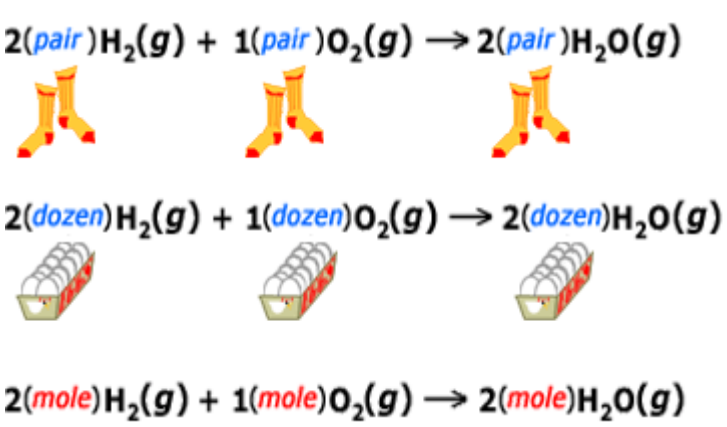
The Mole and Avogadro's Number

key concepts:

- The **mole** is a unit of measure that connects the atomic-molecular world with the macroscopic world.
- **Avogadro's number** helps to connect the **periodic table** with things that can be physically measured.



Atoms and most **molecules** are far too tiny to measure individually. The mole (abbreviated mol) is the collective unit used to measure atoms, **ions**, and molecules in chemical reactions.

The mole is useful because it depends only on the number of particles and not the mass or the size of the particles being measured.

A mole is that amount of substance that contains as many elementary entities (atoms, ions, or molecules) as there are atoms present in exactly 12 grams of carbon-12 (^{12}C).

^{12}C was chosen as the standard partly because it is the first **element** in the periodic table whose mass may be conveniently measured.

$$\frac{1 \text{ mol F atoms}}{6.022 \times 10^{23} \text{ F atoms}} = \frac{6.022 \times 10^{23} \text{ F atoms}}{6.022 \times 10^{23} \text{ F atoms}}$$

so $\dfrac{1 \text{ mol F atoms}}{6.022 \times 10^{23} \text{ F atoms}} = 1$

$$\frac{1 \text{ mol F atoms}}{1 \text{ mol F atoms}} = \frac{6.022 \times 10^{23} \text{ F atoms}}{1 \text{ mol F atoms}}$$

so $1 = \dfrac{6.022 \times 10^{23} \text{ F atoms}}{1 \text{ mol F atoms}}$

Avogadro's number, 6.022×10^{23}, represents the number of units in a mole.

Conversion factors are factors of one relating the same quantity between two systems of units. They are used to convert measurements from one set of units to another. Thus, one mole of fluorine atoms is the same as 6.022×10^{23} atoms of fluorine.