Lesson Topic: The Scientific Method

Objective:
Students will be able to:

1. Explain the process of the scientific method
2. Complete an experiment using all steps of the process

Time Required: 95 minutes

Materials Needed:

- Plastic resealable bag filled with water, sealed
- Sharpened colored pencils (3 - 4 of varying colors)
- Sticky notes (2 per student)
- 2 beakers with water per group
- Mints (5 per group)
- Thermometer
- Teacher computer with internet access
- Projector/Smartboard
- 1 computer/laptop/iPad per student with internet access
- The Scientific Method handout and Does Mint Actually Cool? handout (attached)
- Does Mint Actually Cool? Line graph template (attached)

Teacher Preparation:

- Assign a Legends of Learning Instructional Quick Play playlist for the day(s) you will be teaching the lesson.
    - Instructional - Middle School - The Scientific Method
- Set aside plastic bag with water and sharpened colored pencils
- Hand out 2 sticky notes per student
- Set up 2 beakers with water, thermometer, 5 mints for each group
- Make copies of The Scientific Method handout, Does Mint Actually Cool? Handout, and Does Mint Actually Cool? line graph template (1 per student)

Engage (15 minutes):

1. Take out resealable plastic bag filled with water and colored pencils.
2. As you show students the bag/ pencils, ask students what questions they have about what they see?
    a. Answer: Why are the pencils sharpened? Why is the bag is filled with water? I wonder what would happen if the pencils poked through the bag?
3. Next, ask students to make a prediction as to what would happen if you poked a sharpened pencil through the bag?
    a. Answer: Accept reasonable answers, The bag would pop. The water would leak from the bag.
    b. These predictions can be written down on the board, or students can each write their prediction on their sticky note.
4. After predictions are made, take a sharpened pencil and stab it into the bag and water, pushing it through all the way until it pokes out the other side.

   a. *Note: The pencil itself will plug the holes, so the water won't leak or at least very minimally. You can do this several times with different colored pencils.*
5. Have students make observations while this is happening. They can talk with a partner or record on their sticky note.
6. Next, prompt students to share their results about what happened.
   a. Answer: I found that the water did not leak out of the bag. I found the bag did not pop from the pencils.
7. Ask students to draw a conclusion as to why the bag did not leak?
   a. Answer: Accept reasonable answers
8. Finally, ask students to share what they learned. This can be done orally or students can write a sentence on their second sticky note summing up what they learned about during the demonstration.
9. Explain to students that they just went through the Scientific Method with this demonstration. They are going to learn more about each step and then actually do an experiment following each step.

Explore (25 minutes):

1. Have your students sign in to Legends of Learning. Instruct students to complete the Instructional playlist.
2. As students complete the assigned game, students should fill out the Scientific Method Handout.
3. Assist students as needed during game play, pause playlist if you need to address content or questions to the entire class.

Explain (15 minutes):

1. Review answers to The Scientific Method handout by drawing diagrams on board or using Smartboard.
2. Relate student knowledge to demonstration at the beginning of class.
   a. What is a "hypothesis" and what was ours during the demonstration earlier?
      i. Answer: A hypothesis is a prediction of what will happen during an experiment. Our hypothesis was that the bag would pop, etc.
   b. What are "results" in the scientific method and what was our result?
      i. Answer: Results are the outcome of an experiment. Our results were that the colored pencils plugged the holes and the water did not leak.
   c. How did we share our findings?
      i. Answer: We wrote them on a sticky note and discussed it as a class.

Elaborate (25 minutes):

