MODELS FOR ILLUSTRATING THE RELATIONSHIP BETWEEN GAS VOLUMES AND MOLECULAR WEIGHTS[1].

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THE difficulty experienced by students in fully comprehending the laws of Gay Lussac, and the hypothesis of Avogadro, has led the author to the use of object lessons in his lectures. The particular models herein described are intended to represent atoms and molecules, each atom possessing a definite weight, but a changeable volume. By means of these may be illustrated the alterations which occur in the volume of gases when they undergo chemical change; as well as the relations existing among those volumes, and among their molecular weights.

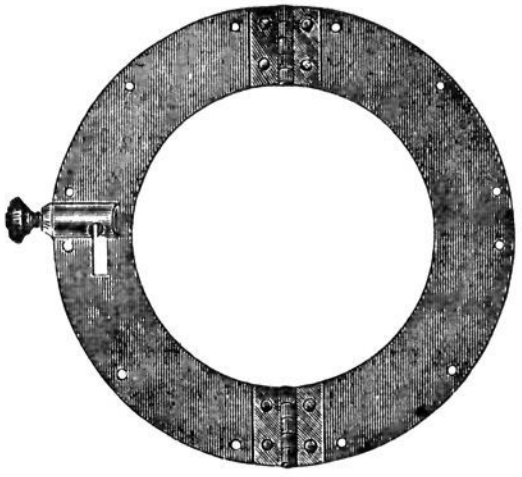

FIGURE 1.

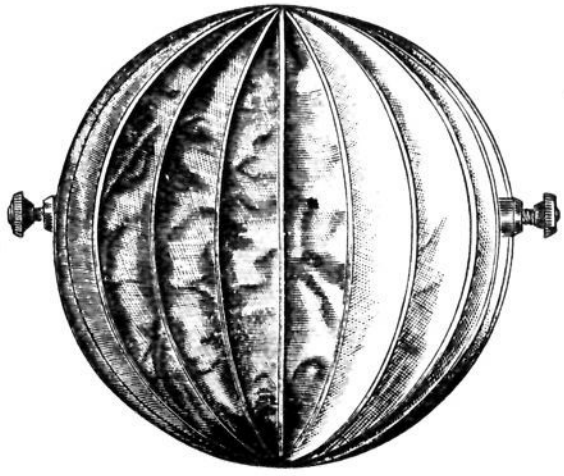

FIGURE 2.

The models may be described as follows:—

To a circular metallic frame (Fig. 1) of five centimeters diameter, formed of two semi-circular pieces joined by hinges, is fastened a hemisphere of cloth or leather, arranged in folds like an accordeon bellows. The frames are provided with locks which permit the joining together of two (or more) hemispheres, as shown in Fig. 2. Two or more hemispheres form a spherical molecule. By using various materials in constructing the frames, the hemispheres are made to correspond to the atomic

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weights of the different elements, which latter a characteristic color serves to distinguish. Thus, a black hemisphere, representing carbon, weighs twelve times as much, and a green one representing chlorine thirty-five times as much, as a pale blue hydrogen hemisphere.

To illustrate the changes which take place when hydrogen and oxygen combine to form water:—Two glass cylinders of five cm. diameter and twenty cm. high are filled with hydrogen molecules, and a like cylinder is filled with oxygen molecules. The condensation to two volumes is effected by joining an oxygen atom to each two atoms of hydrogen, forming a spherical molecule of water. The volumes should be weighed before and after condensation.

The writer begs to remind teachers that the use of the models should always be accompanied by an experiment with the gases themselves, and also to recall the necessity of impressing upon students the fact that the models are intended only to represent pictures (however distorted) of our conceptions of some chemical changes; and that they are not magnified illustrations of actual atoms and molecules.

NOTES.

A Mineral Group from York, Pa.—In the same quarry from which fluorite was reported,[1] the writer recently found a group of four minerals, namely, fluorite, calcite, pyrite, and dolomite, all except fluorite showing very perfect crystals. The fluorite is imbedded in calcite and dolomite which are closely intermingled. The crystals of calcite are the common prisms with rhombohedral terminations, the length and thickness being about equal. Others are thin, tabular in form. They vary in size up to an inch or more in diameter. The pyrite occurs on the surface of the dolomite and consists of perfect little cubes, scarcely more than one-half mm. square. Their surface is brown owing to oxidation.

As the dolomite has not to my knowledge been heretofore reported from this locality it is noticed a little more fully. It is

[1] See *J. Anal. Chem.*, July, 1890.