

Mission 1: Scientific Thinking (SC.5.N.1.1)

LEARNING GOAL: The student will be able to define a problem, use appropriate reference materials to support scientific understanding, plan and carry out scientific investigations of various types such as: systematic observations; experiments requiring the identification of variables; collecting and organizing data; interpreting data in charts, tables, and graphics; analyze information; make predictions; and defend conclusions.

DEMO: Lab - Which cup material best prevents ice from melting?

Cup material	Material: _____	Material: _____	Material: _____
Water in cup at beginning (mL)	_____ mL	_____ mL	_____ mL
Water in cup after 20 minutes (mL)	_____ mL	_____ mL	_____ mL

WRITING:

Juan has collected data from growing plants. He displays the following table.

Plant Height Data (Centimeters)

Day	Pot A	Pot B	Pot C
15	1.8	2.7	1.6
20	3.2	4.3	3.1
25	4.6	5.9	4.8
30	5.8	7.5	6.3
35	6.8	9.0	7.5
40	8.0	10.4	8.9
45	8.9	12.2	10.1
50	10.0	14.0	11.0

Pot A: Tomato, 3 lights, 50 mL water, soil

Pot B: Tomato, 3 lights, 50 mL water, soil, fertilizer

Pot C: Tomato, 3 lights, 50 mL water, soil, compost

Analyze the data table and explain which conditions would be best to grow a tomato plant and why.

MULTIPLE CHOICE:

1. Maurice followed these steps of an investigation:

Step 1. Collect five objects made of different types of metal.

Step 2. Place them on a large laboratory table.

Step 3. Touch each metal object with a magnet and lift slowly.

Step 4. Record observations.

Which of the following statements is Maurice **most likely** testing?

- A. Metals are attracted to magnets.
 - B. Each magnet can lift the metal object to the same height.
 - C. Larger magnets can pick up heavier metal objects than smaller magnets can.
 - D. Heavier metal objects are more attracted to magnets than lighter metal objects are.
2. Carla went on a nature walk. She sees a bird in a tree. She gathers information about the bird and its habitat. She notes the bird is red, the tree has brown bark and green leaves. What type of investigation is Carla performing?
- A. Experiment
 - B. Model
 - C. Free Exploration or Field Work
 - D. Lab Work
3. Lucas told his mom he wanted to know how tall the members of his family are. Each family member takes turns measuring each other. His mom is 5 feet 2 inches, his dad is 6 feet, his sister is 3 feet 3 inches tall and he is 4 feet 7 inches tall. What could Lucas do with this data to make it easier to read and analyze?
- A. Create a data table
 - B. Ask a Question
 - C. Make a prediction
 - D. Draw a conclusion
4. Martha followed these steps of an investigation:

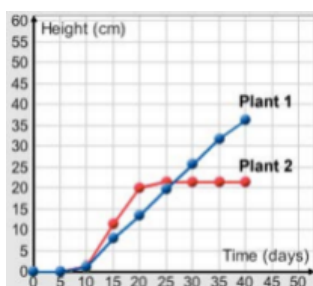
Step 1: Gather 3 microwavable cups the same size and material and label the cups A, B, and C.

Step 2: Add 25 mL of water to Cup A, 50 mL of water to Cup B, 100 mL of water to Cup C

Step 3: Heat each cup for 1 minute in a microwave and measure the temperature of the water.

What is the best choice for what she should do after Step 3?

- A. Added more water to each cup.
 - B. Recorded the temperatures as her results.
 - C. Write a conclusion.
 - D. Repeat the experiment again
5. What does this graph of plant heights show?

