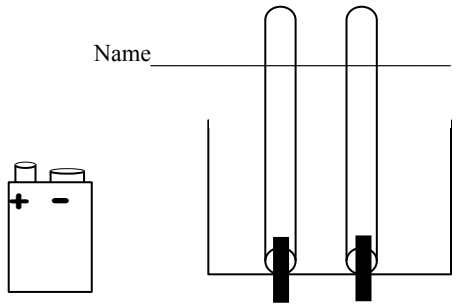
LAD G5 (pg 1 of 2) Decomposition Reactions

Name_____

1. Electrolysis of Water

Label the gases in the diagram, connect the wires, mark the level of gases in the collection tubes.



a. Observations:

b. Reaction:

c. You may remember that water doesn't conduct electricity very well, so the liquid is actually a *very* dilute solution of sulfuric acid. Write out the chemical formula for sodium bicarbonate and write an equation that demonstrates what happens when put into water. Explain why it is necessary to help "conduct" the electricity.

d. What substance(s) is(are) in the bubbles?

e. What are the relative amounts of gas forming in each tube? Why is there more of one gas than the other? Which gas is which?

f. Which gas is forming at the – end of the battery? Explain why this would be occurring at the negative end of the battery.

2. Hydrogen Peroxide Genie

a. Observations:

b. Reaction:

c. Water vapor is colorless, so it's not water vapor that you see coming out of the top of the bottle. What is it?

d. What landed on the lab bench?

e. What rushed out of the bottle, and what caused it to rush out of the top of the bottle?

f. What is the temperature of the bottle after the reactions? What happened to the shape/size of the bottle immediately after the reaction? Explain why. Is this reaction exothermic or endothermic? How do you know?

g. When the cap was put on after the reaction the bottle appears to slowly crush inward. Explain why.

h. H_2O_2 has an unstable O—O bond. Explain why it is sold in brown bottles.

3. Elephant Toothpaste – A Discussion About Catalysts

a. Observations:

Introduction to catalysts

Catalysts are agents that change the speed of a chemical reaction without undergoing a permanent chemical change itself in the process. They affect the collisions that cause the reaction to occur. Catalysts play a crucial role in our lives. The physiology of most living species depends on enzymes, which are protein molecules that act as catalysts, increasing the rates of selected biochemical reactions. Much industrial chemical research is devoted to the search for new and more effective catalysts for reactions of commercial importance because fast reactions means more product in less time, which means more profit. Chemists sign contracts to keep them from engaging in "chemical espionage." Extensive research efforts are devoted to finding means of inhibiting or eliminating certain catalysts that promote undesirable reactions, such as those that corrode metals, age our bodies, and cause tooth decay.

Catalysts fall into two general categories. A catalyst that is present in the same physical state as the reacting molecule is a *homogeneous catalyst*. A *heterogeneous catalyst* exists in a different physical state from the reactant molecules, usually as a solid in contact with either gaseous reactants or with reactants in a liquid solution. A heterogeneous example is the catalytic converter that is part of your exhaust system underneath your car. Metal oxides in the catalytic converter help to react any unburned gasoline that gets out of the engine. The metals used in these metal oxides are platinum, palladium, and rhodium, all of which are more expensive than gold, and what make the catalytic converter so expensive to replace.

The reaction that occurred to cause the "Elephant Toothpaste"

The test tube contained hydrogen peroxide, H_2O_2 (with dish soap added for effect), an unstable molecule which was catalyzed by the I^- in the KI solution. The mechanism for the reaction occurs in two steps which occur at different speeds.

b. In the space below, add the two reaction steps to get the overall reaction, crossing out any particles that occur on both sides of the reaction − this will result in the reaction.

step 1 (slow reaction) $H_2O_{2(aq)} + I^-_{(aq)} \rightarrow IO^-_{(aq)} + H_2O_{(L)}$

step 2 (fast reaction) $H_2O_{2(aq)} + IO^- \rightarrow H_2O_{(L)} + O_{2(g)} + I^-_{(aq)}$

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net result

c. How do the two reactions show that I^- is a catalyst?

d. A compound that forms during a reaction, and then gets used up before the reaction is over is called an *intermediate*. Which substance is the intermediate in this reaction?

e. What gas was formed inside the bubbles? What lab test was done to help confirm the presence of this gas?

f. What caused the foam to form from the soap suds?

g. As the reaction proceeded, did it warm up or cool down? How could you tell? Is this an *exothermic* or *endothermic* reaction?