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CONVERSATIONS

ON

CHEMISTRY.

CONVERSATION XIII.

ON THE ATTRACTION OF COMPOSITION.

MRS. B.

HAVING completed our examination of the simple or elementary bodies, we are now to proceed to those of a compound nature; but before we enter on this extensive subject, it will be necessary to make you acquainted with the principal laws by which chemical combinations are governed.

You recollect, I hope, what we formerly said of the nature of the attraction of composition, or chemical attraction, or affinity, as it is also called?

EMILY.

Yes, I think perfectly; it is the attraction that

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subsists between bodies of a different nature, which occasions them to combine and form a compound, when they come in contact, and, according to Sir H. Davy's opinion, this effect is produced by the attraction of the opposite electricities, which prevail in bodies of different kinds.

MRS. B.

Very well; your definition comprehends the first law of chemical attraction, which is, that *it takes place only between bodies of a different nature*; as, for instance, between an acid and an alkali; between oxygen and a metal, &c.

CAROLINE.

That we understand of course; for the attraction between particles of a similar nature is that of aggregation, or cohesion, which is independent of any chemical power.

MRS. B.

The 2d law of chemical attraction is, that *it takes place only between the most minute particles of bodies*; therefore, the more you divide the particles of the bodies to be combined, the more readily they act upon each other.

CAROLINE.

That is again a circumstance which we might

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have supposed, for the finer the particles of the two substances are, the more easily and perfectly they will come in contact with each other, which must greatly facilitate their union. It was for this purpose, you said, that you used iron filings, in preference to wires or pieces of iron, for the decomposition of water.

MRS. B.

It was once supposed that no mechanical power could divide bodies into particles sufficiently minute for them to act on each other; and that, in order to produce the extreme division requisite for a chemical action, one, if not both of the bodies, should be in a fluid state. There are, however, a few instances in which two solid bodies, very finely pulverized, exert a chemical action on one another; but such exceptions to the general rule are very rare indeed.

EMILY.

In all the combinations that we have hitherto seen, one of the constituents has, I believe, been either liquid or aëriform. In combustions, for instance, the oxygen is taken from the atmosphere, in which it existed in the state of gas; and whenever we have seen acids combine with metals or with alkalies, they were either in a liquid or an aëriform state.

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MRS. B.

The 3d law of chemical attraction is, that *it can take place between two, three, four, or even a greater number of bodies.*

CAROLINE.

Oxyds and acids are bodies composed of two constituents; but I recollect no instance of the combination of a greater number of principles.

MRS. B.

The compound salts, formed by the union of the metals with acids, are composed of three principles. And there are salts formed by the combination of the alkalies with the earths which are of a similar description.

CAROLINE.

Are they of the same kind as the metallic salts?

MRS. B.

Yes; they are very analogous in their nature, although different in many of their properties.

A methodical nomenclature, similar to that of the acids, has been adopted for the compound salts. Each individual salt derives its name from its constituent parts, so that every name implies a knowledge of the composition of the salt.

The three alkalies, the alkaline earths, and the

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metals, are called *salifiable bases* or *radicals*; and the acids, *salifying principles*. The name of each salt is composed both of that of the acid and the salifiable base; and it terminates in *at* or *it*, according to the degree of the oxygenation of the acid. Thus, for instance, all those salts which are formed by the combination of the sulphuric acid with any of the salifiable bases are called *sulphats*, and the name of the radical is added for the specific distinction of the salt; if it be potash, it will compose a *sulphat of potash*; if ammonia, *sulphat of ammonia*, &c.

EMILY.

The crystals which we obtained from the combination of iron and sulphuric acid were therefore *sulphat of iron?*

MRS. B.

Precisely; and those which we prepared by dissolving copper in nitric acid, *nitrat of copper*, and so on. — But this is not all; if the salt be formed by that class of acids which ends in *ous*, (which you know indicates a less degree of oxygenation,) the termination of the name of the salt will be in *it*, as *sulphit of potash*, *sulphit of ammonia*, &c.

EMILY.

There must be an immense number of compound

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salts, since there is so great a variety of salifiable radicals, as well as of salifying principles.

MRS. B.

Their real number cannot be ascertained, since it increases every day. But we must not proceed further in the investigation of the compound salts, until we have completed the examination of the nature of the ingredients of which they are composed.

The 4th law of chemical attraction is, that *a change of temperature always takes place at the moment of combination.* This arises from the extrication of the two electricities in the form of caloric, which takes place when bodies unite; and also sometimes in part from a change of capacity of the bodies for heat, which always takes place when the combination is attended with an increase of density, but more especially when the compound passes from the liquid to the solid form. I shall now show you a striking instance of a change of temperature from chemical union, merely by pouring some nitrous acid on this small quantity of oil of turpentine — the oil will instantly combine with the oxygen of the acid, and produce a considerable change of temperature.

