Name_____

Hindenburg Disaster Reenactment: "Oh, the humanity!"

Introduction:
The suddenness of the disaster was shocking. At 7:25 p.m. on May 6, 1937, while the *Hindenburg* was attempting to land at the Lakehurst Naval Air Station in New Jersey, a flame appeared on the outer cover of the rear of the *Hindenburg*. Within 34 seconds, the entire airship was consumed by fire. *Watch the footage and listen to the commentary of Herbert Morrison.*

Science Concepts:
When hydrochloric acid is added to zinc metal, zinc chloride is formed in the flask liberating hydrogen gas, This hydrogen gas will be collected in a balloon. *Zinc* and *HCl* acid are the reactants and *zinc chloride* and *hydrogen* are the products.

Write the equation for this reaction below. Try it yourself first…You'll get a hint soon.

Materials:

balloon "Hindenburg"	25 mL HCl acid (6 M)
125 mL Erlenmeyer flask	matches
meter stick with string tied to it	candle
10 grams of zinc metal	safety goggles

Read the story of the Hindenburg on the last page of this lab.

Safety: Be sure everyone is wearing safety goggles!

Directions Part I: Filling the "Hindenburg"
1. Pour hydrochloric acid (25mL) into the flask. (rinse hands, any spills and all equipment)
2. Mass and put the zinc metal (10g) in the balloon. (choose skinny pieces so they fit)
3. Attach balloon containing zinc to the flask. (do NOT let the zinc fall into the HCl acid)
4. Lift the balloon to allow the zinc to fall into the HCl acid.
5. Collect the gas in the balloon. Make observations and answer Questions #1-8.

Explanation:
When the zinc and hydrochloric acid are combined, they form hydrogen gas. The gas molecules collide with the walls of the balloon, causing pressure, which causes the balloon to inflate. When the bubbling ceases it indicates the end of the reaction.

Question #1: Write down observations of the reaction. Use all your senses (EXCEPT TASTE!)

Question #2. What was the limiting factor in your reaction? The HCl or the zinc?

Question #3: How do you know which (zinc or HCl) was the limiting factor?

Changes in Matter
Question #4: What are the three states of matter?

Question #5: What is the difference between a physical change and a chemical change?

Chemical Reactions
Question #6: What is a chemical reaction?

Question #7: Feel the Flask, is this an exothermic or endothermic reaction? (Explain why)

Question #8: How do synthesis, single replacement, and double replacement reactions differ?

Directions Part II: Reenacting the Disaster, "Oh, the humanity!"
6. After the reaction has ceased, remove and tie the balloon.
7. Tie the balloon to the end of a meter stick with the string.
8. Light the candle and put it in the middle of a cleared off table.
9. Hold the meter stick and move the balloon over the flame, as you scream, "Oh, the humanity!"
10. Clean up all equipment, tables and hands. Complete questions #9-14.

Hydrogen gas is also extremely flammable, and when the flame is held up to the balloon, it causes that intense explosion from the reaction with oxygen in the air. *Hydrogen* and *oxygen* are the reactants and *water* is the product. (both Hydrogen and Oxygen are diatomic [2] molecules)

Write the equation for this reaction below. Try it yourself first…You'll get a hint soon.

The Hindenburg
Question #9: What do you know about the Hindenburg?

Question #10: What was happening in America and Germany in the 1930's?

Hydrogen and the Hindenburg
Question #11: Why was the Hindenburg inflated with hydrogen instead of helium?

Question #12: What are some uses of hydrogen in today's society?

The End of the Airship Era
Q #13: With knowledge of what happened to the Hindenburg, can airship travel be safe today?

Q #14: Give 3 examples of major historic disasters and accidents and how were they caused?

The Story of the Hindenburg Disaster

On May 6, 1937, at 19:25 the German zeppelin ***Hindenburg*** caught fire and was utterly destroyed within a minute while attempting to dock with its mooring mast at Lakehurst Naval Air Station in New Jersey. Although the disaster is famous, of the 97 people on board, only 35 died.

The LZ-129 *Hindenburg* was the largest aircraft ever. The craft was named after President of Germany Paul von Hindenburg. He (German airships have always been referred to in the masculine) was a brand-new all aluminium design: 245 m long (804 feet), 41 m in diameter (135 ft), containing 211,890 m3 of gas in 16 bags or cells, with a useful lift of 112 tons, powered by four 1100 horsepower engines giving it a maximum speed of 135 km/hr (83 mph). He could carry 72 passengers (50 transatlantic) and had a crew of 61. For aerodynamic reasons the passenger quarters were contained within the body rather than in gondolas. He was skinned in cotton, coated in cellulose varnish and then aluminium. Constructed by Luftschiffbau Zeppelin in 1935 at a cost of £500,000. He made his first flight in March 1936 and completed a record double-crossing in five days, 19 hours, 51 minutes in July.

The *Hindenburg* was intended to be filled with helium but a United States military embargo on helium forced the Germans to use highly flammable hydrogen as the lift gas. Knowing of the risks with the hydrogen gas, the engineers used various safety measures to keep the hydrogen from causing any fire when it leaked, and they also treated the airship's coating to prevent electric sparks that could cause fires.

The disaster is remembered because of extraordinary newsreel coverage, photographs, and Herbert Morrison's recorded radio eyewitness report from the landing field. Morrison's words were not broadcast until the next day. Parts of his report were later dubbed onto the newsreel footage (giving an incorrect impression to some modern eyes accustomed to live television that the words and film had always been together). See: Hindenburg Disaster Newsreel Footage)

There had been a series of other airship accidents (none of them Zeppelins) prior to the *Hindenburg* fire, most due to bad weather. However, Zeppelins had accumulated an impressive safety record. For instance, the Graf Zeppelin had flown safely for more than 1 million miles including making the first complete circumnavigation of the globe. The Zeppelin company was very proud of the fact that no passenger had ever been injured on one of their airships. Zeppelins were considered safe.

But the *Hindenburg* accident changed all that. Public faith in airships was completely shattered by the spectacular movie footage and live voice recording from the scene. Because of this vivid publicity, Zeppelin transport came to an end. It marked the end of the giant, passenger-carrying rigid airships.

Questions and controversy surround the accident to this day. There are two major points of contention: 1) How the fire started and 2) Why the fire spread so quickly. The most commonly postulated causes for the start of the fire are sabotage or a spark caused by atmospheric static buildup.

The controversy around the rapid spread of the flames centers around whether blame lies primarily with the use of hydrogen gas for lift or the flamable coating used on the outside of the envelope fabric.
Proponents of the "flammable fabric" theory contend that the extremely flammable aluminium coating could have caught fire from atmospheric static, resulting in a leak through which flammable hydrogen gas could escape. Hydrogen burns invisibly, so the visible flames (see photo) may prove that the fire could not have been caused by the hydrogen gas. Also, the naturally odorless hydrogen gas in the *Hindenburg* was 'odorised' with garlic so that any leaks could be detected, and nobody reported any smell of garlic during the flight or at the landing prior to the disaster. Had the ship been filled with the chemically inert helium, the gas could possibly have snuffed the fire at the beginning, resulting only in a leak.