Nature via Nurture

Unit 3

Sharing and Use

This slide deck is intended to help guide you and your students through the sequence of this unit. While you may choose to use these slides as a helpful tool to prompt and facilitate students, all detailed information for each unit is in the student and teacher unit booklets.

Unit Essential Question

How can we use environmental and genetic factors to explain changes in organisms?

The Mystery of the Algal Bloom

Lift-Off Task

The Toxic Algal Bloom in Lake Temescal

https://abc7news.com/health/toxic-algae-bloom-in-oaklands-lake-temescal-prompts-closure/2156561/ (Pause at 1:30)

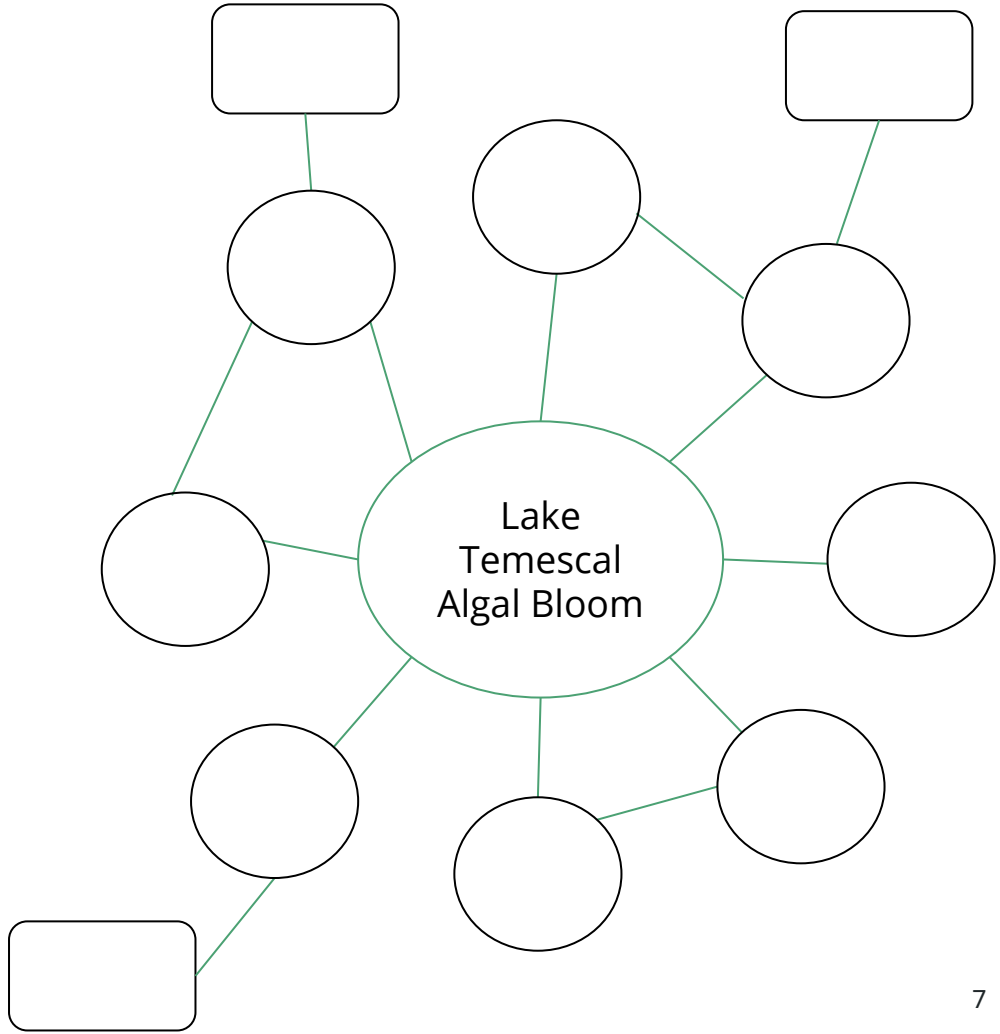
Generate Questions!

If you wanted to know more about what the toxic algal bloom in Lake Temescal, what questions would you ask?

Group Concept Map

As a group, create a concept map that shows:

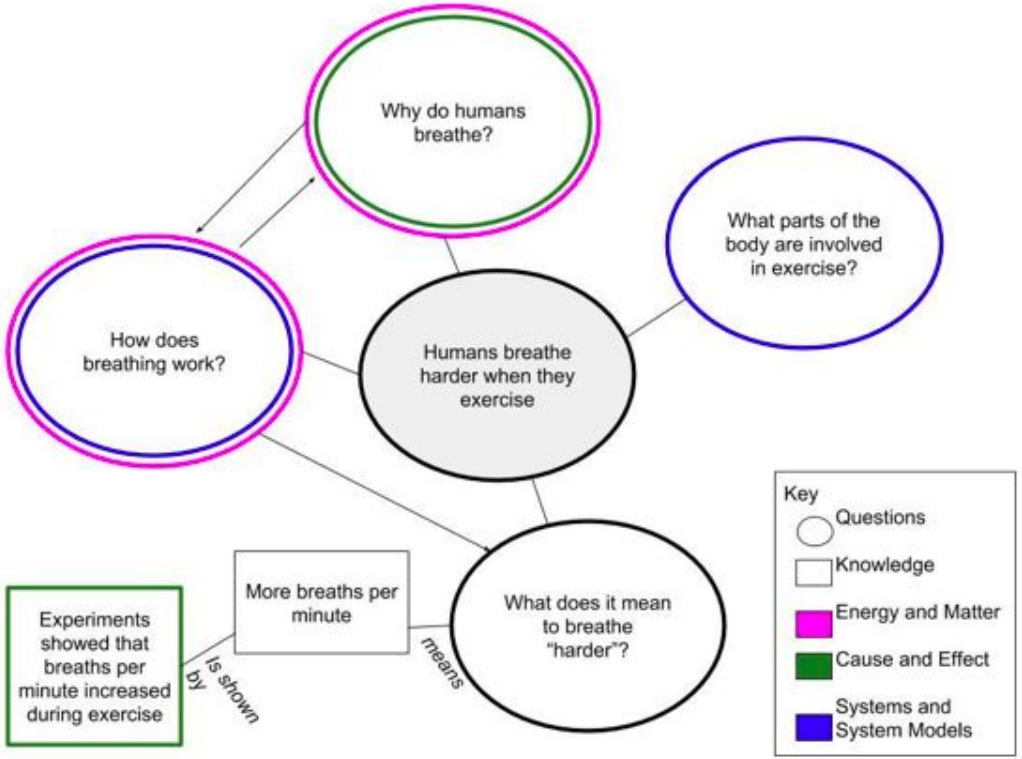
- Questions your group members had in common (circles)
- Possible answers to some questions (squares)
- Connections between related questions (lines)



Class Concept Map

As a class, create a concept map that shows:

- Key questions (circles)
- Possible answers to some questions (squares)
- Connections between related questions (lines)
- Crosscutting concepts used (trace in color)



Introduction to the Culminating Project

Solve the Mystery of the Local Algal Bloom and Advocate For a Solution

Group Project - Create a News Report Update on the Local Algal Bloom Issue

Individual Project - Write a Letter to the Town Mayor Advocating For a Solution to the Local Algal Bloom Issue

Background Information - Location

- The lake is located in the middle of a neighborhood of residential homes.
- It is fed by a small creek that travels through homes and a number of small farms on the outskirts of the neighborhood.

Background Information - Description of Algae

- The toxic algae in the lake is also known as “blue-green algae”
- Technically, it is not algae at all; it is a bacteria called *Cyanobacteria*
- *Cyanobacteria* do photosynthesis, just like algae
- Water temperatures above 75° Fahrenheit are optimal for *Cyanobacteria* to grow
    - Most other types of algae, which are not toxic, grow best at temperatures between 53° and 59° Fahrenheit

Background Information - History of Algal Blooms in the Area

	Presence of Toxic Algal Bloom in Local Lake	Average Summer Temperature (° F)	Annual Rainfall (inches)
4 Years Ago	No	78° F	30 inches
3 Years Ago	Yes	80° F	37 inches
2 Years Ago	No	80° F	30 inches
1 Year Ago	Yes	84° F	31 inches
This Year	Yes	85° F	34 inches

Think-Pair-Share

Discuss what you know so far and make some initial hypotheses: What does this background information tell you about the lake problem?

Connecting to the Culminating Project

You have been asked to give a news story update on a local lake that is also suffering from a recurring toxic algal bloom. Based on what you learned from the Lake Temescal news story and the background information about the local lake you are focusing on, answer the following questions.

- Why are algal blooms a problem?
- What do you think might be causing the algal bloom in the local lake?

Complete this **individually** in your Project Organizer.

Reflection

Complete the questions at the end of your student guide to reflect on what you have learned in the Lift-Off Task.

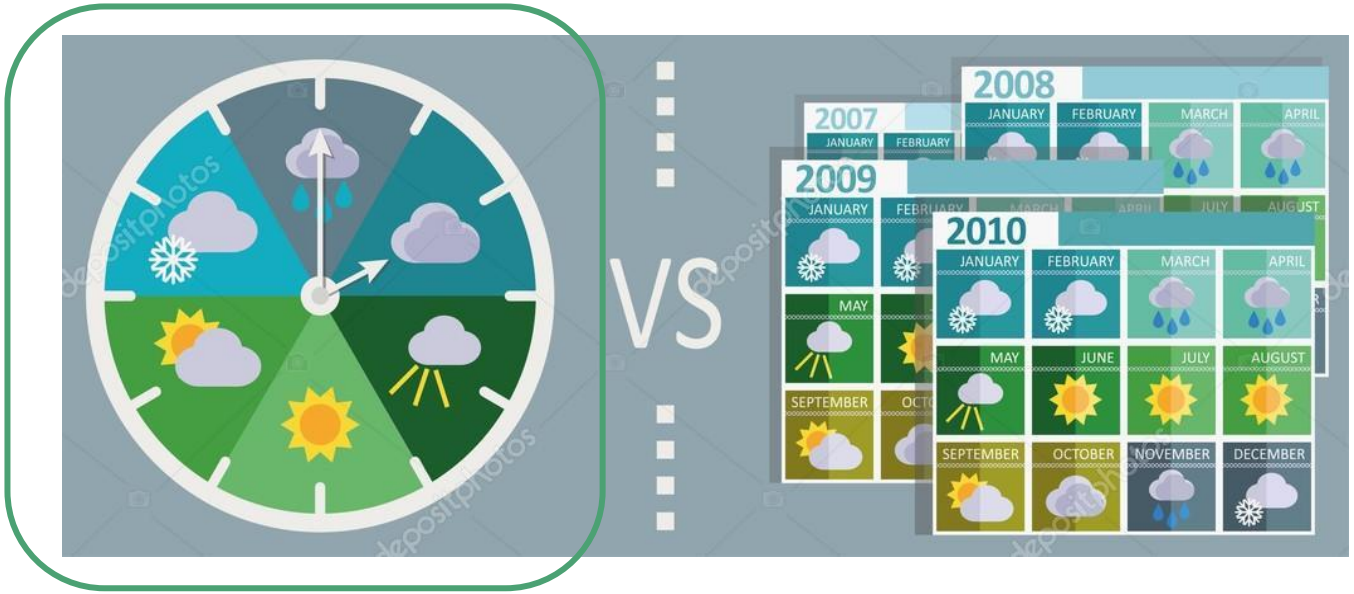
Forecasting the Weather

Task 1

What questions do you still have?

