Student directions *States of Matter*: Phase Changes and Diagrams
Also could use *Atomic Interactions*

60 minutes

Learning Goals: Students will be able to: (2 levels of goals listed)

A. Identifying and Describing Particle behavior as it relates to phase.

1. Describe differences and similarities between monatomic, diatomic, and polyatomic particle behavior.
2. Describe how the vapor pressure of a liquid or solid is measured.
3. Describe how changing the pressure or temperature can change the state of matter.
4. Given the position on a phase diagram from which the labels are all removed, identify the phase present and determine the microscopic behavior of molecules. And vice versa.

B. Explaining behavior using Bonding

5. Develop ideas about why there is variation in inter-particle forces (other references will be needed).
6. Differentiate between non-polar and polar molecular behavior as it relates to phase.
7. Relate changes in the strength of the inter-particle bonding to changes in the phase diagram, vapor pressure, and transition temperatures.

Directions:

1. For the learning goals in Section A, design experiments to learn 1-4. For your paper, you should write the learning goal #, a description of the tests that you used, and an explanation of the results that demonstrate your learning. You may use a set of experiments to learn multiple goals - just make sure that it is clear. For example you might state: " For goals 2 and 3, we ..(description of experiment)..". Then include diagrams and descriptions that demonstrate that you can do goals.

2. For Section B #6, use your text or other resources to
    a. Define Dipole-Dipole force and London dispersion forces.
    b. Explain which is stronger and why.
    c. Describe how the inter-particle forces (strength) of each could vary.
    d. Identify which type of bonding each of the example (Ne, Ar, O_2, H_20) particles has.

3. For Section B #5-7, design and describe experiments. Then demonstrate your goal proficiency. You may want to use the simulation ***Atomic Interactions*** to help with this section.