

AP Chem Chp3 Stoichiometry

Wkst: Molar mass, % Composition

Show work!! Use sig figs to round your answers.

Part 1: Find the molar mass for each.

1. Aluminum nitrate $\text{Al}(\text{NO}_3)_3$

$$\begin{array}{l} \text{Al } 1 \times 26.98 = 26.98 \\ \text{N } 3 \times 14.01 = 42.03 \\ \text{O } 9 \times 16.00 = 144.0 \end{array}$$

$$213.01 \text{ g } \text{Al}(\text{NO}_3)_3 \Rightarrow \boxed{213.01 \text{ g}}$$

2. Iron (III) hydroxide $\text{Fe}(\text{OH})_3$

$$\begin{array}{l} \text{Fe } 1 \times 55.85 = 55.85 \\ \text{O } 3 \times 16.00 = 48.00 \\ \text{H } 3 \times 1.008 = 3.024 \end{array}$$

Part 2: Find the number of grams for each sample listed

3. 0.30 mol NaHCO_3

$$\begin{array}{r} 22.99 \\ 1.008 \\ 12.01 \\ 48.00 \\ \hline 84.01 \end{array}$$

$$\left(\frac{0.30 \text{ mole } \text{NaHCO}_3}{1} \right) \left(\frac{84.01 \text{ g } \text{NaHCO}_3}{1 \text{ mole } \text{NaHCO}_3} \right) = \boxed{25 \text{ g } \text{NaHCO}_3}$$

4. 1.50 mol H_2SO_4

$$\begin{array}{r} 2.016 \\ 32.06 \\ 64.00 \\ \hline 98.08 \end{array}$$

$$\left(\frac{1.5 \text{ mole } \text{H}_2\text{SO}_4}{1} \right) \left(\frac{98.08 \text{ g } \text{H}_2\text{SO}_4}{1 \text{ mole } \text{H}_2\text{SO}_4} \right) = \boxed{147 \text{ g } \text{H}_2\text{SO}_4}$$

5. 1.26×10^{-4} mol sodium dihydrogen phosphate

$$\begin{array}{r} 22.99 \\ 2.016 \\ 30.97 \\ 64.00 \\ \hline 119.98 \end{array}$$

$$\left(\frac{1.26 \times 10^{-4} \text{ mol } \text{NaH}_2\text{PO}_4}{1} \right) \left(\frac{119.98 \text{ g } \text{NaH}_2\text{PO}_4}{1 \text{ mole } \text{NaH}_2\text{PO}_4} \right) = \boxed{1.51 \times 10^{-2} \text{ g } \text{NaH}_2\text{PO}_4}$$

Part 3: Calculate the number of moles for each sample listed

6. 17.1 g H_2S

$$\begin{array}{r} 2.016 \\ 32.06 \\ \hline 34.08 \end{array}$$

$$\left(\frac{17.1 \text{ g } \text{H}_2\text{S}}{34.08 \text{ g } \text{H}_2\text{S}} \right) \left(\frac{1 \text{ mole } \text{H}_2\text{S}}{1} \right) = \boxed{.502 \text{ mole } \text{H}_2\text{S}}$$

7. 10.08 g calcium nitrate

$$\begin{array}{r} 40.08 \\ 28.02 \\ 96.00 \\ \hline 164.10 \end{array}$$

$$\left(\frac{10.08 \text{ g } \text{Ca}(\text{NO}_3)_2}{164.10 \text{ g } \text{Ca}(\text{NO}_3)_2} \right) \left(\frac{1 \text{ mole } \text{Ca}(\text{NO}_3)_2}{1} \right) = \boxed{6.143 \times 10^{-2} \text{ mole } \text{Ca}(\text{NO}_3)_2}$$

8. 8.8 g potassium carbonate

$$\begin{array}{r} 78.20 \\ 12.01 \\ 48.00 \\ \hline 138.21 \end{array}$$

$$\left(\frac{8.8 \text{ g } \text{K}_2\text{CO}_3}{138.21 \text{ g } \text{K}_2\text{CO}_3} \right) \left(\frac{1 \text{ mole } \text{K}_2\text{CO}_3}{1} \right) = \boxed{6.4 \times 10^{-2} \text{ mole } \text{K}_2\text{CO}_3}$$

Part 4: Find the mass in grams for each quantity.

