General Chemistry - MOOC Cheat Sheet

by dswelam via cheatography.com/122607/cs/22839/

Gas Laws & Conditions

760 Torrs = 760 mmHg = 1 atm

P = pressure V = volume

T = temperature n = moles

Boyle's Law (P↑↓V): $P_1V_1 = P_2V_2$

Charles' Law (T↑↑V): $(V_1/T_1) = (V_2/T_2)$

Avogadro's Law (M↑↑V): $(V_1/n_1) = (V_2/n_2)$

Static Conditions:

PV = nRT `R = 0.0821 L*atm/ mol*K`

`note: units should be L, K, atm, & mol`

Dalton's Law Pressure:

$P_{total} = P_{gas1} + P_{gas2} + P_{gas3} + P...$

Types of Branches

Alkyl Branches: named based on # of carbon contained

`have a -yl ending`

CH_3 methyl branch

CH_2CH_3 ethyl branch

$CH_2CH_2CH_3$ propyl branch

Halogen Branches: from group 17 of periodic table

F - fluoro

Cl - chloro

Br - bromo

I - iodo

Units of Conversion

100 centimeters	= 1 meter
1,000 millimeters	= 1 meter
10,000 micrometers	= 1 meter
1,000,000 nanometers	= 1 meter
1,000 meters	= 1 kilometer

Density Equation

Density = (m/v) g/mL ^{3}

Energy

4184J	= 4.184kJ	= 1 kcal	=1000 cal
Kinetic Energy	= (1/2) mv^2		
Kelvin	= C^o + 273.15		
Specific Heat (q)	= ms△T	(△ change in temp.)	
Fats	= 9 kcal/g		
Carbs	= 4 kcal/g		
Proteins	= 4 kcal/g		
Liquid ⟶ Solid	= freezing		
Solid ⟶ Gas	= sublimation		
Gas ⟶ Liquid	= condensation		
Solid⟶ Liquid	= melting		
Liquid ⟶ Gas	= deposition		
Gas ⟶ Solid	= vaporization		

Molarity & Concentration

Molarity = moles ÷ L

Dilution: $M_1V_1 = M_2V_2$

Acids & Bases

Arrhenius Acids	increase H^+ / increases protons / increases H_3O^+
Arrhenius Bases	increase OH^- (hydroxide)

Acids & Bases (cont)

Simple Acids	H + element off periodic table (e.g. HCl)
Oxoacid	H + polyatomic ion (e.g. HNO_3)

Naming Acids: Drop the ending in simple acids and add "-ic acid" ex: Hydrochloric Acid

If the polyatomic ion ends in "-ite", change to "-ous acid" ex: Chlorous Acid

Note: Strong acids and strong bases dissociate completely.

pH & Relative Acidity

Calculating Hydroxide: $1x10^{-14}=[H_3O^+][OH^-]$

pH Equation: $pH = - \log[H^+]$

Finding pH from Hydroxide Equation: solve for H_3O^+, then solve for pH.

Intermolecular Attractive Forces

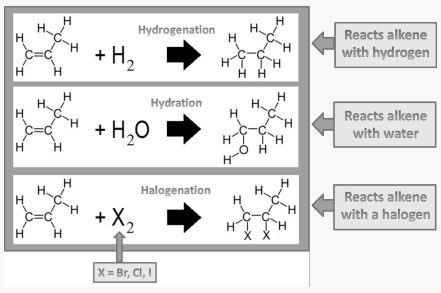
Hydrogen Bonding - Strongest of the three. Requires an H to be directly bonded to an N, O, or F within a molecule.

Dipole-Dipole - During the next two sections of this module we'll learn to ID molecules with this IMF. Molecules with dipole-dipole forces have a permanent positive and negative "sidedness" or polarity.

Dispersion Forces - Weakest of the three. All molecules have dispersion forces, but they're the primary (strongest) forces for nonpolar molecules.

