

## Underwater Flashes

### Purpose

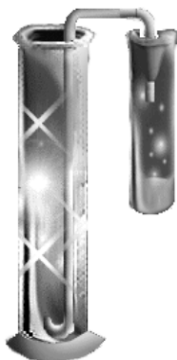
To show the dramatic exothermic reaction between chlorine and acetylene gases.

### Materials

|   |                                 |
|---|---------------------------------|
| 18 × 150 test tube                      | calcium carbide (2 or 3 pieces) |
| two hole stopper (00)                   | KMnO <sub>4</sub> (0.5 g)       |
| glass tubing (3 feet)                   | concentrated HCl                |
| 1 mL microtip, or long stem Beral pipet | ring stand                      |
| test tube clamp                         | 1000 mL hydrometer              |

### Procedure

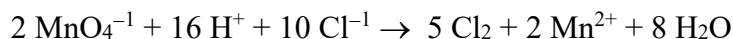
1. Bend the glass tubing and insert it into the rubber stopper, along with the pipet. Assemble the apparatus as shown in the diagram below:



2. Place the KMnO<sub>4</sub> in the test tube. Fill the Beral pipet with concentrated HCl and place the assembly in the test tube, being careful not to squeeze the pipet bulb.
3. Fill the hydrometer with water.
4. To begin generating chlorine gas squeeze several drops of HCl from the pipet onto the KMnO<sub>4</sub>. The chlorine gas will be delivered into the hydrometer and bubbles should appear. **Be careful to generate only enough chlorine to produce the reaction.**
5. Add 2 or 3 pieces of calcium carbide to the hydrometer and observe the flashes which are produced when the chlorine and acetylene react. Additional HCl may be added to generate enough chlorine gas to continue the reaction.

### Additional Information

1. Acetylene gas is produced by the reaction  $\text{CaC}_2 + 2 \text{H}_2\text{O} \rightarrow \text{C}_2\text{H}_2 + \text{Ca}(\text{OH})_2$ .
2. The chlorine gas is generated by the following reaction:



3. The sparks result from the exothermic addition of chlorine across the triple bond. Some evidence suggests that the product is actually a chlorinated polymer of acetylene.

### **Reference**

ICE Chemistry Fundamentals Workshop, Mt. San Antonio College, 1993.