Engage

In Unit 2, you learned about climate



In this task, we will focus on weather!

Watch a Weather Forecast From the Lake Temescal Region!

https://abc7news.com/weather/accuweather-forecast-atmospheric-river-arrives-today/39468/

In pairs, discuss different examples of weather conditions.

Explore

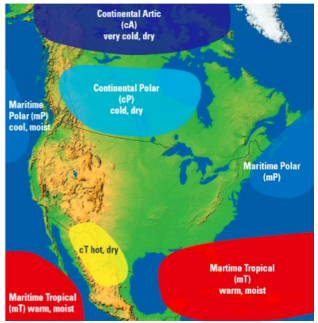
This Year's Weather in Oakland - Lots of Winter Storms and an Unusually Warm Summer

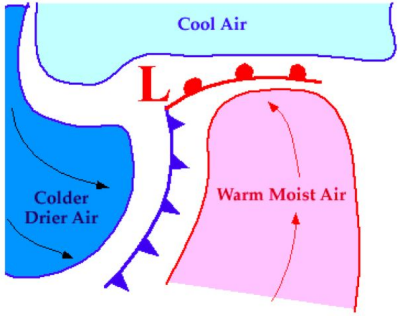
	Presence of Toxic Algal Bloom in Local Lake	Average Summer Temperature (° F)	Annual Rainfall (inches)
4 Years Ago	No	78° F	30 inches
3 Years Ago	Yes	80° F	37 inches
2 Years Ago	No	80° F	30 inches
1 Year Ago	Yes	84° F	31 inches
This Year	Yes	85° F	34 inches

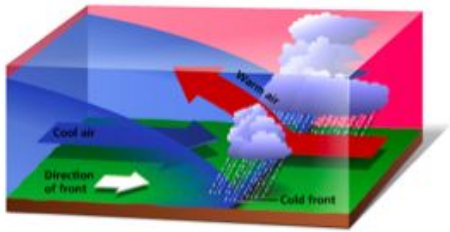
Planning and Carrying Out Investigations

In groups, collect data to make sense of why regions like Oakland, experience the kinds of weather they do.

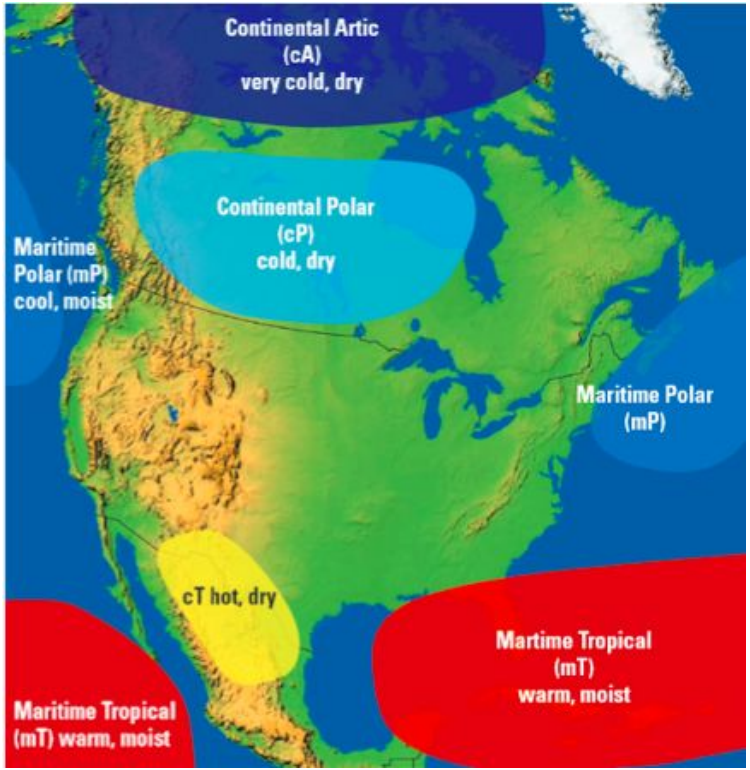
- Use the resource cards provided by your teacher to learn about causes of weather
- Record your data analysis in the chart in your Student Guide



