Name:_____ **Date:** _____ **Block:** _____

Science 8: Changes of State Lab

Purpose: to heat water through its three states of matter, graph the data, and interpret the results

Materials:

- Safety goggles
- Crushed ice
- 400-mL beaker
- Wire gauze or hot pad
- Hot plate
- Oven mitts OR tongs
- Timer (phone ok)
- Thermometer
- Ring stand with clamp

Safety:

- Be careful and use your common sense when handling hot objects and surfaces.
- If your skin comes in contact with hot water or a hot object, flush it immediately with lukewarm tap water for 10 minutes or as directed by your teacher. Inform your teacher immediately.
- Thermometers are made of glass and can easily break or roll. When not in use, place them perpendicular to the edge of the table or between objects so they cannot roll off the table.

Procedure:

1. Wash your hands. Tie your hair back if needed.
2. Set up the experiment as directed by your teacher. Put ice in your beaker. Make sure the bottom of the thermometer is *close to, but not touching* the beaker bottom.
3. Record the temperature of the ice at 0 minutes, in your observation table.
4. Draw a picture of the set-up in your lab report. Include labels of the lab equipment. (Recommend: take a photo for later so you can refer to it later if needed.)
5. Put on your safety goggles.
6. Remove your beaker carefully from the hot plate, then turn the hot plate to high heat. Wait until the hot plate becomes hot. (Put the back of your hand close to it.)
7. Raise your thermometer out of the way, put your beaker onto the hot plate, then replace your thermometer to its original position. Start your timer.
8. Record the temperature every 30 seconds as the ice is heated.
9. Describe any changes you observe, in the “Additional Observations” column. (Make sure to record the times of the observations.)
10. The water is ‘boiling’ when very large bubbles rise up at a rapid pace. Continue recording the temperature for 2 minutes after this point.

Observations

Time	Temperature (ºC)	Additional Observations (indicate time of observations)
0		
0:30		
1:00		
1:30		
2:00		
2:30		
3:00		
3:30		
4:00		
4:30		
5:00		
5:30		
6:00		
6:30		
7:00		
7:30		
8:00		
8:30		
9:00		
9:30		
10:00		

Experimental Set-up

Draw and label your experimental set-up. Your drawing should include the following: beaker, ice, thermometer, clamp, ring stand, hot plate.

Lab Questions

Answer the following eight questions in full sentences, except where otherwise indicated. Use your notes, the 2.3 powerpoint, and textbook pages 139-141 to help you.

1. What is 'temperature'?

2. a) What does 'melting point' of a substance mean? (Hint: you should use the word 'temperature' in your answer.)

   b) What does 'boiling point' of a substance mean? (Hint: you should use the word 'temperature' in your answer.)

3. a) Do some extra (internet) research to complete this table. Check with a neighbour to make sure your table is correct before continuing.

Substance	**Melting Point (°C)**	**Boiling Point (°C)**
Water (H_2O)		
Carbon dioxide (CO_2)		
Gold (Au)		
Aluminium (Al)		
Nitrogen (N_2)		

What website(s) did you use to help you fill out the table?

b) Use the information from part 'a' to complete these statements.

i. Water is a _____ (solid/liquid/gas) at –30°C.

ii. Water is a _____ (solid/liquid/gas) at 50°C.

iii. Solid gold can melt into liquid gold at _____°C.

iv. Gold condenses from a gas to a liquid at or below _____°C.

v. At 1000°C, aluminium is a _____ (solid/liquid/gas).

vi. At 25°C, nitrogen is a _____ (solid/liquid/gas)

vii. At 0°C, carbon dioxide is a _____ (solid/liquid/gas).

viii. At -100°C, carbon dioxide is a _____ (solid/liquid/gas).

ix. At or below _____°C, aluminium can freeze from a liquid to a gas.

c) Liquid nitrogen is extremely cold and can damage your skin if you are not careful. Explain why this is the case.

Results

4. In your experiment, what temperature was the ice at the very beginning? (point form ok)

5. In your experiment, what temperature did you record *right after* all the ice had just melted? (point form ok)

Discussion Questions

6. How did the temperature of the liquid water change as you continued to add heat? Explain what this tells you about the kinetic energy of the particles during this time.

7. As you continued to heat the water past the boiling point, why did the temperature stop increasing? Where is the heat energy going?

8. Use the KMT to explain how a solid becomes a liquid. Your response should be a paragraph and should discuss kinetic energy, attraction, and particle spacing and movement. Use as many vocabulary words from 2.3 as you are able. You may continue your paragraph on the back of this page if you run out of space.

Results: Graph

Your teacher will provide further instruction about how to create a graph to illustrate your results. Attach your graph to the back of this lab report when you hand it in.

- Plot time(minutes) on the x-axis.
- Plot temperature (^oC) on the y-axis.
- Connect the plotted dots with straight lines.
- Ensure your graph has a title, x and y axis labels, and is completed in pencil. Your graph should fill up at least half the page provided: the bigger the better!