

Name: _____

Date: _____

Class: _____

States of Matter Simulation Lab

OBJECTIVE- Students will be able to: (1) Identify the familiar states of matter using atomic and molecular pictures; (2) Interpret the unusual properties of water using atomic and molecular pictures; (3) Predict how varying the temperature changes the behavior of the atoms or molecules.

INTRODUCTION: There are more states of matter than just three. One such example is plasma, present in your plasma TV, or in the stars, and it is the most common state of matter in the universe. In Chemistry, however, we are mainly concerned with the most common states of matter on planet Earth: Solids (s), Liquids (l), and Gases (g).

Before you open the simulation

PREDICT

1. Draw a diagram below showing what you think the molecules will look like for each state of matter, solid, liquid, and gas. Write a sentence below each diagram predicting what the motion of the molecules will be like.

| | Solid | Liquid | Gas |
|---|-------|--------|-----|
| Diagram of molecules | | | |
| Sentence explaining how molecules will be moving. | | | |

2. If you start with a substance as a solid, what will happen to the molecules as you add thermal energy (heat)?

ONCE YOU HAVE COMPLETED THIS PAGE, YOU MAY BEGIN THE SIMULATION.

Open the simulation. https://phet.colorado.edu/sims/html/states-of-matter/latest/states-of-matter_en.html

INVESTIGATE:

3. Use the menu on the right side of the program to select Water and Solid. Draw and describe what you see in the space below.

| Diagram | Description |
|---------|-------------|
| | |

4. Now, use the slider on the bottom of the program to Add Heat. Notice the thermometer at the top of the program. What temperature scale is this thermometer showing?

5. What happens to the water as you increase the temperature?

6. What is the melting/freezing point of water in Kelvin?

7. Add heat until the temperature is just below and then just above the melting point of water. How is water different below its melting point and above it?

8. Draw and describe what water looks like as a liquid.

| Diagram | Description |
|---------|-------------|
| | |

| | |
|--|--|
| | |
|--|--|

9. What is the boiling/condensation point of water in Kelvin?

10. Continue to add heat until you are just below and then just above the boiling point of water. How is water different below its boiling point and above it?

11. Draw and describe what water looks like as a gas.

| Diagram | Description |
|---------|-------------|
| | |

12. Choose one of the other three substances listed in the menu on the right. Investigate what happens when you add and remove heat from this substance. Use the buttons on the right to see this substance as a solid, liquid, and gas. Draw and describe its properties in the table below.

Substance Selected:

| | Solid | Liquid | Gas |
|---|-------|--------|-----|
| Diagram of molecules | | | |
| Sentence explaining how molecules are moving. | | | |

ANALYZE:

13. How was this substance similar to water in each state of matter? How was it different?

14. Were your predictions (see p. 1) correct or incorrect? Explain.

BONUS: Optional, worth up to 10 points added to the lab's final grade

15. Choose a substance other than water from the menu on the right side of the program. Use the slider to add and remove heat. Based on what the molecules do, figure out the approximate temperatures of the melting point and boiling point of this substance. (Hint: The temperatures given when you click solid, liquid, and gas are NOT the melting and boiling points.)

Substance:

Melting Point:

How did you figure it out?

Boiling Point:

How did you figure it out?
