Computational Thinking and Modeling (CTM)
Daily Do Task 2

Overview: This task builds on CTM Daily Do Task 1 that provided an introduction to the StarLogo Nova blocks-based programming environment, including how to create an account and program a project. In CTM Daily Do Task 2, you will experience the phenomenon of bananas rotting in a closed jar. Over time, the bananas seem to disappear, and the jar smells terrible when opened. These observations lead to the question: "What happened to the bananas in the jar?" You will develop a computational model using StarLogo Nova to figure out the answer to this question.

The Phenomenon

Meet Lucía. Lucía was cleaning her kitchen and found a bunch of bananas that she wanted to save and eat later. So, Lucía decided to peel the bananas and put them in a jar. Lucía closed the jar and left it on the kitchen counter.

Eight weeks went by, and Lucía completely forgot about the jar of bananas. When Lucía found the jar, she noticed that the bananas were gross! When she opened the jar, a terrible, horrible smell traveled to her nose.

Bananas in jar on day 1

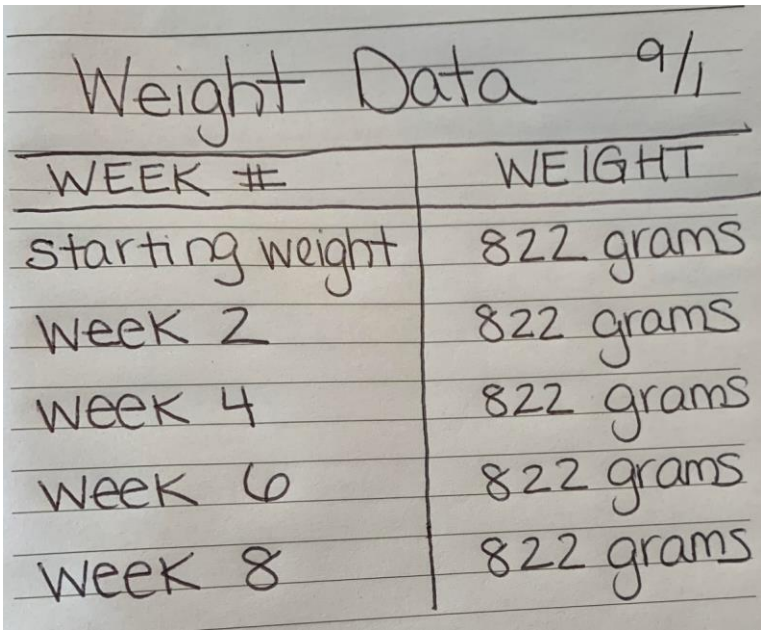
Bananas in jar after 8 weeks

Lucía wondered how the bananas could disappear when the jar was closed the entire time. She also wondered about the reason for the terrible smell. Lucía asked, **"What happened to the bananas in the jar?"**

Carrying Out an Investigation

Lucía decided to investigate her question, "What happened to the bananas in the jar?" She cut up more bananas and placed them in a tightly sealed jar. Lucía learned in science class that a tightly sealed jar is an example of a closed system because nothing can get in or out. This time, Lucía weighed the closed system with the bananas inside. She recorded the data in her science notebook.

Lucía kept the system closed and weighed it every 2 weeks for 8 weeks. She recorded the data in her science notebook:



Weight Data 9/1

WEEK #	WEIGHT
starting weight	822 grams
week 2	822 grams
week 4	822 grams
week 6	822 grams
week 8	822 grams

TRY IT OUT

With a parent, teacher, or other adult, you can create your own jar. Place slices of a fruit inside a tightly sealed, transparent jar. Weigh the jar over several weeks. Observe what happens to the fruit and to the weight of the jar. Don't forget to record your observations in your science notebook!

Think and Share:

What do you notice in Lucía's weight data of the closed system over 8 weeks?

A system has different parts, or components. What are the parts of the closed system that Lucía is using for her investigation? For example, Lucía knows the closed system includes a jar and air. What are the other components of the closed system?

1. jar
2. air

Obtaining Information

Lucía needed more information to answer her question. She found a helpful article on the Internet.

