Activity

Fig. 8.4 A welder works with an acetylene torch on a pipeline. (Public Archives Canada, C 47009)

Formation of acetylene, a covalent compound

Covalently bonded compounds make up an incredibly large and important group of compounds. Examples are the oxygen that we breath, carbon dioxide that plants use in photosynthesis, and the nitrogen that makes up about eighty percent of the air in the atmosphere.

Many biologically important compounds are also covalently bonded. Common sugar is an example. It is an important energy source for the human body. In addition to sugar there are many other biologically important covalent compounds such as proteins, fats, and carbohydrates. All of these compounds are necessary for the proper maintenance and functioning of the human body.

Another very large and important class of covalently bonded compounds are the hydrocarbons. Hydrocarbons are used as fuels and you probably recognize some of the more familiar names such as propane, butane, and octane.

In this activity you will produce a hydrocarbon called acetylene. Acetylene is a fuel used in welding torches. When it combines with oxygen, it produces a very hot flame that can melt certain metals.

Since welding often involves the joining of pieces of pipe, the welder must be able to add a piece of metal that can be melted around the spot where the pipe is to be joined. After the metal is melted by the acetylene torch, the torch is removed, the metal cools, and the metal at the join becomes solid.

When acetylene combusts or burns in pure oxygen, it produces carbon dioxide. This is called complete combustion. However, if there is not enough oxygen supplied during combustion, additional products are formed besides carbon dioxide. This is called incomplete combustion. In this activity you will see both complete and incomplete combustion.

Caution: Goggles and laboratory aprons must be worn.

Material

burner	250 mL beaker
forceps	tap water
wooden splints	calcium carbide lumps
test tubes (4)	limewater

Method

1. Invert a test tube full of water into a beaker of water, making sure that no water runs out of the test tube.
2. Use the forceps to place a few small pieces of calcium carbide into the beaker. Observe the bubbles rising from the calcium carbide. These bubbles are acetylene gas.
3. Place the inverted test tube over the calcium carbide and let the

acetylene gas completely fill the test tube.

4. Remove the test tube from the water and place it mouth-down on the desk top.
5. Repeat step 3 three more times with the three other test tubes, collecting one-half, one-third and one-twelfth of a test tube of acetylene, respectively.
6. Lift each tube from the water, always keeping them inverted. Allow air to replace the water that runs out of the test tubes.
7. Place your thumb over the end of each test tube. Shake each vigorously for 20 to 30 s to mix the air and the acetylene. Place each test tube mouth-down on the desk top.
8. Hold each test tube in a horizontal position and bring a burning splint close to its mouth. Wait until each reaction is complete. Place each test tube mouth-down on the desk top. Observe each test tube carefully and make diagrams of what you observe.
9. Add a few millilitres of limewater to each test tube. Shake vigorously for several seconds. Record your observations.

Questions and Conclusions

1. Which test tube held the least oxygen? The most?
2. What do the results of the limewater test indicate?
3. In which test tube did complete combustion occur? How could you tell?
4. In which test tubes did incomplete combustion occur? What other products were formed?
5. Acetylene is covalently bonded. The atoms in acetylene are arranged as follows: **H C C H.** Draw a Lewis structure to show the bond arrangement in this molecule.
6. Which type of multiple bond exists in acetylene?