**Experiment #1 Changing from liquid to gas**

**What this experiment aims to show:**

In this experiment we will be demonstrating the differences in properties between gasses and liquids by evaporating water. By boiling water by adding heat energy, we will cause a phase change from liquid to gas. This experiment shows two main things, the first is the properties of liquid and gas and how they fill spaces. This demonstrates how molecules spread out between gas and liquids. The second thing shown by this experiment is how states change at certain amount of heat energy, or temperature, depending on the substance. In the case of water, we do not start to get vapor until the water reaches 100 degrees Celsius or 212 degrees Fahrenheit.

**Supplies:**

-Pot

-thermometer

-ladle or some way to transfer the boiling water

-balloon

-water

-thermos

-ice (optional)

**Safety:**

Because we are boiling water, we will need to be careful to not be burned. There will be hot surfaces used to heat the water. These should be clearly marked and made known. Next is the boiling water and hot pan, these will take time to cool down so just because the heat is off doesn’t mean these are hot. When pouring the water into the thermos be careful not to spill on yourself or others. The hot water vapor fills the balloon also becomes very dangerous if it pops. To handle this only allow the balloon to inflate enough to show the demonstration then let the water cool down and the balloon deflate before cleaning up the experiment, or if you have ice place in the pot of water to speed up the process.

**Instructions:**

First you will want to prepare to boil the water. Pour water into the pot and heat using using a hotplate or stove. You will have to wait for the water to boil so prepare the thermos in the meantime. Take the lid off the thermos and place the balloon around the throat off the lid so that it is secured. It should stay on, but you might want to hold the base of the balloon and the throat of the lid to prevent it from coming off. Using the thermometer, you can watch to see that the water doesn’t boil till reaching 212 degrees Fahrenheit. When the water is boiling you will want to transfer it to the thermos canaster. Transfer enough boiling water so that it wont cool off to quickly, this will probably be around 1 cup of water. Once the water is in the thermos screw on the lid with the balloon. Allow the balloon to inflate with the water vapor and not how much it expands. Allow too cool and the balloon to deflate before taking it off and pouring out the water and before disposing of the water in the pot. You can ice cubes to cool down the water if you need or want to clean up faster.

**Experiment #2 Heat energy and its effects on same state properties**

**What this experiment aims to show:**

This experiment demonstrates how even before phase changes, adding heat energy or taking it away effects the properties of the material. These changes in properties are small compared to the massive changes in phases, but still slightly changes in the phase it is progressing towards. In this experiment we will be demonstrating how solids can expand and contract depending on the heat energy present in it despite not having enough to change states. To show this we will use a metal lid on a jar. When the jar is cooled the metal contracts because the molecules will pack tighter together like how they did when it turned from a liquid to a solid. This makes it harder to open the jar as the lid squeezes on to it. To get it off we run it under warm/hot water causing it to expand and loosen off the jar. This exemplifies the molecules getting more heat energy and spreading out as it moves closer to changing into a liquid.

**Supplies:**

-Jar and its metal lid

-freezer or way to cool the jar

-warm water or other way to warm it up

**Safety:**

There is not much possible harm in this experiment. The only thing to look out for is how hot the water is when you go to heat the jar as it could cause the glass to crack or burn your hand. Another might be the coldness of the jar and what you cool it with. If you were to be constantly exposed this, it could cause cold related damages. Other then these warnings there is not much danger proposed by this experiment.

**Instructions:**

First thing you need to do is take off the lid of the jar at room temperature. Take not of how difficult it was to take off on a scale of 1, being like butter, or 10 being impossible. Next you will want to put the lid back on and place in freezer for 10 minutes. After 10 minutes take out the jar making sure not to touch the metal lid as you don’t want to heat it before you try an open it. Open the lid and rate the difficulty like before on a scale of 1-10. Next place the jar back in the freezer for 5 minutes to get it cold again. Now when you take it outrun the lid under warm water for 20 seconds and open the lid, once again rating it on a scale of 1-10. While these scores vary lots because of individual strength and perception of difficulty. You should notice that the lid was very difficult to open cold when compared to room temperate or after it has been warmed by water.