Exercise 1: Writing and Balancing Chemical Equations

For the following chemical reactions:
Step 1. Write the word equation.
Step 2. Write the chemical equation (use the criss-cross rule to find the formulas of ionic compounds).
Step 3. Balance the chemical equation.

The chemical formula for oxygen gas is O_2 and for hydrogen gas is H_2.

1. Silver metal reacts with hydrogen sulfide (H_2S) to form silver sulfide and hydrogen gas.

silver + hydrogen sulfide → silver sulfide + Hydrogen gas.

$Ag + H_2S \rightarrow Ag_2S + H_2$

$2Ag + H_2S \rightarrow Ag_2S + H_2$

	R	P	
Ag	2	2	✗
H	2	2	✓
S	1	1	✓

2. When pentane (C_5H_{12}) burns in air, it produces carbon dioxide and water vapour.

pentane + oxygen → carbon dioxide + water

$C_5H_{12} + O_2 \rightarrow CO_2 + H_2O$

$C_5H_{12} + 8O_2 \rightarrow 5CO_2 + 6H_2O$

	R	P
C	5	5
H	12	12
O	16	16

3. When ammonia (NH_3) reacts with water it produces ammonium hydroxide.

ammonia + water → ammonium hydroxide

✓✓ $NH_3 + H_2O \rightarrow NH_4OH$

	R	P
N	1	1
H	5	5
O	1	1

4. When gold metal is placed in nitric acid (HNO_3) it produces gold (I) nitrate and hydrogen gas.

gold + nitric acid → gold(I) nitrate + hydrogen gas.

$Au + HNO_3 \rightarrow AuNO_3 + H_2$

$2Au + 2HNO_3 \rightarrow 2AuNO_3 + H_2$

	R	P
Au	2	2
H	2	2
N	2	2
O	6	6

5. When lead metal is added to nickel (II) sulfate, it produces nickel metal and lead (II) sulfate.

lead + nickel(II) sulfate → nickel + lead(II) sulfate

✓✓ $Pb + NiSO_4 \rightarrow Ni + PbSO_4$

6. When nonane (C_9H_{20}) burns in air, it produces carbon dioxide and water vapour.

nonane + Oxygen → carbon dioxide + water

$C_9H_{20} + O_2 \rightarrow CO_2 + H_2O$

$C_9H_{20} + 14O_2 \rightarrow 9CO_2 + 10H_2O$

	R	P
C	9	9
H	20	20
O	28	28

7. When sodium azide (NaN_3) reacts, it produces nitrogen gas and sodium metal.

sodium azide → nitrogen gas + sodium

$NaN_3 \rightarrow N_2 + Na$

$2NaN_3 \rightarrow 3N_2 + 2Na$

8. Iron metal reacts with oxygen gas in the air to form iron (III) oxide (rust).

iron + oxygen gas → iron(III) oxide.

$Fe + O_2 \rightarrow Fe_2O_3$

$4Fe + 3O_2 \rightarrow 2Fe_2O_3$

9. When propane (C_3H_8) burns in oxygen gas, it produces carbon dioxide and water.

propane + oxygen → carbon dioxide + water

$C_3H_8 + O_2 \rightarrow CO_2 + H_2O$

$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

10. When sodium hydrogen carbonate is heated, it breaks down to form sodium carbonate and ~~hydrogen gas.~~ water plus carbon dioxide.

sodium hydrogen carbonate → sodium carbonate + water + carbon dioxide

$NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$

$2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$

11. Acetylene gas (C_2H_2) burns in oxygen to produce carbon dioxide and water vapour.

acetylene gas + oxygen → carbon dioxide + water

$C_2H_2 + O_2 \rightarrow CO_2 + H_2O$

$2C_2H_2 + 5O_2 \rightarrow 4CO_2 + 2H_2O$

12. Calcium hydroxide reacts with copper (II) sulfate to produce calcium sulfate and copper (II) hydroxide.

Calcium hydroxide + copper(II) sulfate → calcium sulfate + copper(II) hydroxide

✓✓ $Ca(OH)_2 + CuSO_4 \rightarrow CaSO_4 + Cu(OH)_2$

13. Ammonium chloride reacts with barium hydroxide to produce ammonia gas (NH_3), water vapour and barium chloride.

ammonium chloride + barium hydroxide → ammonia gas + water + barium chloride.

$NH_4Cl + Ba(OH)_2 \rightarrow NH_3 + H_2O + BaCl_2$

$2NH_4Cl + Ba(OH)_2 \rightarrow 2NH_3 + 2H_2O + BaCl_2$

14. When aluminum metal is placed in a solution of copper (II) sulfide, a reaction occurs that produces copper metal and aluminum sulfide.

aluminum + copper(II) sulfide → Copper + aluminum sulphide

$Al + CuS \rightarrow Cu + Al_2S_3$

$2Al + 3CuS \rightarrow 3Cu + Al_2S_3$