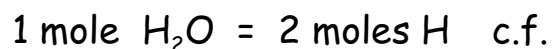
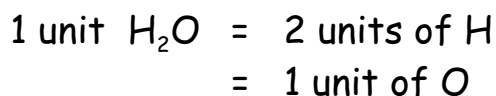
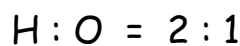


The Relationship Between the Formula of a Compound and the Elements Which Make It Up - A 2nd Conversion Factor

- consider the formula H_2O



- these are c.f.'s which allow the conversion from the compound to a single element in the compound

Note: In terms of the numbers of particles, molecules or formula units are used for compounds and atoms are used for elements

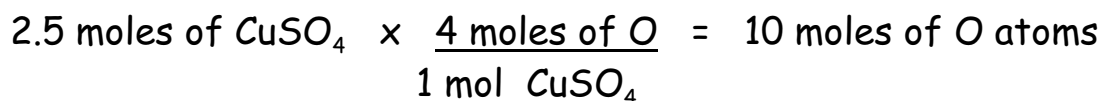
In general:



or



e.g. How many moles of O are present in 2.5 moles of $CuSO_4$?



e.g. How many atoms of O are present in 3.01×10^{23} molecules of CuSO_4 ?

1 molecule CuSO_4 = 4 atoms O

$$3.01 \times 10^{23} \text{ molecules of } \text{CuSO}_4 \times \frac{4 \text{ atoms O}}{1 \text{ molecule } \text{CuSO}_4}$$
$$= 1.2 \times 10^{24} \text{ atoms O}$$

Review

How many molecules of $\text{Na}_2\text{S}_2\text{O}_3$ are present in 0.25 moles of $\text{Na}_2\text{S}_2\text{O}_3$?

c.f. 1 mole of $\text{Na}_2\text{S}_2\text{O}_3$ = 6.02×10^{23} molecules of $\text{Na}_2\text{S}_2\text{O}_3$

$$0.25 \text{ moles of } \text{Na}_2\text{S}_2\text{O}_3 \times \frac{6.02 \times 10^{23} \text{ molecules of } \text{Na}_2\text{S}_2\text{O}_3}{1 \text{ mole } \text{H}_2\text{O}}$$
$$= 1.5 \times 10^{23} \text{ molecules of}$$

$\text{Na}_2\text{S}_2\text{O}_3$

e.g. How many atoms of S are present in 1.5×10^{23} molecules of $\text{Na}_2\text{S}_2\text{O}_3$?

1 molecule $\text{Na}_2\text{S}_2\text{O}_3$ = 2 atoms S

$$1.5 \times 10^{23} \text{ molecules of } \text{Na}_2\text{S}_2\text{O}_3 \times \frac{2 \text{ atoms S}}{1 \text{ molecule } \text{Na}_2\text{S}_2\text{O}_3}$$
$$= 3.0 \times 10^{23} \text{ atoms S}$$

Two Conversion Factors:

1. N_A

$$\begin{aligned} \# \text{ mol element} & \xrightarrow{N_A} \# \text{ atoms element} \\ \# \text{ mol compound} & \xrightarrow{N_A} \# \text{ molecules compound} \end{aligned}$$

2. formula subscript

$$\begin{aligned} \# \text{ mol compound} & \xrightarrow{\text{subscript}} \# \text{ moles element} \\ \# \text{ molecules} & \xrightarrow{\text{subscript}} \# \text{ atoms of element} \end{aligned}$$

Note: You cannot go directly from moles of a compound to atoms of an element. You must use two steps.

e.g. How many atoms of S are present in 0.25 moles of $\text{Na}_2\text{S}_2\text{O}_3$?

$$1 \text{ mole } \text{Na}_2\text{S}_2\text{O}_3 = 2 \text{ moles S} \quad 1 \text{ mole S} = 6.02 \times 10^{23} \text{ atoms S}$$

$$0.25 \text{ moles of } \text{Na}_2\text{S}_2\text{O}_3 \times \frac{6.02 \times 10^{23} \text{ molecules of } \text{Na}_2\text{S}_2\text{O}_3}{1 \text{ mole } \text{Na}_2\text{S}_2\text{O}_3}$$

$$= 1.5 \times 10^{23} \text{ molecules of}$$

$\text{Na}_2\text{S}_2\text{O}_3$

$$1.5 \times 10^{23} \text{ molecules of } \text{Na}_2\text{S}_2\text{O}_3 \times \frac{2 \text{ atoms S}}{1 \text{ molecule } \text{Na}_2\text{S}_2\text{O}_3}$$

$$= 3.0 \times 10^{23} \text{ atoms S}$$