**Rocket Lab: Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Today we will be looking at a miniature version of the reaction that NASA uses in some of their rockets engines that carry space shuttles into orbit. Several combinations will be tested for relative reactivity.

**Pre-Lab Questions:**

1. In order to test for the reactivity; we need to examine several of the reactions. The first reaction takes place when Zinc is added to a 3.0 M solution of Hydrochloric Acid.  
   1. Write and balance the chemical reaction below. Include states of matter.   
      (*Hint: diatomic molecules!*)
   2. Looking at the reactants, which type of reaction will take place?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. The second reaction takes place when Potassium Iodide is added to catalyze the decomposition of Hydrogen Peroxide (H2­O2) into water and oxygen gas.   
   1. Write and balance the chemical reaction below. Include states of matter.   
      (*Hint: diatomic molecules!*)
   2. What is the purpose of a catalyst? Are catalysts consumed in a reaction?

**Procedure:**

We are going to use these reactions to produce the gases needed for this experiment. Inside each container, we will capture combinations of Hydrogen gas and Oxygen gas.

1. In a container labeled with an H – Add a few pieces of Zinc metal, and add HCl until about ½ of the container is full. Seal the container with a top.
2. In a container labeled with an O – Fill the container ½ full with Hydrogen Peroxide and add a small amount of Potassium Iodide catalyst. Seal the container with a top and Allow a few minutes for the reaction to get going.
3. Submerge the rocket pipette, and fill with water *completely*. There can be no air in the rocket.
4. Invert the rocket over each gas container and capture the gases inside the container. Be sure to leave a little water in the bottom of the rocket to keep the gas from escaping. This is critical to it working!
   1. Fill the rocket with just oxygen gas. Then squeeze the air out right next to the Bunsen burner flame.   
      **Observation: How does a container filled with all Oxygen react to the flame?**
   2. Fill the rocket with just hydrogen gas. Then squeeze the air out right next to the Bunsen burner flame. **Observation: How does a container filled with all Hydrogen react to the flame?**
   3. **Observation: How does a container filled with half Oxygen and half Hydrogen react to the flame?**
5. Load your rocket pipette with different ratios of H2 and O2 gas. Determine what the best ratio of gases is to produce the largest explosion!   
   **Write your conclusions and justify your results:**

1. Now that you have found the best ratio of H2 and O2, prepare two test rockets for a competition. You will be allowed to change the amount of gas and launch angle so it may be worth conducting a few trials before launch!

**Post-Lab Questions:**

1. When we ignite the lighter on the launch pad, an explosion takes place inside of the rocket causing the temperature to increase. Explain what is happening inside of the rocket that it is able to fly off of the launch pad. Use concepts from KMT **and** PV=nRT to explain your answer.
2. The volume of gas inside the rocket is 5.00 mL. Using your ideal ratio of oxygen and hydrogen, determine how many Liters of each gas are inside your rocket.
3. At standard conditions, 1 mole of any gas occupies 22.4 L. Using this equivalence, determine the moles of H2 and moles of O2 gas in your rocket. (Standard Conditions “STP” are 273 K and 1 atm).
4. During the combustion of the two gases, the temperature inside the rocket temporary increases to approximately 800 degrees Celsius. Use the ideal gas law to determine the pressure generated inside the rocket during combustion:

1. NASA uses this same reaction of oxygen and hydrogen to propel their rockets; however it requires a great deal of oxygen and hydrogen. Using gas law knowledge, hypothesize on how NASA is able to store the required amount of gas for a space launch.