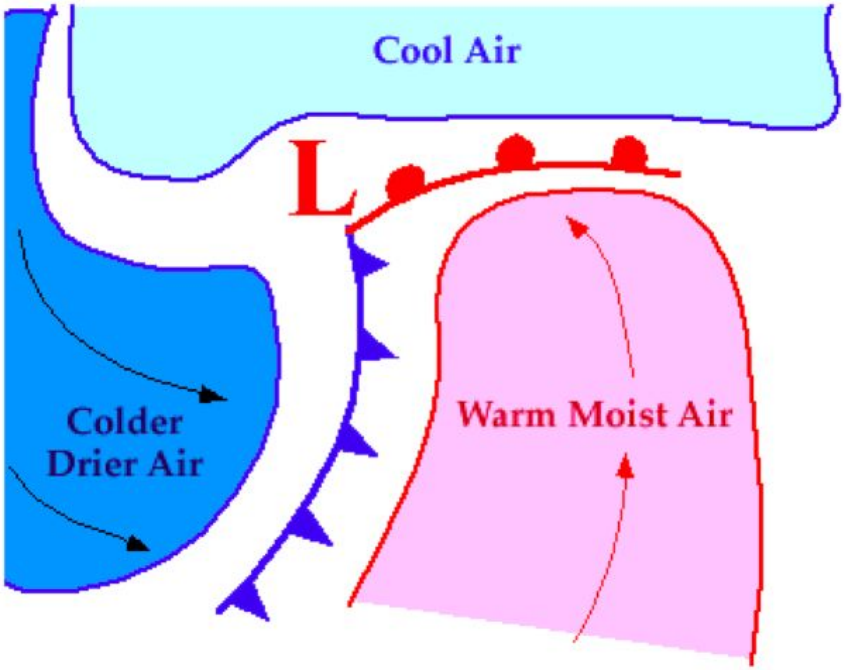




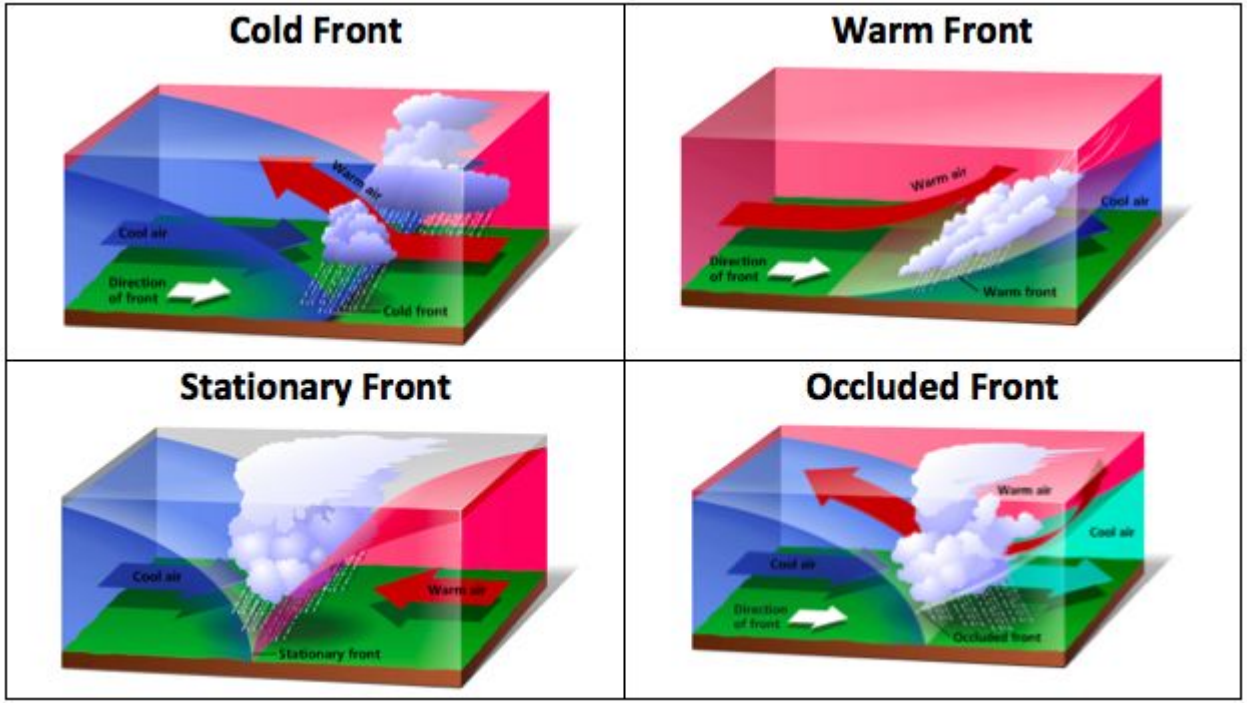
Class debrief - Air Masses



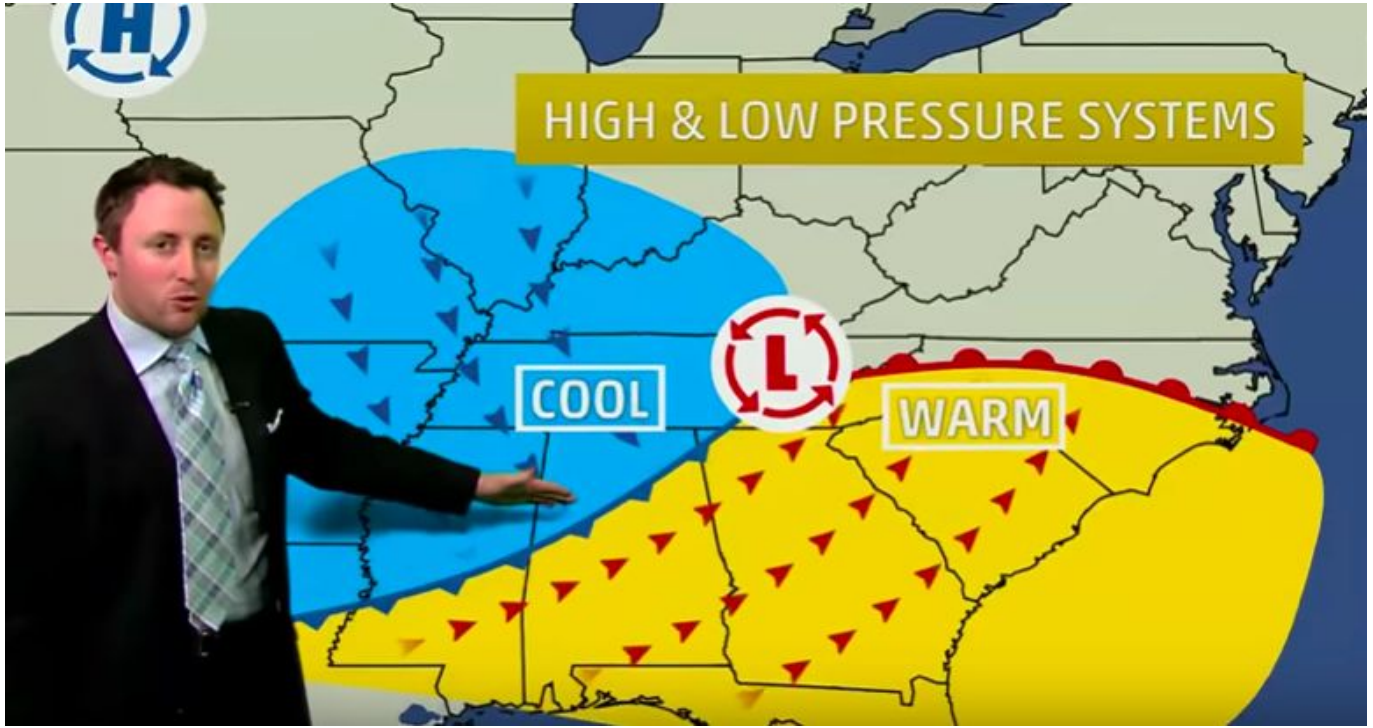
Class debrief - How Air Masses Move



Class debrief - Weather Fronts



Class debrief - Weather Maps and Pressure Systems



Explain

What are some possible causes for Oakland's storms in winter and high temperatures in summer?

	Presence of Toxic Algal Bloom in Local Lake	Average Summer Temperature (° F)	Annual Rainfall (inches)
This Year	Yes	85° F	34 inches

Individually, write and/or draw diagrams to explain Oakland's storms in winter and unusually high temperatures in summer.

Elaborate

Stronger Clearer

1. **Individual Think Time:** What will you say to your partner without looking at your explanation or diagram?

2. **Partner Discussions:**
   a. **Student A:** Describe your explanation/diagram.
   b. **Student B:** Listen and ask clarifying questions.
   c. **Student A and Student B:** Write down any notes to make your explanation/diagram stronger and clearer.

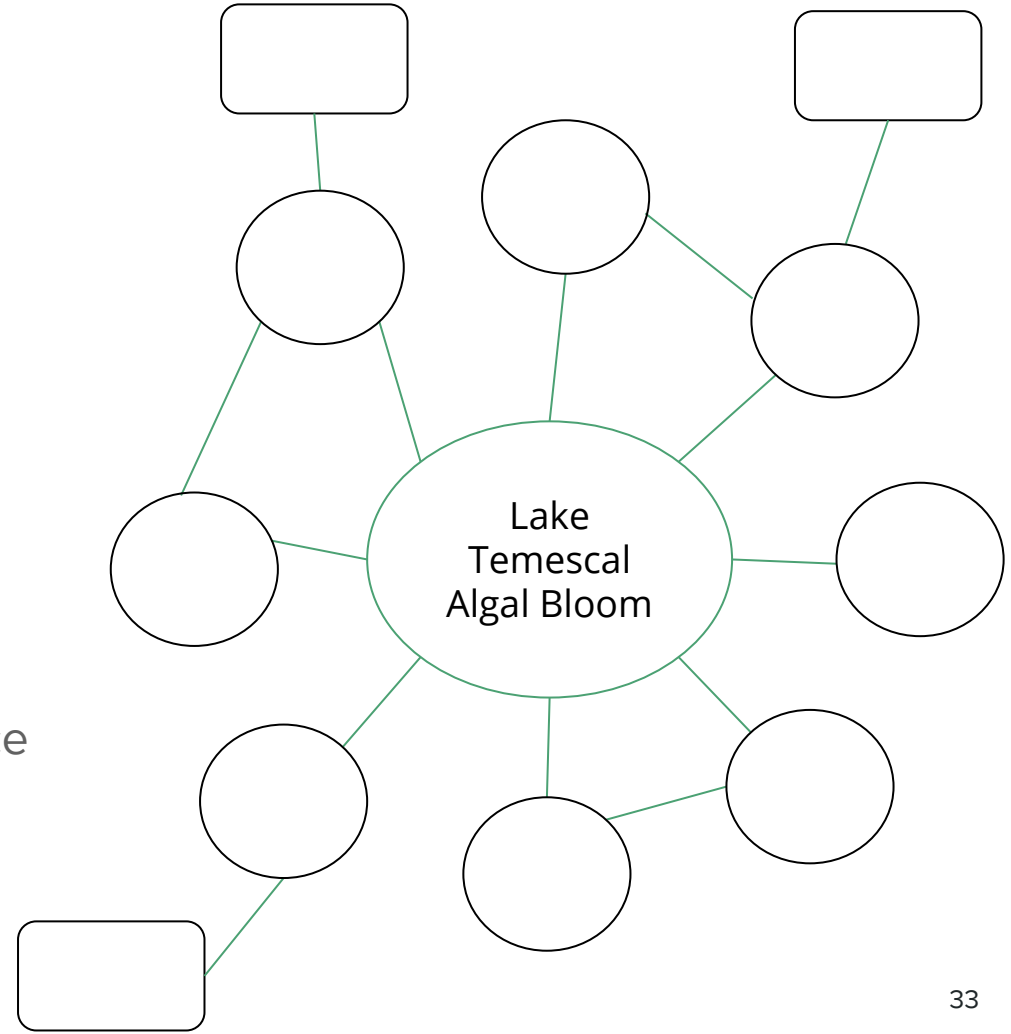
3. **Repeat with 2 more partners!**

4. **Revise your explanation/diagram.**

Class Concept Map

Add to your class concept map:

- New questions (circles)
- New ideas learned (squares)
- New connections (lines and connector words)
- Crosscutting concepts used (trace in color)
    - Cause and Effect



Evaluate

Connecting to the Culminating Project

You have been asked to give a news story update on a local lake that is suffering from a recurring toxic algal bloom. In your Culminating Project document, you were given background information on the region where the lake is located. Review this information and answer the following questions:

- How has the weather changed from year to year?
- Based on what you learned about air masses and weather fronts, what causes these different kinds of weather?
- What role might weather play in algal blooms, based on the data?

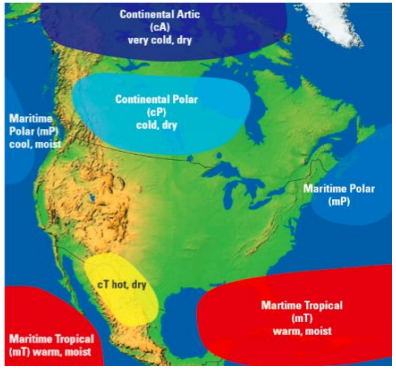
Reflection

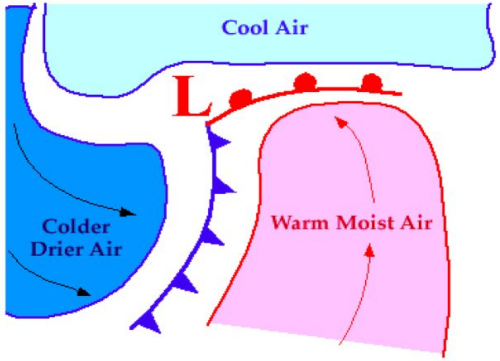
Complete the questions at the end of your student guide to reflect on what you have learned in Task 1.

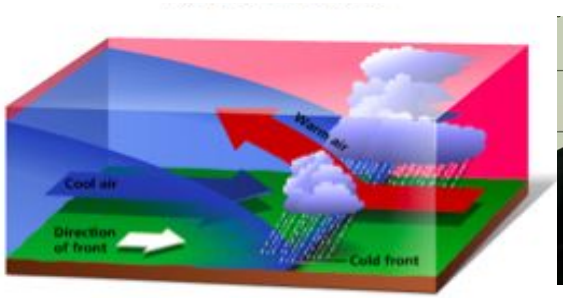
What Affects Plant Growth?

Task 2

What questions do you still have?







Engage

Weather Causes Environmental Changes For Plants and Animals

In pairs, use your prior knowledge to discuss:

1. What do plants need to grow?
2. How do you think changing these environmental conditions would affect the growth of plants?

