which we may designate as O and N; that it had resistance and possessed weight; that among its other qualities were those that assist vision and render sound possible; that it possessed properties of refraction and reflection, of holding moisture, and so on. We saw, too, that the O part of the atmosphere is very intimately connected with all life; that it is the part that supports a flame, or, in a wider sense, combustion; that in a pure state it will even consume steel; that it is diluted with N in the proportion of 1 to 4, but in water 2 to 4.

Oxygen is so active that it unites with each of the elementary bodies, with the exception of Fluorine. We have seen how substances that burn in air, burn in O with much greater energy. Suppose we take now a piece of heated charcoal on the end of a wire and suspend it in a jar of O; it will burn rapidly, throwing out bright sparks, and will produce a new colorless gas, called carbonic acid gas. Now chemical action took place. It required a certain amount of heat to start this action, and then was formed something entirely different from either of the two substances that united. The chief constituent of charcoal is carbon, or C, the purest form of which is supposed to be diamond. This is what we find in coal and in wood, the smoke being largely unburnt C. Now, when the charcoal burned it was owing to the O uniting with the C of the charcoal, and in the proportion of one of C to two of O—hence, $C O_2$ represents carbonic acid gas. Put a candle into this gas and it goes out; it does not support a flame or combustion and consequently it will not support life. It is unfit to breathe.

Let us try something else. Here is water in a dish fitted for the purpose. It is an easy matter to run a current of electricity through it in such a way as to break it up into two gases, which may be collected in separate vessels. Suppose this to be done, and you have two tubes, and when one of which is discovered full the other is found to be only one-half full. If you put a glowing splinter into each, in the one the splinter will burst into flame, in the other it will go out, but the gas itself will burn. The one supports combustion, the other does not, but burns. The one, then, must be oxygen. What is the other? It cannot be N, nor $C O_2$, for though these do not support combustion, neither will they themselves burn. This gas is known by the name of hydrogen—symbol, H. To make doubly sure that H and O are the two gases that, when chemically united, form water, take twice as much H as O and pass a current of electricity through them mixed, or even bring them under the influence of a flame and they unite with a loud report. Upon examination the product is found to be water, and nothing else. Hence, $H_2 O$ represents water. You will observe that the same force which separated them is capable of uniting them; but it is something like our law on marriage, which places no great obstacles in the way of man and woman uniting, but makes it hard to get a divorce. A mere "flame" will follow the law in one case; in the other, the shock can only be produced by the strong force of the law. There is quite a parallel in the matter of reports, also. Bring a light to the mouth of a jar filled with pure H, it will burn slowly away, in presence of air. In this case, the O of the air unites with H, forming $H_2 O$. Suppose that you shake up H with pure O, or the air which contains O, and apply a light, a union throughout takes place at once and with explosion.

What a peculiar thing water is. You may drive it off in the form of steam, or in the form of vapor; but the steam and vapor are still $H_2 O$. You may break up the water into H and O—two invisible gases; one will burn, and the other enables it to burn; and yet, after they are united, through the influence of a flame, a visible substance is produced that puts out a flame. Remember, then, that under certain conditions the O of the air will unite with C to form $C O_2$, and with H to form $H_2 O$.

In lesson No. 1 it was pointed out that we breathe *in* the O and the N of the atmosphere. Now, what do we breathe *out?* Let us see. Suppose you breathe against a dry glass, or window pane,—it becomes dim. You have noticed, on a cold winter's day, your breath like fog or steam. Were it nothing but the O and the N which you breathed *in*, you could not see it. The fact is, it is moisture—water, $H_2 O$.