

The pupils are now in a position to understand the argument of page 18 on the indirect analysis of water; and as they have seen several syntheses (sodium oxide, zinc oxide, magnetic oxide of iron, etc.) and analyses (red oxide of mercury, white vitriol into water and zinc sulphate, water indirectly) the conception of a chemical element may be explained.

WATER

The composition of water (electrolysis, eudiometer) may now be taken up, affording a new illustration of combination in definite proportions, and introducing the law of combination of gases by volume.

Then the action of steam on hot magnesium (which does not need such a high temperature as iron) may be compared with the action of water on sodium. The respects in which water and aqueous solutions resemble one another have already been spoken of under hydrogen; here is the opportunity to point out that both oxygen and steam are gases, and that both form oxides with magnesium, iron, etc.; the oxygen has not lost *all* its properties by uniting with hydrogen.

The action of steam on hot iron requires a fairly high temperature, it is well to use as many burners as can be got under the tube (gas pipe), and to concentrate the heat by pieces of asbestos paste-board, or tiles; the experiment is only worth bothering with because the reduction of the magnetic oxide by hydrogen furnishes the first example of a chemical reaction reversed; but if the experiments are too troublesome it might be better to postpone all discussion of this subject until "acids, bases, and salts" are taken up, when the reversible reaction between hydrochloric acid and sodium sulphate should be studied.

CHLORINE

Among other experiments, sodium should be burned in chlorine, and the composition (in parts per hundred) of the resulting salt given. The composition of hydrochloric acid should be demonstrated by experiments, and its properties as an "acid" illustrated.

The reaction between sodium oxide and hydrochloric acid giving water and common salt may then be discussed after the manner of page 21 introducing the law of reciprocal proportions, and the use of tickets. "Sodium 74.24" and "oxygen 25.76" may be taken to represent 100 g of sodium oxide, and "hydrogen 3.238" "chlorine 114.1" to represent the hydrochloric acid containing hydrogen enough to form water with the oxygen of the 100 g of sodium oxide. After shewing that the actual numbers chosen for the tickets are arbitrary, and that their ratios only are of importance for the present purpose (page 26) introduce the international weights, as an established convention, reserving the intermediate steps of the argument until the use of formulæ is more familiar.