CAROLINE.

What a blaze! The temperature of the oil and

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the acid must be greatly raised, indeed, to produce such a violent combustion.

MRS. B.

There is, however, a peculiarity in this combustion, which is, that the oxygen, instead of being derived from the atmosphere alone, is principally supplied by the acid itself.

EMILY.

And are not all combustions instances of the change of temperature produced by the chemical combination of two bodies?

MRS. B.

Undoubtedly; when oxygen loses its gaseous form, in order to combine with a solid body, it becomes condensed, and the caloric evolved produces the elevation of temperature. The specific gravity of bodies is at the same time altered by chemical combination; for in consequence of a change of capacity for heat, a change of density must be produced.

CAROLINE.

That was the case with the sulphuric acid and water, which, by being mixed together, gave out a great deal of heat, and increased in density.

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MRS. B.

The 5th law of chemical attraction is, that *the properties which characterise bodies, when separate, are altered or destroyed by their combination.*

CAROLINE.

Certainly; what, for instance, can be so different from water as the hydrogen and oxygen gases?

EMILY.

Or what more unlike sulphat of iron than iron or sulphuric acid?

MRS. B.

Every chemical combination is an illustration of this rule. But let us proceed —

The 6th law is, that *the force of chemical affinity between the constituents of a body is estimated by that which is required for their separation.* This force is not always proportional to the facility with which bodies unite; for manganese, for instance, which, you know, is so much disposed to unite with oxygen that it is never found in a metallic state, yields it more easily than any other metal.

EMILY.

But, Mrs. B., you speak of estimating the force of attraction between bodies, by the force required

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to separate them; how can you measure these forces?

MRS. B.

They cannot be precisely *measured*, but they are comparatively ascertained by experiment, and can be represented by numbers which express the relative degrees of attraction.

The 7th law is, that *bodies have amongst themselves different degrees of attraction.* Upon this law, (which you may have discovered yourselves long since,) the whole science of chemistry depends; for it is by means of the various degrees of affinity which bodies have for each other, that all the chemical compositions and decompositions are effected. Every chemical fact or experiment is an instance of the same kind; and whenever the decomposition of a body is performed by the addition of any single new substance, it is said to be effected by *simple elective attractions.* But it often happens that no simple substance will decompose a body, and that, in order to effect this, you must offer to the compound a body which is itself composed of two, or sometimes three principles, which would not, each separately, perform the decomposition. In this case there are two new compounds formed in consequence of a reciprocal decomposition and recomposition. All instances of this kind are called *double elective attractions.*

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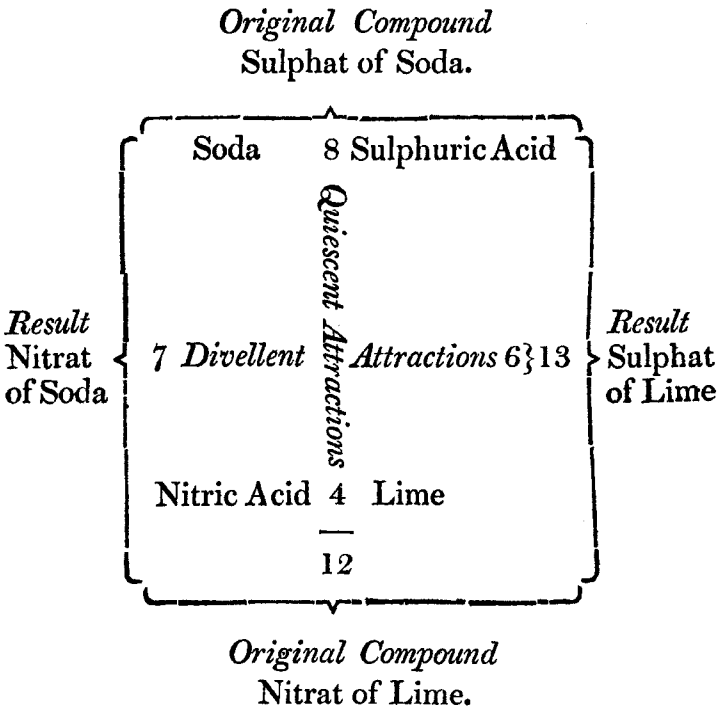
CAROLINE.

I confess I do not understand this clearly.

MRS. B.

You will easily comprehend it by the assistance of this diagram, in which the reciprocal forces of attraction are represented by numbers:



We here suppose that we are to decompose sulphat of soda; that is, to separate the acid from

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