

FAMILIARIZING CHEMISTRY STUDENTS WITH THE
GRAM-MOLECULAR VOLUME OF GASES.

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Most teachers of general chemistry have doubtless found students slow in grasping the full significance of molecular weights and gram-molecular volume. Since we arrive at approximate atomic weights through molecular weights, in the case of most elements at least, and since the application of the law of combining volumes necessitates a real familiarity with the volume of the gram-molecule, it is important that students become familiar with molecular weights, not merely as they are represented by a formula so readily written by the instructor, but by actual determination of the molecular weights of the more common elements or compounds as they are presented in the class or lecture room.

The ordinary method used is to evacuate a small glass balloon and then fill it with the gas under consideration. From the weight of the empty balloon, the weight filled with the gas, and the capacity of the balloon, the density of the gas compared with hydrogen is obtained and this value doubled gives the molecular weight.

A balloon flask cannot be used conveniently as indicated unless an automatic generator is being used for producing the gas, or unless the gas is stored under very moderate pressure, as in an ordinary gasometer.

The author has found a satisfactory solution of the problem by employing a light weight gas pipette having a capacity of approximately 500 cc and fitted at each end with a glass stopcock. For more accurate weighing a similar pipette but without the stopcocks is used as a tare. A lecture balance weighing to a centigram or a little less will give results sufficiently accurate for the purpose.

Previous to any determinations of molecular weights in class, the instructor will have determined the capacity of the pipette and its weight when evacuated. In the lecture room the pipette is simply introduced into the stream of gas being prepared for illustrative purposes. Hydrogen, oxygen, chlorine, hydrogen chloride, nitrogen, carbon dioxide, etc., fills the pipette as it flows from the generating vessel on its way to the pneumatic trough or receiving jars, the gas being dried if a little greater accuracy is desired. The pipette is supported in an upright position by a suitable clamp and the gas is introduced at the top when lighter than air, at the bottom when heavier. By the time the instructor has collected all the gas necessary for his lecture demonstrations, the air in the pipette will have been completely replaced by the gas under investigation. The stopcocks are closed, the pipette removed from the system and weighed. Only one weighing being necessary, little time is consumed for the entire operation. From a wall chart prepared for the purpose, the factor for reducing volume to

standard conditions is obtained and in a minute or two the student has the weight of 22.4 liters of the gas under standard conditions. After a few such demonstrations he soon learns that the chemical formula is obtained from a determination of molecular weight and not the molecular weight by merely writing down a formula.