PhET Simulator:
Particle Motion & Phase Changes

Name: _____

Date: _____ Period: _____

Type in the web address: **http://phet.colorado.edu/en/simulation/states-of-matter-basics** and click the "**Play**" button. You will need the latest version of Java to use the simulator.

Part A: Phase Changes

1) 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 apply or remove heat- head to a temperature converter to see how the *Kelvin* unit compared to *Celsius* or *Fahrenheit*. You'll need to use the converter later on.) When ready, hit "**Reset All**" on the bottom left corner.

2) Complete the chart below by sketching the shape the different substances taken when solid.

	Neon	**Argon**	**Oxygen**	**Water (H_2O)**
Sketch the shape the molecules take in <u>SOLID</u> form.				

3) a) What do you notice is different about the arrangement of the **H_2O molecules** in solid form compared to the arrangement of molecules in 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 (H_2O) option at the top and click between the Solid and Liquid phases. Using what you observe, <u>explain</u> why the solid form of water (H_2O) is able to float in its liquid form.

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_____

4) Click between Solid, Liquid and Gas for each substance and pay careful attention to the "attraction" between molecules in each phase. For each state, rank which has the **GREATEST** to **LEAST** attraction between molecules.

   Solid: _____   Liquid: _____   Gas: _____

5) Click "**Reset All**" again on the bottom left. Select *any* of the four substances to place into the container. Increase the heat at the bottom of the container and observe. Can you tell when your substance changes state <u>just by observing the particles</u>? Create a "rule" for when you *know* that your substance has changed state:

      a) Solid to Liquid: _____

      b) Liquid to Gas: _____

      c) Gas to Liquid: _____

      d) Liquid to Solid: _____

6) What is happening to the **<u>volume</u>** and **<u>density</u>** of your selected substance as it is being heated?

_____

7) Click "**Reset All**" again on the bottom left. Use the thermometer at the top to try and find the <u>melting</u>, <u>boiling</u>, <u>condensation</u> and <u>freezing</u> points for each substances in K, °C and °F (use the online converter)! (You may verify your temperatures for accuracy online).
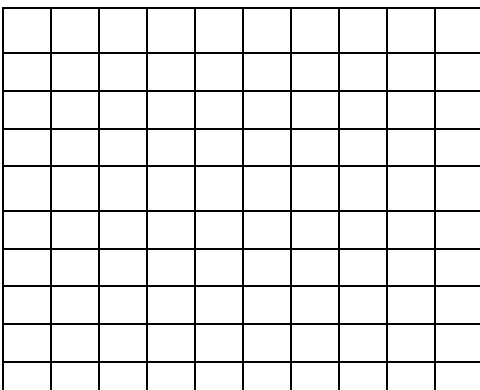
Temperature	Neon (K, °C, °F)	Argon (K, °C, °F)	Oxygen (K, °C, °F)	Water (K, °C, °F)
Melting Point				
Boiling Point				
Condensation Point				
Freezing Point				

8) Pick one of the four substances and <u>graph the two phase changes</u> as it's being **heated** and a separate graph showing the phase changes as it is **losing heat.**
      a) Choose any units for time on the x-axis, **<u>use °C</u>** as your units for temperature on the y-axis.
      b) Label the phase changes as well as when the substance is a solid, liquid and gas for both.

      _____ **being heated**   _____ **losing heat**