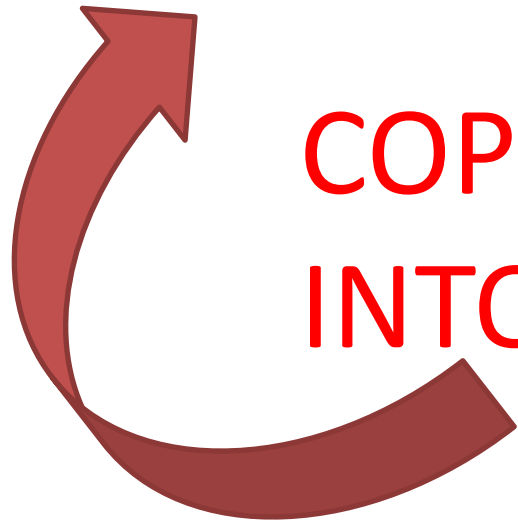


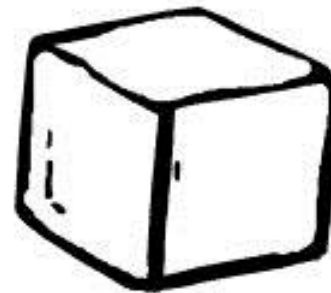
LW#10: JUST A PHASE

PROBLEM: How does the motion of the particles in a substance change as it moves from state to state?

**COPY THE TITLE AND PROBLEM
INTO YOUR SCIENCE NOTEBOOK**



SOLID



GAS




LIQUID

RESEARCH:

When you are ready, go to

<http://phet.Colorado.edu/en/simulation/states-of-matter-basics>

and begin the simulation by clicking the “**PLAY**” button.

- Choose “STATES” on the LEFT-HAND SIDE.
- On the TOP RIGHT, notice the options to view **NEON, ARGON, OXYGEN AND WATER**.
- Experiment with adjusting the amount of heat applied to the system using the control at the bottom of the container (notice you can see the temperature change as you add or remove heat).
- When you are ready to begin the experiment, hit “**RESET**”  on the bottom RIGHT CORNER.

PROCEDURE:

PART A: OBSERVING EACH STATE OF MATTER

1. Copy the chart below into your notebook.

	NEON	ARGON	OXYGEN	WATER (H ₂ O)
The shape the particles take in SOLID FORM				
The shape the particles take in LIQUID FORM				
The shape the particles take in GAS FORM				

2. On the right side, click on the SOLID button to begin.

3. In the UPPER RIGHT, change from one substance to another and draw an example of EACH SUBSTANCE in the SOLID STATE.

4. Change the state of the substance to LIQUID by clicking on the LIQUID BUTTON, and draw an example of EACH SUBSTANCE in the LIQUID STATE.


5. Change the state of the substance to GAS by clicking on the GAS BUTTON, and draw an example of EACH SUBSTANCE in the GASEOUS STATE.

PART A ANALYSIS:

A. HOW is the arrangement of the WATER (H₂O) MOLECULES in solid form different from the arrangement of solid molecules of the other substances?

B. Did you know water is the ONLY substance on Earth where the solid form is less dense than its liquid form? Select the WATER (H₂O) option at the top and click between the solid and liquid states. Using what you observe and your past experience with DENSITY, EXPLAIN why the solid form of water (H₂O) is able to float in its liquid form.

PART B : OBSERVING AS MATTER CHANGES STATE

1. Click “RESET”  again on the BOTTOM RIGHT.
2. Select *ANY ONE* of the four substances for the container.
****MAKE SURE TO CHANGE THE THERMOMETER TO °C, NOT K!!****
3. Increase the heat at the bottom of the container and observe what happens to the particles’ energy AND the distance between the particles.