IMF Strength: `(lowest)` D ➠ D-D ➠ HB `(highest)`

Reactions of Alkenes



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Calculating Abundance

(mass x abundance %) + (mass x abundance %)

Note:abundance must be calculated by a decimal (moving decimal place two times to the front)

Molecular Prefixes

1 = mono

2 = di

3 = tri

4 = tetra

5 = penta

6 = hexa

7 = hepta

8 = octa

9 = nona

10 = deca

Note: Ending of last element is replaced by -ide.
Example: CO_2 - carbon dioxide SF_6 - sulfur hexafluoride

Percent Yield

PY = (Actual Yield (g) x 100) ÷ (Theoretical Yield (g))

Ionic Compounds

Acetate ⟶ $(C_3H_3O_2)^{-1}$

Nitrate ⟶ $(NO_3)^{-1}$

Chlorate ⟶ $(ClO_3)^{-1}$

Chlorate ⟶ $(ClO_4)^{-1}$

Ammonium ⟶ $(NH_4)^{+1}$

Hydronium ⟶ $(H_3O)^{-1}$

Carbonate ⟶ $(CO_3)^{-2}$

Phosphate ⟶ $(PO_4)^{-3}$

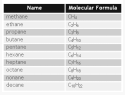
Hydroxide ⟶ $(OH)^{-1}$

Ionic Compounds (cont)

Sulfate ⟶ $(SO_4)^{-2}$

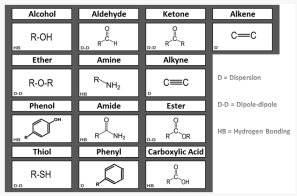
Contains : a metal and/or a polyatomic ion
Note: Cations come first (+) and Anions come last (-)
Ion Charges (exceptions): Al ⟶ +3 Zn⟶ +2
Writing Formulas: Cation keeps the name off periodic table while anion ends in -ide.

Hydrocarbon Alkanes



Name	Molecular Formula
methane	CH_4
ethane	C_2H_6
propane	C_3H_8
butane	C_4H_{10}
pentane	C_5H_{12}
hexane	C_6H_{14}
heptane	C_7H_{16}
octane	C_8H_{18}
nonane	C_9H_{20}
decane	$C_{10}H_{22}$

Functional Groups List



Relating IMF Strength

As IMF strength increases:
① Boiling point (B.P.) will require higher temperature to boil.
② Melting point (M.P.) will require higher temperature to melt.
③ Solubility in water will increase (like dissolves like, and water exhibits H-bonding, a strong IMF)
④ Volatility, how readily a substance will go to the gas phase, will decrease.
IMF ⇑ B.P. ⇑ M.P. ⇑ Solubility in Water ⇓ Volatility

Types of Reactions

Decomposition Reaction	**ex:** $2HgO(s) \rightarrow 2Hg(l)+O_2(g)$
Combustion Reaction	**ex:** $C_3H_7(g)+5O_2(g) \rightarrow 3CO_2(g)+4H_2O(g)$
Single-Replacement Reaction	**ex:** $Zn(s)+2HCl(aq) \rightarrow ZnCl_2(aq)+H_2(g)$

Types of Reactions (cont)

Double-Replacement Reaction	**ex:** $Na_2S(aq)+2HCl(aq) \rightarrow 2NaCl(aq)+H_2S(g)$
Combination Reaction	**ex:** $2Na(s)+Cl_2(g) \rightarrow 2NaCl(s)$

Note: △⟶ reaction is heated up
hλ ⟶ energy is added in form of light

Strong Acids

HCl	HBr	$HClO_3$
HI	HNO_3	$HClO_4$
H_2SO_4		

Notes: Molecular substances act as nonelectrolytes. Soluble Ionic substances make for strong electrolytes.

Balanced equations with double-sided arrows (⟷) rules an electrolyte is weak because it dissociates and recombines.

Conversion Roadmap

mass ⟶ moles (use molar mass)

moles ⟶ molecules (use Avogadro's number)

molecules ⟶ atoms (use chemical formula)

Note: Avogadro's Number $6.022x10^{23}$

Stoichiometry

Step #1: Balance Equation
Step #2: Given mass, convert with moles
Step #3: Perform Stoichiometry, convert back to mass at the end if needed.

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