Chapter 9 - Gases Cheat Sheet

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Gas Laws

Boyle's Law	$P^{initial}V^{initial}=P^{final}V^{final}$
Charles's Law	$V^i \div T^i = V^f \div T^f$
Combined Gas Law	$P^iV^i \div T^i = P^fV^f \div T^f$
Avogadro's Law	$V^i \div n^i = V^f \div n^f$
Ideal Gas Law	PV=nRT
Dalton's Law of Partial Pressure	$P^{total}=P^1+P^2+P^3...$

Dalton's Law of Partial Pressure

Partial Pressure	P^{gas}(atm)=(total pressure x $moles^{gas}$)÷total moles
PP when volumes are different	$P^{total}=P^1(atm x V^1 \div V^{total})+P^2(atm x V^2 \div V^{total})...$
Mole fraction	moles of gas ÷ total moles
Wet Gas	$P^{wet\ gas}=P^{total}-P^{H2O}$
	then use PV=nRT to solve for variables

Real Gases

Van der waal's equation	$P=[(nRT)\div(V-nb)] - [(a*n^2)\div(V^2)]$
When comparing real gases	a gas with a larger "a" value will require the largest correction to account for intermolecular forces
	a gas with a smaller "b" value will behave most ideally at high pressures
	If Vdw's pressure is lower than the ideal pressure, attractive forces dominate
	If Vdw's pressure is higher than ideal pressure, repulsive forces dominate

Real Gases (cont)

Real Gas Behavior	attractive forces between molecules cause a decrease in pressure
	As molecules increase in size deviations from ideal behavior become apparent at relatively HIGH temps
	In general, most gases behave most ideally at HIGH temps and LOW pressures

Pressure Units and Conversions

1 atm=	1 atm (R= .08206)
	760 mmHg (R= 62.364)
	760 torr
	$1.013 x 10^5$ Pa
	101.3 kPa
	29.92 inches Hg
	14.69 psi
	1.01325 bar

Stoichiometry and Gases

Mole ratio = Volume ratio	2A+3B=AB
	2A:3B
	2mL A:3mL B

Kinetic Molecular Theory

Temperature	If temperature is increased, Pressure and KE increase by a factor of $T^f \div T^i$ and rms increases by a factor of $\sqrt{T^f \div T^i}$
Volume	If volume is increased, Pressure increases by a factor of $V^i \div V^f$ while KE and rms increase by a factor of 1 (because they are not affected))
Moles	If moles are increased, pressure increases by a factor of $n^f \div n^i$, while KE and rms increase by a factor of 1 (no change)

Using Ideal Gas Law to Calculate Gas Properties

Ideal Gas Law	PV=nRT
STP	0 degrees celcius, 273 degrees Kelvin, 1 atm, 22.4 L/mol
Density	d=MP÷RT where M is molar mass
Volume	When not given volume, but told to assume ideal gas behavior, use V=1L

Diffusion and Effusion

G1=gas 1	G2=gas 2
Average Kinetic Energy	$KE^{G1} = KE^{G2}$ when $T^{G1}=T^{G2}$
Molecular Speed	$\sqrt{u^2} = \sqrt{3RT \div M}$ where M is the molar mass
	$\sqrt{u^2 G1} \div \sqrt{u^2 G2} = \sqrt{M^{G2}} \div \sqrt{M^{G1}}$
Rate	$d/dx^{G1} \div d/dx^{G2} = \sqrt{M^{G2}} \div \sqrt{M^{G1}}$
Time	$t^{G2} \div t^{G1} = \sqrt{M^{G2}} \div \sqrt{M^{G1}}$

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