Percent Comp, Empirical & Molecular Review

1. 29.0 g Ar + 4.30 g S = 33.3 g total

$$\% \text{ Ar} = \frac{29.0 \text{ g Ar}}{33.3 \text{ g total}} \times 100 = \boxed{87.1 \% \text{ Ar}}$$

$$\% \text{ S} = \frac{4.30 \text{ g S}}{33.3 \text{ g total}} \times 100 = \boxed{12.9 \% \text{ S}}$$

★ or since the compound is made of Ar + S only

then $\% \text{ Ar} + \% \text{ S} = 100\%$

$87.1\% \text{ Ar} + \% \text{S} = 100\%$

$\therefore \% \text{S} = 100 - 87.1 = \underline{12.9\% \text{ S}}$

2. 222.6 g Na + 77.4 g O = 300.0 g total

$$\% \text{ Na} = \frac{222.6 \text{ g}}{300 \text{ g total}} \times 100 = \boxed{74.2 \% \text{ Na}}$$

$$\% \text{ O} = \frac{77.4 \text{ g O}}{300 \text{ g total}} \times 100 = \boxed{25.8 \% \text{ O}}$$

★ or $\% \text{ O} = 100\% - 74.2\% = \underline{25.8\% \text{ O}}$

3. $C_2H_6 = 30.08$ g/mol

$$\% \text{ H} = \frac{(1.01 \times 6)}{30.08} \times 100 = \boxed{20.1 \% \text{ H}}$$

4. $NaHSO_4$ = 120.06 g/mol

$$\%\ H = \frac{(1.01 \times 1)}{120.06} \times 100 = \boxed{0.841\ \%\ H}$$

5. $Ca(C_2H_3O_2)_2$ = 158.18 g/mol

$$\%\ H = \frac{(1.01 \times 6)}{158.18} \times 100 = \boxed{3.83\ \%\ H}$$

6. EMPIRICAL = MOST Reduced/simplest subscripts

a. $C_5H_{10}O_5$ - molecular, can be reduced to CH_2O

b. $C_6H_{12}O_2$ - molecular, can be reduced to C_3H_6O

c. $C_{55}H_{72}MgN_4O_5$ - empirical, cannot reduce

d. $C_{12}H_{17}ON$ - empirical, cannot reduce

e. $H_2C_2O_4$ - molecular, can be reduced to HCO_2

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7a. $94.1\%\ O = \frac{94.1\ g\ O \mid 1\ mol\ O}{16\ g\ O} = 5.88125 / 5.84158 = 1\ mol\ O$

$5.9\%\ H = \frac{5.9\ g\ H \mid 1\ mol\ H}{1.01\ g} = 5.84158 / 5.84158 = 1\ mol\ H$

$\therefore$ Empirical = OH

7b. $79.9\%\ C = \frac{79.9\ g\ C \mid 1\ mol\ C}{12.01\ g\ C} = 6.652789 / 6.652789 = 1\ mol\ C$

$20.1\%\ H = \frac{20.1\ g\ H \mid 1\ mol\ H}{1.01\ g\ H} = 19.90099 / 6.652789 = 2.99 \approx 3\ mol\ H$

$\therefore$ Empirical = CH_3

8. $\frac{58.8\ g\ C \mid 1\ mol\ C}{12.01\ g\ C} = 4.89592 / 1.9625 = 2.5 \times 2 = 5\ mol\ C$

(cannot round, must multiply)

$\frac{9.8\ g\ H \mid 1\ mol\ H}{1.01\ g\ H} = 9.70297 / 1.9625 = 4.9 \approx 5 \times 2 = 10\ mol\ H$

$\frac{31.4\ g\ O \mid 1\ mol\ O}{16\ g\ O} = 1.9625 / 1.9625 = 1 \times 2 = 2\ mol\ O$

$\therefore$ Empirical = $C_5H_{10}O_2 = 102.15\ g/mol$

$\frac{\text{Molecular Mass}}{\text{Empirical Mass}} = \frac{102}{102} = 1$

$\therefore$ Molecular = Emp $\times$ 1 = $C_5H_{10}O_2$

9a. $\frac{92.25\ g\ C \mid 1\ mol\ C}{12.01\ g\ C} = 7.681099 / 7.673267 = 1\ mol\ C$

$\frac{7.75\ g\ H \mid 1\ mol\ H}{1.01\ g\ H} = 7.673267 / 7.673267 = 1\ mol\ H$

$\therefore$ empirical = CH 13.02 g/mol

9b. $\frac{\text{Molecular Mass}}{\text{Empirical Mass}} = \frac{52.03}{13.02} = 4$

$\therefore$ Molecular = Empirical $\times$ 4

= CH $\times$ 4 = C_4H_4