Decomposers in Our Environment

Have you ever opened the refrigerator door and immediately smelled something bad? Oops! You forgot to throw out an apple. Now the apple is rotten. What happened to the apple?

Decomposition

Decomposition is the name of a process. It's when materials break down into smaller or simpler parts. The decomposition of materials causes the properties of the materials to change. For example, the apple was red and fresh-smelling when you put it in the refrigerator. When the apple decomposed, or broke down, it turned brown and smelly. Many different types of materials decompose, such as watermelons, leaves, and bread. When these materials decompose, their properties change in similar ways. For example, all of the materials change color and start to smell bad. What causes these patterns?

Types of Decomposers

Decomposers are organisms that decompose, or break down, materials. There are two different types of decomposers: animals and microbes.

Animals

When organisms die, some animals break down the dead organisms by eating them. These animals are decomposers because they eat dead plant and animal materials. Cockroaches, earthworms, and ants are examples of animal decomposers.

Cockroach

Earthworms

Ants

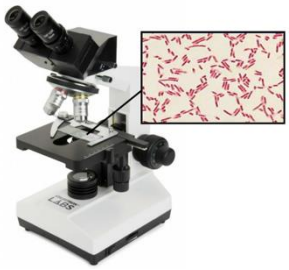
Microbes

Another type of decomposer is microbes. Similar to animal decomposers, microbes break down plant and animal materials by eating them. Bacteria and fungi are examples of microbes. Microbes decompose these materials into small pieces that end up in the soil or in the air as gases. When microbes decompose plant and animal materials, they release gases that smell. Remember, it was the decomposing apple that caused the refrigerator to smell so bad.

Microbes are so small that we cannot see them unless there are many in one place. Scientists use a special tool called an agar plate to observe microbes that are too small to see. Microbes on an agar plate multiply to a large number and appear as a blob. Scientists refer to these blobs as colonies of microbes. The colonies on an agar plate are evidence that microbes are present.

Microbes on food materials

Agar plate with colonies of microbes



Microbes enlarged under a microscope

Think and Share:

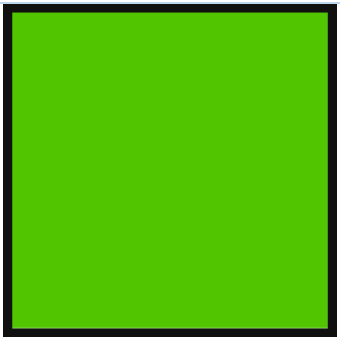
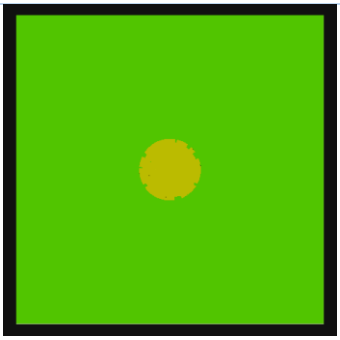
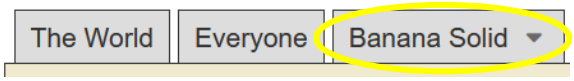
What do you predict microbes are doing in Lucía's closed system?

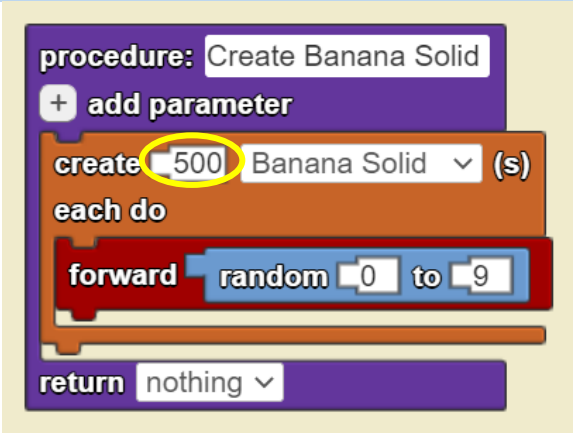
Using a Computational Model

Lucía thought that microbes caused the bananas to decompose in the jar. But she still could not completely answer her question. The bananas seemed to disappear, but the weight stayed the same. Lucía remembered from her science class that computational models, or models developed on a computer, can be useful tools for answering questions like this one.

