

Name: \_\_\_\_\_

**Unit 4 - Topic 2**  
*Particle Attractions – Intermolecular Forces (IMFs)*

Concept: Energy and Interactions

- Lab: Particle Behavior
- Assignments: Particles & Attractions

**READ** - *Underline key points. The information contained in this reading is all testable. If you're unsure of a vocabulary word, highlight it and look up its definition for a bonus point!*

Although it is important to compare the phases of matter from a properties standpoint, we can go a step further and explain why the different phases of matter have the properties that they do from a *kinetic molecular theory* standpoint. It really has to do with particle attractions; in other words, particles clinging to one another. When comparing a solid to a liquid or to a gas, the relative attraction between particles decreases. This should make sense if you think about the particles in terms of energy.

Particles in a solid have little kinetic energy on average compared to that of a liquid or a gas. Particles in a solid are simply vibrating and thus remain close together and fixed in position. As heat energy is absorbed by a solid, the particles wiggle and vibrate in place more and more, until finally they have too much energy to stay put. The attractions between the particles in the solid state are weakened as the particles gain energy. At this point the solid starts to melt.

As heat continues to be added, eventually all the solid particles are freed from their positions and can all move and flow past one another. At this point we say the solid has completely melted. As the particles in the liquid state continue to be heated, they move faster as noted by the increase in temperature of the liquid. (Remember that temperature is a measure of the average kinetic energy of the particles in a sample.) As the addition of thermal energy causes the molecules to move faster and faster, eventually there comes a point where they can no longer attract each other at all. When this happens, the particles 'escape' from each other, vaporizing into the gas state.

Vocabulary word I didn't know and its definition: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Name: \_\_\_\_\_

Questions:

1. Temperature is the measure of: \_\_\_\_\_

2. Rank the following from least to most particle attractions: SOLID, LIQUID, GAS

3. Rank the following from least to most particle motion: SOLID, LIQUID, GAS

4. Name the following phase changes:

1. Solid → liquid \_\_\_\_\_

4. solid → gas \_\_\_\_\_

2. Liquid → solid \_\_\_\_\_

5. gas → liquid \_\_\_\_\_

3. liquid → gas \_\_\_\_\_

6. gas → solid \_\_\_\_\_

5. Explain what happens to particle attractions during melting and vaporizing.

6. Explain what happens to particle motion during melting and vaporizing.

7. Explain what happens to particle attractions during freezing and condensation.

8. Explain what happens to particle motion during freezing and condensation.

Use the following graphic organizers on the following page to compare solids, liquids, and gases. Your textbook is an excellent resource for filling these out.

Name: \_\_\_\_\_

|   |  |
|---|--|
| General Characteristics   | 3 Examples of elements that exist as solids at STP                                     |
| <b>SOLID</b><br>(p. 396)  |  |
| Particle Attractions<br>(Describe the degree of attraction between particles) | Particle Diagram<br>(Draw a particle diagram of the compound NaCl(s) - Include a key!) |

|   |  |
|---|--|
| General Characteristics   | 2 Examples of elements that exist as liquids at STP  |
| <b>Liquid</b><br>(p. 390)   |  |
| Particle Attractions<br>(Describe the degree of attraction between particles) | Particle Diagram<br>(Draw a particle diagram of the compound Br <sub>2</sub> (l) - Include a key!) |

|   |  |
|---|--|
| General Characteristics   | List all the elements that are gases at room temperature (20°C)  |
| <b>Gas</b><br>(p. 385+)   |  |
| Particle Attractions<br>(Describe the degree of attraction between particles) | Particle Diagram<br>(Draw a particle diagram of a mixture of elements F <sub>2</sub> (g) and Ne(g) - Include a key!) |