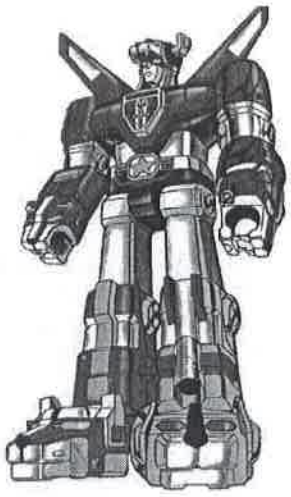
More Funner with PV=nRT



Density At STP (DENSITY = grams / Liter)

Remember (1 mol of any gas = 22.4 L) at STP

1) Find density of O_2 gas at STP:

32.00 g / 22.4 L = 1.43 g/L

2) Find density of CO_2 gas at STP

44.01 g / 22.4 L = 1.96 g/L

Molar mass (M) = grams (m) / mole (n) $M = \frac{m}{n}$

n = m / M $n = \frac{m}{M}$

b) Sub this into PV=nRT

c) New equation: PV = m RT / M $PV = \frac{mRT}{M}$ or $M = \frac{mRT}{PV}$

ex) At 28^0 C and 0.974 atm, 1.00 L of gas has a mass of 5.16 g. What is the molar mass of the gas?

M = mRT / PV

$$M = \frac{(5.16\,g)\left(0.0821\,\frac{L \cdot atm}{mol \cdot K}\right)(301\,K)}{(0.974\,atm)(1.00\,L)}$$

$M = 131\ g/mol$

Gettin' Jiggy with PV=nRT: Finding Density of a Gas

a) Density = g / L

b) m/V already in equation – M = mRT / PV

$M = \frac{mRT}{PV}$

c) New equations: M = DRT / P or D = PM / RT

$M = \frac{DRT}{P}$,, $D = \frac{PM}{RT}$

ex) the density of dry air at sea level (1 atm) is 1.225 g/L at 15 C. What is the average molar mass of the air?

$M = \frac{DRT}{P} = \frac{(1.225\ g/L)(0.0821\ \frac{L \cdot atm}{mol \cdot K})(288\ K)}{(1.00\ atm)}$

$M = 28.96 \approx 29.0\ g/mol$

Ex) gas XX has a density of 2.10 g / L at 25 °C and 1.12 atm. Determine the molar mass of this gas.

Ex) determine the density of Cl_2 gas at 1.50 atm and standard temp.

$D = \frac{PM}{RT} = \frac{(1.50\ atm)(70.90\ g/mol)}{(0.0821\ \frac{L \cdot atm}{mol \cdot K})(273\ K)} = 4.74\ g/L$