's supporting sentences.
- Before you begin, review the criteria in the Evaluation Guidelines that follow to help you clearly understand the expectations of the exercise.

Evaluation Guidelines

Element	1	2	3	Feedback
Content	The work makes an inadequate argument in support of the topic sentence with no references to the science in this collection.	The work is an adequate completion of a structured paragraph but weak in alignment with the topic sentence.	The paragraph provides thorough support of the chosen topic sentence, citing related scientific reasoning.	
Supporting sentences (details)	Writing contains incomplete sentences, or details irrelevant to the paragraph topic.	Writing contains complete sentences, but too few; argument is lacking in support from the reading, or unclear relationship with the topic sentence.	Paragraph includes at least six complete sentences, encompassing one or more major points from the reading that argue in support of the topic sentence.	
Organization and transitions	Statements display little clear relationship to the topic sentence or each other; paragraph is missing a concluding sentence.	Key supporting details are present, but transitions are absent or choppy; concluding sentence is present but weak.	Ideas appear in an order that helps the topic make increasingly more sense; paragraph ends with a strong concluding sentence.	
Grammar and mechanics	Six or more errors in appear punctuation, capitalization, and spelling.	Three to five errors appear in punctuation, capitalization, and spelling.	Fewer than three errors appear in punctuation, capitalization, and spelling.	

Additional Feedback Notes:

CKSci™

Core Knowledge SCIENCE™

Editorial Director

Daniel H. Franck

Source Material Attribution

Unit Development Team

Jamie Noll, Unit Lead, Northwestern University

Tara McGill, Field Test Unit Lead and Reviewer, Northwestern University

Dawn Novak, Writer, BSCS Science Learning

Meghan McCleary, Writer, University of Illinois Extension

Sue Gasper, Writer, University of Illinois Extension

Katy Fattaleh, Writer, The Nora Project

Michael Novak, Writer, Northwestern University

Kate Cook-Whitt, Writer, Maine Mathematics and Science Alliance

Emily Harris, Writer, BSCS Science Learning

Tyler Scaletta, Writer, Chicago Public Schools

Katie Van Horne, Assessment Specialist

Kelsey Edwards, Project Coordinator, Northwestern University

Christina Murzynski, Project Coordinator, Northwestern University

Misty Richmond, Pilot Teacher, James Ward School

Mary Colannino, Teacher Advisor, Hugh B. Bain Middle School

Elizabeth Xeng de los Santos, Advisory Team, University of Nevada - Reno

Chris Griesemer, Advisory Team, University of California - Davis

Cindy Passmore, Unit Advisory Chair, University of California - Davis

Production Team

BSCS Science Learning

- Christine Osborne, Copyeditor, Independent Contractor
- Valerie Maltese, Marketing Specialist & Project Coordinator
- Alyssa Markle, Project Coordinator
- Chris Moraine, Multimedia Graphic Designer

OpenSciEd

James Ryan, Executive Director

Sarah Delaney, Director

Developers Consortium Leadership

Daniel C. Edelson, Director

Audrey Mohan, Associate Director

Professional Learning Center at Boston College

- Katherine McNeill, Director
- Renee Affolter, Assoc. Director

Instructional Materials Center at BSCS Science Learning

- Daniel C. Edelson, Director
- Audrey Mohan, Assoc. Director

Field Test Implementation and Evaluation Center at Charles A. Dana Center, The University of Texas at Austin

- Carolyn Landel, Director
- Sara Spiegel, Assoc. Director, Implementation
- Carol Pazera, Assoc. Director, Evaluation

Field Test Evaluation Center at Digital Promise

- Andrew Krumm, Director
- William Penuel, University of Colorado, Boulder, Co-Director

Instructional Materials Center at Northwestern University

- Brian Reiser, Director
- Michael Novak, Assoc. Director

State Steering Committee

California
- Kathy DiRanna
- Phil Lafontaine
- Jill Grace

Iowa
- Tami Plein

Louisiana
- Jill Cowart
- Lydia Hill
- Breigh Rhodes

Massachusetts
- Erin Hashimoto-Martell
- Nicole Scola
- Hillary Metcalf

Michigan
- Mary Starr

New Jersey
- Michael Heinz

New Mexico
- Yanira Vazquez
- Shafiq Chaudhary

Oklahoma
- Tiffany Neill
- Susan Wray

Rhode Island
- Kate Schulz
- Erin Escher

Washington
- Ellen Ebert

Field Test Teachers

California
- Lana Albertson
- Zoe Carpenter
- Kathryn Ducharme
- Michel Perez

Iowa
- Jody Bigger
- Brandy Borg
- Kari Etherington
- Anne Friederich
- Nancy Johnson
- Shawn Johnson
- Will Warren
- Ryan Zittritsch

Massachusetts
- Maria Citrin
- Charles Hickey
- Deserea Meristil
- Jamie Mitchell
- Roselynn Rodriguez
- Julie Callanan
- Elizabeth Packhem

Michigan
- Cheryl Czarnik
- Sandie Dameron
- Stephani Dzubak
- Craig Goff
- Shannon McNamara
- Heather Schulz
- Al Schweihofer

New Jersey
- Kristen Haycook
- Ashley Komal
- Zachary Kovach
- Evelyn Lees
- Amanda Leighton
- James McGinn
- David Parke
- Beth Snyder
- Conover White

New Mexico
- Theresa Armijo
- Sandra Beaudet
- Nadine Brady
- Jawna Carlo
- Denise Garcia
- Keith Hamilton
- Joan Henderson
- Gina Jones
- Lillian Montoya
- Kim Orphal
- Kerrie Thatcher

Oklahoma
- Rennie Brewer
- Sharolyn Davis
- Kelli McDonald
- Kristi McMurtry
- Tracy Roberts-Hoover
- Shelby Stapleton

Rhode Island
- Mary Colannino
- John Labriola
- Alyssa Wood
- Jackie Zahm

Washington
- Karin Akmal
- Scott Borgmann
- Sacha Buller
- Bridget Burke
- Fa Fairbank
- Gregory Glascock
- Scott Hagensen
- Katie James
- Maureen McNulty
- Lynn Nelson
- Heather Williams

Illustrations and Photo Credits

agefotostock / Alamy Stock Photo: 5a
Ariadne Van Zandbergen / Alamy Stock Photo: 7a
Chris Hellier / Alamy Stock Photo: 6a
Cultura Creative Ltd / Alamy Stock Photo: 27c
EyeEm / Alamy Stock Photo: Cover, i
imageBROKER / Alamy Stock Photo: 8a
Grant Heilman Photography / Alamy Stock Photo: 27b
Jose Calvo / Alamy Stock Photo: 27a
Panther Media GmbH / Alamy Stock Photo: 27d

Core Knowledge Foundation

Science Literacy Development Partner

Six Red Marbles
- Carri Walters
  Executive Editor
- Kimberly Merlino
  Writer

CKSci™

Core Knowledge SCIENCE™

A comprehensive program in science, integrating topics from Earth and Space, Life, and Physical Sciences with concepts specified in the ***Core Knowledge Sequence*** (content and skill guidelines for Grades K–8).

Core Knowledge SCIENCE™
units at this level include:

Chemical Reactions and Matter
Chemical Reactions and Energy
Metabolic Reactions
Matter Cycling and Photosynthesis
Ecosystem Dynamics
Earth's Resources and Human Impact

www.coreknowledge.org

Core Knowledge Curriculum Series™

ISBN: 978-1-68380-727-8