More Efficient Combustion Lab

Theory:

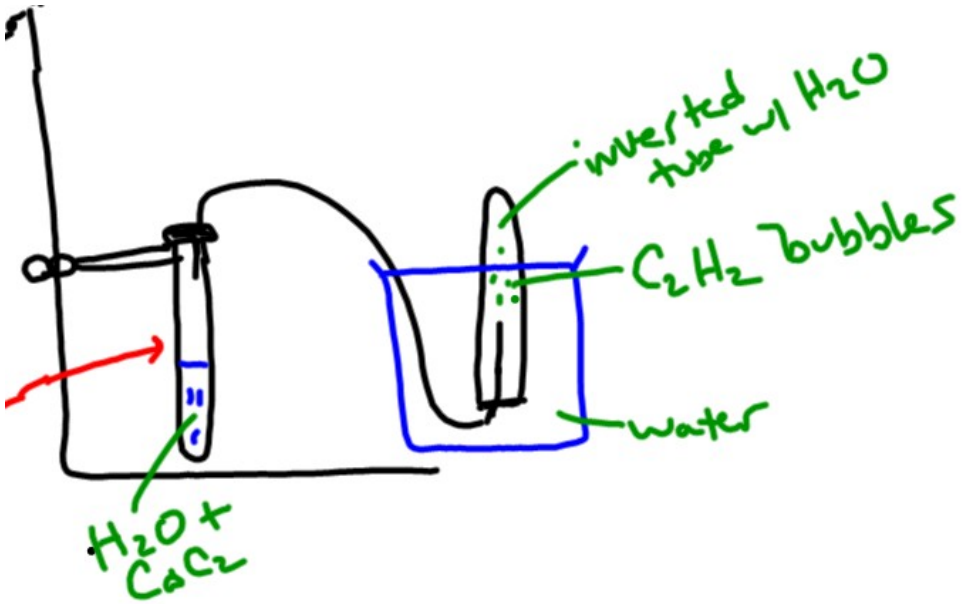
Background Information: Organic chemistry is the study of the chemistry of the covalent bonds of carbon. There are some similarities between organic and inorganic reactions. However, many organic reactions are slower and require more care in the control of facture such as temperature and concentration of reactants.

The simplest organic compounds are hydrocarbons—compounds of carbon and hydrogen. There are millions of compounds that contain only carbon and hydrogen. Carbon, unlike most other elements, forms rings and chains in its compounds. Most of these compounds have isomers. Isomers are compounds that have the same molecular formula but differ in structure.

Many carbon compounds contain additional elements, such as oxygen and nitrogen. These elements often form parts of the molecule that have higher reactivity than the rest of the molecule. These more active groups are called functional groups. Functional groups replace some of the hydrogen atoms in the basic organic molecule.

Purpose: You will prepare an alkyne and observe complete and incomplete combustion. You will be testing a reaction of an unsaturated of multiple bond, hydrocarbon.

Materials: 250 mL beaker, test tubes, water, 4-5 pea size chunks of CaC_2, splints
Safety Gear: Apron and goggles



set up

Procedure:

CAUTION: The solution formed when calcium carbide reacts with water is calcium hydroxide, a strong base. It is corrosive and avoid skin contact. Rinse spills with plenty of water.

1. Fill a 250 mL beaker ¾ full of tap water.
2. In a gas collecting test tube, use forceps to place pieces of CaC_2 in a DRY tube.
3. Lubricate the end of a glass dropper with glycerin and insert it into one hole of a two-hole stopper. Remove the bulb for the dropper. If best glass is available, use it instead.
4. Fill a second dropper with water. Being careful not to release any water, insert this dropper into the other hole of the stopper.
5. Put the stopper assembly into the test tube of calcium carbide. Use a test tube clamp & attach to ring stand.
6. Attach one end of the rubber tube to the end of the glass tube from the dropper.
7. Place the other end of the rubber tube at the mouth of an inverted test tube (which has been filled completed with DI water) in the beaker of water as shown in Figure A.
8. Add several drops of water to the calcium carbide by squeezing the dropper inserted in the stopper. Observe the reaction.
9. When the inverted test tube is filled with gas, remove it from the beaker. Keeping the mouth of the tube down, place a burning splint in the mouth of the tube. Record observations. Label the tube and put aside for reference.
10. Repeat the above procedure using test tubes that are ½ full and 1/10 full of water. Record observations.
11. Before cleaning the tubes, record observations of the amount of C on each. Do not place burned splints in the sink. Extinguish them under water and put in trash. Neutralize your base with acid and put into sink with running water.

Data:

Observations table

Discussion:

1. Calcium carbide reacts with water to produce ethyne gas and calcium oxide. Write and balance the equation for this reaction. (calcium oxide reacts with water to form calcium hydroxide, too)
2. Compare the amount of soot on each test tube after the ethyne gas was burned. A) full – 100% ethyne, B) ½ full, 50% ethyne-50% air, C) 1/10 full, 10% ethyne-90% air.
3. Write and balance the chemical equation for the complete combustion of ethyne gas.
4. Does the amount of oxygen gas (air) in relation to the amount of fuel (ethyne gas) affect the rate of combustion? Which test tube mixture gave you the fastest rate of combustion?
5. Which gas-air mixture produced the greatest amount of air pollution? Why?
6. Which gas-air mixture produced the greatest amount of energy? Why?
7. Another name for ethyne is acetylene. What are some of its uses?

Error Analysis:

Conclusion: