

Given

$M \text{ of Al} = 26.982 \text{ g/mol}$

$M \text{ of S} = 32.066 \text{ g/mol}$

$M \text{ of O} = 15.999 \text{ g/mol}$

$n\# \text{ of Al} = 2$

$n\# \text{ of S} = 3$

$n\# \text{ of O} = 4(3) = 12$

Required

$\% \text{ Al} = ?$

$\% \text{ S} = ?$

$\% \text{ O} = ?$

$$\begin{aligned}
 M \text{ of } \text{Al}_2(\text{SO}_4)_3 &= (M \text{ of Al}) 2 + (M \text{ of S}) 3 + (M \text{ of O}) 12 \text{ g/mol} \\
 &= 26.982(2) + 32.066(3) + 15.999(12) \text{ g/mol} \\
 &= 342.15 \text{ g/mol}
 \end{aligned}$$

Solution

$$\% \text{ element} = \frac{n \times M \text{ element}}{M \text{ compound}} \times 100\%$$

$$\% \text{ Al} = \frac{2 \times 26.982 \text{ g/mol}}{342.15 \text{ g/mol}} \times 100\%$$

$$= 15.77203 \approx 15.77\%$$

$$\% \text{ S} = \frac{3 \times 32.066 \text{ g/mol}}{342.15 \text{ g/mol}} \times 100\%$$

$$= 28.115739 \approx 28.12\%$$

$$\% \text{ O} = \frac{12 \times 15.999 \text{ g/mol}}{342.15 \text{ g/mol}} \times 100\%$$

$$= 56.112231 \approx 56.11\%$$

\therefore The percent composition of mass by Aluminum, sulfur & oxygen are: ~~15.77%~~

Al: 15.77%

S: 28.12%

O: 56.11%

2. Assume total mass of 100 grams

Given

$$m_{\text{Na}} = 32.4 \text{ g Na}$$

$$m_{\text{S}} = 22.5 \text{ g S}$$

$$m_{\text{O}} = 45.1 \text{ g O}$$

$$M_{\text{Na}} = 22.990 \text{ g/mol}$$

$$M_{\text{S}} = 32.066 \text{ g/mol}$$

$$M_{\text{O}} = 15.999 \text{ g/mol}$$

Required

Empirical Formula

$$\text{NaSO} = ?$$

$$n_{\text{Na}} = ?$$

$$n_{\text{S}} = ?$$

$$n_{\text{O}} = ?$$

Solution

$$n_{\text{Na}} = \frac{m_{\text{Na}}}{M_{\text{Na}}}$$

$$= \frac{32.4 \text{ g}}{22.990 \text{ g/mol}}$$

$$= 1.409308395 \text{ mol}$$

$$\approx 1.41 \text{ mol Na}$$

$$n_{\text{S}} = \frac{m_{\text{S}}}{M_{\text{S}}}$$

$$= \frac{22.5 \text{ g}}{32.066 \text{ g/mol}}$$

$$= 0.7016777896 \text{ mol}$$

$$\approx 0.70 \text{ mol S}$$

$$n_{\text{O}} = \frac{m_{\text{O}}}{M_{\text{O}}}$$

$$= \frac{45.1 \text{ g}}{15.999 \text{ g/mol}}$$

$$= 2.818926183 \text{ mol}$$

$$\approx 2.82 \text{ mol O}$$

	Na	S	O
Divide by ←	1.41	0.70	2.82
lowest mole value, 0.70 mol →	2.01	1	4.03
Rounded ← 2		1	4

∴ the empirical formula is Na_2SO_4

3. Assume a 100 g sample

Given

$$m_C = 64.9 \text{ g C} \quad M_C = 12.011 \text{ g/mol}$$

$$m_H = 13.5 \text{ g H} \quad M_H = 1.008 \text{ g/mol}$$

$$m_O = 21.6 \text{ g O} \quad M_O = 15.999 \text{ g/mol}$$

~~#1 CH₃OH~~

$$M_{\text{compound}} = 74.14 \text{ g/mol}$$

Required

Molecular Formula for CHO

$$n_C = ?$$

$$n_H = ?$$

$$n_O = ?$$

Solution

$$n_C = \frac{m_C}{M_C}$$

$$n_H = \frac{m_H}{M_H}$$

$$n_O = \frac{m_O}{M_O}$$

$$= \frac{64.9}{12.011 \text{ g/mol}}$$

$$= \frac{13.5}{1.008 \text{ g/mol}}$$

$$= \frac{21.6}{15.999}$$

$$= 5.403390235 \text{ mol}$$

$$= 13.39285714 \text{ mol}$$

$$= 1.35008438 \text{ mol}$$

$$\hat{=} 5.40 \text{ mol C}$$

$$\hat{=} 13.39 \text{ mol H}$$

$$\hat{=} 1.35 \text{ mol O}$$