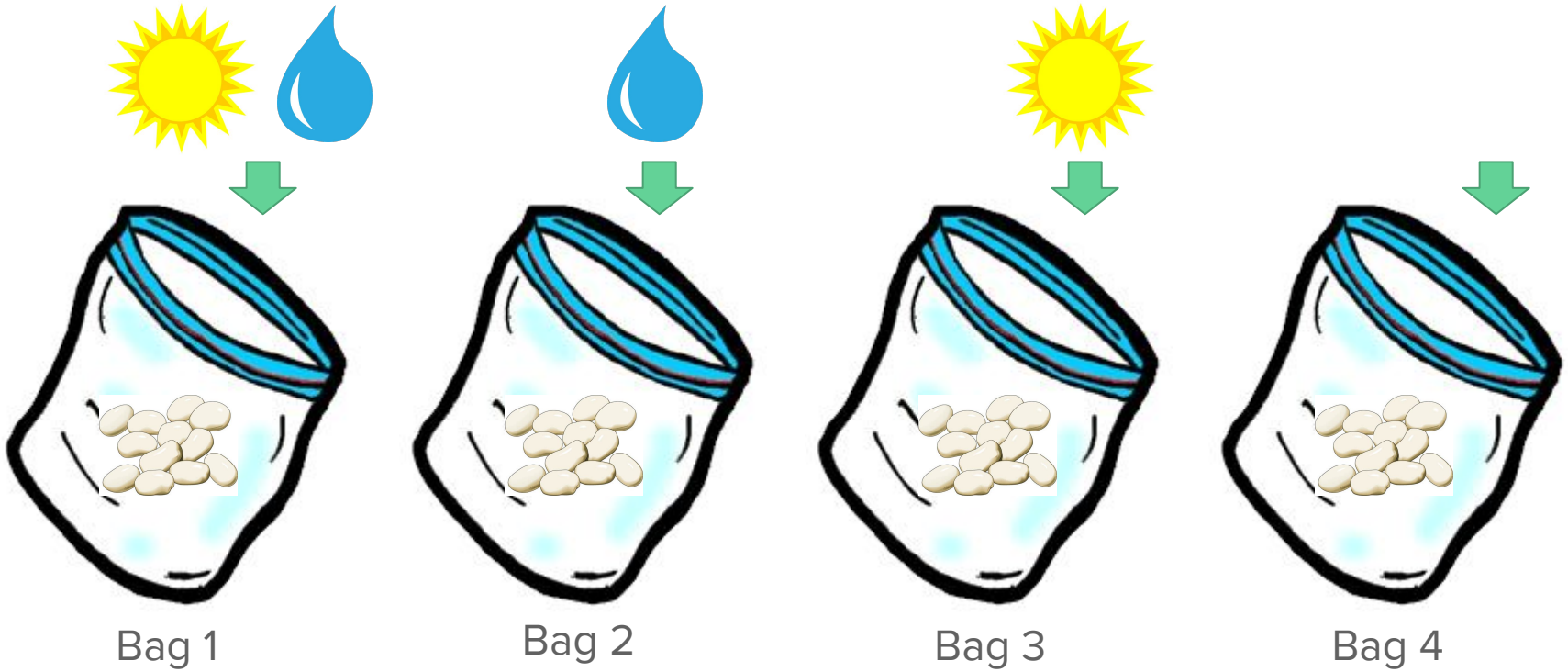
Explore

Do Environmental Conditions Affect Plant Growth?

With your group,

1. Follow the procedure in your Student Guide to conduct an investigation.
2. Record your data in the table in your Student Guide.

Do Environmental Conditions Affect Plant Growth?



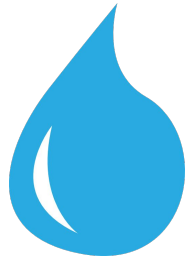
Class Debrief - What Did You Observe?

Explain

Constructing Explanations

Remember from the last task that weather conditions can change the environment for plants. What if Oakland had more rainy days one winter? What if Oakland had more sunny days one summer? How might these kinds of environmental factors affect plant growth?

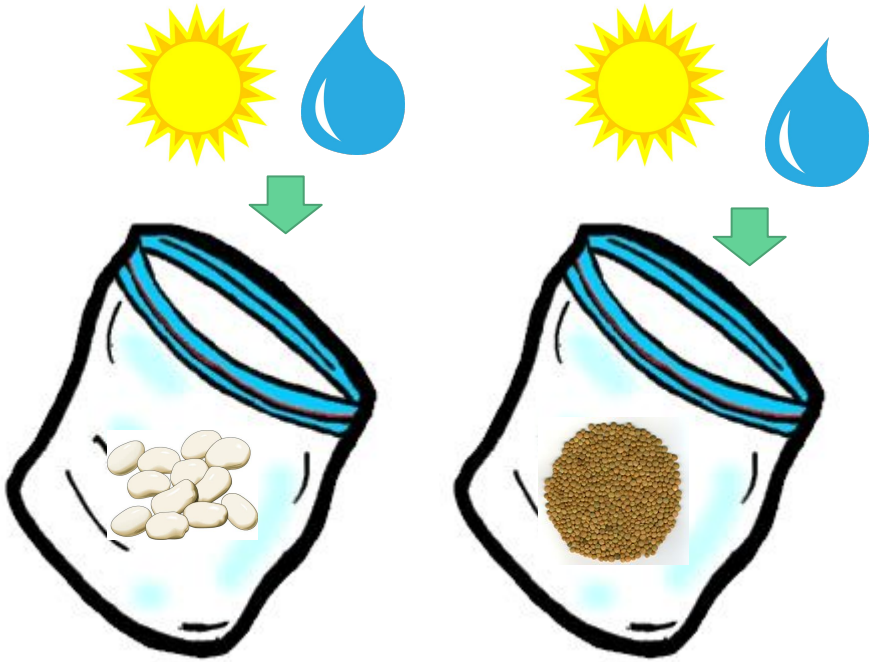
	Average Summer Temperature (° F)	**Annual Rainfall (inches)**
This Year	85° F	34 inches



Individually, construct an explanation to answer this question, using evidence from your investigation to support your claim.

Elaborate

You decide to repeat your investigation using different type of plant - Lentils



Lima Beans

Lentils

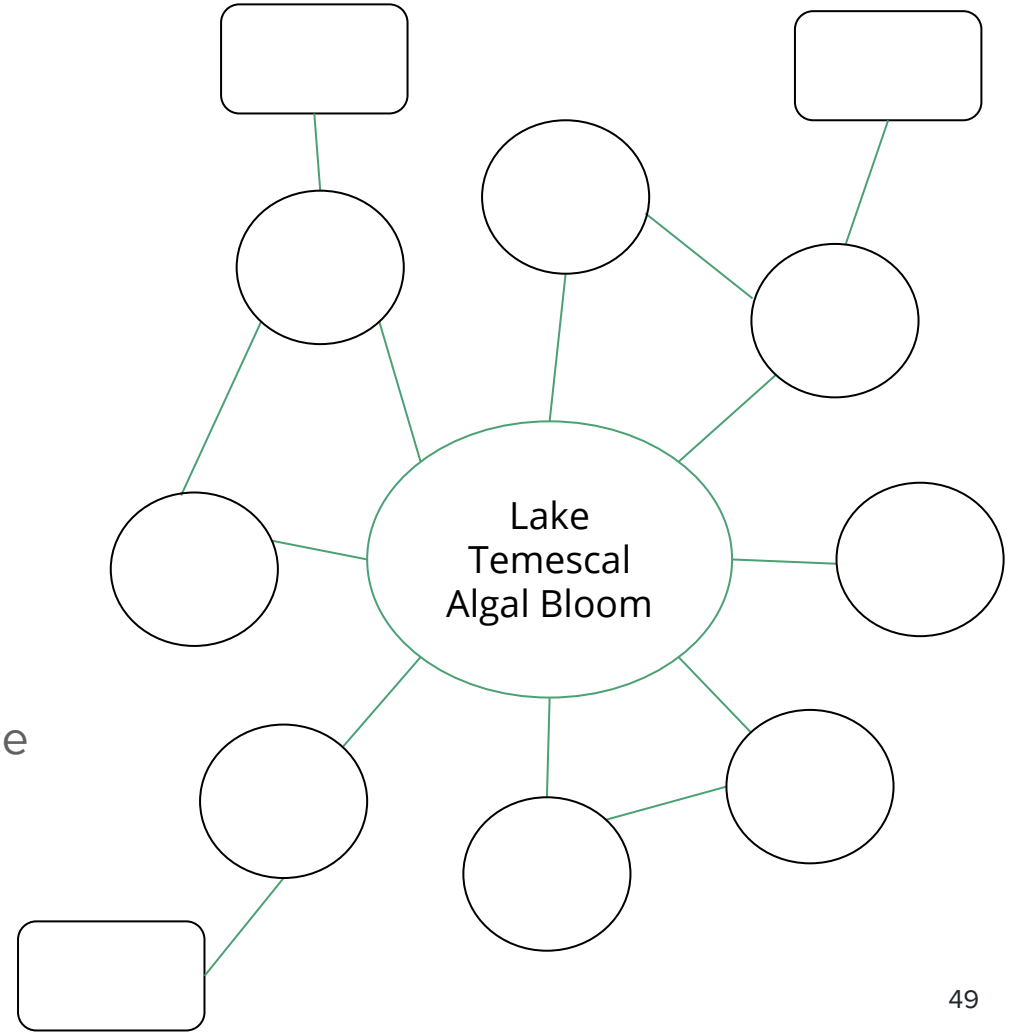
You give them the same amount of water and sunlight as your other plant in Baggie #1, but there is much less growth!

How can you explain this? Discuss and make a hypothesis with a partner.

Class Concept Map

Add to your class concept map:

- New questions (circles)
- New ideas learned (squares)
- New connections (lines and connector words)
- Crosscutting concepts used (trace in color)
    - Cause and Effect



Evaluate

Connecting to the Culminating Project

You have been asked to give a news story update on a local lake that is suffering from a recurring toxic algal bloom. We have seen how environmental factors can play a role in the growth of organisms.

- What natural environmental factors do you think affect the growth of the toxic algae?
  - How does the data from the Culminating Project handout support this?
- Do some research on what other environmental factors might also be affecting the growth of the toxic algae. What else might be causing algal blooms besides weather conditions?

Complete this **individually** in your Project Organizer.

Reflection

Complete the questions at the end of your student guide to reflect on what you have learned in Task 2.

