

CHEMISTRY.

FIRST CLASS.

Q. 1. (a.) State the laws of chemical combination by volume and by weight. (b.) Define the terms empirical, molecular and constitutional formulae: simple and compound radicle.

(a). (1). Law of Constant Proportion. The same substance always consists of the same elements united in the same proportions.

(2). Law of Multiple Proportion. When one body combines with another in several proportions the higher proportions are multiples of the first or lowest.

(3). Law of Reciprocal Proportion. — If two bodies combine with a third, the proportions in which they combine with that third body are measures or multiples of the proportions in which they may combine with each other.

(4). Law of Compound Proportion. — The combining proportion of a compound is the sum or a multiple of the sum of the combining proportions of its constituents.

These laws respecting the constancy of weight with which the elements combine, apply with equal force to combination by volume. It was Gay Lussac who in 1809 established the truth of this, at least for such elements as exist in or can be made to assume the gaseous condition. The reasonings of Avogadro and Ampere in 1811 and 1814 upon the laws of Mariotte and Charles (that all gases are similarly affected by variations of pressure and temperature) have lead to the following deduction: "If EQUAL VOLUMES of gases be taken under like conditions, each will contain the SAME NUMBER OF MOLECULES, SIMILAR IN SIZE and equally DISTANT APART." The experiments of Gay Lussac as well as the reasoning of Avogadro have given to Dalton's theory of atoms its chief support.

(b). An Empirical formula is an arrange-

ment of symbols which merely gives the relative number of atoms in a substance, and is deduced from the analysis of the substance represented.

A molecular formula is an arrangement of symbols, representing the smallest particle of a simple or compound substance capable of existing in a free state.

A constitutional formula is a combination of symbols so arranged as to indicate the relative position of the elements or radicles composing the molecule, and how these may be replaced by other elements or radicles.

A simple radicle is any element which forms the basis or common ingredient of a series of compounds.

A compound radicle is a group of two or more elements in chemical combination which acts in many respects as an elementary body.

Q.—2. How would you proceed to calculate empirical formulae from percentage composition? (b). The analysis of a compound leads to these numbers: Carbon = 37.20, Hydrogen = 7.90, Chlorine = 54.95 What is the formula.

(a). Divide the percentage of each element present by its atomic weight, the resulting quotients will be proportional to the number of atoms of each element in the compound.

$$(b). \frac{37.20}{12} = 3.1, \frac{7.9}{1} = 7.9, \frac{54.95}{35} = 1.547.$$

∴ 2:5:1 are the proportions of the number of atoms in each. Hence C_2H_5Cl is the formula.

Q. 3. Give occurrence, preparation and properties (a) of Silicon, and (b) of Arsenic. (c) Describe briefly Marsh's test for Arsenic.

(a) 1. Silicon does not occur free in nature, but is combined with Oxygen to form Silicon dioxide or Silica, which exists nearly pure in