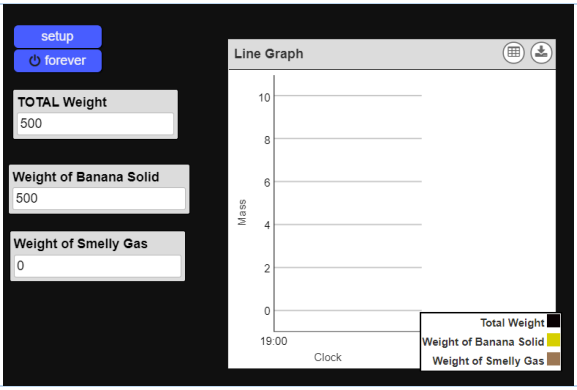
Computational models can show things too small to see, like microbes! Computational models can also be used to test ideas.

Lucía decided to develop a computational model to test her ideas about what happens when microbes break down the bananas in the jar. To test her ideas, Lucía began developing a computational model. Because a system has many parts, or components, she makes decisions on what parts to include in the model. She also makes decisions about what not to include.

	1. Lucía knows that she wants to represent a closed system in her model, just like in her investigation. Lucía decides that the green terrain will represent the closed jar.
 	2. Lucía also knows that the model should include solid banana pieces, just like in her investigation. She adds a Banana Solid agent to her model and programs the banana solids to appear in the center of the terrain.



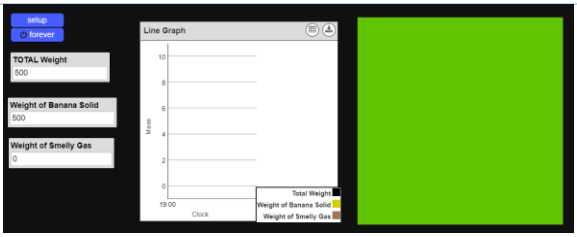
Lucía programs the model so that the Banana Solid is made up of 500 pieces.



3. Lucía also adds data boxes to keep track of the weight when she runs the model. Look at the data boxes. What 3 types of weight data is Lucía keeping track of?

4. Log in to Lucía's starter model.

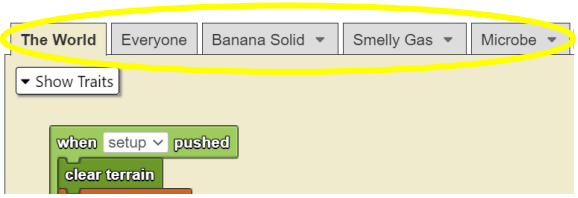
In a web browser with an Internet connection, open www.SLnova.org. Log into your account. See the CTM Daily Do Task 1 for more instructions on creating an account.



5. Open Lucía's starter model by clicking this link:

https://www.slnova.org/ams728/projects/801179/edit/

Remember, this starter model represents Lucía's closed system. The green terrain represents the closed banana jar. The yellow dots represent the solid bananas in the closed system.



6. Try out the starter model. What do you observe? Press the blue setup and forever buttons. What do you notice?

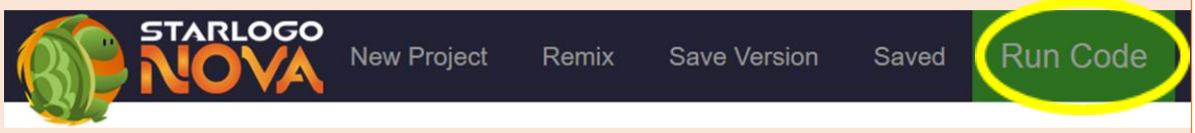
Scroll down to the code. What agents exist?

7. Scroll to the top of the page. Click remix. This will load a new version of the starter model for you to modify.

Follow the instructions on the next page to help Lucía test ideas.

DON'T FORGET TO RUN CODE!

RUN CODE is a button in the toolbar at the top of the page. When the button appears green, this means you have added or changed the code and need to update the model.



Remember, any time you add or change code in the model, click **RUN CODE** to update the model.

