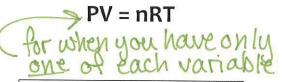
Unit 9 Part 3: Ideal Gas Law

Ideal Gas Law

- P = pressure (variable units)
- V = volume (MUST be in <u>L</u>)
- R = universal gas constant (variable units)
- T = temperature (MUST be in $\frac{1}{1}$, of course)

Universal Gas Constant, R

- Value depends on the units for pressure!
- Values are given on the formula chart!
- R relates the energy scale in physics to the temperature scale: super important!



Gas Constant, R, Values

- = 0.08206 L atm mol⁻¹K⁻¹
- $= 62.36 L mmHg mol^{-1}K^{-1}$
- = 62.36 L torr mol⁻¹K⁻¹
- $= 8.314 L kPa mol^{-1}K^{-1}$
- $= 0.08206 L atm mol^{-1}K^{-1}$



Examples:		
1. What is the pressure in atmospheres exerted by	a 0.500 mol sample of nitroge	n gas in a 10.0 L container at 298
K?	PV=NR	
P=?atm 50 R=0.08206 Latm mol·K	P(10 01)=10500	mot) (0.08206 Eatm) (298
N = 0.500 mol	10.0 L	
V=10.0 L		10.0 K
T=298K	P=1.2	2 atm
2. What is the volume, in liters, of 8.00 g of oxyger		lg pressure? L'mmto
8.00 a Oz I mal Oz	PV=NRT	T > R=62.36 mol· K
8.00 g 0z 1 mol 0z = (740.24	10 251 1 251	0 mol) (62.36 L. mmtg) (193
9-71/8	.24 wm Ha	740.29 nantta
n = 0.250 mol 02	V=6.17L	, so. in Igaretta
3. What mass of chlorine gas, Cl_2 , in grams, is contain	iined in a 10.0 L tank at 27.0°C a	And the state of t
get from n	+273	=T L>R=0.08206
(3.50 atm) (10.02) = n (0.08206 %	101.K) (300.0K)	
(0.08206 not 300.0x) (0.08206	(300.0K)	= 1101 a Cl
n = 1.42 mol	C/2 70.90 a C	12
	1 10101 (1-	

→ PV=nRT can also be used to describe relationships between pressure, volume, number

of moles, and temperature!
Inversely related if on same side.
Directly related if on opposite sides.

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If we decrease the volume of a gaseous system by a factor of 3, what will happen to the pressure of the system same side, so (if all other variables remain constant)?

PV=NRT inversely related if V decreases by a factor of 3, P will increase by a factor of 3 (triple)

If we increase the temperature of a gaseous system by a factor of 2, what will happen to the volume of the system (if all other variables remain constant)?

opposite sides, so directly related if Tincreases by a factor of Zi (doubles)

Pincreases by a factor of Z (doubles)

6. If we lower the temperature of a gaseous system by a factor of 4 and increase the volume by a factor of 2, what

will happen to the pressure of the system (if all other variables remain constant)?

means P will decrease to Y4 V × 2 means P will decrease to 14 P decreases by a

1/8 the original

Practice Makes Perfect! - R = 62.36 L for Mol. K

1. What pressure, in torr, is exerted by 0.325 mol of hydrogen gas in a 4.08 L container at 35.0°C?

P(4.08L) = (0.325 mol) (62.36 L. torr) (308.0K)

P= 1530 torr

2. If we increase the temperature of a gaseous system by a factor of 2 and increase the volume by a factor of 4, what will happen to the pressure of the system (if all other variables remain constant)?

TXZ means Pwill increase x Z VXU means P will decrease to /4

P decreases by a factor of 2, to 1/2 the original

3. What is the mass, in grams, of oxygen gas in a 12.5 L container at 45.0°C and 731.39 kPa?

(731.39 KPa) (12.5L) = n (8.314 L· KPa) (318.0 K) 8.314 K. KPa.) 818,0 K (8.814 L. KPa.) (318.0 K

N=3.46 mol 02 32 g 02 = 111 a