Genetics or Environment?

Task 3

What questions do you still have?

Engage

The “Nature vs. Nurture” Argument

Nature = Genetics

Nurture = Environment

What do you think makes you who you are today? Nature or nurture?

Mo and Jasper, long-lost twins, are having the same argument

https://www.youtube.com/watch?v=udCtpMZ95r0 (Stop at 2:15)

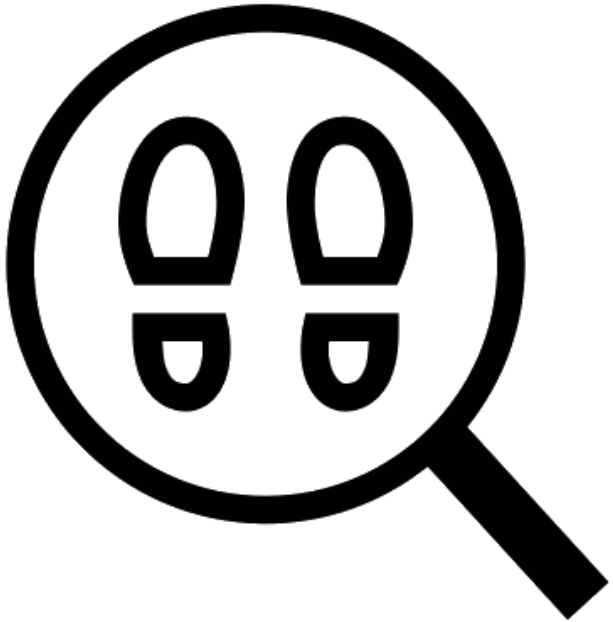
Make a hypothesis: What do you think made them the way they are --genetics or environment?

Let’s Take a Vote!

What do you think made Mo and Jasper the way they are --genetics or environment?

Explore

To help answer this question, we need evidence!



In groups,

- Visit the research stations to learn more about the role of genetics and environment in different contexts
- Record your analysis in the evidence chart in your Student Guide

Explain

Back to Mo and Jasper

https://www.youtube.com/watch?v=udCtpMZ95r0

Gather more information from the video and take notes in your Student Guide

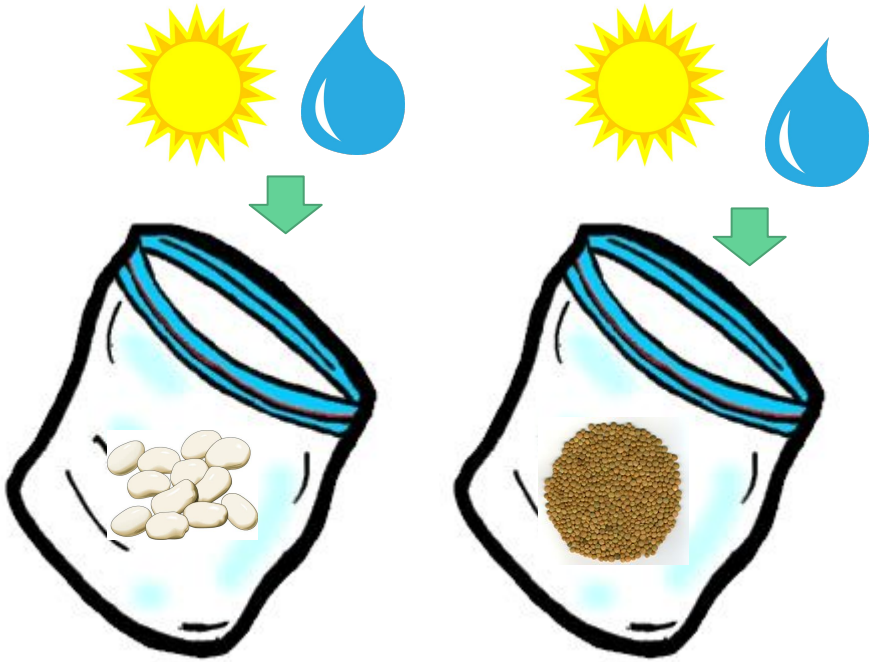
Constructing Explanations

Mo said it was environment that made them who they are; Jasper says it was because of genetics. Which is it?

Individually, construct an explanation to answer Mo's and Jasper's question, using multiple pieces of evidence from your Task 2 investigation, the *Explore* stations, and the video to support your claim .

Elaborate

Think back to the scenario from Task 2



Lima Beans

Lentils

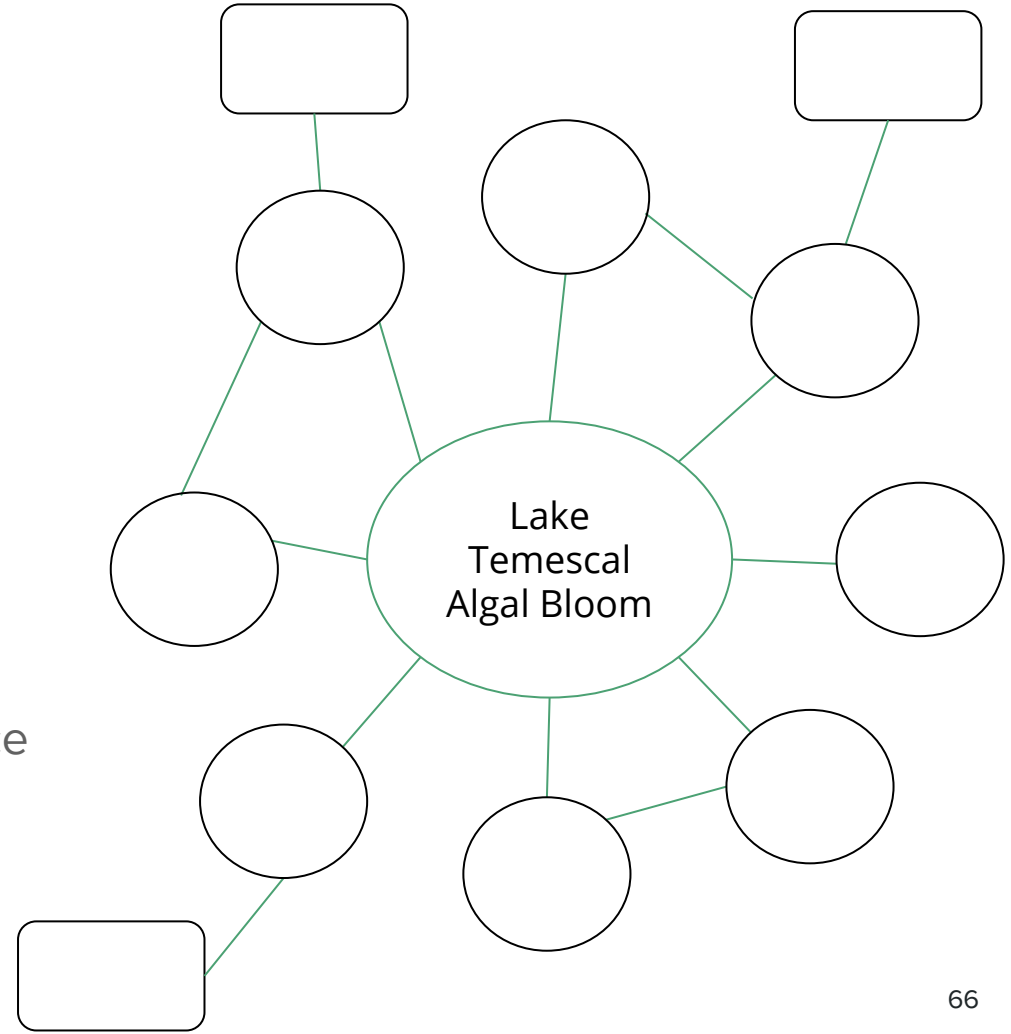
When you placed lentils and lima beans in the same environmental conditions, you got much different results.

How can you and your partner explain this? Use at least one piece of evidence from this task to support your explanation.

Class Concept Map

Add to your class concept map:

- New questions (circles)
- New ideas learned (squares)
- New connections (lines and connector words)
- Crosscutting concepts used (trace in color)
    - Cause and Effect



Evaluate

Connecting to the Culminating Project

You have been asked to give a news story update on a local lake that is suffering from a recurring toxic algal bloom. In Task 2, we identified some environmental factors that cause toxic algae growth. Researchers have also identified the gene that leads to the toxic protein, but it is not found in all types of algae, just toxic ones like Blue-Green algae.

➢ Based on the information you have, do you think the toxic algal bloom in the local lake is caused by genetics or environmental factors? Explain your reasoning.

Complete this **individually** in your Project Organizer.

Reflection

Complete the questions at the end of your student guide to reflect on what you have learned in Task 3.

From Parents to Offspring

Task 4

What questions do you still have?

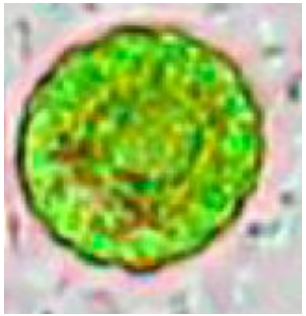
Engage

We know genetics plays a role, but how do traits actually get passed from parent to offspring?