Using the Computational Model to Test Ideas

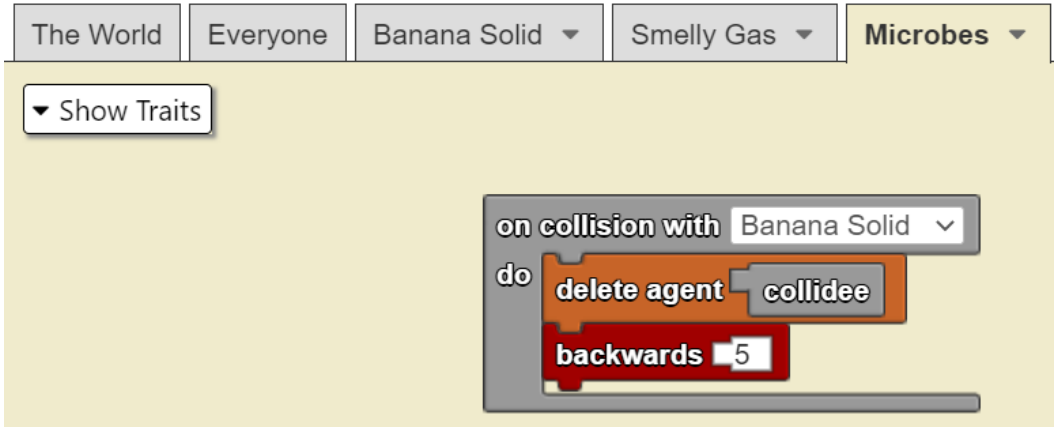
Lucía is ready to program her model to represent what happens when microbes break down the bananas in the jar. Lucía has three different ideas about how this happens.

Idea 1

Make a Prediction: Lucía used code blocks to represent her first idea. Try interpreting Lucía's code blocks. Then, predict what will happen when those code blocks are added to the computational model.

Read Code Blocks	Interpret Code Blocks	Make a Prediction
Code for microbe agent	**What is this code instructing the microbe agent to do?**	**What do you predict will happen to the weights when you run the model?**
Idea 1: 	When a microbe collides with a banana solid, the microbe deletes the banana solid and moves backwards 5 steps.	**The banana solid weight will: (check one)** ☐ Go Up ☐ Go Down ☐ Stay the Same **The smelly gas weight will: (check one)** ☐ Go Up ☐ Go Down ☐ Stay the Same **The total weight will: (check one)** ☐ Go Up ☐ Go Down ☐ Stay the Same

Program the Model: It's time to program the model! Add the following code blocks to your model under the microbe tab:

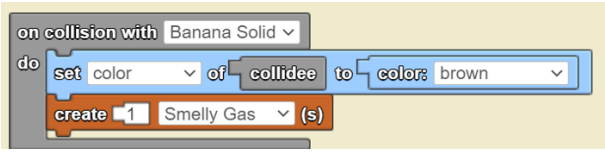


Run the model and observe what happens. Don't forget to click RUN CODE first! Stop the model at some point before all of the banana solids disappear. Record your data below:

Idea 1 	**Starting weight of the Banana Solid** _____ **Weight of the Banana Solid after running the model** _____	**Starting weight of the Smelly Gas** _____ **Weight of the Smelly Gas after running the model** _____	**Starting total weight** _____ **Total weight after running the model** _____	**Look at your data. What happened to the weight?** **The banana solid weight: (check one)** ☐ Went Up ☐ Went Down ☐ Stayed the Same **The smelly gas weight: (check one)** ☐ Went Up ☐ Went Down ☐ Stayed the Same **The total weight: (check one)** ☐ Went Up ☐ Went Down ☐ Stayed the Same

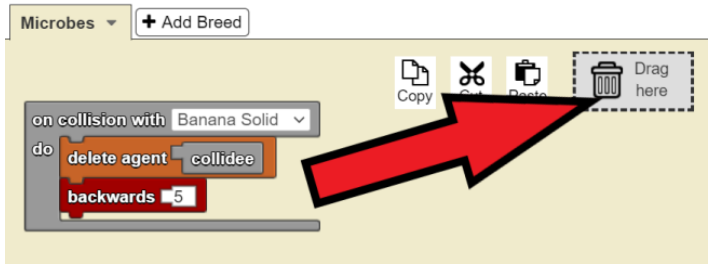
Idea 2

Make a Prediction: Lucía wants to try a second idea. Try interpreting Lucía's code blocks. Then predict what will happen when those code blocks are added to the computational model.