PART B: ANALYSIS

C. Describe how the PARTICLES ENERGY and DISTANCE BETWEEN PARTICLES changes as the substance moves from state to state.

D. Create a “RULE” for when you know that your substance has changed state for each of the following:

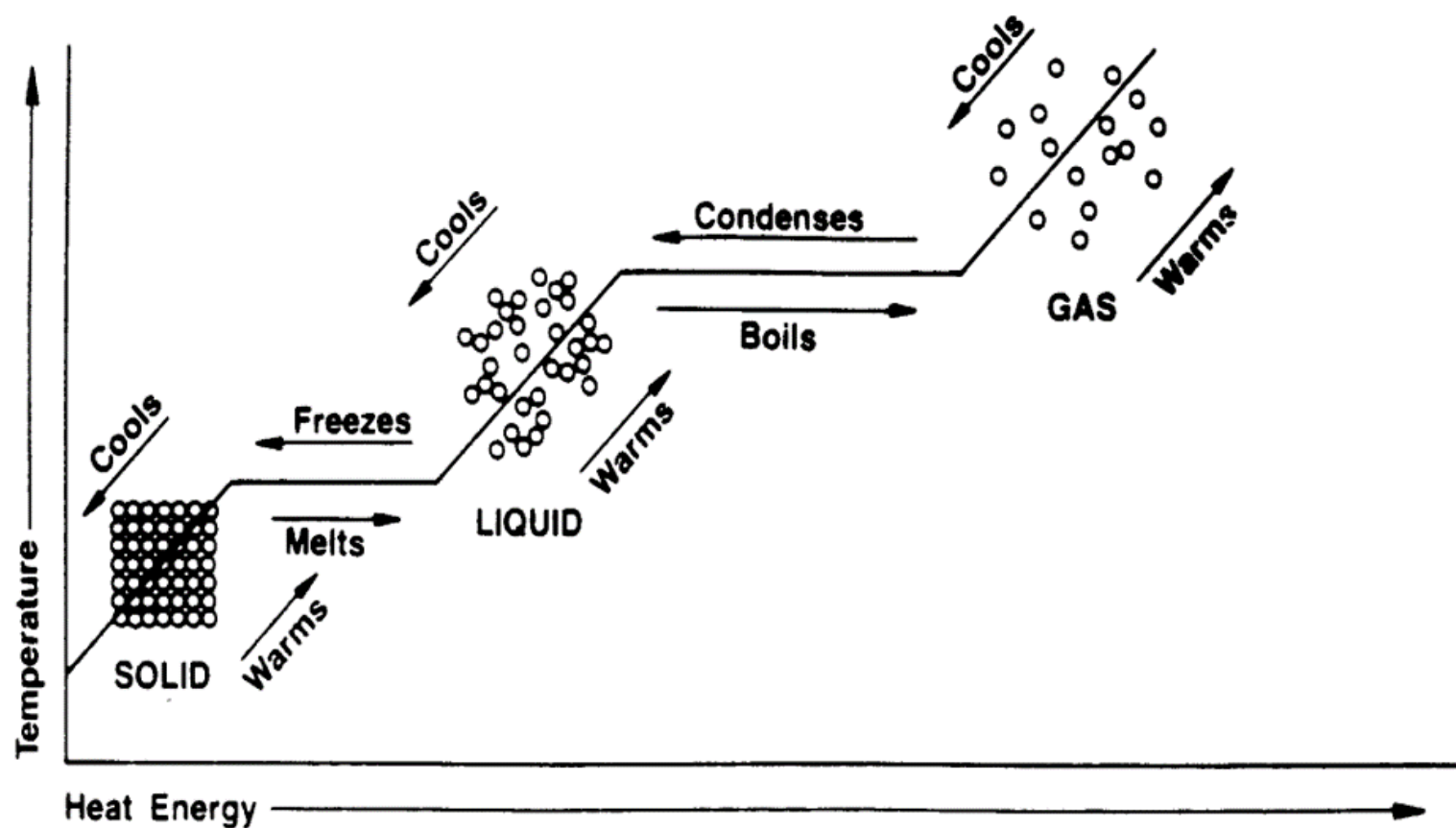
- *SOLID → LIQUID → GAS*
- *GAS → LIQUID → SOLID*

E. What is happening to the VOLUME of your selected substances as it is being heated?

F. What is happening to the DENSITY of your selected substances as it is being heated?

FINAL ANALYSIS:

Copy the graph below into your notebook, THEN answer the following questions:



G. Notice the graph contains TWO places where it flat lines (no increase in TEMPERATURE even though there is an increase in HEAT ENERGY). Why do you suppose the temperature is not increasing even with the added heat energy (where is the energy going)?

In science, TEMPERATURE is defined as a measure of the amount of Kinetic energy in a substance...therefore,

H. Can a substance get hotter once is it boiling, AND can a substance get colder once it is frozen? Why do you suppose that is?

I. Is an ice cube releasing heat or taking in heat from the environment when it melts? EXPLAIN

J. When water is freezing, is it releasing heat or taking heat from the environment? EXPLAIN