

the International table differ as little as possible from those in general use at the time of its first publication (in 1900).

With regard to the volume. One litre of carbon monoxide contains very nearly the same amount of oxygen as a litre of steam measured at the same temperature and pressure; a litre of oxygen gas or carbon dioxide twice as much; a litre of the vapour of glycerine three times, and a litre of nickel carbonyl four times as much; in fact, so far as is known, all the gaseous compounds of oxygen contain either the same amount of oxygen per litre as steam does, or some whole multiple of that amount. There is therefore no necessity to write the formula for steam with more than one O, that of oxygen gas would then have two, glycerine three, etc. But O_2 stands for 32.000 g of oxygen; and therefore the volume of 32 g of oxygen is the volume which the formula of the chemical compound in the gaseous state must be constructed to represent.

To some of those who are accustomed to teach chemistry "by atoms" the question may suggest itself—"What is gained by all this talk about laws of combination, tickets, formula weights, international weights, and the rest of it, if nothing but the ordinary chemical formulæ are to be used after all? Would it not be much easier to stick to the familiar atoms and molecules?"

The gain is primarily to the pupil, and loss of ease primarily to the teacher. If a boy asks "Why is H_2O written for water?" the Teacher-by-Atoms may reply, "Because its molecule contains one atom of oxygen and two of hydrogen"; but the Teacher-By-Tickets has no such refuge—he must tell the whole truth or be found out. If, parodying his colleague's answer, he replies "Because the group of tickets representing water is made up of one oxygen and two hydrogen tickets" he will promptly be met with the further question "Why is that?" To the corresponding question the Teacher-By-Atoms might retort, "That has been found out by very delicate measurements, which are quite beyond your comprehension at this stage"; but as the Teacher-By-Tickets has introduced his symbols with the avowed object of assisting the class to comprehend the laws of combination, he cannot dodge the issue, but must go into the whole matter again and again, until both he and his pupils are thoroughly familiar with the meaning of the chemical formulæ, and of the laws on which their use is based.

Nothing less should satisfy him.