

1.5 Applications of the perfect gas equation

In ancient times the perfect gas equation was used to determine molar masses M [g/mol]

$$pV = nRT = \frac{m}{M} RT \quad ; \quad (1.8)$$

e.g. fixing V (known flask), T and p (1 atm), the determination of m with the aid of a balance (very precise) allows to calculate M using the above equation. Thus the determination of a molecular property is possible without knowledge about the molecules. For example such measurements allow to characterize aggregates, e.g. S_8 . The density and vapor pressure of sulfur at 500 °C was determined to be $\rho = 3.71$ g/l and 699 Torr, respectively. To identify the kind of molecules present in the vapor we take into account that $M = \rho RT/p = 256$ g/mol must be a multiple of the atomic mass of sulfur (i.e. 32 g/mol), thus obviously S_8 is the species in the vapor phase.