The Mole Review

Calculate Molar Mass

1. $PbSO_4$ 207.2g + 32.06g + 4(16.00g) = 303.26 g/mol

2. $Ca(NO_3)_2$ 40.08 + 2(14.01) + 6(16.00) = 164.10 g/mol

Mole Conversions:

3. How many particles are in 0.0695 moles of HNO2?

$$.0695 \text{ mol} \times \frac{6.02 \times 10^{23} \text{ particles}}{1 \text{ mol}} = \mathbf{4.28 \times 10^{22} \text{ particles}}$$

4. How many grams of benzene (C_6H_6) are in 4.60 moles?

molar mass C_6H_6 = 6(12.01) + 6(1.01) = 78.12 g/mol

$$4.60 \text{ mol} \times \frac{78.12 \text{ g}}{1 \text{ mol}} = \mathbf{359.35 \text{ g} = 359 \text{ g}}$$

5. What is the mass of 6.30 moles of $PbSO_4$?

molar mass $PbSO_4$ = 207.2g + 32.06g + 4(16.00g) = 303.26 g/mol

$$6.30 \text{ mol} \times \frac{303.26 \text{ g}}{1 \text{ mol}} = \mathbf{1910.54 \text{ g} = 1910 \text{ g}}$$

6. How many particles are in 144g of Al_2O_3?

molar mass Al_2O_3 = 2(26.98) + 3(16.00) = 101.96 g/mol

$$144 \text{ g} \times \frac{1 \text{ mol}}{101.96 \text{ g}} \times \frac{6.02 \times 10^{23} \text{ particles}}{1 \text{ mol}} = \mathbf{8.50 \times 10^{23} \text{ particles}}$$

7. What is the mass of 7.68×10^{24} atoms of gold?

$$7.68 \times 10^{24} \text{ atoms} \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ atoms}} \times \frac{196.97 \text{ g}}{1 \text{ mol}} = \mathbf{2513.34 \text{ g} = 2510 \text{ g}}$$

8. How many particles are in .371 grams of iron (III) oxide?

$$.371 \text{ g} \times \frac{1 \text{ mol}}{159.70 \text{ g}} \times \frac{6.02 \times 10^{23} \text{ particles}}{1 \text{ mol}} = \mathbf{1.40 \times 10^{21} \text{ particles}}$$

Percent Composition:

9. What is the percent composition for each element in sulfur dioxide (SO_2)?

SO_2 S 32.06
2 O 16.00 x 2

total mass 64.06 g

% S:
$\frac{32.06\ g}{64.06\ g} \times 100 =$ **50.0%**

%O:
$\frac{32.00\ g}{64.06\ g} \times 100 =$ **50.0%**

10. What is the percent composition of oxygen in $Al_2(SO_4)_3$?

$Al_2(SO_4)_3$ 2 Al 26.98 x 2
3 S 32.06 x 3
12 O 16.00 x 12

total mass 342.14 g

%Al:
$\frac{26.98g \times 2}{342.14\ g} \times 100 =$ **15.77%**

% S:
$\frac{32.06g \times 3}{342.14\ g} \times 100 =$ **28.11%**

%O:
$\frac{16.00g \times 12}{342.14\ g} \times 100 =$ **56.12%**

Empirical & Molecular Formulas:

11. What is the empirical formula for a compound if a sample contains 4.09g of zinc and 1.00g of oxygen?

$4.09\ g\ Zn \times \frac{1\ mol}{65.39\ g} = \frac{.0625\ mol}{.0625\ mol} = 1\ Zn$

$1.00\ g\ O \times \frac{1\ mol}{16.00\ g} = \frac{.0625\ mol}{.0625\ mol} = 1\ O$ **ZnO**

12. Determine the empirical formula of a compound containing 24.74 grams potassium, 34.76 grams manganese, and 40.50 grams oxygen.

$24.74\ g\ K \times \frac{1\ mol}{39.10\ g} = \frac{.633\ mol}{.633\ mol} = 1K$

$34.76\ g\ Mn \times \frac{1\ mol}{54.93\ g} = \frac{.633\ mol}{.633\ mol} = 1\ Mn$

$40.50\ g\ O \times \frac{1\ mol}{16.00\ g} = \frac{2.53\ mol}{.633\ mol} = 4\ O$ **$KMnO_4$**

13. Determine the empirical and molecular formulas of an unknown compound, given that a 212.1g sample contains 42.4g of hydrogen and 169.7g of carbon. The molecular mass is 30.0g/mol.

$$42.4\text{ g H} \times \frac{1\text{ mol}}{1.01\text{ g}} = \frac{41.98\text{ mol}}{14.13\text{ mol}} = 3\text{ H}$$

$$167.70\text{g C} \times \frac{1\text{ mol}}{12.01\text{ g}} = \frac{14.13\text{ mol}}{14.13\text{ mol}} = 1\text{ C} \qquad \mathbf{CH_3}$$

empirical formula CH_3

CH_3 empirical mass: $12.01 + 3(1.01) = 15.04$ g

$$\frac{\text{molecular mass}}{\text{empirical mass}} = \frac{30.0\text{ g}}{15.04} = 2$$

C_2H_6 molecular formula