

A Voyage through Equations

After working on this worksheet, you should be able to do the following:

- 1) Given an equation, you should be able to tell what kind of reaction it is.
- 2) Predict the products of a reaction when given the reactants.

Section 1: Identify the type of reaction

For the following reactions, indicate whether the following are examples of synthesis, decomposition, combustion, single displacement, double displacement, or acid-base reactions (neutralization).

- 1) $\text{Na}_3\text{PO}_4 + 3 \text{KOH} \rightarrow 3 \text{NaOH} + \text{K}_3\text{PO}_4$ Double Displacement ✓
- 2) $\text{MgCl}_2 + \text{Li}_2\text{CO}_3 \rightarrow \text{MgCO}_3 + 2 \text{LiCl}$ Double Displacement ✓
- 3) $\text{C}_6\text{H}_{12} + 9 \text{O}_2 \rightarrow 6 \text{CO}_2 + 6 \text{H}_2\text{O}$ combustion ✓
- 4) $\text{Pb} + \text{FeSO}_4 \rightarrow \text{PbSO}_4 + \text{Fe}$ Single Displacement ✓
- 5) $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ Decomposition ✓
- 6) $\text{P}_4 + 3 \text{O}_2 \rightarrow 2 \text{P}_2\text{O}_3$ synthesis ✓
- 7) $2 \text{RbNO}_3 + \text{BeF}_2 \rightarrow \text{Be}(\text{NO}_3)_2 + 2 \text{RbF}$ Double Displacement ✓
- 8) $2 \text{AgNO}_3 + \text{Cu} \rightarrow \text{Cu}(\text{NO}_3)_2 + 2 \text{Ag}$ Single Displacement ✓
- 9) $\text{C}_3\text{H}_8\text{O} + 4 \text{O}_2 \rightarrow 3 \text{CO}_2 + 3 \text{H}_2\text{O}$ combustion ✓
- 10) $2 \text{C}_5\text{H}_5 + \text{Fe} \rightarrow \text{Fe}(\text{C}_5\text{H}_5)_2$ synthesis ✓
- 11) $\text{SeCl}_6 + \text{O}_2 \rightarrow \text{SeO}_2 + 3 \text{Cl}_2$ single Displacement ✓
- 12) $2 \text{MgI}_2 + \text{Mn}(\text{SO}_3)_2 \rightarrow 2 \text{MgSO}_3 + \text{MnI}_4$ double Displacement ✓
- 13) $\text{O}_3 \rightarrow \text{O} + \text{O}_2$ Decomposition ✓
- 14) $2 \text{NO}_2 \rightarrow 2 \text{O}_2 + \text{N}_2$ Decomposition ✓

Section 2: Practicing equation balancing

Before you can write a balanced equation for a problem which asks you to predict the products of a reaction, you need to know how to balance an equation. Because some of you may not fully remember how to balance an equation, here are some practice problems:

- 1) $2 \text{C}_6\text{H}_6 + 15 \text{O}_2 \rightarrow 6 \text{H}_2\text{O} + 12 \text{CO}_2$
- 2) $4 \text{NaI} + \text{Pb}(\text{SO}_4)_2 \rightarrow \text{PbI}_4 + 2 \text{Na}_2\text{SO}_4$
- 3) $2 \text{NH}_3 + 5/2 \text{O}_2 \rightarrow 2 \text{NO} + 3 \text{H}_2\text{O}$
- 4) $2 \text{Fe}(\text{OH})_3 \rightarrow \text{Fe}_2\text{O}_3 + 3 \text{H}_2\text{O}$
- 5) $2 \text{HNO}_3 + \text{Mg}(\text{OH})_2 \rightarrow 2 \text{H}_2\text{O} + \text{Mg}(\text{NO}_3)_2$
- 6) $\text{H}_3\text{PO}_4 + 3 \text{NaBr} \rightarrow 3 \text{HBr} + \text{Na}_3\text{PO}_4$
- 7) $3 \text{C} + 4 \text{H}_2 \rightarrow \text{C}_3\text{H}_8$
- 8) $2 \text{CaO} + \text{MnI}_4 \rightarrow \text{MnO}_2 + 2 \text{CaI}_2$
- 9) $\text{Fe}_2\text{O}_3 + 3 \text{H}_2\text{O} \rightarrow 2 \text{Fe}(\text{OH})_3$
- 10) $\text{C}_2\text{H}_2 + 2 \text{H}_2 \rightarrow \text{C}_2\text{H}_6$
- 11) $2 \text{VF}_5 + 10 \text{HI} \rightarrow \text{V}_2\text{I}_{10} + 10 \text{HF}$
- 12) $\text{OsO}_4 + 2 \text{PtCl}_4 \rightarrow 2 \text{PtO}_2 + \text{OsCl}_6$
- 13) $\text{CF}_4 + 2 \text{Br}_2 \rightarrow \text{CBr}_4 + 2 \text{F}_2$
- 14) $2 \text{Hg}_2\text{I}_2 + \text{O}_2 \rightarrow 2 \text{Hg}_2\text{O} + 2 \text{I}_2$
- 15) $\text{Y}(\text{NO}_3)_2 + \text{GaPO}_4 \rightarrow \text{YPO}_4 + \text{Ga}(\text{NO}_3)_2$

