Stoichiometry

- Mole to Mole – Use Mole Ratio
- Mole to Mass – Use Mole Ratio then multiply by Molar Mass
- Mass to Mole – Divide by Molar Mass then use Mole Ratio
- Mass to Mass – Divide by Molar Mass, then Mole Ratio, and finally multiply by the other Molar Mass

$$2Al + 3Pb(NO_3)_2 \rightarrow 3\ Pb + 2Al(NO_3)_3$$

- If 6 moles of lead (II) nitrate react with aluminum, how many moles of aluminum nitrate will be yielded?

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- If 6 moles of lead (II) nitrate react with aluminum, how many moles of aluminum nitrate will be yielded?

$$\frac{6\ \text{mol}\ Pb(NO_3)_2}{3\ \text{mol}\ Pb(NO_3)_3} \quad \left| \quad 2\ \text{mol}\ Al(NO_3)_3 \right.$$

$$= 4\ \text{mol}\ Al(NO_3)_3$$

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

- If 12 moles of water decomposes, how many grams of oxygen will be yielded?

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

- If 12 moles of water decomposes, how many grams of oxygen will be yielded?

$$\frac{12 \text{ mol } H_2O}{} \left| \frac{1 \text{ mol } O_2}{2 \text{ mol } H_2O} \right| \frac{32 \text{ g } O_2}{1 \text{ mol } O_2}$$

Molar Mass of O_2 = 2 atoms x 16 g = 32 g/mol

= 192 g O_2

$$3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$$

- If 50 grams of iron oxide are yielded, how many moles of water are needed to react with iron?

$3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$

- If 50 grams of iron oxide are yielded, how many moles of water are needed to react with iron?

$$\frac{50\ g\ Fe_3O_4}{} \left| \frac{1\ mol\ Fe_3O_4}{232\ g\ Fe_3O_4} \right| \frac{4\ mol\ H_2O}{1\ mol\ Fe_3O_4}$$

Molar Mass of Fe_3O_4- O = 4 atoms x 16 g = 64 g/mol

Fe = 3 atoms x 56 g = 168 g/mol

= 232 g/mol

= 0.86 mol H_2O

$2Na + Cl_2 \rightarrow 2NaCl$

- If 100 grams of sodium react with chlorine gas, how many grams of sodium chloride are yielded?

$2Na + Cl_2 \rightarrow 2NaCl$

- If 100 grams of sodium react with chlorine gas, how many grams of sodium chloride are yielded?

$$\frac{100\text{ g Na}}{} \left| \frac{1\text{ mol Na}}{23\text{ g Na}} \right| \frac{2\text{ mol NaCl}}{2\text{ mol Na}} \left| \frac{58.5\text{ g NaCl}}{1\text{ mol NaCl}} \right.$$

Molar Mass of NaCl Na = 1 atom x 23 g = 23 g/mol

Cl = 1 atom x 35.5 g = 35.5g/mol

= 58.5 g/mol

= 254 g NaCl

$HCl + NaOH \rightarrow NaCl + H_2O$

- If 25 grams of hydrochloric acid react with sodium hydroxide, how many grams of water are yielded?

$HCl + NaOH \rightarrow NaCl + H_2O$

- If 25 grams of hydrochloric acid react with sodium hydroxide, how many grams of water are yielded?

$$25\ g\ HCl \left| \frac{1\ mol\ HCl}{36.5\ g\ HCl} \right| \frac{1\ mol\ H_2O}{1\ mol\ HCl} \left| \frac{18\ g\ H_2O}{1\ mol\ H_2O} \right.$$

Molar Mass of HCl H= 1 atom x 1 g = 1g/mol

Cl = 1 atom x 35.5 g = 35.5g/mol

= 36.5 g/mol

$= 12.3\ g\ H_2O$

Molar Mass of H_2O H = 2 atom x 1 g = 2 g/mol

O = 1 atom x 16 g = 16 g/mol

= 18 g/mol

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

- How many moles of oxygen are needed to produce 12 moles of carbon dioxide?

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

- How many moles of oxygen are needed to produce 12 moles of carbon dioxide?

$$\frac{12 \text{ mol } CO_2 \mid 5 \text{ mol } O_2}{\mid 3 \text{ mol } CO_2}$$

$$= 20 \text{ mol } O_2$$

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

- How many moles of propane are needed to produce 12 moles of water?

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

- How many moles of propane are needed to produce 12 moles of water?

$$\frac{12 \text{ mol } H_2O}{} \left| \frac{1 \text{ mol } C_3H_8}{4 \text{ mol } H_2O} \right.$$

$$= 3 \text{ mol } C_3H_8$$

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

- How many grams of propane are needed to produce 13.5 moles of carbon dioxide?

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

- How many grams of propane are needed to produce 13.5 moles of carbon dioxide?

$$13.5 \text{ mol } CO_2 \left| \frac{1 \text{ mol } C_3H_8}{3 \text{ mol } CO_2} \right| \frac{44 \text{ g } C_3H_8}{1 \text{ mol } C_3H_8}$$

Molar Mass of C_3H_8

C = 3 atoms x 12 g = 36 g/mol

H = 8 atoms x 1 g = 8 g/mol

= 44 g/mol

= 198 g C_3H_8