Organizer – Kinetic Molecular Theory (KMT) and the Behavior of Gases

Three Assumptions of Kinetic Molecular Theory:
1. Molecules of gases are in continual motion in straight lines
2. Molecules of gases are far apart and move independently of one another
3. Energy is not lost when molecules collide with each other or with the walls of the container (called *elastic* collisions)

Important Properties of Gases
1. Gases are **fluid** - particles easily flow past one another
2. Gases exert pressure when they collide with the walls of a container
3. Low Density - A substance in the gaseous state has 1/1000 the density of the same substance in the liquid or solid state
4. Gases can be compressed, decreasing the distance between particles, and decreasing the volume occupied by the gas
5. Gases diffuse - spontaneous mixing of particles of two substances caused by their ***random motion***

	Increase the volume of the container		**Increase the Temperature**		**Increase the mass of the molecules**	
	Effect of change	**Explanation**	**Effect of change**	**Explanation**	**Effect of change**	**Explanation**
Rate of Diffusion	Increased rate of diffusion	In a larger container, the molecules are farther apart, so they collide with each other less often, and diffusion speeds up	Increased rate of diffusion	At higher temperature, the molecules will move faster, so diffusion takes place faster as well	Decreased rate of diffusion	Large molecules move more slowly than small molecules, so they diffuse more slowly as well
Pressure	Decreased pressure	The number of molecules does not change, nor does their speed. The increase in surface area means that there will be fewer collision per unit of area, thus lower pressure	Increased pressure	Increases in temperature cause the molecules to move faster, so they hit the walls of the container more often, and harder	No Change	Kinetic energy increases with temperature only. Notice that we don't care about the identity of a gas when calculating pressure

Some Practice questions:
1. Which of the following gases diffuses most rapidly at 25 °C?
   O_2 N_2 He H_2
2. One mole of a gas is in a ten liter container. At which temperature does it have the highest pressure?
   0 °C 15 °C 25 °C 100 °C
3. Each of the following jars contains the same number of molecules, at the same temperature. In which is the pressure highest?
   1 Liter jar 5 Liter jar 10 Liter jar 25 Liter jar
4. At which temperature will hydrogen cyanide gas be diffusing most rapidly through a room?
   10 °C 18 °C 25 °C 30 °C
5. At what temperature will gas molecules in a room be moving fastest?
   10 °C 18 °C 25 °C 30 °C
6. Which of these gases has the greatest density, assuming all are at the same temperature?
   O_2 N_2 He H_2