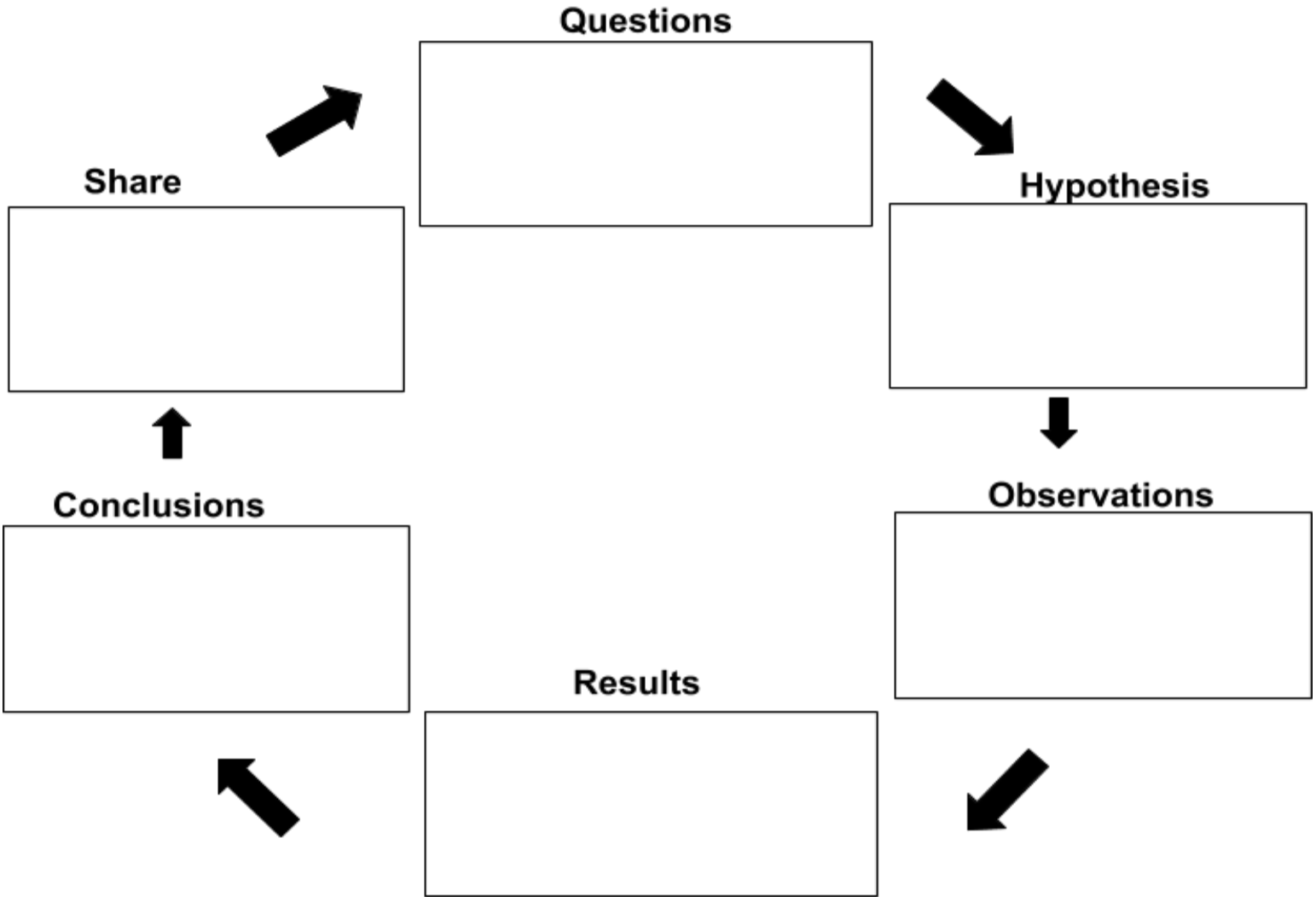
1. Instruct students to get with a partner and distribute materials to each pair. Each pair should have 2 beakers filled with water, 5 mints, and a thermometer.
2. In pairs, have students work through the "Does Mint Actually Cool?" experiment, filling out all parts of the handout.
3. Assist students as needed.

Evaluate (15 minutes):

1. After pairs have finished the experiment, discuss their findings as a class.
2. If time allows, have students graph their data using the paper provided.

Additional Lesson Strategies: ● To use Legends for additional instruction, create a custom playlist with an instructional game and pre and post assessment. ● To use Legends for a quick formative assessment, create a 5-question assessment in a playlist. ● To use Legends for a student-directed experience, create a targeted freeplay playlist. ● Encourage students to play on their own at home in Legends of Learning: Awakening for a student-driven experience including avatars, battling, and quests all centered around topics they are covering in class.

The Scientific Method



Independent variable: _____

Dependent variable: _____

Control:_____

Does Mint Actually Cool?

Directions: Read and follow the directions for the experiment below. Use the chart to record your data. Fill in all the boxes with the correct part of the experiment.

Materials:

- 2 Beakers filled with water
- Mints
- Thermometer

Procedure:

1. Use the thermometer to take the temperature of both beakers. Record in the chart below.
2. Add all mints to one of the beakers and let sit for 2 minutes.
3. Use the thermometer to take temperatures of both beakers for every time increment on sheet. Record the temperatures on the chart below.

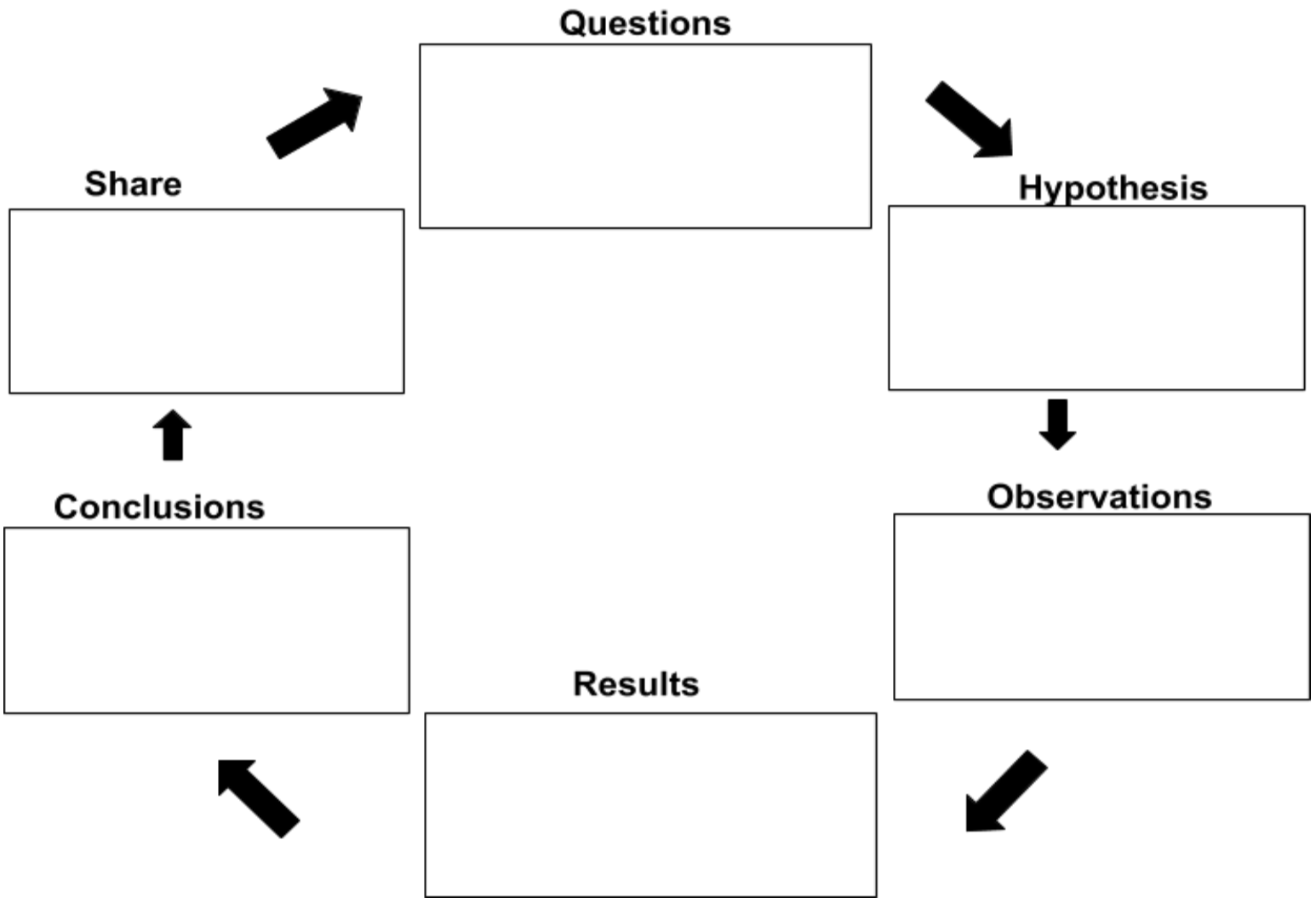
	Starting Temperature	After 2 minutes	After 5 minutes	After 10 minutes
Control Water				
Mint Water				

