Molecular Weight.—*The molecular weight of an element or compound is the sum of the atomic weights of the element or elements comprising its molecule.*

Chemical Notation.—Instead of writing the names of the elements in full, chemists have agreed to use a set of symbols to represent them. These symbols, however, not only represent the particular element but also *a certain definite quantity of it;* thus, the letter H always stands for 1 atom, or 1 part by weight of hydrogen; the letter O stands for 1 atom, or 16 parts by weight of oxygen. Compounds are in like manner represented by writing the symbols of their constituent elements side by side, and if more than 1 atom of each element is present, the number is indicated by a numeral placed on the right of the symbol of the element below the line. Thus water is represented by the symbol H_2O, that is, a compound of 2 atoms of hydrogen with 1 atom of oxygen, or 2 parts by weight of hydrogen with 16 parts by weight of oxygen. Again, sulphuric acid is represented by the formula H_2SO_4, which is a statement that it consists of two atoms of hydrogen, one atom of sulphur, and four atoms of oxygen, and consequently a certain relative weight of these elements. A figure placed to the right of a symbol only affects the symbol to which it is attached, but when placed to the left all the symbols are affected by it; thus $2H_2O$ means two molecules of water.

The great value and comprehensiveness of the symbols in chemistry may be illustrated by the amount of information condensed into the concise expression H_2O. We learn from it:—

(1.) The *number* and *names* of the elements entering into the composition of water.

(2.) The *ratio* in which the elements are united in this compound by *weight.*

(3.) The ratio in which the elements are united therein by *volume.*

(4.) The *ratio* in which the volume of the compound *when formed* stands to the volume of the constituents *before combination.*

(5.) The relative *volume-weight* or specific gravity in the state of gas (water-gas), hydrogen being taken as unity.

Chemical Equations. Chemical symbols give at once a simple means of representing all chemical changes. As these changes almost invariably result from the reaction of one substance on another, they are called Chemical Reactions. When the symbols of the elements are written with a figure to the right, this indicates a molecule of the element, the symbol alone representing an atom. Since, in all cases of chemical change, the change is necessarily between molecules, such symbols should, when possible, be employed. Thus, the formation of steam (water-gas) from hydrogen and oxygen is correctly represented by the equation:—

$$2H_2+O_2=2H_2O;$$

that is to say:

(1.) Two molecules of hydrogen and one molecule of oxygen give two molecules of steam.

(2.) That a certain definite weight, say four grams of hydrogen, and thirty-two grams of oxygen, furnish thirty-six grams of steam or water-gas.

(3.) Four volumes of hydrogen and two volumes of oxygen furnish four volumes of steam or water gas. A simple equation like the above, therefore, when properly interpreted affords a large amount of information, whilst the equation—

$$H_2+O=H_2O,$$

merely represents the relative weights of the elements which enter into the mixture, and is not a complete expression of what is supposed to take place.

In every chemical reaction the substances which are involved in the change are called the *factors,* and the substances produced the *products* of the reaction. As matter is indestructible it follows that *the sum of the weights of the products of any reaction must always be equal to the sum of the factors,* and further, that *the number of atoms of each element in the products must be the same as the number of atoms of the same kind in the factors.*

It is necessary to bear carefully in mind that a chemical equation differs essentially from an algebraic equation. Any inference that may be legitimately drawn from an algebraic equation must, in some sense, be true. It is not so, however, with chemical equations. These are simply expressions of observed facts, and, although important inferences may sometimes be drawn from the mere form of the expression, yet they are of no value whatever unless confirmed by experiment. Moreover, it is important to discriminate with the greatest care between the facts directly stated or expressed by the equations, and the inferences drawn from them.

Practical Department.

DRAWING.

BY WILLIAM BURNS, DRAWING MASTER, HIGH SCHOOL, BRAMPTON.

The aim of this series of papers will be to set before such of our public-school teachers as may not previously have taught the subject of Drawing, an outline of a course sufficiently extensive to enable a class commencing this branch to qualify, at least, at the December entrance to High Schools. It will obviously be impossible to enter into minute details in the space and time available, but should difficulties arise the author of these lessons will be glad to reply to any queries through the columns of the JOURNAL, as it not unfrequently happens that a doubt or question which suggests itself to one mind has already been present in many others, and therefore becomes of more than individual interest in the answering.

Let me remark at the outset that teachers should take courage in undertaking this comparatively new branch of common school education. How often during the past few months has the exclamation been heard from good and even experienced teachers—"I can never teach Drawing; I can never be an artist." The latter may be quite true, perhaps, but it should be remembered that a good artist is not necessarily a good teacher of Drawing. What the Department has in view in this branch is obviously the training of the children to observe what they see; and any one can direct their attention to numerous facts of which they were quite aware before and which they had seen many times and yet had never properly observed. *To this consideration I would more especially* urge our teachers to pay great attention. From experience I can assure them that all such time is well spent. Again, how much more interesting is a Reading lesson if the teacher can explain pictorially as well as verbally. *Of this fact the numerous engravings* in our new Readers are a sufficient recognition, and still more interesting and instructive to children are even rough sketches on the board of the objects mentioned to them. This fact alone makes Drawing deserve the fullest attention of the teacher.

It is usual in commencing to give a series of elaborate "cautions" to the pupil, but here it will be sufficient briefly to mention the points to which attention should be specially directed at first by the teacher. Perhaps others may be mentioned in the course of these papers.

1. Let the pupils be provided with pencils, properly sharpened. Be very careful not to allow use of small fragments of pencil. It is a bad habit and tends to encourage carelessness. The paper should be of fair quality and not highly glazed. The use of eraser should be discouraged, it is apt to induce carelessness in work. *Occasionally let the work be given in with all the lines of construc*tion or errors remaining intact.

2. Do not be too exacting from your pupils. In nothing so much as in Drawing will you find differences even in a class of equal average ability. So long as progress in idea, neatness, correctness and knowledge is made, be sure that no part of your time has been wasted. If a drawing is badly executed, and the pupil can show you the fault himself, you have gained one very great point, viz.: you have taught him to judge of correctness by eye alone; and this in itself is the first great step towards improvement in the next copy. Gradual progress will be more marked in this than in any other subject.

3. Let the drawing lesson be connected with some other branch of school-work and accessory to it. Every one can see how fractions can be shown pictorially by a divided line, and so it is with