Offspring are the young born of living organisms

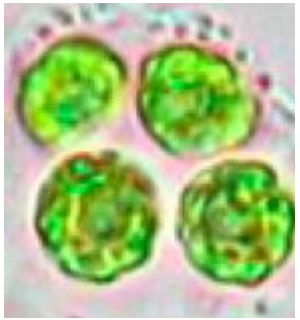
Dog Parents

Bacterium Parent



Dog Offspring

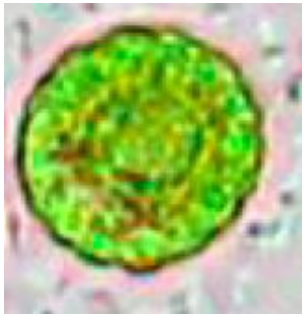
Bacteria Offspring



Make observations of the parents and offspring below

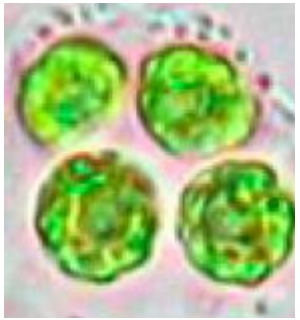
Dog Parents

Bacterium Parent



Dog Offspring

Bacteria Offspring



With a partner, discuss and answer the questions in your Student Guide

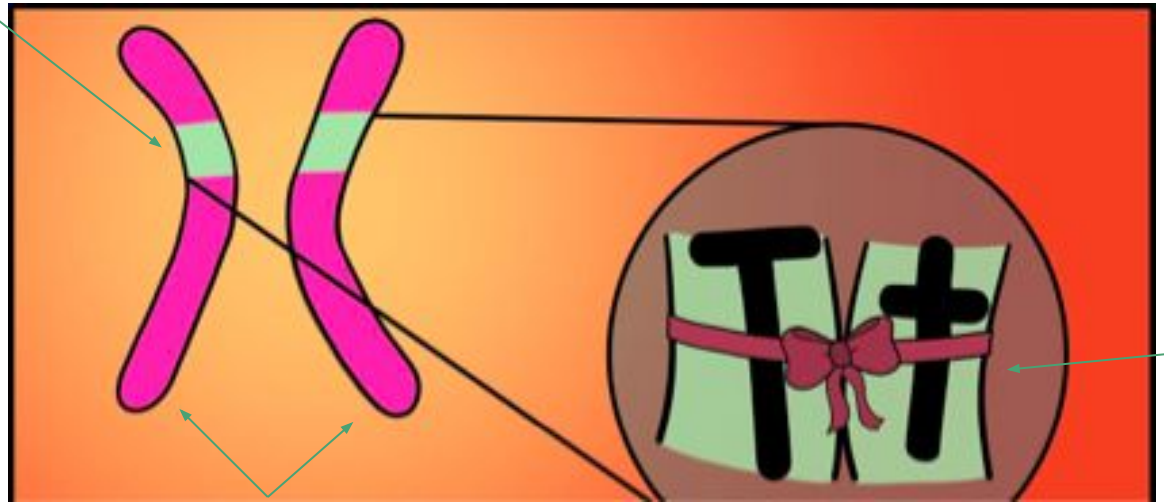
Explore

Why do some organisms have variation (difference) in traits that is different from their parents?

Let’s model the process of reproduction to help us answer this question!

But first, let's review scientific terms from Task 3

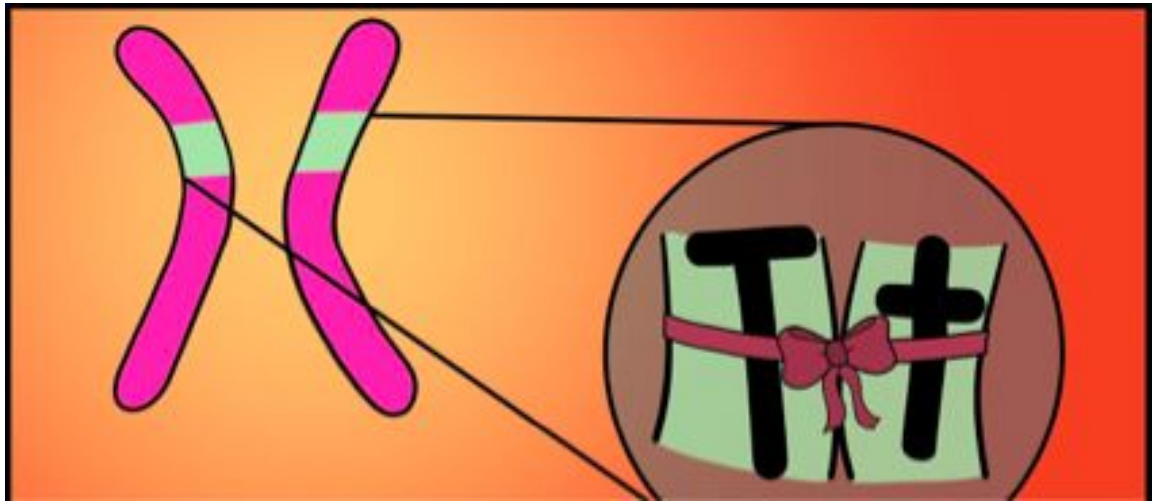
Gene = specific section of our **DNA** that codes for a specific **trait**



This is why there are two **alleles** for each gene, which are shown as letters (Tt)

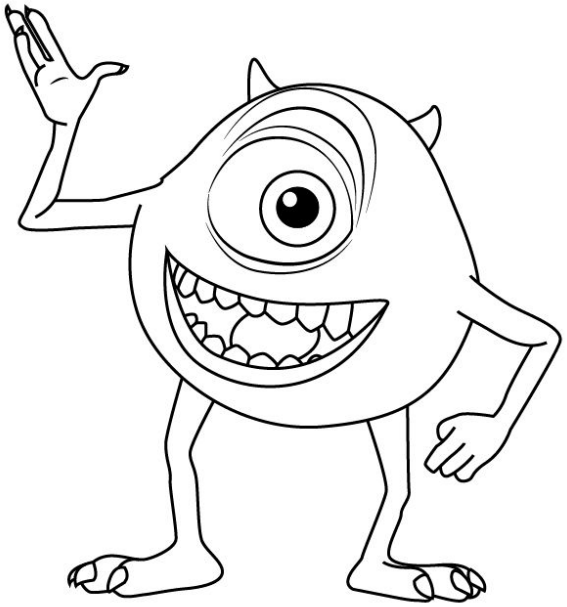
Organisms have two of each **chromosome**

Let’s Practice



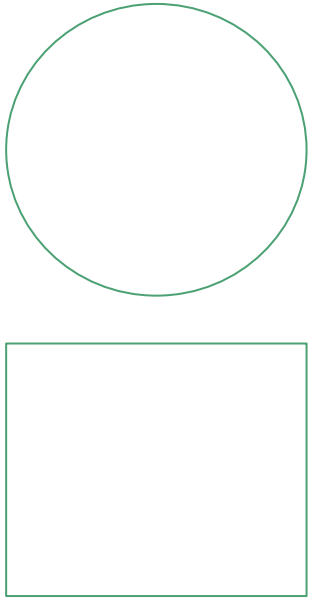
Practice using the following terms to explain this picture to your partner:
gene, DNA, trait, chromosome, alleles

Developing and Using Models



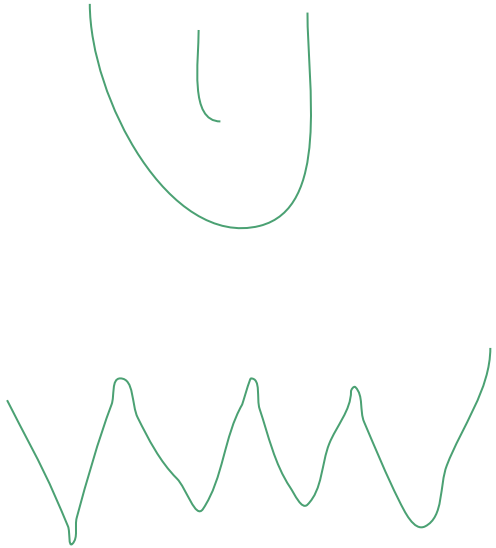
Follow the directions in your Student Guide to create a Monster Baby!

Possible Traits



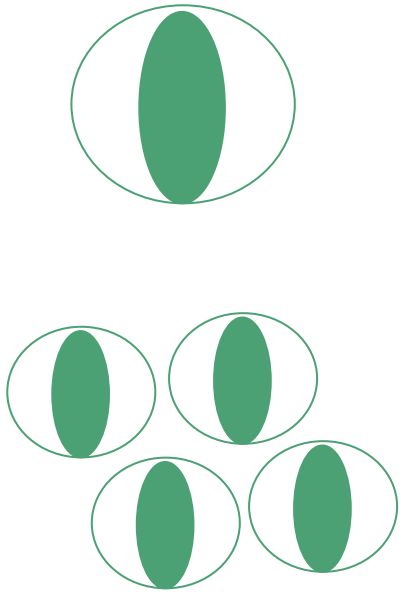
Head Shape

(Circular vs. Square)



Mouth Features

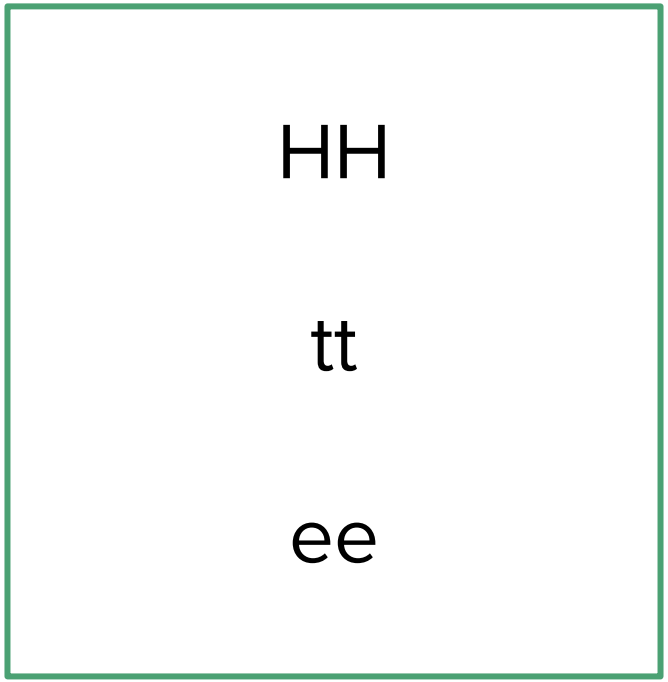
(Tongue Out vs. Teeth)



Number of Eyes

(One vs. Four)

Genes Card Example



How To Use the Genetic Codebreaker

	At Least One Capital Letter	Both Lowercase Letters
Head Shape (H)	Circular (HH or Hh)	Square (hh)
Mouth Features (T)	Tongue Out (TT or Tt)	Teeth (tt)
Number of Eyes (E)	One Eye (EE or Ee)	Four Eyes (ee)

HH

tt

ee

	Head Shape	Mouth Features	Number of Eyes
Alleles (Letters)	HH	tt	ee
Trait	Circular	Teeth	Four Eyes

Now You Try!

