Empirical Formula and Molecular Formula.

Empirical → Smallest ratio of elements

Molecular → actual ratio.

Determine the empirical formula of a mineral with 28.59% O, 24.95% Fe and 46.46% Ca. What is its formula unit if the actual mass is 1316 g/mol.

(1) $28.59 + 24.95 + 46.46 = 100\%$

(2) Convert % to g e.g. $28.59\%\ O \equiv 28.59\text{g O}$.

(3) convert to moles.

$$28.59\text{g O} \times \frac{1\text{mol O}}{16.00\text{g}} = 1.787\text{ mol O}$$

$$24.95\text{g Fe} \times \frac{1\text{mol Fe}}{55.85\text{g Fe}} = 0.447\text{ mol Fe}$$

$$46.46\text{g Ca} \times \frac{1\text{mol Ca}}{40.08\text{g Ca}} = 1.109\text{ mol Ca}$$

(4)

$$\frac{Ca_{1.109}}{0.447}\quad \frac{Fe_{0.447}}{0.447}\quad \frac{O_{1.787}}{0.447}$$

$$Ca_{2.48}\ Fe_1\ O_{3.99}$$

$$\equiv 2$$

$$(Ca_{2.48}\ Fe_1\ O_{3.99}) \times 2 = \boxed{Ca_5 Fe_2 O_8}$$ empirical formula.

(5) Find formula unit. $n = \frac{\text{formula unit mass}}{\text{empirical formula mass}}$.

$Ca_5 Fe_2 O_8$

$40.08 \times 5 \quad 55.85 \times 2 \quad 16.00 \times 8$

$= 200.4 + 111.1 + 128 = \boxed{438.5\text{ g/mol}}$ mass of emp. formul.

(6) $\frac{1316\text{ g/mol}}{438.5\text{ g/mol}} = 3$

(7) $(Ca_5 Fe_2 O_8) \times 3 = \boxed{Ca_{15} Fe_6 O_{24}}$ formula unit.