Science 10
Notes: Chemical Reactions – Writing and Balancing Equations

Terms to know:

Reactants, products, chemical reaction, law of conservation of mass,
Skeleton equation, word equation, symbolic equation, balanced equation

chemical reactants — Chemical products.

nitrogen monoxide gas + oxygen gas → nitrogen dioxide gas word equation.

$NO + O_2 \rightarrow NO_2$ ← skeleton equation

Law of conservation of mass: mass of all reactants = mass of products.

For chemical reactions, this means that the number of atoms in the reactants must equal:

the number of atoms in the products.

How to balance a chemical reaction:

1. Start with the skeleton equation. You may need to find the chemical formulas from the names of the compounds.

   Be aware of common names: water : H_2O

   And

   Diatomic molecules: $O_2, N_2, H_2, Cl_2, I_2, Br_2, F_2$

2. Simple equations can be balanced by adding coefficients by trial and error / common sense
   - a. Balance compounds first
   - b. Add coefficients only. Do not change subscripts
   - c. If you add a coefficient to a compound, balance all of those atoms first before moving on
   - d. Make sure that all of the coefficients are whole numbers. You can double or triple all of the coefficients if necessary
   - e. Polyatomic ions can be treated as a whole unit

Eg: $H_{2\,(g)} + Cl_{2\,(g)} \rightarrow HCl_{(aq)}$

$H_2 + Cl_2 \rightarrow 2HCl$

H ✓
Cl ✓

$CH_4 + O_2 \rightarrow CO_2 + H_2O$

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

H ✓
C ✓ O

3. Balance the following:

$FeBr_3 + CaS \rightarrow Fe_2S_3 + CaBr_2$ $Ca(NO_3)_2 + HCl \rightarrow CaCl_2 + HNO_3$

$2FeBr_3 + 3CaS \rightarrow Fe_2S_3 + 3CaBr_2$ $Ca(NO_3)_2 + 2HCl \rightarrow CaCl_2 + 2HNO_3$

Fe ✓
Br ✓
Ca ✓
S ✓

NO_3 ✓
Ca ✓
H ✓
Cl

4. Complicated equations can be balanced by counting atoms:

Ex 12: $C_3H_7OH + O_2 \rightarrow CO_2 + H_2O$

$1C_3H_7OH + 4.5O_2 \rightarrow 3CO_2 + 4H_2O$

multiply to get rid of decimal or fraction coefficients

C ✓
H ✓

$2C_3H_7OH + 9O_2 \rightarrow 6CO_2 + 8H_2O$

Eg. Plants convert carbon dioxide gas and water into glucose ($C_6H_{12}O_6$) and oxygen

$6CO_2 + 6H_2O \longrightarrow 1C_6H_{12}O_6 + 6O_2$

C ✓
H ✓
O : 12 + 6 = 6 + 12

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