

Dumas Method Encyclopedia Article

Dumas Method

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Dumas Method

The Dumas method is a protocol with methodology allowing the **molecular weight** of an unknown substance to be determined. The molecular weight of a compound is the sum of the atomic weights of the atoms which comprise the **molecule**. For instance, the molecular weight of **water** (H_2O) is equal to the atomic weight of **oxygen** plus the atomic weights of two **hydrogen** atoms. Often, the Dumas method is used to determine the molecular weights of volatile organic substances that are **liquids** at room **temperature**.

Using the Dumas method, molecular weight is calculated by measuring the **mass** of a known **volume** of a vaporized liquid. The mass of the vapor produced is measured by condensing it into liquid. The Ideal Gas Law, $PV=nRT$, is then used to determine the volume of the gas, and from that, its **density**. In the Ideal Gas Law, P is pressure, V is the volume of gas in liters, n is the number of moles of the gas, R is the Ideal Gas Constant, and T is the temperature of the gas (on Kelvin scale). From the density of the substance, the molecular weight can be estimated. Once the molecular weight of a substance is known, estimates of its atomic composition, or which elements it is made from and in what proportions, can be made. The method was designed by a french chemist named **Jean Baptiste André Dumas**, after whom the procedure is now named. Even though, during the nineteenth century the science of **chemistry** was at a relatively early state, Dumas was able to show that the vapor densities of some organic compounds are directly proportional to their molecular weights.