	At Least One Capital Letter	Both Lowercase Letters
Head Shape (H)	Circular (HH or Hh)	Square (hh)
Mouth Features (T)	Tongue Out (TT or Tt)	Teeth (tt)
Number of Eyes (E)	One Eye (EE or Ee)	Four Eyes (ee)

?

?

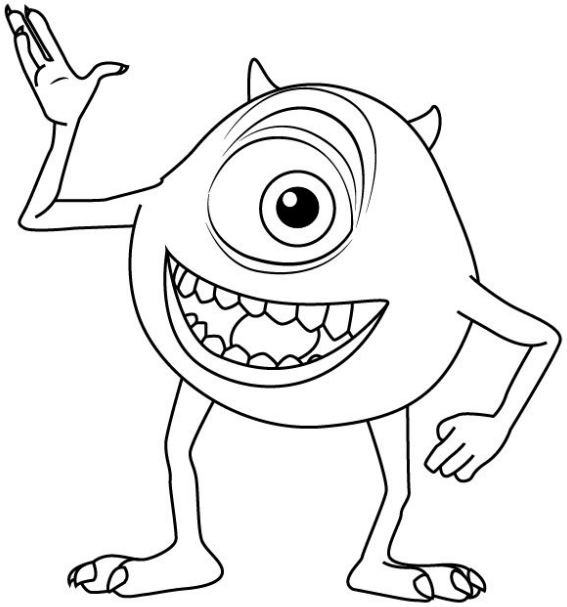
?

	Head Shape	Mouth Features	Number of Eyes
Alleles (Letters)	?	?	?
Trait	?	?	?

How To Make A Monster Baby

Follow the directions in your Student Guide

Class Debrief



Does your monster offspring have the exact same traits as you? The same as your mate?

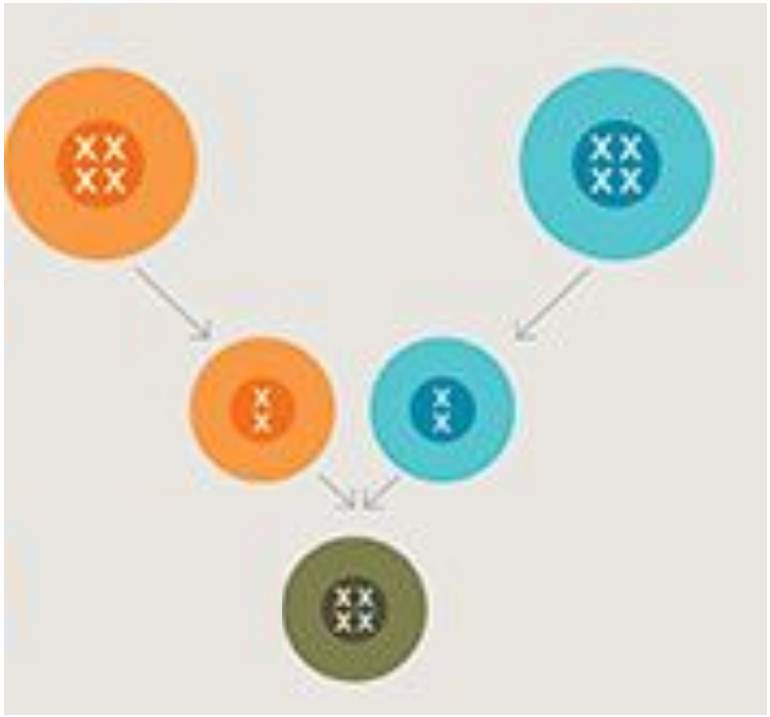
Explain

Developing and Using Models

Your monster offspring wants to know where it came from! Individually, draw a model that shows the monster parents, the monster offspring, and the process that results in the offspring's traits.

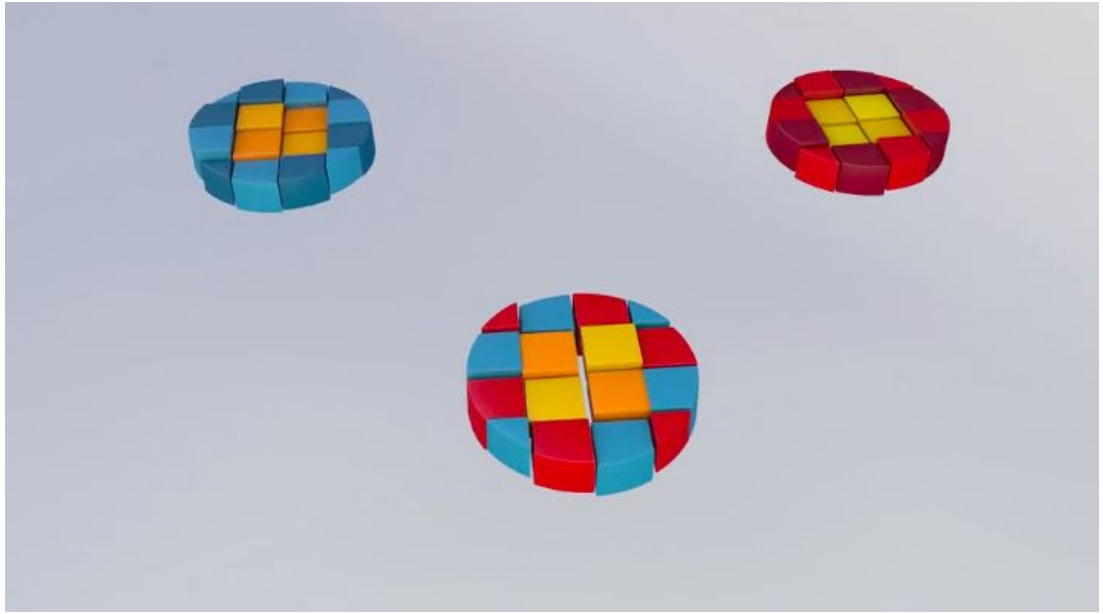
Use the checklist in your Student Guide to make sure you include all the parts.

Sexual Reproduction



This kind of reproduction is called sexual reproduction. Why does this kind of reproduction process create offspring with genetic variation (different genes between parents and siblings)?

Review: Sexual Reproduction and Variation



https://learn.genetics.utah.edu/content/basics/inheritance/

Elaborate

Modeling Asexual Reproduction

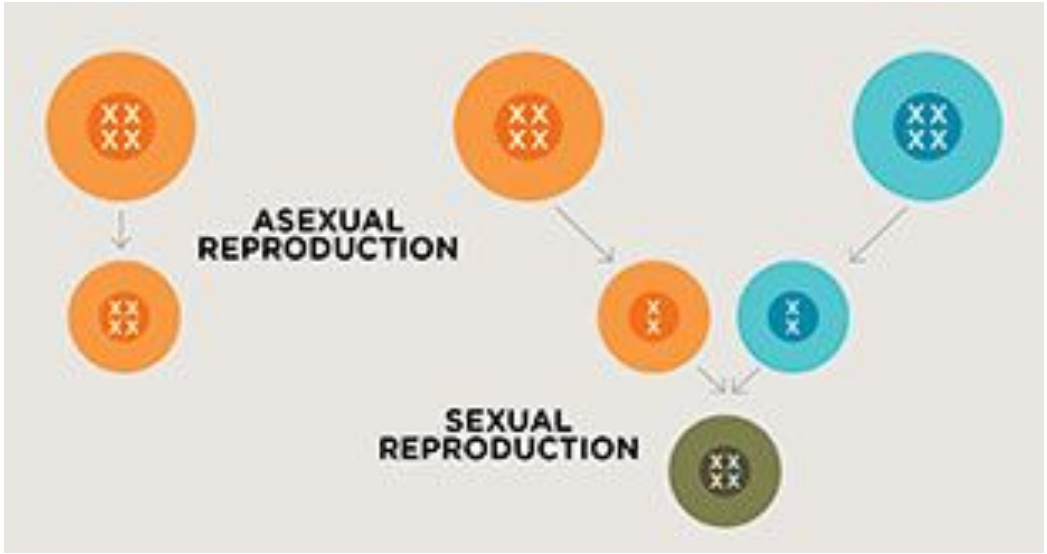
Organisms like Blue-Green Algae, or *Cyanobacteria*, do asexual reproduction. Follow the directions in your Student Guide to model this process.

Developing and Using Models

Draw another model that shows the process of asexual reproduction.

Use the checklist in your Student Guide to make sure you include all the parts.

