The Mole

1 mole = 6.02 x 10^{23} entities

Entities are atoms, ions, molecules, formula units, etc.

Mole day is on October 23. This is in honor of Avogadro's Number, N_A. Avogadro's number is 6.02 x 10^{23}.

What is the molar mass of oxygen?
Look at the periodic table for oxygen.
The molar mass = **15.9994 g/mol**

How many grams are in one mole of carbon?
Look at the periodic table for carbon.
1 mole C = **12.011 g**

How many nitrogen atoms are in 6.25 moles of nitrogen?
mol N → N atoms 1 mole N = 6.02 x 10^{23} atoms

$$6.25\ mol\ N \times \frac{6.02\times10^{23}\ N\ atoms}{1\ mol\ N} = \mathbf{3.76\ x\ 10^{24}\ N\ atoms}$$

What is the mass of one aluminum, Al, atom?
1 mol Al = 6.02 x 10^{23} Al atoms and 1 mol Al = 26.98 g
atom → mol → g

$$1\ Al\ atom \times \frac{1\ mol\ Al}{6.02\times10^{23}\ Al\ atoms} \times \frac{26.98\ g\ Al}{1\ mol\ Al} = \mathbf{4.50\ \times 10^{-23}\ g}$$

Calculate the number of moles in 24.25 g of copper, Cu.
mol → g 1 mol Cu = 63.546 g

$$24.25\ g\ Cu \times \frac{1\ mol}{63.546\ g} = \mathbf{0.382\ mol\ Cu}$$

How many copper atoms are in 24.25 g of copper, Cu?
From the above problem we have 0.382 mol Cu.
1 mol Cu = 6.02 x 10^{23} atoms

$$0.382\ mol\ Cu \times \frac{6.02\times10^{23}\ Cu\ atoms}{1\ mol\ Cu} = \mathbf{2.30\ \times 10^{23}\ Cu\ atoms}$$

Calculate the number of moles in 2.45 x 10^{24} magnesium, Mg, atoms.
Atoms → moles 1 mole Mg = 6.02 x 10^{23} atoms

$$2.45\times10^{23}\ atoms \times \frac{1\ mol}{6.02\times10^{23}\ atoms} = \mathbf{0.407\ mol\ Mg}$$