Section 3: Predicting the products of chemical reactions

Predict the products of the following reactions: Balance & identify type.

- 1) $2 \text{Ag} + \text{CuSO}_4 \rightarrow \text{Cu} + \text{Ag}_2\text{SO}_4$
Type: Single Displacement
- 2) $2 \text{NaI} + \text{CaCl}_2 \rightarrow 2 \text{NaCl} + \text{CaI}_2$
Type: Double Displacement
- 3) $\text{O}_2 + 2 \text{H}_2 \rightarrow 2 \text{H}_2\text{O}$
Type: Synthesis
- 4) $2 \text{HNO}_3 + \text{Mn(OH)}_2 \rightarrow \text{Mn(NO}_3)_2 + 2 \text{H}_2\text{O}$
Type: Neutralization
- 5) $2 \text{AgNO}_2 + \text{BaSO}_4 \rightarrow \text{Ag}_2\text{SO}_4 + \text{Ba(NO}_2)_2$
Type: Double Displacement
- 6) $2 \text{HCN} + \text{CuSO}_4 \rightarrow \text{H}_2\text{SO}_4 + \text{Cu(CN)}_2$
Type: Double Displacement
- 7) $\text{H}_2\text{O} + 2 \text{AgI} \rightarrow 2 \text{HI} + \text{Ag}_2\text{O}$
Type: Double Displacement
- 8) $3 \text{HNO}_3 + \text{Fe(OH)}_3 \rightarrow \text{Fe(NO}_3)_3 + 3 \text{H}_2\text{O}$
Type: Neutralization
- 9) $4 \text{LiBr} + \text{Co(SO}_3)_2 \rightarrow 2 \text{Li}_2\text{SO}_3 + \text{CoBr}_4$
Type: Double Displacement
- 10) $\text{LiNO}_3 + \text{Ag} \rightarrow \text{AgNO}_3 + \text{Li}$
Type: Single Displacement

- 11) $\text{N}_2 + 2 \text{O}_2 \rightarrow 2 \text{NO}_2$
Type: Synthesis
- 12) $\text{H}_2\text{CO}_3 \rightarrow \text{H}_2 + \text{CO}_3$
Type: Decomposition
- 13) $\text{AlCl}_3 + 3 \text{Cs} \rightarrow 3 \text{CsCl} + \text{Al}$
Type: Single Displacement
- 14) $\text{Al(NO}_3)_3 + \text{Ga} \rightarrow \text{Ga(NO}_3)_3 + \text{Al}$
Type: Single Displacement
- 15) $\text{H}_2\text{SO}_4 + 2 \text{NH}_4\text{OH} \rightarrow (\text{NH}_4)_2\text{SO}_4 + 2 \text{H}_2\text{O}$
Type: Neutralization
- 16) $\text{CH}_3\text{COOH} + 2 \text{O}_2 \rightarrow 2 \text{H}_2\text{O} + 2 \text{CO}_2$
Type: Combustion
- 17) $\text{C}_4\text{H}_8 + 6 \text{O}_2 \rightarrow 4 \text{H}_2\text{O} + 4 \text{CO}_2$
Type: Combustion
- 18) $2 \text{KCl} + \text{Mg(OH)}_2 \rightarrow 2 \text{KOH} + \text{MgCl}_2$
Type: Double Displacement
- 19) $\text{Zn} + \text{Au(NO}_3)_2 \rightarrow \text{Zn(NO}_3)_2 + \text{Au}$
Type: Single Displacement
- 20) $2 \text{KOH} + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 2 \text{H}_2\text{O}$
Type: Neutralization
- 21) $\text{BaS} + \text{PtCl}_2 \rightarrow \text{BaCl}_2 + \text{PtS}$
Type: Double Displacement
- 22) $2 \text{Na}_2\text{O} \rightarrow 4 \text{Na} + \text{O}_2$
Type: Decomposition