

## HOW HOT IS IT?

Prep Time: 15 minutes

Teaching Time: 45 minutes

### Science Concept:

The temperature of planets decreases as the distance from the sun increases.

### Objectives:

The student will:

- complete an experiment to demonstrate that there is a correlation between a planet's distance from the sun and its temperature;
- interpret data and make inferences; and
- graph data.

### GLEs Addressed:

#### Science

- [8] SD4.1 The student demonstrates an understanding of the theories regarding the origin and evolution of the universe by creating models of the solar system illustrating size, location/position, composition, moons/rings, and conditions.
- [8] SA1.1 The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring, and communicating.

#### Math

- [8] S&P-1 The student demonstrates an ability to classify and organize data by designing, collecting, organizing, displaying, or explaining the classification of data in real-world problems (e.g., science or humanities, peers or community), using histograms, scatter plots, or box and whisker plots with appropriate scale or with technology.

### Vocabulary:

*dependent variable*- a variable whose value is determined by that of one or more other variables in a function

*independent variable*- a variable that is independent of other variables in an expression or function and whose value determines one or more of the values of the other variables

*temperature*- the degree to which something is hot or cold (as air, water, or the body) as shown by a thermometer

*tendency*- direction or approach toward a place, object, effect, or limit

### Materials:

- Large heat lamp
- Stand to hold lamp securely
- Wire
- Clothespins
- Thermometers
- Three hot plates
- Safety goggles

### Activity Preparation:

Shortly before the activity begins, set up all three hot plates. Set each hot plate to a different temperature.

## Activity Procedure:

### Gear Up

#### *Process Skills: inferring and communicating*

1. Ask students to put their hands over each hot plate at varying distances. Caution students against touching the hot plates.
2. Ask students if the hot plates feel the same. Ask them to explain their reasoning.
3. Ask the class the following questions:
  - a. When people are gathered around a fire on a cold day, why do they turn around front to back?
  - b. Why do people move away from a large bonfire?
  - c. If you were around a large fire and could not move, how would you be affected?

### Explore

#### *Process Skills: observing and communicating*

4. Divide students into pairs and distribute a candle and matches to each pair.
5. Ask students to put the candle on a table and light the candle. Ask students to move away from the flame and discuss what they feel as they move away from the flame. (NOTE: Light bulbs can be used in place of direct flame.)
6. Ask students to write five observations about the candle relating to distance and temperature.

### Generalize

#### *Process Skill: communicating*

7. Ask students to share their observations in small groups.
8. Ask students how the distance from a heat source affects the temperature of an object.
9. Ask the class to infer how the temperature of a planet changes as the distance from the sun increases. Discuss.
10. Ask students what the temperature might be of a planet that was found beyond Pluto?

### Experiment

#### *Process Skills: gathering data, inferring, and measuring*

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**Teacher's Note:** Try this experiment before class; results will vary based on lamp wattage. Black paper behind each thermometer, or wrapped around the thermometer will enhance results.

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11. Set up a secured heat lamp on a table or floor. Hang a wire in front of the lamp. Ask students to measure and mark 5 centimeter intervals from the lamp.
12. Ask students to prepare a chart that provides a place for notes to record temperature and distance; this data will be graphed later.
13. Divide the class into small groups. Issue each group a thermometer and a clothespin.
14. Remind students that they must be careful around the light and with the thermometers. Instruct students to go to any marked distance from the heat source and attach their thermometer to the wire with the clothespin to collect temperature data. They should read the thermometer after the temperature no longer changes.
15. Instruct groups to log their data in their tables and then on the board. Discuss trends as a class.

### Interpret

#### *Process Skills: collecting data and interpreting data*

16. As a class, discuss the independent and dependent variables of the experiment that students will graph.
17. Ask students to make a graph of the data that they collected.
18. As a class, plot data and create a line graph showing tendency.
19. Ask students to write a conclusion relating the distance from a heat source to the temperature recorded.

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### Apply/Assess

#### *Process Skills: inferring and predicting*

20. Ask students to reflect on the following in their lab write up:
  - a. How fast does the heat decrease when going away from the source?
  - b. Is there a correlation between distance and temperature?
  - c. Make a prediction about the temperature of the side of Mercury facing away from the sun.

### Extension Ideas:

#### *Process Skills: communicating and inferring*

Ask students to reflect on the following:

1. If a planet is a gas, how does it affect the correlation of distance from heat source to temperature?
2. What would happen to Earth if the sun lost its heat intensity?
3. Instruct students to complete research on the Internet to find the actual temperatures of each planet in our solar system.

<b>Objective</b>	<b>GLE</b>	<b>Emergent</b>	<b>Developing</b>	<b>Proficient</b>	<b>Advanced</b>
The student completes an experiment to demonstrate that there is a correlation between a planet's distance from the sun and its temperature.	[8] SD4.1	The student does not complete the experiment.	The student attempts the experiment but does not make the conclusion that a planet's distance from the sun and temperature correlate.	The student conducts an experiment and states that a planet's distance from the sun and its temperature correlate.	The student completes an experiment and makes the connection between the experiment and the correlation between a planet's distance from the sun and its temperature.
The student interprets data and makes inferences.	[8] SA1.2	The student does not collect data and/or does not make any inferences.	The student collects data. However, the data is incorrect. The student's inferences are unclear or illogical.	The student collects accurate data and makes at least one logical inference.	The student collects accurate data and makes more than one logical inference.
The student graphs data.	[8] S&P-1	The student does not attempt to graph his or her data.	The student attempts a graph but does not include labels, or graphs data incorrectly.	The student graphs data. He or she labels the axes, plots data, gives the graph a title, and adds a line of best fit.	The student graphs data. He or she labels the axes, plots data, gives the graph a title, and adds a line of best fit. The graph is neat and easy to read.