Chemistry — Predicting Products – Summary Chart — Ms. Chubbuck

Single Replacement

A + BC → AC + B

Type 1

Reactants	metal + compound*(aq)*

$Al + 3\ CuCl_2 \rightarrow 2\ AlCl_3 + 3\ Cu$

Al > Cu ✓charges

Special Case 1

Reactants	metal + water (HOH)

$Ca + 2\ HOH \rightarrow Ca(OH)_2 + H_2$

Top 6 metals ✓charges

Type 2

Reactants	halogen + metal halide*(aq)*

$Cl_2 + 2\ NaI \rightarrow 2\ NaCl + I_2$

Cl >I ✓charges

Decomposition

AB → A + B

Type 1

Reactants	1 binary substance

$2\ H_2O \rightarrow 2\ H_2 + O_2$

Forms elements - ✓diatomics

Type 2

Reactants	1 ternary substance

Metal bicarbonate → metal carbonate + CO_2 + H_2O

Metal carbonate → metal oxide + CO_2

Metal chlorate → metal chloride + O_2

Metal nitrate → metal nitrite + O_2

✓charges

Know the recipes

Combination (Synthesis)

A + B → AB

Type 1

Reactants	Element + Element

$2\ Al + 3\ Cl_2 \rightarrow 2\ AlCl_3$

✓diatomics

✓charges on ionic product

Type 2

Reactants	2 compounds (covalent)

$Na_2O + CO_2 \rightarrow Na_2CO_3$

Metal first, polyatomic ion

✓charges

$SO_3 + H_2O \rightarrow H_2SO_4$

No metal, Hydrogen first, polyatomic ion ✓charges

Double Displacement

AB + CD → AD + CB

Type 1 – Precipitation

Reactants	Ionic*(aq)* + Ionic*(aq)*

$Pb(NO_3)_2 + 2\ KCl \rightarrow PbCl_2\downarrow + 2\ KNO_3$

Swap the anions & ✓charges

One product must be insoluble

Type 2 – Neutralization

reactants	Acid (H^+) + Base (OH^-)

$H_2SO_4 + 2\ KOH \rightarrow 2\ HOH + K_2SO_4$

Swap the anions & ✓charges

No check – always occur

Combustion

Hydrocarbons (C_xH_y) burn when they combine with oxygen gas to form carbon dioxide and water.

$C_xH_y + O_2 \rightarrow CO_2 + H_2O$

$C_xH_yO_z + O_2 \rightarrow CO_2 + H_2O$

Activity Series

Li > K > Ba > Sr > Ca > Na >

Mg > Al > Mn > Zn > Fe > Cd > Co > Ni > Sn > Pb > H > Cu > Ag > Hg > Au

Solubility Rules

Compounds containing the following ions are generally **soluble** in water:

1. alkali metal ions and ammonium ions, Li^+, Na^+, K^+, NH_4^+
2. acetate ion, $C_2H_3O_2^-$
3. nitrate ion, NO_3^-
4. halide ions (X^-), Cl^-, Br^-, I^- (AgX, Hg_2X_2, PbX_2 are insoluble exceptions)
5. sulfate ions, SO_4^{2-}, ($BaSO_4$, $SrSO_4$, and $PbSO_4$ are insoluble exceptions)

Compounds containing the following ions are generally **insoluble** in water:

6. carbonate ions, CO_3^{2-} (see rule 1 exceptions, which are soluble)
7. chromate ions, CrO_4^{2-} (see rule 1 exceptions, which are soluble)
8. phosphate ions, PO_4^{3-} (see rule 1 exceptions, which are soluble)
9. sulfide ions, S^{2-} (CaS, SrS, BaS, and rule 1 exceptions are soluble)
10. hydroxide ions, OH^- [$Ca(OH)_2$, $Sr(OH)_2$, $Ba(OH)_2$, and rule 1 exceptions are soluble]