AR Chemistry Review Notes 2

Balancing Equations

Rules: Balance POLYATOMICS first
Save Oxygen and Hydrogen for Last
Save Single Elements for the very last (put whatever number is necessary at the end)
**it is okay to have ½'s in the equation

ex: $MgCl_2 + NaOH \rightarrow Mg(OH)_2 + NaCl$
$MgCl_2 + \mathbf{2}\ NaOH \rightarrow Mg(OH)_2 + NaCl$
$MgCl_2 + 2\ NaOH \rightarrow Mg(OH)_2 + \mathbf{2}\ NaCl$

$C_{12}H_{22}O_{11} + O_2 \rightarrow CO_2 + H_2O$
$\mathbf{C_{12}}H_{22}O_{11} + O_2 \rightarrow 12\ CO_2 + H_2O$
$C_{12}\mathbf{H_{22}}O_{11} + O_2 \rightarrow 12\ CO_2 + 11\ H_2O$
$C_{12}H_{22}\mathbf{O_{11}} + \mathbf{12}\ O_2 \rightarrow \mathbf{12}\ CO_2 + \mathbf{11}\ H_2O$

Writing Equations

1. Predict formula of compound formed: Al / O Al^{+3} O^{-2} Al_2O_3
2. Write skeleton with elements on the left: $Al + O \rightarrow Al_2O_3$
3. HOFBrINCl-ize the reactants: $Al + O_2 \rightarrow Al_2O_3$
4. Balance: $4\ Al + 3\ O_2 \rightarrow 2\ Al_2O_3$

Types of Chemical Reactions

Single Replacement	1 element switches with an ion	$C\mathbf{u}SO_4 + Al^0 \rightarrow Al_2(SO_4)_3 + Cu^0$
Double Replacement	2 ions switch, forming precipitate	$Na_2CO_3 + CaCl_2 \rightarrow CaCO_{3\,(s)} + 2\ NaCl$
Formation	Form compound from elements	$2\ H_2 + O_2 \rightarrow 2\ H_2O$
Decomposition	Compound breaks into elements	$CaCO_3 \rightarrow CaO + CO_2 \rightarrow Ca + 1.5\ O_2 + C$
Combustion	Reacts with Oxygen	$Mg + O_2 \rightarrow 2\ MgO$
	CH and CHO always form CO_2/H_2O	$CH_3OH + O_2 \rightarrow CO_2 + H_2O$

The Atomic Scale and The Mole

The Atomic Mass Scale is based on $_6{}^{12}C$ having a mass of 12 atomic mass units (amu)

1 mole = 6.02×10^{23} atoms or molecules
6.02×10^{23} atoms or molecules = atomic/molecular mass in GRAMS

1 Mole = 6.02×10^{23} atoms/mole. = MM grams = 22.4 L @ STP

1 mol H_2	=	6.02×10^{23} mole. H_2	=	**2.02 grams H_2**	=	22.4 L @ STP
1 mol CH_4	=	6.02×10^{23} mole. CH_4	=	**16.05 grams CH_4**	=	22.4 L @ STP
1 mole $Ca(OH)_2$	=	6.02×10^{23} mole. $Ca(OH)_2$	=	**74.10 grams $Ca(OH)_2$**	=	22.4 L @ STP

Mass / Density / Weight

Mass = "Amount of Stuff" = Inertia = Resistance to a change in motion — grams, kilograms
Weight = Gravity's effects on Mass (mass x gravity) — dynes, Newtons
Density = Concentration of Matter = mass / volume

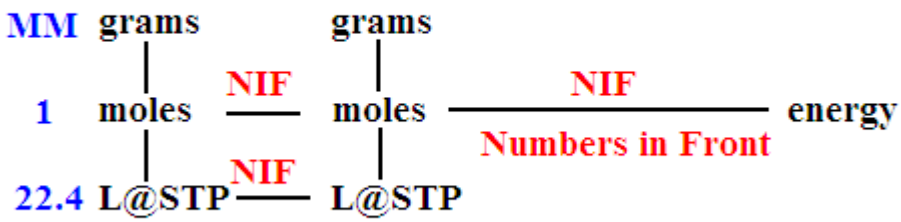
Density never changes, small mass of lead has same density / concentration as a large mass

27 g Al, 10 mL | **54 g Al, 20 mL** | **99 g Ni, 10 mL** | **198 g Ni, 20 ml**

$D_{Al} = 2.7$ g / mL $\qquad D_{Ni} = 9.9$ g / mL

Conversions in Balanced Equations: Follow the Road Map

$$2\ H_2 + 1\ O_2 \rightarrow 2\ H_2O \qquad \Delta H = -136 \text{ kcal}$$



Examples: Convert 6.06 grams H_2O to grams O_2, L O_2 @ STP, and Energy

6.06 g H_2 x (1 mol H_2 / 2.02 g H_2) x (1 mol O_2 / 2 mol H_2) x (32.00 g O_2 / 1 mol O_2) = 48.00 g O_2

6.06 g H_2 x (1 mol H_2 / 2.02 g H_2) x (1 mol O_2 / 2 mol H_2) x (22.4 L STP / 1 mol O_2) = 33.6 L O_2

6.06 g H_2 x (1 mol H_2 / 2.02 g H_2) x (-136 kcal / 2 mol H_2) = -204 kcal

REDOX Reactions (Oxidation / Reduction)

Electrons are given away in oxidation (eg. neutral metals give electrons away)
Electrons are take in reduction (eg. neutral nonmetals taking electrons)

Charges change in Redox

Oxidized atoms give electrons away, charge gets more positive: $Ca^0 \rightarrow Ca^{+2} + 2\ e^{-1}$
Reduced atoms take electrons, charge gets more negative. $S^0 + 2\ e^{-1} \rightarrow S^{-2}$

$$\mathbf{Ca^0 + S^0 \rightarrow Ca^{+2}S^{-2} \rightarrow CaS}$$