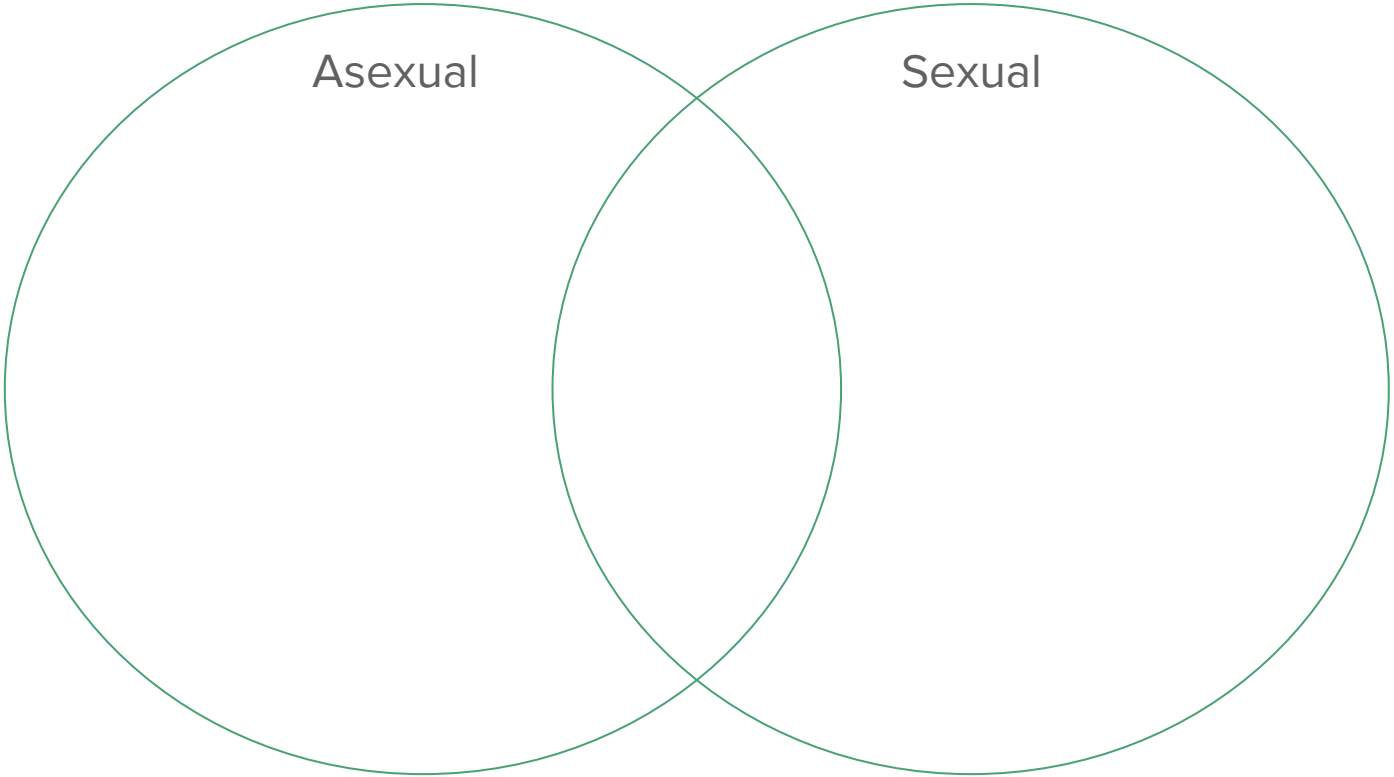
Asexual vs. Sexual Reproduction



How does this process of asexual reproduction (bacteria) seem different from sexual reproduction (monsters)?

Does this process create genetic variation? Why or why not?

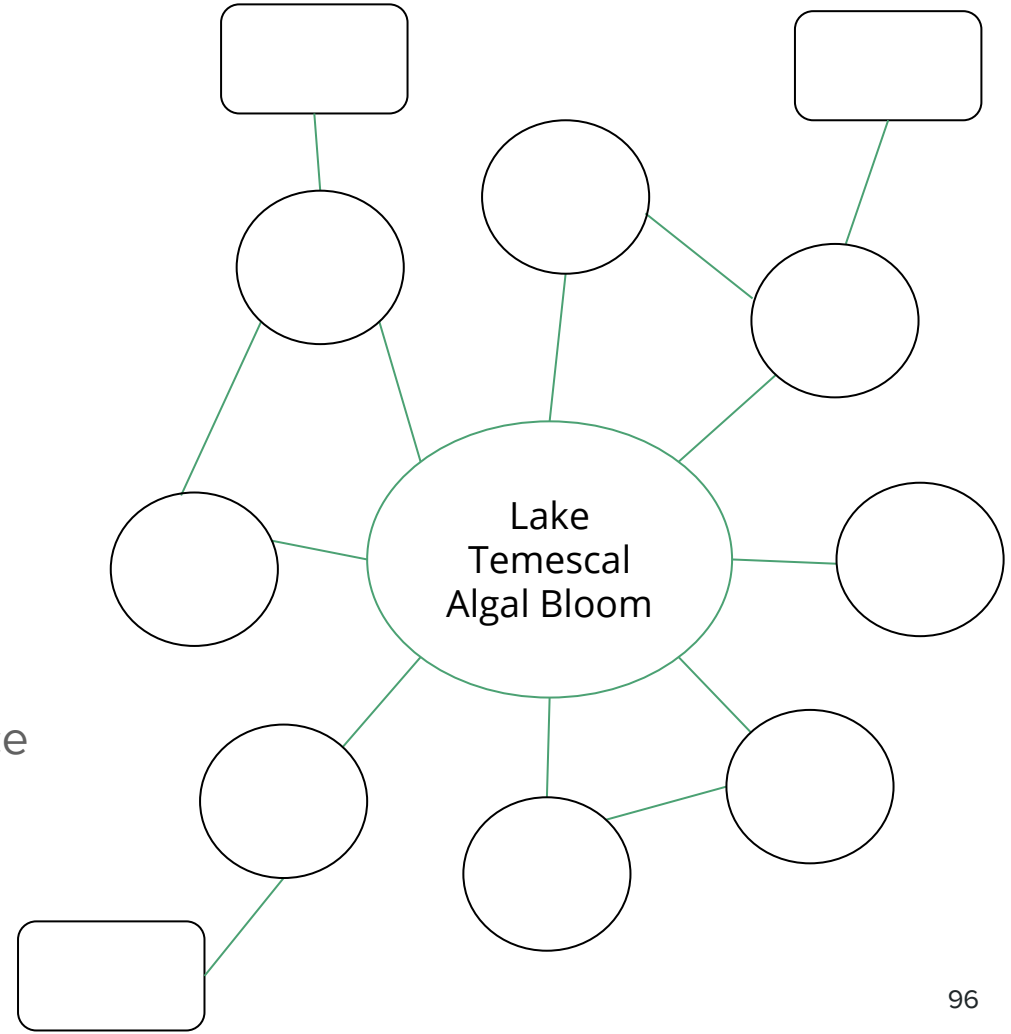
Class Debrief - Asexual vs. Sexual Reproduction



Class Concept Map

Add to your class concept map:

- New questions (circles)
- New ideas learned (squares)
- New connections (lines and connector words)
- Crosscutting concepts used (trace in color)
    - Cause and Effect



Evaluate

Connecting to the Culminating Project

You have been asked to give a news story update on a local lake that is suffering from a recurring toxic algal bloom. An algal bloom refers to a large growth of algae, so we need to know how they actually reproduce!

- ➢ Refer back to your model: How do cyanobacteria (blue-green algae) reproduce?
- ➢ Does this better support the case for algal blooms being caused by genetics or environmental factors? Explain.

Complete this **individually** in your Project Organizer.

Reflection

Complete the questions at the end of your student guide to reflect on what you have learned in Task 4.

Culminating Project

Solve the Mystery of the Local Algal Bloom and Advocate For a Solution

Group Project - Create a News Report Update on the Local Algal Bloom Issue

Individual Project - Write a Letter to the Town Mayor Advocating For a Solution to the Local Algal Bloom Issue

Don’t forget to use your checklist of criteria!

Group Project Criteria for Success

Your news update should include:

- ✓ A recap of the problem at the local lake
  - What is happening to the lake?
  - Why is it a problem?
- ✓ A claim for whether the lake’s algal blooms are caused by genetic and/or environmental factors
  - Provide evidence to support your claim
  - Include an explanation of why algal blooms happen some years but not others
- ✓ A conclusion that encourages your audience to think about solutions now that they know this information
- ✓ Quality News Update Structure
  - Grabs the audience’s attention
  - Is organized logically
  - Includes relevant visuals, when appropriate

Solve the Mystery of the Local Algal Bloom and Advocate For a Solution

Group Project - Create a News Report Update on the Local Algal Bloom Issue

Individual Project - Write a Letter to the Town Mayor Advocating For a Solution to the Local Algal Bloom Issue

Optional Template

Letter to the Mayor Template

Dear Ms. Mayor,

The condition of the local lake is a serious problem! *In this paragraph, describe the problem at the local lake.*

Here is what we know about the toxic algae, which is also known as Blue-Green Algae, or Cyanobacteria. *In this paragraph, describe what you know about the Blue-Green Toxic Algae.*

We also know that these algal blooms have happened before. This is the history of algal blooms in the last five years as well as how weather conditions have varied over these five years. *In this paragraph, use the weather data in the last five years to explain what might have caused these changes.*

I believe that these toxic algal blooms are caused by _____ (environmental or genetic) factors. *In this paragraph, make a claim for whether the toxic algal blooms are caused by environmental or genetic factors, identify the specific factors, and support your claim with evidence.*

Based on this information, I propose that we… *In this paragraph, explain your potential solution for the lake, including a description of how finding out all this information helped inform your solution.*

Thank you for your time and consideration.

Sincerely,

_____

Don’t forget to use your checklist of criteria!

Individual Project Criteria for Success

The letter to the mayor should include:

- ✓ A description of the problem at the local lake
  - What is happening to the lake?
  - Why is it a problem?

- ✓ Background on the Blue-Green Toxic Algae (*Cyanobacteria*), including:
  - A model that shows how they reproduce and what this means for variation in their species
  - A description of their optimal growing conditions

- ✓ Background on the relevant history of weather in the region, including:
  - An explanation of what likely caused these different weather conditions from year to year, supported by data from Task 1 as evidence

- ✓ An explanation for whether the toxic algal blooms are caused by genetic and/or environmental factors, including:
  - All the specific factors that cause the toxic algal blooms
  - Evidence from the tasks that supports the explanation for how environmental and genetic factors affect growth of organisms

- ✓ A potential solution for the local lake, including:
  - A description of how finding out the causes of toxic algal blooms helped you come up with the solution

Peer Review

Letter Peer Review Feedback

Complete after you have a full first draft of your letter to the mayor.

Letter Owner's Name	
Letter Reviewer's Name	

Review the following sections of the Letter to the Mayor:

- ✓ A description of the problem at the local lake
  - What is happening to the lake?
  - Why is it a problem?

  ➢ Positive Comment:

  ➢ Constructive Comment:

- ✓ Background on the Blue-Green Toxic Algae (*Cyanobacteria*), including:
  - A model that shows how they reproduce and what this means for variation in their species
  - A description of their optimal growing conditions

  ➢ Positive Comment:

  ➢ Constructive Comment:

- ✓ Background on the relevant history of weather in the region, including:
  - An explanation of what likely caused these different weather conditions from year to year, supported by data from Task 1 as evidence

  ➢ Positive Comment:

  ➢ Constructive Comment:

- ✓ An explanation for whether the toxic algal blooms are caused by genetic and/or environmental factors, including:
  - All the specific factors that cause the toxic algal blooms
  - Evidence from the tasks that supports the explanation for how environmental and genetic factors affect growth of organisms

  ➢ Positive Comment:

  ➢ Constructive Comment:

- ✓ A potential solution for the local lake, including:
  - A description of how finding out the causes of toxic algal blooms helped you come up with the solution

  ➢ Positive Comment: