coal; during the process of burning, the oxygen of the air combines with the carbon and it passes off in the form of a gas, to which we give the name of carbonic acid. If we burn a diamond in oxygen gas the result is the same. This is the proof positive that the diamond is pure carbon. It was first discovered by Dr. Black in 1757, and called by him *fixed air*, because it was found by him to exist in a fixed or solid state in limestones.

You can easily prepare carbonic acid. Put some chalk, which is composed of carbonic acid and lime, into a glass jar, and pour on some diluted sulphuric acid. Effervescence immediately takes place by the escape of the carbonic acid from the chalk in form of a gas. As the gas is once and a half times heavier than common air, it remains in the jar. It is invisible, but has a pungent odor, such as you can smell after burning charcoal. Under an immense pressure it is condensed into a liquid, and when the pressure is removed it will evaporate so rapidly that it freezes its own vapor so as to produce a white substance looking like the purest snow. Owing to its weight you can pour it from one vessel into another like water, though you cannot see it. Take a tumbler and set a short bit of lighted candle in the bottom, and pour some of the gas from the jar, and it will put out the light as suddenly as if it had been water. A test for carbonic acid is lime water, which, on agitation, produces a milky looking substance. Lime then has a great affinity for carbonic acid, and forms a carbonate of lime. This is the composition of all our limestones and marble. It is found in all natural waters. If you boil water you drive off the carbonic acid and the water tastes flat and insipid. Your soda water, sparkling cider, beer and wines owe their character chiefly to carbonic acid.

Carbonic acid is a deadly poison when breathed. If you should put a kettle of burning charcoal in your tight sleeping apartment when you go to bed you would be found dead in your bed in the morning. Sometimes it exists in the bottom of wells that have not been used, especially in limestone countries. A case of this kind occurred a few years since in the town of Alexandria in this State, when a man descended a well and fell dead. Another descended to rescue him and he too fell dead. A third was with difficulty saved. A few buckets of water thrown into a well will prevent any such catastrophe. Every time you throw out a quantity of air from your lungs, you throw out with it a quantity of carbonic acid. Just make some fresh lime water, and blow into it through a tube or tobacco pipe, and it will become white from the carbonic acid which you have thrown into it.

Plants breathe carbonic acid instead of oxygen. Deprive a plant of carbonic acid and it would sicken and die. Over the surface of leaves are countless numbers of pores or open mouths which take in the carbonic acid. Thus the leaves of plants are like the lungs of animals. It escapes whenever fermentation takes place and whenever bodies are decomposed. Such are some of the properties of carbonic acid—a substance deadly poisonous when breathed, yet absolutely necessary for our very existence.

No. 17—Compounds of Carbon and Hydrogen.

Among the substances useful to man, are the various compounds of carbon and hydrogen. Whenever vegetable matter is undergoing decomposition, a portion of the carbon unites with the hydrogen and forms an inflammable gas, called carburetted hydrogen. If you would go to some stagnant pool, where vegetable matter is decomposing at the bottom, and stir up the sediment, immense bubbles of gas would rise to the surface. This will catch fire, and burn on the surface of the water with a blue flame. It is a pretty experiment to perform on a dark summer evening. We remember reading an account in a scientific journal a few years ago, of a teacher in a boy's school in Pennsylvania, who promised the boys that if they would behave well, he would set the river on fire. The appointed day arrived when he ordered the boys to strip off their clothes, go into the water and stir up the sediment from the bottom. As soon as they had done this, the gas began to rise, when the master touched a flame to the gas and it burned all over the surface of the water, and scorched the boy's skins so that they were glad to hurry on shore, perfectly satisfied with their teacher's experiment. It is this gas that collects in coal mines, which sometimes explodes with terrible violence, killing the workmen in the mines. This gas receives different names, such as fire damp, marsh gas, and light carburetted hydrogen.

Another compound of hydrogen and carbon is called the heavy carburetted hydrogen. This is obtained by a sort of distillation. It is the gas light of our cities. You can make some in a very cheap way. Take an old iron teakettle and fill it with white birch bark or pitch pine wood, put on the cover and lute it down with clay, and then put a cork into the nozzle with a tobacco pipe-stem run through it. Now set it over a fire in a fire-place and pretty soon a dark smoke will issue from the stem, which is this gas. Set it on fire and it will continue to burn two or three hours, if the heat of the fire is not too great. Turn up the wick of a kerosene lamp and the smoke will be this gas. This gas is purified for illuminating purposes by passing it through cold water so as to condense various impurities, and then through dry lime, and afterwards a solution of copperas. It explodes with oxygen with terrible effect, forming as a product water and carbonic acid.

One of the most familiar objects to us is the flame of a lamp, and we may now understand how it is formed. On the application of heat to the wick the temperament is raised so as to disengage a portion of carburetted hydrogen in the form of a gas. When this is inflamed the hydrogen of the gas combines with the oxygen of the air, and forming an intense heat, burns the millions of particles of carbon to a white heat. It is the carbon then that is illuminated. It is only that portion of the gas in contact with the air which is illuminated. The inner portion of the flame is still a gas. You can prove this by holding a piece of glass over a candle, pressing it down on the flame, when you will see a dark spot on the centre of the flame.

Thus you see that by the study of the simplest principles of chemistry you can understand a thousand things that come before you every hour of your life. It is always more pleasant to be able