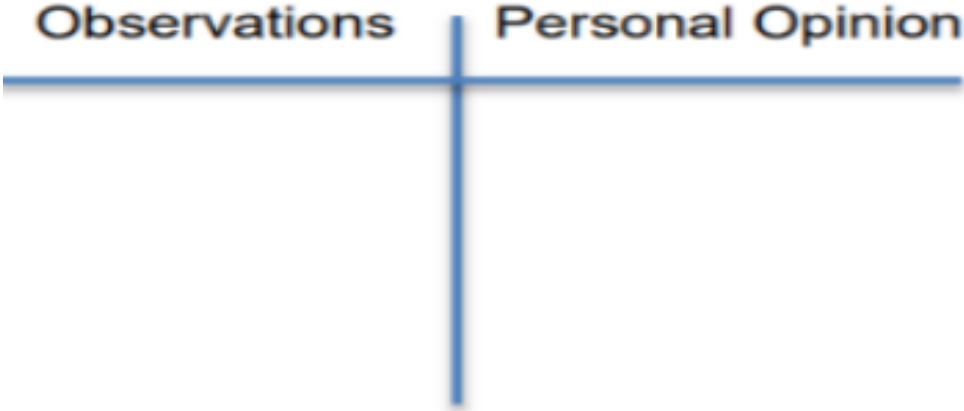
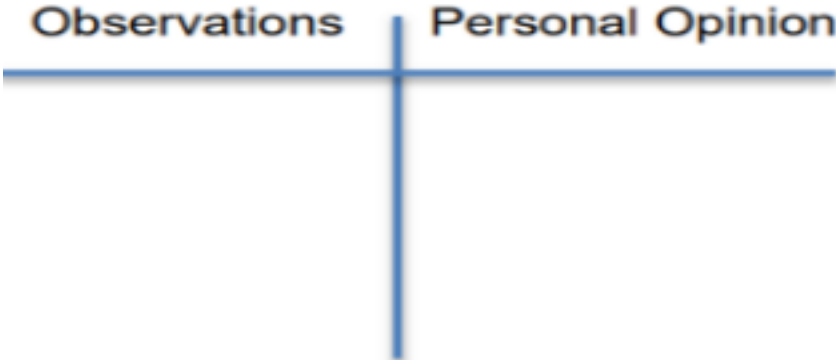
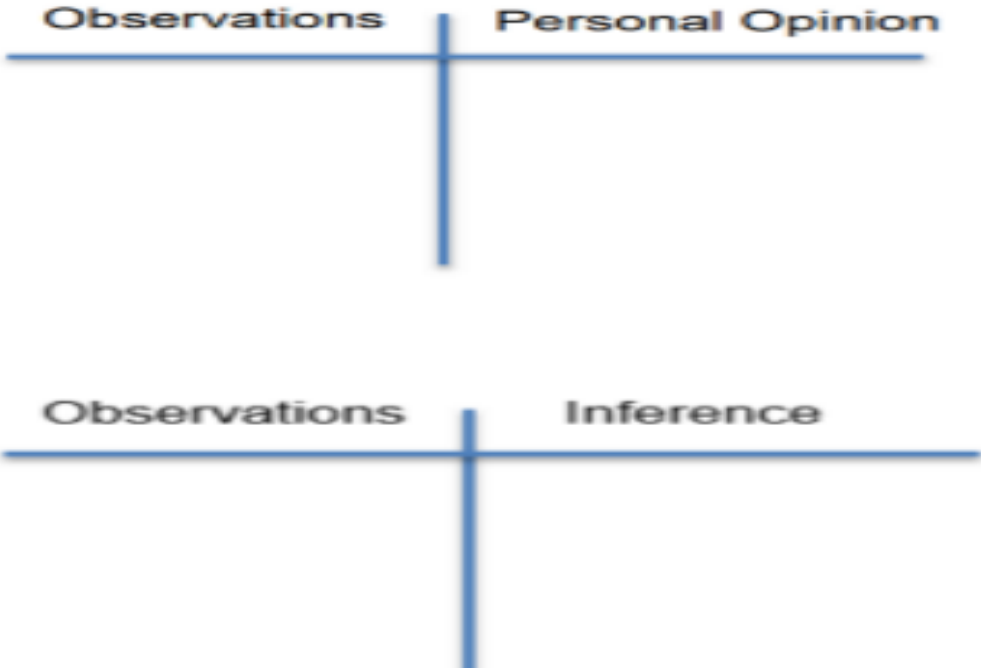


- A. Plant 2 ended up taller than Plant 1.
- B. Plant 1 was always taller than Plant 2.
- C. Plant 1 grew steadily. Plant 2 grew quickly at first and then stopped growing.
- D. Plant 2 grew steadily. Plant 1 grew slowly at first and then grew quickly.

Mission 2: Observations (SC.5.N.2.1)

LEARNING GOAL: The student will be able to recognize and explain that science is grounded in empirical observations that are testable; explanation must always be linked with evidence.

DEMO:

Picture 1	 <p>A T-chart diagram. The horizontal line is divided into two sections. The left section is labeled 'Observations' and the right section is labeled 'Personal Opinion'. A vertical line extends downwards from the center of the horizontal line.</p>
Picture 2	 <p>A T-chart diagram. The horizontal line is divided into two sections. The left section is labeled 'Observations' and the right section is labeled 'Personal Opinion'. A vertical line extends downwards from the center of the horizontal line.</p>
Picture 3	 <p>Two T-chart diagrams. The top diagram has a horizontal line divided into 'Observations' (left) and 'Personal Opinion' (right), with a vertical line extending downwards. The bottom diagram has a horizontal line divided into 'Observations' (left) and 'Inference' (right), with a vertical line extending downwards.</p>

WRITING: Identify an object in the classroom and make an observation about it. Explain why your statement is an observation. How is this the same or different from your personal opinion about the object?

MULTIPLE CHOICE:

1. Omar is performing an investigation using several earthworms. He places a rectangular box under a bright lamp and covers one-half of the box so that it is shaded. Then, he puts the earthworms into the box on the side that is still brightly lit. Later, Omar notices that all of the earthworms have crawled over to the shaded side of the box. Based on his investigation, which of the following is an observation and NOT a personal opinion?

- A. Earthworms are afraid of light.
- B. Earthworms like staying together.
- C. Earthworms move away from light.
- D. Earthworms like living in the ground.

