Worksheet 1: Synthesis, Decomposition & Combustion

Synthesis: Elements combine to form one compound OR compounds combine to form one large compound.

Decomposition: One compound breaks apart to form elements or smaller compounds.

Combustion : A compound "burns" in a reaction with oxygen.

Balance the reactions and state the type of reaction described.

Combustion 1. The first step in the production of sulfuric acid is to burn sulfur.

$S_{8(s)} + 8\ O_{2(g)} \rightarrow 8\ SO_{2(s)}$

Decomposition 2. In 1774 Joseph Priestly discovered oxygen by decomposing the calx of mercury.

$2\ HgO_{(l)} \rightarrow O_{2(g)} + 2\ Hg_{(l)}$

Decomposition 3. Molten table salt is industrially decomposed to produce molten sodium.

$2\ NaCl_{(l)} \rightarrow 2\ Na_{(l)} + Cl_{2(g)}$

Synthesis 4. Nitrogen from the air reacts with hydrogen to produce ammonia fertilizer.

$N_{2(g)} + 3\ H_{2(g)} \rightarrow 2\ NH_{3(g)}$

Combustion 5. The main engine on the space shuttle is a rocket that burns hydrogen.

$2\ H_{2(g)} + O_{2(g)} \rightarrow 2\ H_2O_{(s)}$

Decomposition 6. Copper ore is decomposed to remove the copper metal.

$2\ CuO_{(l)} \rightarrow 2\ Cu + O_2$

Combustion 7. Barbecue charcoal undergoes incomplete combustion that produces deadly carbon monoxide.

$2\ C_{(s)} + O_{2(g)} \rightarrow 2CO$

Synthesis 8. Freshly cut lithium reacts with nitrogen from the air.

$6\ Li_{(s)} + N_{2(g)} \rightarrow 2Li_3N$

Synthesis 9. A silver spoon or coin tarnishes when exposed to sulphur.

$16\ Ag_{(s)} + S_{8(g)} \rightarrow 8Ag_2S$

Decomposition 10. Molten lye (sodium hydroxide) is decomposed industrially into sodium oxide and water.

$2\ NaOH_{(l)} \rightarrow Na_2O + H_2O$

Combustion 11. Aluminum dust burns explosively with oxygen to make aluminum oxide.

$4\ Al + 3\ O_2 \rightarrow 2\ Al_2O_3$

Worksheet 2: Single and Double Displacement

Balance the reactions and state the type of reaction described.

Single 1. Sodium metal reacts vigorously with water giving off a gas.

$2\ Na_{(s)} + 2\ H_2O_{(l)} \rightarrow H_{2(g)} + 2\ NaOH_{(aq)}$

Double 2. Hydrogen chloride gas is commercially made by reacting table salt with sulfuric acid.

$2\ NaCl_{(S)} + H_2SO_{4\ (aq)} \rightarrow 2\ HCl_{(g)} + Na_2SO_{4\ (aq)}$

Single 3. Molten iron produced by the highly exothermic thermit reaction was used to weld railroad rails.

$2Al_{(S)} + Fe_2O_{3\ (s)} \rightarrow 2\ Fe_{(l)} + Al_2O_{3\ (s)}$

Single 4. Aluminum was first produced by Hans Oersted in 1825 by this reaction.

$3\ K_{(S)} + AlCl_{3\ (s)} \rightarrow Al_{(l)} + 3KCl_{\ (s)}$

Single 5. Silver ore can be converted to silver sulfate and then reacted with copper to make silver.

$2\ Cu_{(s)} + Ag_2SO_{4(aq)} \rightarrow Cu_2SO_4 + 2Ag$

Double 6. Phosphoric acid is produced by reacting sulfuric acid with bone ash or rock phosphate.

$Ca_3(PO_4)_{2(aq)} + 3\ H_2SO_{4(aq)} \rightarrow 2H_3PO_4 + 3CaSO_4$

Single 7. Bromine is commercially produced from magnesium bromide found in sea water.

$Cl_{2(g)} + MgBr_{2(aq)} \rightarrow MgCl_2 + Br_2$

Double 8. Hydrogen sulfide (sour gas) found in Alberta's natural gas will react with lead(II) chromate.

$H_2S_{(g)} + PbCrO_{4(s)} \rightarrow PbS + H_2CrO_4$

Single 9. Hydrogen sulfide (sour gas) will react with silverware and silver ornaments.

$H_2S_{(g)} + 2Ag_{(s)} \rightarrow Ag_2S + H_2$

Double 10. Sodium phosphate will form a precipitate when it reacts with calcium nitrate.

$2Na_3PO_4 + 3Ca(NO_3)_2 \rightarrow 6NaNO_3 + Ca_3(PO_4)_2$

Single 11. When aluminum reacts with copper(II) sulfate, copper metal forms as one of the products.

$2Al + 3CuSO_4 \rightarrow 3Cu + Al_2(SO_4)_3$