9. 1.788×10^{29} atoms of carbon

$$\left(\frac{1.788 \times 10^{29} \text{ Atoms } \text{C}}{6.022 \times 10^{23} \text{ Atoms } \text{C}} \right) \left(\frac{1 \text{ mole } \text{C}}{1} \right) \left(\frac{12.01 \text{ g } \text{C}}{1 \text{ mole } \text{C}} \right) = \boxed{3.566 \times 10^6 \text{ g } \text{C}}$$

10. 9.4044×10^{15} molecules of water.

$$\left(\frac{9.4044 \times 10^{15} \text{ H}_2\text{O}}{6.022 \times 10^{23} \text{ molecules } \text{H}_2\text{O}} \right) \left(\frac{1 \text{ mole } \text{H}_2\text{O}}{1} \right) \left(\frac{18.02 \text{ g } \text{H}_2\text{O}}{1 \text{ mole } \text{H}_2\text{O}} \right) = \boxed{2.814 \times 10^7 \text{ g } \text{H}_2\text{O}}$$

Part 5: Identify the type of representative particle for each sample listed and then find the number of particles for each quantity.

11. 19.30 g isopentyl acetate ($C_7H_{14}O_2$)

$$\begin{array}{l} C \ 7 \times 12.01 = 84.07 \\ H \ 14 \times 1.008 = 14.112 \\ O \ 2 \times 16.00 = 32.00 \end{array}$$

$$\left(\frac{19.30g C_7H_{14}O_2}{1} \right) \left(\frac{1 \text{ mole } C_7H_{14}O_2}{130.18g C_7H_{14}O_2} \right) \left(\frac{6.022 \times 10^{23} \text{ molecules } C_7H_{14}O_2}{1 \text{ mole } C_7H_{14}O_2} \right)$$

$$= 8.928 \times 10^{22} \text{ molecules } C_7H_{14}O_2$$

12. 290.45 g copper (II) nitrate $Cu(NO_3)_2$

$$\begin{array}{l} Cu \ 1 \times 63.55 = 63.55 \\ N \ 2 \times 14.01 = 28.02 \\ O \ 6 \times 16.00 = 96.00 \\ \hline 187.57 \end{array}$$

$$\left(\frac{290.45g Cu(NO_3)_2}{1} \right) \left(\frac{1 \text{ mole } Cu(NO_3)_2}{187.57g Cu(NO_3)_2} \right) \left(\frac{6.022 \times 10^{23} \text{ FU } Cu(NO_3)_2}{1 \text{ mole } Cu(NO_3)_2} \right) =$$

$$9.3250 \times 10^{23} \text{ FU } Cu(NO_3)_2$$

Part 6: Find the percentage composition.

13. Calcium phosphate $Ca_3(PO_4)_2$

$$Ca \ 3 \times 40.08 = 120.2g$$

$$P \ 2 \times 30.97 = 61.94g$$

$$O \ 8 \times 16.00 = 128.0g \\ \hline 310.1g$$

$$Ca \ \frac{120.2g}{310.1g} \times 100 = 38.76\% Ca$$

$$P \ \frac{61.94g}{310.1g} \times 100 = 19.97\% P$$

$$O \ \frac{128.0g}{310.1g} \times 100 = 41.28\% O$$

14. A sample of benzene is analyzed and found to consist of 13.74 g carbon and 1.15 g of hydrogen. Find the percent composition.

$$C \ 13.74g$$

$$H \ 1.15g$$

$$\hline 14.89g \text{ total}$$

$$C \ \frac{13.74g}{14.89g} \times 100 = 92.28\% C$$

$$H \ \frac{1.15g}{14.89g} \times 100 = 7.72\% H$$