

Problem:

If $\left(p + \frac{a}{V^2}\right)(V - b) = RT$ find the dimension of a/b .

Solution:

The given equation is the Van der Waals equation of the state of gas, where

$p = [Pa]$ – pressure of gas

$V = [m^3]$ – volume

$R = \left[\frac{J}{mol \cdot K}\right]$ – universal gas constant

$T = [K]$ – temperature

a, b – some constants

As in the equation pressure is added to $\frac{a}{V^2}$, these two physical quantities have the same dimensions. The same way we consider V and b have the same dimensions too. Thus, the dimension of a is the same as the dimension of $p * V^2 = [Pa * m^6]$, and dimension of b is $b = [m^3]$. Then

$$\frac{a}{b} = \left[\frac{Pa * m^6}{m^3}\right] = [Pa * m^3]$$

where

Pa – pascal

m - meter