little to trade with, unless every restriction is completely done away. The agriculturists in self defence require this, as it will be impossible for them to sell in an open market of free competition, and buy in one that is protected, directly and indirectly—no matter that the amount of protection may not be large, and be required for revenue,—the fact is so, that a protection exists to other interests and is to be taken away from agriculture. Other things are necessaries of life as well as the products of agriculture, and if it were not so, the whole population of the earth might be agriculturists. Therefore, if it is desirable that food should be cheap, so is it that all other necessaries should be cheap also. Every man who is really anxious for a free-trade in the productions of the earth and of man's industry and labor, must desire that all restrictions should be done away that would prevent this freedom of trade, and that revenue should be raised by direct taxation on every individual according to his means of paying. No matter what may be the pretensions of free-traders, if they come short of this, we tell them plainly, they are pretenders, and only advocate a principle so far as it will answer and serve their own private interest and the interests of their parties. We deny that partial free-trade can promote the general interests, or improve the condition of the poor, and we defy all the ingenuity of pretended free-traders to prove the contrary. Make all free or none, if you wish to be just towards all.

LECTURES ON THE APPLICATION OF CHEMISTRY TO AGRICULTURE.

ON OXYGEN.

BY J. C. NESBIT, ESQ., F. G. S., M. C. S. L., &C.

GENTLEMEN,—I shall have the honour of directing your attention this evening to one of the most interesting of the chemical elements. In the prosecution of our agricultural course, it will be necessary to take notice of those bodies which enter more or less into the composition of vegetables; and you will recollect that in my introductory lecture, I informed you that a certain portion of the elements of vegetables was taken from the soil, and that another portion was taken from the air. I also mentioned to you that the portion which was taken from the soil was called inorganic and that taken from the air, organic. The organic elements are four—oxygen, hydrogen, nitrogen, and carbon; and we shall commence this evening by taking into consideration the properties of the most important of these four, namely, oxygen: the consideration of hydrogen, nitrogen, and carbon will be reserved for another occasion.

Oxygen is found in the greatest abundance through the whole of this planet. It is found in the air, in the water, in the clouds, in the earth, and in minerals of every variety. It forms a considerable portion of all sand-stones, and clays, and oxides (or rusts) of iron. The fact is, all the oxides or rusts are merely combinations of this substance with different bases or metals; and its very presence in such quantities throughout nature, will sufficiently show the importance of its action. The affinities of oxygen for other bodies are more powerful, perhaps, than those of any element we know; of its action we shall have occasion to speak as we proceed.

The air contains one-fifth of its bulk of oxygen, which, in that case, assumes the character of a gas: every five bushels of common air contain one bushel of oxygen. Oxygen, as a gas, is carried round the world, and penetrates every part; and the substances which require it are always sure to find something from which they can abstract it. Water, which is the next universally extended medium, contains a large quantity of oxygen: every nine tons of water contain eight tons of oxygen—not as a gas, but as a liquid; and in the generality of earthy matters, from one-third to one-half is composed of oxygen.

Having thus seen how generally oxygen is diffused through nature, the next point to conside, is, the method of preparing it. You may naturally ask, if oxygen be so extensively distributed in combination with other substances, can you not separate it from some of them and present it to us? It can be done: for, by taking some of the earthy matters, and acting upon them by means of heat, we can separate the oxygen and the base; and when separated we can examine their properties. If you take the black oxide of manganese (which is a compound of oxygen and a metal called manganese) and bring it to a red heat, it will part with some of its oxygen. One pound of oxide of manganese will, in this manner, furnish about 1,200 cubic inches of oxygen gas.

In this way oxygen may be prepared in large quantities, because oxide of manganese is very common. It is to be found in all parts of the world, and is to be had as an article of commerce in great abundance, being much used in the north of England to make chlorine for bleaching. Oxygen may be produced from other oxides:—If you take red lead (which you know is a combination of lead and oxygen) and bring it to a red heat, a portion of the oxygen will be driven off, and you can then ascertain its character. If you take an oxide of mercure, which is commonly called *real precipitate*, and heat it in a glass tube, a similar result takes place; you will get the oxygen liberated and the mercury likewise.

It is not necessary to show you all these experiments. I shall, hower, show you the one with the *real precipitate*, because we shall obtain not only oxygen, but mercury also; the two elements of which the oxide of mercury is composed.

Now, I will take the oxide of mercury, or *real precipitate*, and heat it over a lamp in a small test-tube; and as the oxygen is given off, it will drive the air out of the tube, because oxygen is heavier than air. We can now detect it by putting a bit of ignited wood into the opening of the tube; the wood will instantly inflame, for oxygen has a very great affinity for combustible bodies. Oxygen, in fact, is in nature the great supporter of flame and combustion.

By means of other substances, oxygen may be easily procured in the most simple manner. Many of these substances consist of various salts, which are combinations of acids with their bases. All the ultrates furnish oxygen in abundance. Thus the nitrate of soda contains a large quantity of oxygen, as does also saltpetre. If I heat saltpetre to a red heat, I get in place of it potash, and oxygen and nitrogen liberated; and in this way you can get from one pound of saltpetre