economy of nature. It is the agent employed in effecting the union and disunion of a vast number of compounds. It is superior to all other elements in the extensive range of its affinities. The the phenomena of combustion and decay are examples of the exercise of its power.

Oxygen is the most generally diffused element on the surface of the earth; for, besides constituting the principal part of the atmosphere which surrounds it, it is a component of almost all the earths and minerals found on its surface. In an isolated state it is a gaseous body, possessed of neither taste nor smell. It is slightly soluble in water, and hence is usually found dissolved in rain and snow, as well as in the water of running streams.

Such are the principal characters of the elements which constitute organic matter; but it remains for us to consider in what form they are united in plants.

The substances which constitute the principal mass of every vegetable are compounds of carbon with oxygen and hydrogen, in the proper relative proportions for forming water. Woody fibre, starch, sugar, and gum, for example, are such compounds of carbon with the elements of water. In another class of substances containing carbon as an element, oxygen and hydrogen are again present; but the proportion of oxygen is greater than would be required for producing water by union with the hydrogen. The numerous organic acids met with in plants belong, with few exceptions, to this class.

A third class of vegetable compounds contains carbon and hydrogen, but no oxygen, or less of that element than would be required to convert all the hydrogen into water. These may be regarded as compounds of carbon with the elements of water, and an excess of hydrogen. Such are the volatile and fixed oils, wax, and the resins. Many of them have acid characters.

The juices of all vegetables contain organic acids, generally combined with the inorganic bases, or metallic oxides; for these metallic oxides exist in every plant, and may be detected in its ashes after incineration.

Nitrogen is an element of vegetable albumen and gluten; it is a constituent of the acid, and of what are termed the "indifferent substances" of plants, as well as of those peculiar vegetable compounds which possess all the properties of metallic oxides, and are known as "organic bases."

Estimated by its proportional weight, nitrogen forms only a very small part of plants; but it is never entirely absent from any part of them. Even when it does not absolutely enter into the composition of a particular part or organ, it is always to be found in the fluids which pervade it.

It follows from the facts thus far detailed, that the development of a plant requires the presence, first, of substances containing carbon and nitrogen, and capable of yielding these elements to the growing organism; secondly, of water and its elements; and lastly, of a soil to furnish the inorganic matters which are likewise essential to vegetable life.

Of the composition of the Atmosphere.

In the normal state of growth plants can only derive their nourishment from the atmosphere and the soil. Hence it is of importance to be acquainted with the composition of these, in order that we may be enabled to judge from which of their constituents the nourishment is afforded.

The composition of the atmosphere has been examined by many chemists with great care, and the results of their researches have shown, that its principal constituents are always present in the same proportion. These are the two gases, oxygen and nitrogen, the general properties of which have been already described. One hundred parts, by weight, of atmospheric air contain 23.1 parts of oxygen, and 76.9 parts of nitrogen; or 100 volumes of air contain nearly 21 volumes of oxygen gas. From the extensive range of affinity which this gas possesses, it is obvious, that were it alone to constitute our atmosphere, and left unchecked to exert its powerful effects, all nature would be one scene of universal destruction. It is on this account that nitrogen is present in the air in so large proportion. It is peculiarly adapted for this purpose, as it does not possess any disposition to unite with oxygen, and exerts no action upon the processes proceeding on the earth. These two gases are intimately mixed, by virtue of a property which all gases possess in common, of diffusing themselves equally through every part of another gas, with which they are placed in contact.

Although oxygen and nitrogen form the principal constituents of the atmosphere, yet they are not the only substances found in it. Watery vapour and carbonic acid gas materially modify its properties. The former of these falls upon the earth as rain, and brings with it any soluble matter which it meets in its passage through the air.

Carbonic acid gas is discharged in immense quantities from the active volcanoes of America, and from many of the mineral springs which abound in various parts of Europe; it is also generated during the combustion and decay of organic matter. It is not, therefore, surprising that it should have been detected in every part of the atmosphere in which its presence has been looked for. Saussure found it even in the air on the summit of Mont Blanc, which is covered with perpetual snow, and where it could not have been produced by the immediate agency of vegetable matter. Carbonic acid gas performs a most important part in the process of vegetable nutrition, the consideration of which belongs to another part of the work.

Carbonic acid water, and ammonia (a compound of hydrogen and nitrogen) are the final products of the decay of animal and vegetable matter. In an Isolated condition, they usually exist in the gaseous form. Hence, on their formation, they must escape into the atmosphere. But ammonia has not hitherto been enumerated amongst the constituents of the air, although, according to our view, it can never be absent. The reason of this is, that it exists in extremely minute quantity in the amount of air usually subjected to experiment in chemical analysis; it has consequently escaped detection. But rain which falls through a large extent of air, carries down in solution all that remains in suspension in it. Now ammonia always exists in rain-water, and from this fact we must conclude that it is invariably present in the atmosphere. Nor can we be surprised at its presence when we consider that many volcanoes now in activity emit large quantities of it. This subject will, however, be discussed more fully in another part of the work.

Such are the principal constituents of the atmosphere from which plants derive their nourishment; for although other matters are supposed to exist in it in minute quantity, yet they do not exercise any influence on vegetation, nor has even their presence been satisfactorily demonstrated.

Of Soils.

A soil may be considered a magazine of inorganic matters which may be prepared by the plant to suit the purposes destined for them in its nutrition. The composition and uses of such substances cannot, however, be studied with advantage, until we have considered the manner in which the organic matter is obtained by plants.

Some virgin soils, such as those of America, contain vegetable matter in large proportion; and as these have been found eminently adapted for the cultivation of most plants, the organic matter contained in them has naturally been recognised as the cause of their fertility. To this matter, the term "vegetable mould," or *humus* has been applied. Indeed, this peculiar substance appears to play such an important part in the phenomena of vegetation, that vegetable physiologists have been induced to ascribe the fertility of every soil to its presence. It is believed by many to be the principal nutriment of plants, and is supposed to be extracted by them from the soil in which they grow. It is itself the product of the decay of vegetable matter, and must therefore contain many of the constituents which are found in plants during life. Its action will therefore be examined in considering whence these constituents are derived.

NEWS.

West India Sugar Duties.—In Parliament the Government plan was defeated by a majority of 2) against Ministers. On Monday night, or half-past one, Tuesday morning the resolution of Friday night was rescinded by the following vote:—

For Mr. Miles' motion, 20s duty	233
For the amendment, 24s duty	255
Majority for Ministers	22

In the iron trade in Wales the greatest number of men ever employed are at present fully occupied, with every prospect of a continuance.