[Translation in English].

CONDORCET, Marie Jean Antoine Nicolas Caritat, Marquis de.
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EXTRACT OF THE PROCEEDINGS OF THE ROYAL
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The Academy charged MM. Vaudermonde, Bertholet and myself to make a report to it on a premier Memoire of M.. Hassenfratz on the proportions of the constituents which make up chemical compounds.

It appears that in separation caused by high or low heat, the primitive molecules which make up the elements of the substances are combined at first, two by two or three by three and that then these binary or ternary combinations enter into chemical combinations as if they would be a single molecule.

As for example, ammonium sulphate is composed of two substances, sulphuric acid and ammonia; but this same acid, sulphuric is not a simple element; it is composed of sulphur and of oxygen. Ammonia on the other hand is composed of hydrogen and azote (nitrogen); so that in the actual state of our knowledge, ammonium sulphate is a quaternary combination in which each of its components is a binary combination.

An acid dissolved in water is also a quaternary combination, sulphuric acid, for example, is a compound of sulphur and oxygen; the water which holds it dissolved is a compound of hydrogen and oxygen. There exists therefore in liquid sulphuric acid four substances grouped two by two.

All the substances of an elementary nature which make up the body of matter which we know, with the exception of caloric heat are susceptible of being weighed, it is quite simplet that chemists having found the means of determining the exact quantity of each of the elements which make up the composition of substances: MM Homberg, Wenzel, Wiegleb, Bergman and especially M. Kirwan are occupying themselves with this problem. But the problem which appears simple is beset with thorny difficulties. The liquid acids present this quality; as they are susceptible of being combined with water in all proportions, nothing at all has been as yet explained of them when one has simply announced the quantity used in an experiment; it is still necessary to specify the state of the acid, and the mode which has been adopted by chemists is in general the specific gravity. M. Hassenfratz in the Memoire which we are reporting on has tested the particular case of the combination of acids with water; and the problem which he has determined to resolve is this: Being given a nitric acid diluted with water of which the specific gravity is known, to determine the exact quanity of acid which it contains.

To resolve this problem, with regard to nitric acid, M. Hassenfratz utilized principally experiments already performed, but which have not yet been published. They consist in the combining together of quantities of nitrogen and oxygen gas in a vessel which contains distilled water, of which one has carefully determined the weight; the two gases combine together, lose their gaseous form and combine in the water to form nitric acid (liquid) The increase in weight of the water gives the exact quantity of acid contained in the

(liquid) acid.

M. Hassenfratz has then determined the specific gravity of this acid; then having succesively cut the known quantities of distilled water and having determined the specific gravity of each of these acids he has succeeded in making a table which expresses the relation which exists between the specific gravity of each acid (in liquid form) and the quantity of real acid which it contains.

Instead of drawing up a numerical table, M. Hassenfratz has thought that it would be preferable to present his results in graphic form. Having then drawn a horizontal line and having divided it into equal parts to represent the increases in specific gravity, he has considered it as the line of the abscissa of a curve; then on each of the divisions of this line he has erected perpendiculars to represent the quantities of actual acid; finally he drew at the ends of all these lines a curve of which the ordinates represent the quantities of actual acid corresponding to a given specific gravity.

These graphic methods have the advantage of representing to the eyes that which occurs during the experiment, to reduce calculations to simple measures which can be encompassed and avoid interruptions which present difficulties to those who are not in the habit of making calculations , and to prevent a loss of time, of some extent, to those who are so accustomed. The same method can be employed to represent the proportions of acidsand bases in different salts. Finally they may be applied to the solutions of a higher order.

What is most remarkable is that the specific gravity always increases in ratio to the decrease in the amount of water in the acid, passes suddenly to the reverse and becomes negative when the water is no longer sufficient in quantity to hold the acid gas in solution: it is then that the acid expands and becomes gaseous. This phenomenon holds true for nitric acid, muriatic acid and in general for all volatile acids.

We shall engage M. Hassenfratz to follow these researches, which are the fundamental basis of chemistry and which will allow, one day, a degree of accuracy in experiments, of which the ancients had not the faintest idea. We shall also engage him to avoid neglecting water which acid gases and gaseous fluids which enter into their composition, could contain. We believe that this premier memoire merits inclusion in the Collection of Memoires presented to the Academie by foreign savants. At the Academie, the 7th of March 1792. (Signed) Lavoisier, Berthollet, Vaudermonde.

I certify that the present copy conforms to the original and to the decision of the Academie at Paris, 29 March 1792.

Condorcet Secretaire perpetuel