12,000 cubic inches of gas, two-thirds of which will be oxygen. If you employ the saltpetre, and do not urge the heat very much, you will have the pure oxygen, but not more than 2,000 or 3,000 cubic inches. When the heat is urged, the nitric acid is decomposed, and its constituents, nitrogen and oxygen, are both set free. When large quantities of oxygen are required, saltpetre will be found very economical. I used it myself for that reason many years since, for the exhibition of the oxy-hydrogen microscope, in the Mechanics' Institute, Manchester.

However, the best substance for procuring the oxygen gas in the *chlorate of potash*. This is a beautiful white salt, consisting of *oxygen*, *chlorine* and *potassium* When this compound is heated red hot, the oxygen is liberated; and the chlorine and potassium having combined together, remain behind in the form of a white salt, called *chloride of potassium*.

I will place a little chlorate of potash in this test-tube. On applying the heat of a spirit-lamp the salt will first melt, and then effervesce from the gas escaping. The heavier oxygiett will drive all the common air out of the tube. If now a small piece of paper or wood be lighted, and the flame be blown out, so as to leave a little portion of the end *red hot*, and then be introduced into the tube, the paper or wood will immediately burst into a flame.

If a small piece of ignited wood, such as a piece of a lucifer, be dropped into the melted chlorate of potash, a most powerful action, attended with a vivid light, takes place, and the wood is, as you see, entirely consumed.

All experiments with the chlorate of potash should be carefully conducted, as it is apt to explode with combustible substances even in the cold.

When oxygen is required to be made from chlorate of potash in large quantities, it is preferable to mix about one-fourth of oxide of copper or oxide of manganese with it; as the gas is then liberated at a much lower temperature.

Oxygen gas is also given out in nature, from the decomposition of some of its combinations. The vegetable world is the great source of oxygen. Vegetables possess the power of decomposing two compounds of oxygen, *carbonic acid* and *water*, and of retaining the carbon of the one, and the hydrogen of the other, to form their own tissues. This operation, however, only goes on in the light of the sun or in the effulgence of day. The process is this:—Plants have roots and leaves. By the roots they take up moisture from the soil, and in this moisture are dissolved those substances which plants require for their subsistence. To form the organized parts of plants, however, it is necessary to have the assistance of the leaves, through the vessels of which the juices of plants must always pass, before they become converted into the substance of the plant. The leaves of plants have a peculiar function, namely, that of separating the carbonic acid from the other constituents of the atmosphere, of retaining the carbon of this carbonic acid, and setting its other ingredient, the oxygen, free. After the sap has thus been mixed in the leaves, with the carbon which the leaves derive from the atmosphere, it goes to increase the growth of the plant. The water taken up by the root undergoes a somewhat similar decomposition, its hydrogen being returned and its oxygen liberated.

In some of the products of plants, such as turpentine, all the oxygen of the water and carbonic acid have been liberated.

Oxygen is chiefly remarkable as a most powerful supporter of combustion: it is the substance which in natural operations, consumes and burns up all vegetable and animal matter. It is this oxygen which, by its action upon the carbon and hydrogen of our wood, coal, oil, &c., produces that light and heat which we feel to be so necessary. It is oxygen which causes this candle to burn at the present moment: if deprived of oxygen, it would be extinguished; but if the supply be augmented, its brilliancy will be much increased. I will immerse the lighted candle in this jar of oxygen. In a moment you see the flame becomes brilliant, and burns with so much splendour as to dazzle the eyes.

A similar increase in the intensity of the action is seen, when other combustible substances, such as sulphur and phosphorus, previously ignited in the air, are brought into contact with pure oxygen gas. I will put some sulphur in this copper spoon, and will then ignite it over the spirit lamp. The combustion in the air is only slow; you will see the difference the moment I immerse the spoon in this jar of oxygen. You perceive the intensity of the beautiful blue flame of the sulphur is much increased, and that it tinges all the surrounding objects.

The burning of phosphorus in oxygen gas is perhaps one of the most brilliant experiments that chemistry can produce. Phosphorus (the base of bones) is well known as the powerful substance used in the manufacture of lucifer matches. It burns with great vehemence in common air; but when introduced into oxygen its combustion is increased to such an extent that it is quite impossible to behold the beauty of the flame with unshaded eyes. I will put this piece of phosphorus, which I have previously dried between folds of blotting-paper, into a cold copper spoon, ignite it with a hot wire, and then quickly introduce it into the jar of oxygen. The brilliant light produced is such as to illuminate the whole room as if by the light of the sun.

Iron, zinc, and other metals will burn in oxygen with great ease, as I shall have occasion to show you towards the close of the lecture.

It will not be difficult for you to understand why chemical action or combustion should be so much more intense in pure oxygen than in air. In the pure oxygen there is nothing to prevent the intimate contact of the two bodies which are uniting with one another, that is, the burning body and the oxygen; and as fast as one portion of oxygen has acted on the combustible body, its place is supplied by another portion, which in its turn will be wholly expended on the burning body. In common air this is different. Before the combustible body can be acted upon by one cubic inch of oxygen, five cubic inches of the atmosphere must be presented to it, which, of course, will take up five times the time. But the four cubic inches of nitrogen have also the effectof cooling the burning body in passing through the flame with the oxygen. The amount of light and heat produced depends on the quantity of chemical action which takes place in a given time. It is quite evident that the greatest action in the least time will take place with the pure materials. If we, by any artifical means, can contrive to make common air pass in large quantities through the interstices of combustible bodies, as charcoal, coal, &c., previously in a state of ignition, we shall in a measure increase the action as if we employed pure oxygen, because we shall cause a greater action in a given period of time.

It must now be apparent to all of you that the more oxygen we can get through a common fire-place, or the more that can be brought in contact with the fuel in a given time, the greater will be the combustion, and the greater the heat. In the open air coals burn dull, and do not give out much heat or light in a given time. If coals be put in fire-place, more air gets through them in a given time, and a great heat