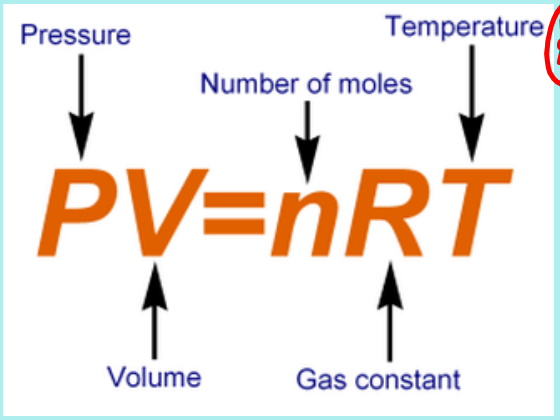
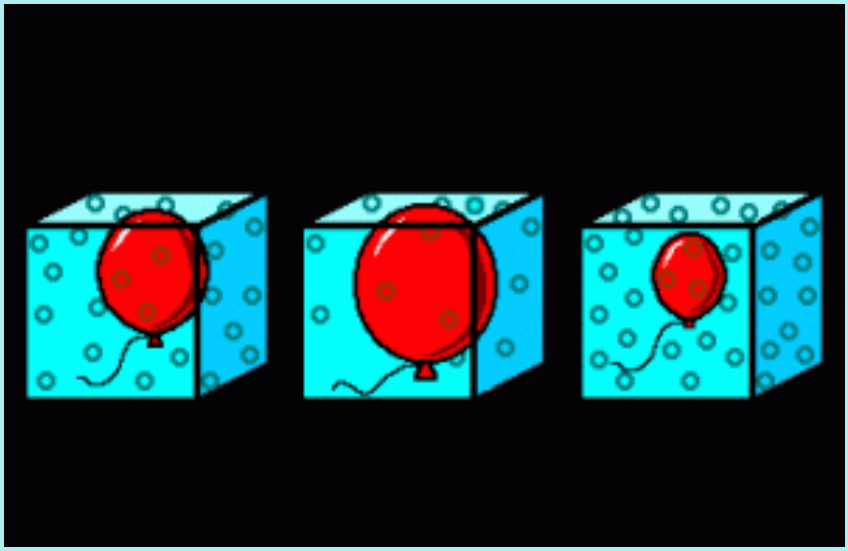
Ideal Gas Law





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The ideal gas law:

R=univeral gas constant

PV=nRT

Pressure

Volume

number of moles

Temperature

Gas Constant

$R = 0.0821 \frac{atm \cdot L}{mol \cdot K}$

P V n T

ideal

gas particles
-travel fast
-very far apart
-collisions are elastic
-no attractions or repulsions

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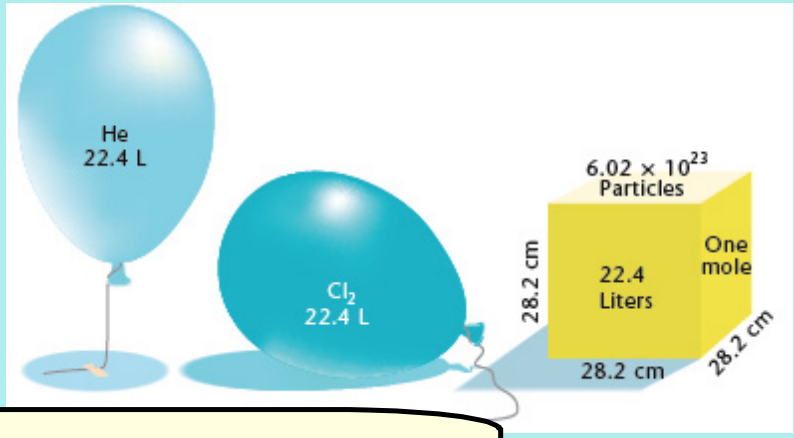
How is R determined?

1 mol = 22.4L at STP



At STP, 1 mol of gas takes up 22.4 L

STP stands for
Standard **T**emperature and **P**ressure

= 0^0C
= 273K

= 1 atm
=760 mmHg
=760 torr

solve for R

$PV=nRT$

$\frac{PV}{nT} = \frac{nRT}{nT}$

$$R = \frac{PV}{nT} = \left(\frac{1\ atm}{1\ mol}\right)\left(\frac{22.4L}{273K}\right) = 0.0821\ \frac{atm \cdot L}{mol \cdot K}$$

$$R = 0.0821\ \frac{atm \cdot L}{mol \cdot K}$$

must have these units to use this constant!

Which Equation to Use?

look at variables

$\frac{V_1P_1}{T_1} = \frac{V_2P_2}{T_2}$

this one has a "before" and "after"

$PV=nRT$

this one has "n" as number of moles

or grams (to convert to mol)

If I have an unknown quantity of H_2 gas at a pressure of 1.2 atm a volume of 31 liters, and a temperature of 87 ^{0}C, how many moles of gas do I have? How many grams is this?

P=1.2 atm

V= 31 L

T = 87^{0}C + 273 = 360 K

n = ?

R = 0.0821 $\frac{atm \cdot L}{mol \cdot K}$

PV=nRT solve for n $\frac{PV}{RT} = \frac{nRT}{RT}$

$n = \frac{PV}{RT} = \frac{(1.2\ atm)(31\ L)}{(0.0821\ \frac{atm \cdot L}{mol \cdot K})(360\ K)} = 1.26\ mol\ H_2$

How many grams?

molar mass of H_2 = 2 g/mol

$1.26\ mol\ H_2 \left| \frac{2\ grams}{1\ mol} \right. = 2.52\ g\ H_2$

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