Independent variable: _____

Dependent variable: _____

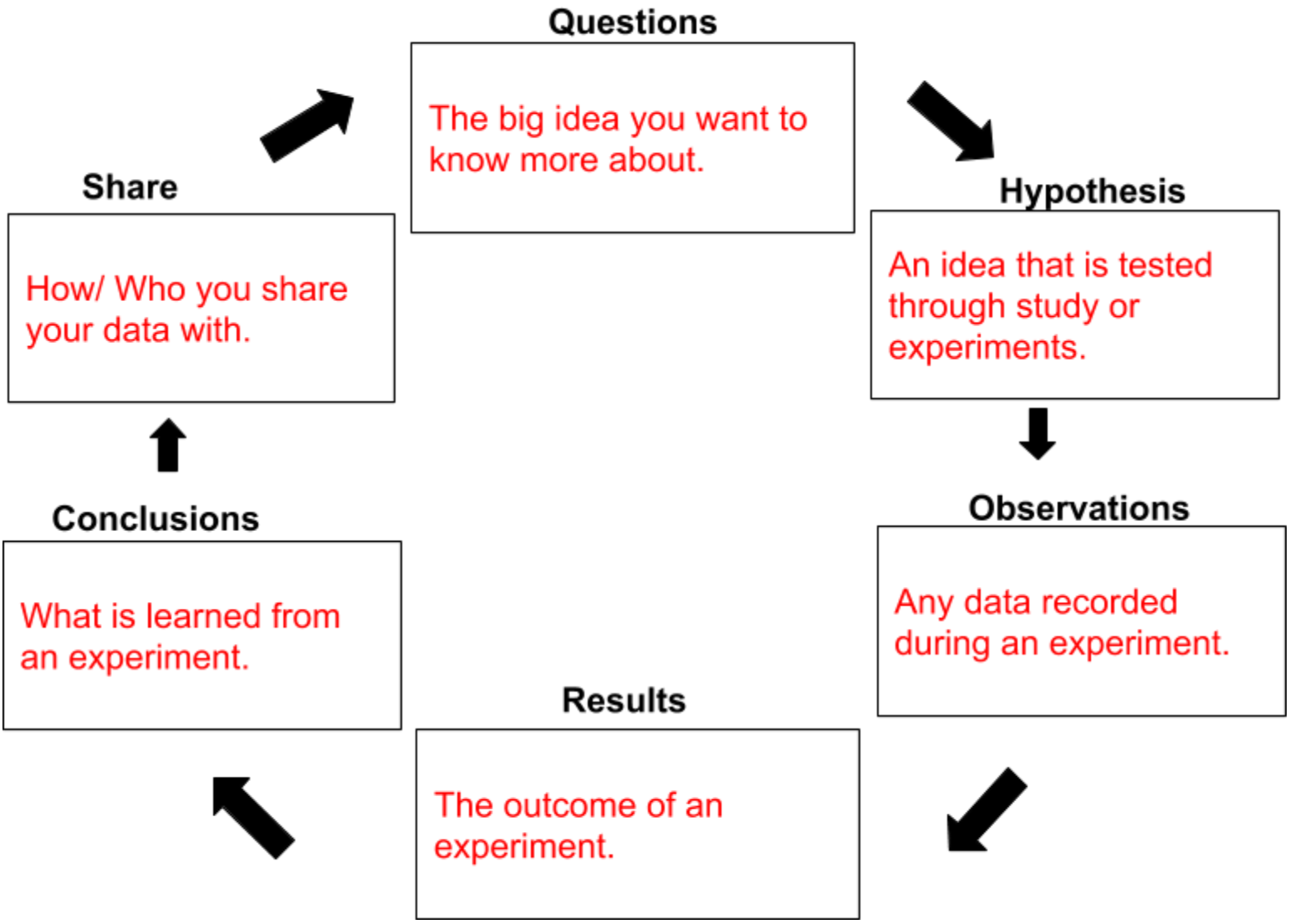
Control:_____

Does Mint Actually Cool?




Does Mint Actually Cool?
30
20
10
0
Starting Temperature
2 minutes
5 minutes
10 minutes

The Scientific Method Key



Independent variable: the variable that is changed in an experiment

Dependent variable: the variable that is being tested and measured

Control: the part that doesn't change

Does Mint Actually Cool? Key

Directions: Read and follow the directions for the experiment below. Use the chart to record your data. Fill in all the boxes with the correct part of the experiment.

Materials:

- 2 Beakers filled with water
- Mints
- thermometer

Procedure:

1. Take the temperature of both beakers. Record in chart.
2. Add - mints and let sit for 2 minutes.
3. Record temperatures of both beakers for every time increment on sheet.

	Starting Temperature	After 2 minutes	After 5 minutes	After 10 minutes
Control Water	*20 -25 ℃*	*20 -25 ℃*	*20 -25 ℃*	*20 -25 ℃*
Mint Water	*20 -25 ℃*	*20 -25 ℃*	*20 -25 ℃*	*20 -25 ℃*

Independent variable: *The mints added*

Dependent variable: *The water temperature*

Control: *the beaker with no mints*

Does Mint Actually Cool? Key