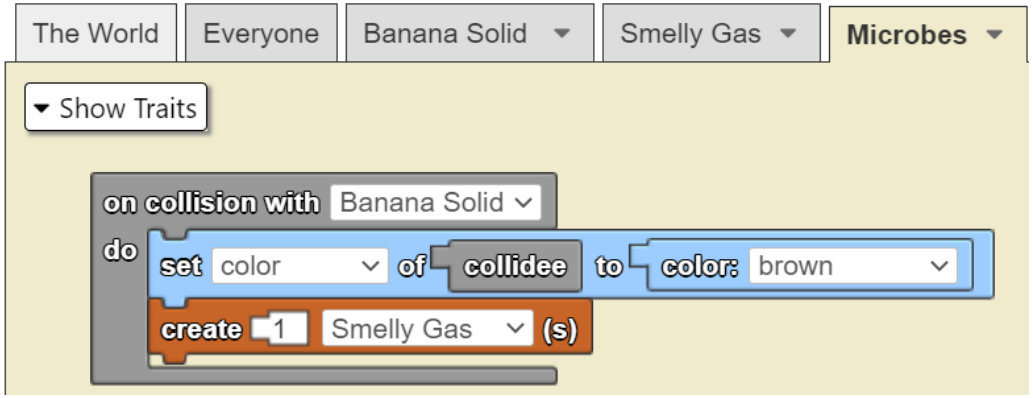
Read Code Blocks	Interpret Code Blocks	Make a Prediction
Code for microbe agent	**What is this code instructing the microbe agent to do?**	**What do you predict will happen to the weights when you run the model?**
Idea 2: 		**The banana solid weight will: (check one)** ☐ Go Up ☐ Go Down ☐ Stay the Same **The smelly gas weight will: (check one)** ☐ Go Up ☐ Go Down ☐ Stay the Same **The total weight will: (check one)** ☐ Go Up ☐ Go Down ☐ Stay the Same

Program the Model: It's time to program the second idea!

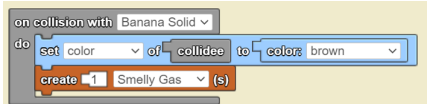
Delete the code you added in the microbe tab for Idea 1 by dragging the blocks into the trash can.



Add the following code blocks to your model under the microbe tab:

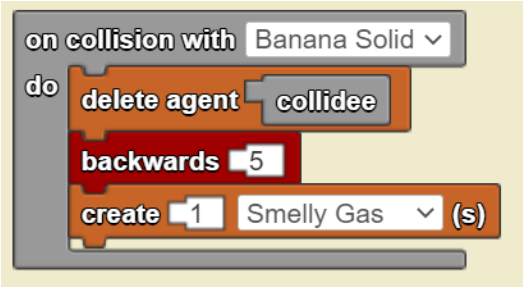


Run the model and observe what happens. Don't forget to click RUN CODE first! Stop the model at some point before all of the banana solids disappear. Record your data below:

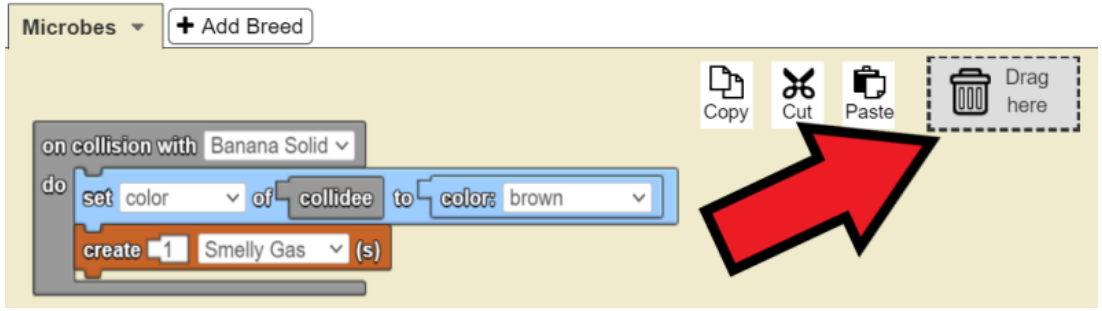
Idea 2 	**Starting weight of the Banana Solid** _____ **Weight of the Banana Solid after running the model** _____	**Starting weight of the Smelly Gas** _____ **Weight of the Smelly Gas after running the model** _____	**Starting total weight** _____ **Total weight after running the model** _____	**Look at your data. What happened to the weight?** **The banana solid weight: (check one)** ☐ Went Up ☐ Went Down ☐ Stayed the Same **The smelly gas weight: (check one)** ☐ Went Up ☐ Went Down ☐ Stayed the Same **The total weight: (check one)** ☐ Went Up ☐ Went Down ☐ Stayed the Same

Idea 3

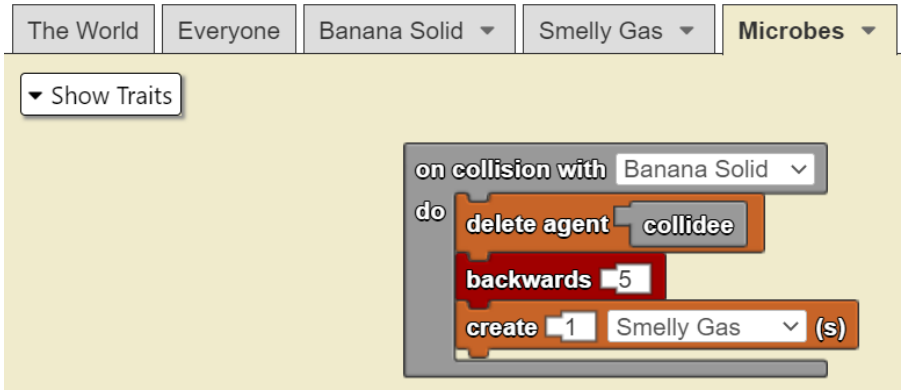
Make a Prediction: Lucía wants to try a second idea. Try interpreting Lucía's code blocks. Then predict what will happen when those code blocks are added to the computational model.

Read Code Blocks	Interpret Code Blocks	Make a Prediction
Code for microbe agent	**What is this code instructing the microbe agent to do?**	**What do you predict will happen to the weights when you run the model?**
Idea 3: 		**The banana solid weight will: (check one)** ☐ Go Up ☐ Go Down ☐ Stay the Same **The smelly gas weight will: (check one)** ☐ Go Up ☐ Go Down ☐ Stay the Same **The total weight will: (check one)** ☐ Go Up ☐ Go Down ☐ Stay the Same

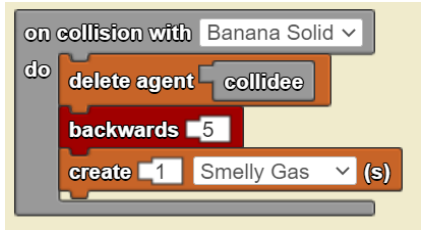
Program the Model: It's time to program the third idea!
Delete the code you added in the microbe tab for Idea 2 by dragging the blocks into the trash can.



Add the following code blocks to your model under the microbe tab:



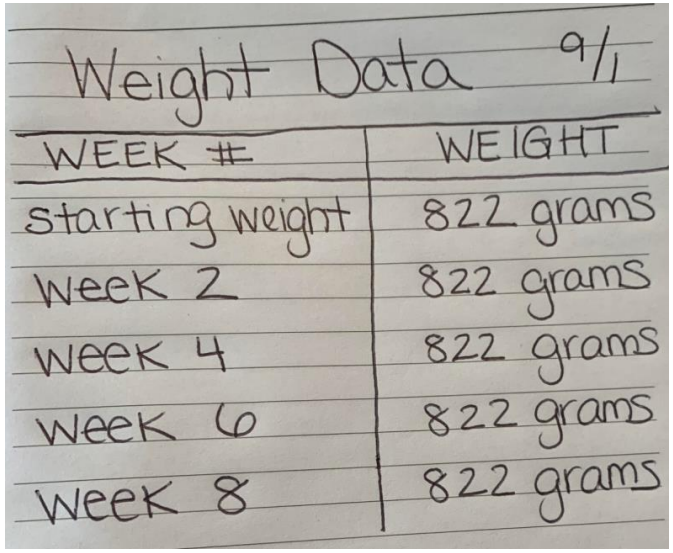
Run the model and observe what happens. Don't forget to click RUN CODE first! Stop the model at some point before all of the banana solids disappear. Record your data below:

Idea 3 	**Starting weight of the Banana Solid** _____ **Weight of the Banana Solid after running the model** _____	**Starting weight of the Smelly Gas** _____ **Weight of the Smelly Gas after running the model** _____	**Starting total weight** _____ **Total weight after running the model** _____	**Look at your data. What happened to the weight?** **The banana solid weight: (check one)** ☐ Went Up ☐ Went Down ☐ Stayed the Same **The smelly gas weight: (check one)** ☐ Went Up ☐ Went Down ☐ Stayed the Same **The total weight: (check one)** ☐ Went Up ☐ Went Down ☐ Stayed the Same

Optional: If you have another idea try it out!

Think and Share:

What is the pattern you notice when you compare the weight data from the computational model and the weight data from the banana jar in Lucía's kitchen?



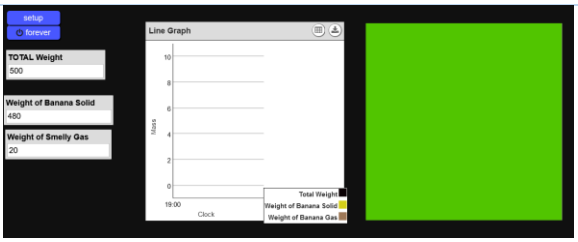
Weight Data 9/1

WEEK #	WEIGHT
starting weight	822 grams
week 2	822 grams
week 4	822 grams
week 6	822 grams
week 8	822 grams

Based on the pattern you notice, which idea best represents what happens when microbes break down the bananas in the jar?

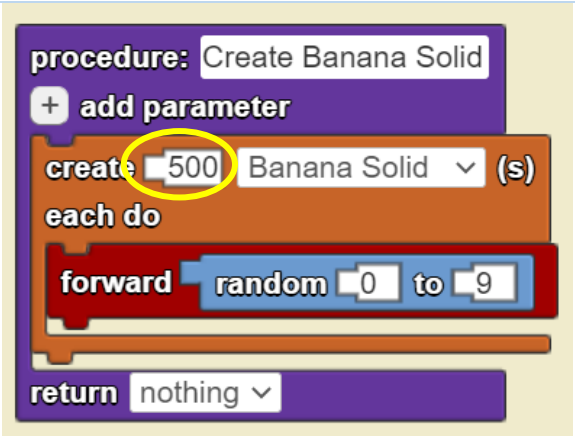
Using the Computational Model to Test More Ideas

Lucía figured something out! The microbes decomposed the solid banana and produced a smelly gas. After developing a model, Lucía had a new question. What will happen to the **total weight** of the system if more bananas are added to the jar? Help Lucía use the computational model to answer this question.



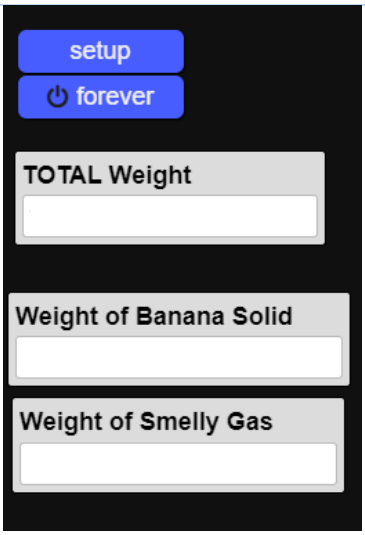
1. Open Lucía's model by clicking this link:

https://www.slnova.org/ams728/projects/801181/edit/



2. Scroll down to the code in the World tab. Find the Create Banana Solid procedure block.

Notice that the Banana Solid is made up of 500 pieces.



3. Run the model. Observe what happens. Record the weight data below.

Starting Number of Banana Solid pieces = 500 pieces

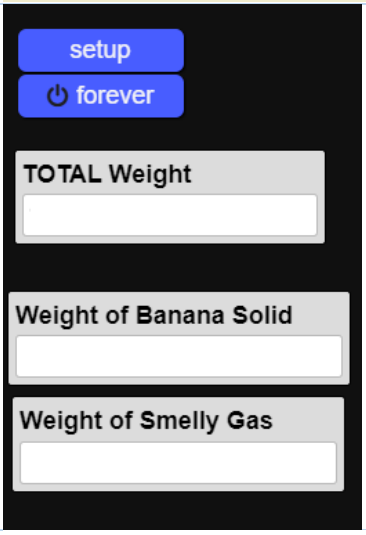
Starting Total Weight = 500

Total Weight after running the model =

4. Lucía wanted to know what would happen to the total weight if she added more bananas to the jar.

Change the code so that, instead of starting with 500 Banana Solid pieces, Lucía starts with 1,000 Banana Solid pieces.

Click **RUN CODE**.

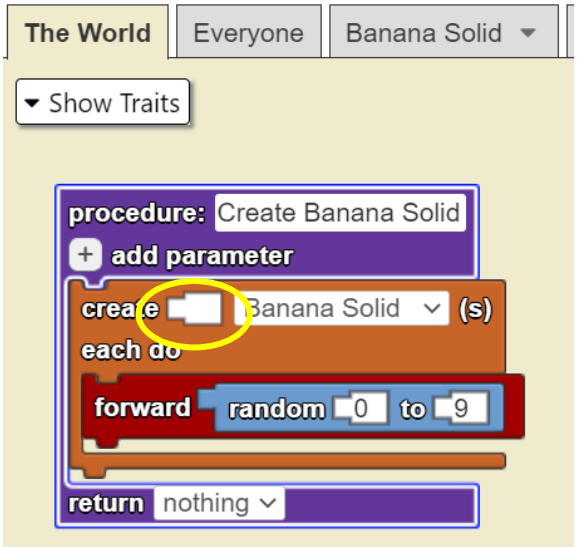


5. Run the model. Observe what happens. Record the weight data below.

Starting Number of Banana Solid pieces = 1,000 pieces

Starting Total Weight = 1,000

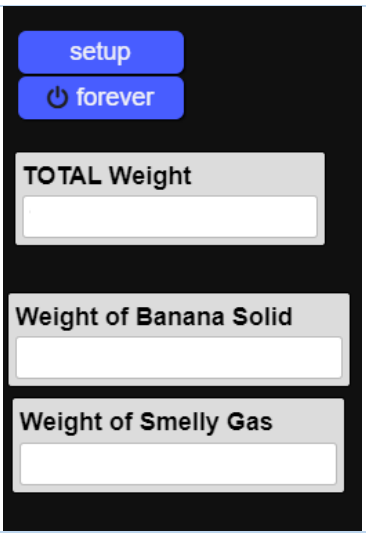
Total Weight after running the model =



6. Choose your own number of banana solid pieces to start with.

Change the code to the starting number that you chose.

Don't forget to click **RUN CODE**.



7. Run the model. Observe what happens. Record the weight data below.

Starting Number of Banana Solid pieces =

_____ pieces

Starting Total Weight = _____

Total Weight after running the model =

_____

Think and Share:

Compare the starting total weight and the total weight after running the model in each trial. What happened to the total weight of the system after running the model?

Where did the solid banana matter go?

Why did that happen to the total weight of the system?

Answering the Question

You helped Lucía figure out the answer to her question, **What happened to the bananas in the jar**? Lucía wants to share her findings with her science class at school!

In the box below, describe what is happening in the closed system of the jar.

Don't forget to use Lucía's investigation data and the data from your computational model. Your answer may include pictures, symbols, words, and numbers.

Key concepts and ideas
closed system, components, microbes, solid banana, smelly gas, weight