

Some of Robert Boyle's original data (1662) for air

Atmospheric pressure was found to support a column of mercury $29\frac{2}{16}$ inches high.

The data below refer to air compressed in the closed end of a J-tube by mercury.

(1) Difference in Hg levels, in inches	(2) Difference in Hg levels plus atmospheric pressure measures pressure of gas	(3) Length of the air column (in arbitrary units) is proportional to its volume	(4) Product PV of columns (2) and (3)
0	$29\frac{2}{16}$	12	349.5
$6\frac{3}{16}$	$35\frac{5}{16}$	10	353.1
$15\frac{1}{16}$	$44\frac{3}{16}$	8	353.5
$29\frac{11}{16}$	$58\frac{13}{16}$	6	352.9
$41\frac{9}{16}$	$70\frac{11}{16}$	5	353.4
$88\frac{7}{16}$	$117\frac{9}{16}$	3	352.7

20th century data for 1.00000 mole of gas at 0.000°C

CO ₂		O ₂	
P (atm)	PV (L·atm)	P (atm)	PV (L·atm)
1.00000	22.2643	1.00000	22.3939
0.66667	22.3148	0.75000	22.3987
0.50000	22.3397	0.50000	22.4045
0.33333	22.3654	0.25000	22.4096
0.25000	22.3775		
0.16667	22.3897		

The density ($\rho = \text{rho}$) of methane gas (CH₄) as a function of pressure at 0°C

Pressure: P (atm)	1.00000	0.75000	0.50000	0.25000
Density: ρ (g/L)	0.71707	0.53745	0.35808	0.17893
Ratio ρ/P (g/L·atm)	0.71707	0.71660	0.71616	0.71572

Note that the ratio ρ/P is not exactly constant, as it would be for an ideal gas. The variation in ρ/P , while very small, is significant. The ratio ρ/P decreases continuously as P decreases; the value of ρ/P found by extrapolating back to the limit of zero P is the ideal gas law value. That extrapolated ideal gas law value gives the most accurate molecular weight M when using the formula $M = w/n = wRT/PV = RT\rho/P$, which is derived from the ideal gas law.