2. Sylvia records the following about her pet hamster Mel.

- Mel is 630 grams.
- Mel is 10 centimeters.
- Mel eats carrots.
- Mel likes the color red.
- Mel lives at my house.

Which of the following from Sylvia's list is NOT an observation?

- A. Mel is 630 grams.
- B. Mel lives at my house.
- C. Mel likes the color red.
- D. Mel eats carrots.

3. Which of the following is **not** a scientific explanation supported by evidence or observation?

- A. Object A measures 5 cm. and object B measures 10 cm. Object B is longer than object A because of the difference in measurements.
- B. The fire truck that passed us on the street was red.
- C. Sally ran faster than Billy around the track. Sally ran in 45 seconds while Billy ran in 55 seconds.
- D. All students like candy.

Mission 3: Evidence and Replication (SC.5.N.2.2)

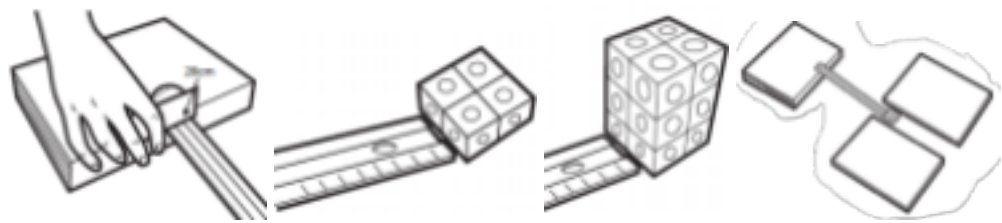
LEARNING GOAL: The student will be able to recognize and explain that when scientific investigations are carried out, the evidence produced by those investigations should be replicable by others.

MATERIALS:

2 grooved rulers , Books , 12 connecting cubes , golf ball

DEMO/PROCEDURE:

1. Place the cubes at the base of the ruler. All four cubes should be touching the ground. The cubes (and the ramp) should be centered between the two books.
2. Place the golf ball at the top of the grooved ruler. Use the second ruler to hold it in place. 3. Adjust the position of the golf ball so that it is at the 28-cm mark. Lift the ruler you are holding to release the golf ball.
4. Measure and record the distance from the base of the ruler ramp to the closest edge of the connecting cubes. Repeat two more times for a total of three trials.
5. Add a layer of connecting cubes to the square. It should now be a 2x2x2 cube. Repeat the procedure using the new cube.
6. Add a third layer of connecting cubes to the cube. It should now be a 2x2x3 cube. Repeat the procedure using the new cube. Be sure only four cubes (not six) are touching the surface.



DEMO:

Class Data

	Four Cubes	Eight Cubes	Twelve Cubes
Trial 1			
Trial 2			
Trial 3			
Average			

Data from another group of scientists:

	Four Cubes	Eight Cubes	Twelve Cubes
Trial 1	10cm	7 cm	3 cm
Trial 2	3cm	7 cm	2 cm
Trial 3	7cm	8 cm	5 cm
Average	10 cm	11 cm	5 cm

Why do you think there were differences in the class data compared to the data from the other group of scientists that did the same exact experiment? _____

Why is it important for both your class and the group of scientists to keep the same setup for their ruler ramps?

WRITING:

Why is it so important for scientists to do repeated trials and have other scientists replicate the same experiment as other groups of scientists? _____

MULTIPLE CHOICE:

1. Gabriel is designing an experiment to see whether sugar or artificial sweetener will attract the greater number of ants. Which statement **best** describes why Gabriel should write down his experimental procedure?
 - A. The exact experiment can be repeated by others and the results compared.
 - B. The experiment can be changed by others to get different results.
 - C. The data will help people decide what type of sweetener to use.
 - D. The data will show people which ants are more common.
2. Samantha's science class is doing an experiment. They need to gather the following materials: three pieces of string all the same length (200 centimeters long), 1 large paper clip, and 6 small paper clips. Her classmate Martin, who is in a different group, cannot find 6 small paper clips, so he takes 6 large paper clips. At the end of the experiment Samantha's group and Martin's group data are very different. What caused the data to be different?
 - A. Martin's group had better data
 - B. Samantha's group's data is wrong
 - C. Martin should have used 6 small paper clips like the materials listed.
 - D. Samantha could not have followed the procedures correctly.
3. Sometimes scientists replicate the research of other scientists. Which of the following is the **most likely** reason scientists do this?
 - A. to form new theories
 - B. to improve the research
 - C. to win prizes for their work
 - D. to verify that the work is accurate

4. Why is it important to measure very carefully in an investigation?
- A. to practice measuring skills
 - B. to keep good records
 - C. so others can replicate the work
 - D. to test the accuracy of our tools
5. On two different days, two students measured the force required to hold a pair of scissors using a spring scale. How should the results compare?
- A. The results should be the same because the mass of the scissors and the force of gravity are the same.
 - B. The results should be the same because friction does not change between the two experiments.
 - C. The results should be different because two people never perform an experiment exactly the same way.
 - D. The results should be different because changes in conditions between different days will cause the results to change.