Special.

ELEMENTARY CHEMISTRY.

CHAPTER III.—*Continued.*

CARBON MONOXIDE.

Symbol, CO. Molecular Weight, 28.

The element carbon forms with oxygen, besides the compound carbon dioxide, a second compound called carbon monoxide or carbonic oxide, which has the symbol, CO.

PREPARATION.

By the decomposition of Oxalic Acid by Sulphuric Acid.

Exp. 1.—Put a few crystals of oxalic acid, $H\ C_2O_4$, into a test-tube, add sufficient sulphuric acid to cover them, and gently heat; effervescence soon takes place. After a few moments bring a lighted taper to the mouth of the tube; a gas takes fire and burns with a pale blue flame. Extinguish the flame, incline the tube and hold a bottle over it for a few minutes, pour some lime-water into the bottle and shake it briskly; the lime-water becomes turbid, showing the presence of carbon dioxide. Since carbon dioxide is not an inflammable gas, two gases must have been produced. The one is carbon dioxide, the other carbon monoxide. The reaction is expressed by the following equation:—

$$H_2C_2O_4 + H_2SO_4 = H_2O, H_2SO_4 + CO_2 + CO$$

Oxalic acid. Sulphuric acid. Dilute sulphuric acid. Carbon dioxide. Carbon monoxide.

The sulphuric acid takes no part in the reaction, except removing the water, and setting free the two gases.

Exp. 2.—Place 10 grams of crystallized oxalic acid in the hydrogen flask, and through the funnel-tube pour about 30 c.c. of strong sulphuric acid. Heat the flask gently, and after allowing the air to escape, collect a large bottle full of the gases over water in the pneumatic trough. Remove the bottle when full, and place it mouth downwards on a piece of glass or in a saucer. The generating flask should be placed in a draught or out of doors, as carbon monoxide is very poisonous.

PROPERTIES.

Exp. 3.—Pour about 20 c.c. of a strong solution of caustic potash or soda into the bottle, close its mouth with the hand and shake briskly; the hand feels pressed into the bottle, showing that some gas has been absorbed. The caustic potash combines with the carbon dioxide, leaving the carbon monoxide untouched. Invert the bottle beneath the water and withdraw the hand; the water rushes in until the bottle is half full. *The gases are, therefore, set free in equal volumes.*

Exp. 4.—Fill a small bottle with water, place it mouth downwards in the trough, and bring the mouth of the bottle containing the carbon monoxide under it, and gently pour the gas from one bottle into the other. Bring a light to the mouth of the bottle, the gas will take fire and burn with the characteristic blue flame noticed in the first experiment. Add a little lime-water to the bottle, and shake it up; the lime-water becomes turbid, showing that carbon dioxide is present. The carbon monoxide has combined with the atmospheric oxygen, forming carbon dioxide:—

$$2CO + O_2 = 2CO_2$$

Carbon monoxide. Oxygen. Carbon dioxide.

OTHER METHODS OF PREPARING CARBON MONOXIDE.

By the decomposition of Potassium Ferrocyanide by strong Sulphuric Acid.

Exp. 5.—Well-dried and finely-powdered potassium ferrocyanide (yellow prussiate of potash), $K\ Fe(CN)_6$, is heated with about nine times its weight of strong sulphuric acid. The reaction is at first slow, and then violently quick as the temperature rises. The gas evolved is carbon monoxide, only very slightly contaminated with carbon dioxide. This is the best method of preparing the gas.

By the incomplete Combustion of Carbon.

Exp. 6.—Fill a porcelain or hard glass tube with small lumps of charcoal, and place it in a small furnace, or in some way heat it through its entire length, and pass a stream of air through it. If the coals are glowing strongly, and the stream of air very slow, the gas issuing from the tube will be carbon monoxide:—

$$2C + O_2 = 2CO$$

Carbon. Oxygen. Carbon monoxide.

By the reduction of Carbon Dioxide by glowing Charcoal.

Exp. 7.—Use the same apparatus as in the last experiment, and pass carbon dioxide in a slow stream over the heated coals. The red-hot charcoal reduces the carbon dioxide; thus:—

$$CO_2 + C = 2CO$$

Carbon dioxide. Carbon. Carbon monoxide.

By heating a Carbonate with Carbon.

Exp. 8.—Mix together finely powdered chalk and charcoal, place the mixture in an iron tube, and heat in a small furnace; the calcium carbonate is reduced to an oxide, and carbon monoxide set free. This is the change which takes place in lime-kilns:—

$$CaCO_3 + C = CaO + 2CO$$

Calcium carbonate. Carbon. Lime. Carbon monoxide.

SUMMARY AND ADDITIONAL PROPERTIES.

History.—Carbon monoxide was discovered by Priestley when igniting chalk in a gun barrel.

Occurrence.—It is never found except as an artificial product, as in the neighborhood of brick or lime-kilns.

Properties. — Carbon monoxide is a colorless, tasteless gas, possessing a peculiar though slight smell. It is very slightly soluble in water. It is a very poisonous gas, and much of the ill repute which attaches to carbon dioxide really belongs to this gas. Small animals when placed in it die almost instantly. It is the presence of this gas which occasions the peculiar sensation of oppression and headache which is experienced in rooms into