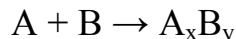


Chem3a – Summary of Major Reactions – Predicting Reactions

Remember all reactions must be balanced after predictions

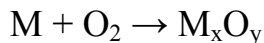
Combinations

- 1) Metal plus Non-metal give a binary



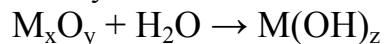
(x and y are determined by the charges)

- 2) Metal plus Oxygen gas give a metal oxide



(x and y are determined by the charges)

- 3) Metal oxide plus water gives a metal hydroxide

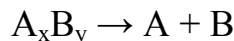


(x, y, and z determined by charges)

- 4) Gas plus water gives acids or bases

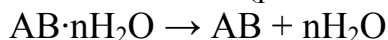
Decomposition

- 1) Binary plus heat gives elements (metal and non-metal total decomposition)

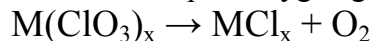


(opposite of combination 1)

- 2) Hydrates plus heat give anhydrous salts and water (partial decomposition)

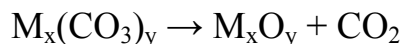


- 3) Metal chlorates plus heat give metal chlorides plus oxygen gas (partial decomposition)



(x is determined by the charge on the metal and is the same in the metal chlorate and the metal chloride)

- 4) Metal carbonates plus heat give metal oxides and carbon dioxide gas (partial decomposition)

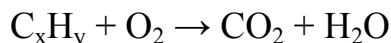


(x and y are determined by the charges)

- 5) Weak acids and weak bases plus heat give a gas and water. The opposite of combination 4

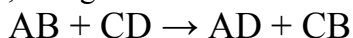
Total Combustion of a Hydrocarbon

- 1) Hydrocarbons plus oxygen gas give carbon dioxide gas and water vapor. (Formula of hydrocarbon will be given)



Double Replacement

- 1) Occurs with salts in solution. Reaction occurs if one of the following is formed: insoluble salt (solid), weak or non-electrolyte, or a gas.

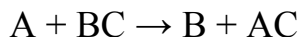


(Breaks down into the following – use the solubility table and the weak electrolyte table)

(a. Total molecular reaction b. Total ionic reaction c. Net ionic reaction)

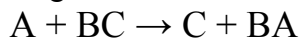
Single Replacement

- 1) Metal plus salt gives new metal and a new salt (occurs only if the metal is more active than the metal form of the cation)



(A is metal #1 which forms a cation, B is the cation which forms new metal B, C is the unchanged anion)

- 2) Halogen plus halide salt give new halogen and new halide salt



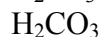
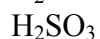
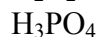
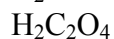
(A is the Halogen, C is the Halide and B is the unchanged cation)

Solubility Table

| | $C_2H_3O_2^-$ | AsO_4^{3-} | Br^- | CO_3^{2-} | Cl^- | CrO_4^{2-} | OH^- | I^- | NO_3^- | $C_2O_4^{2-}$ | O^{2-} | PO_4^{3-} | SO_4^{2-} | S^{2-} | SO_3^{2-} |
|-------------|---------------|---------------|-----------|---------------|-----------|---------------|---------------|-----------|-----------|---------------|---------------|---------------|-------------|-----------|---------------|
| Al^{3+} | <i>aq</i> | I | <i>aq</i> | – | <i>aq</i> | – | I | <i>aq</i> | <i>aq</i> | – | I | I | <i>aq</i> | d | – |
| NH_4^+ | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | – | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> |
| Ba^{2+} | <i>aq</i> | I | <i>aq</i> | I | <i>aq</i> | I | <i>sl. aq</i> | <i>aq</i> | <i>aq</i> | I | <i>sl. aq</i> | I | I | d | I |
| Bi^{3+} | – | <i>sl. aq</i> | d | I | d | – | I | I | d | I | I | <i>sl. aq</i> | d | I | – |
| Ca^{2+} | <i>aq</i> | I | <i>aq</i> | I | <i>aq</i> | <i>aq</i> | I | <i>aq</i> | <i>aq</i> | I | I | I | I | d | I |
| Co^{2+} | <i>aq</i> | I | <i>aq</i> | I | <i>aq</i> | I | I | <i>aq</i> | <i>aq</i> | I | I | I | <i>aq</i> | I | I |
| Cu^{2+} | <i>aq</i> | I | <i>aq</i> | I | <i>aq</i> | I | I | – | <i>aq</i> | I | I | I | <i>aq</i> | I | – |
| Fe^{2+} | <i>aq</i> | I | <i>aq</i> | <i>sl. aq</i> | <i>aq</i> | – | I | <i>aq</i> | <i>aq</i> | I | I | I | <i>aq</i> | I | <i>sl. aq</i> |
| Fe^{3+} | I | I | <i>aq</i> | I | <i>aq</i> | I | I | – | <i>aq</i> | <i>aq</i> | I | I | <i>aq</i> | I | – |
| Pb^{2+} | <i>aq</i> | I | I | I | I | I | I | I | <i>aq</i> | I | I | I | I | I | I |
| Mg^{2+} | <i>aq</i> | d | <i>aq</i> | I | <i>aq</i> | <i>aq</i> | I | <i>aq</i> | <i>aq</i> | I | I | I | <i>aq</i> | d | <i>sl. aq</i> |
| Hg_2^{2+} | <i>sl. aq</i> | I | I | I | I | <i>sl. aq</i> | – | I | <i>aq</i> | I | I | I | I | I | – |
| Hg^{2+} | <i>aq</i> | I | I | I | <i>aq</i> | <i>sl. aq</i> | I | I | <i>aq</i> | I | I | I | d | I | – |
| K^+ | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> |
| Ag^+ | <i>sl. aq</i> | I | I | I | I | I | – | I | <i>aq</i> | I | I | I | I | I | I |
| Na^+ | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> | <i>aq</i> |
| Zn^{2+} | <i>aq</i> | I | <i>aq</i> | I | <i>aq</i> | I | I | <i>aq</i> | <i>aq</i> | I | I | I | <i>aq</i> | I | I |

Key: *aq* = Soluble in water I = Insoluble in water (less than 1 g/100 g H₂O)
sl. aq = Slightly soluble in water d = Decomposes in water

Weak Electrolytes



} Decompose

