Stoichiometry

What does 'equal amounts' mean in the following reaction?

$$Fe_{(s)} + S_{(s)} \rightarrow FeS_{(s)}$$

- Mass? No
- Volume? No
- Atoms? Yes

Relative Atomic Mass (A_r)

"The average mass of all the atoms of an element compared with the mass of the Carbon 12 Isotope which is defined as having a mass value of 12.000"

Relative atomic mass is the atomic mass number that we find on the periodic table. A_r is a ratio. It has no units

Relative Molar Mass (M_r)

"The mass of a molecule compared with the mass of the carbon 12 isotope.
This is obtained by finding the sum of the relative atomic masses of all the individual atoms in a molecule"

Examples.
A_r(H) = 1, A_r(O) = 16, A_r(C) = 12

- M_r (H_2O) = 2 x A_r (Hydrogen) + 1 x A_r(Oxygen)
  = (2 x 1) + 16
  = 18.0
- M_r (CO_2) = 1 x A_r (Carbon) + 2 x A_r(Oxygen)
  = 12 + (2 x 16)
  = 44.0

Avogadro's Number (6.02×10^{23})

The mass number of hydrogen is 1 and oxygen is 16.

Therefore, in **1 gram of hydrogen there is the same number of atoms as in 16 grams of oxygen.**

In 4 grams of hydrogen there is the same number of atoms as in 64 grams of oxygen.

But just how many atoms is this?

1 g of H	=	**6.02×10^{23}** atoms	
16 g of O	=	**6.02×10^{23}** atoms	
4 g of H	=	4(**6.02×10^{23}**)	= 24.08×10^{23}atoms
64 g of O	=	4(**6.02×10^{23}**)	= 24.08×10^{23}atoms

The Mole (n)

"1 mole ('n') is the number of carbon atoms in 12.000 grams of carbon 12.
1 mol of anything has 6.02×10^{23} atoms"
The unit of moles is 'mol'

Avogadro's number tells you the number of atoms in 1 mol of a substance.

1 mol of hydrogen weighs 1 g and has 6.02×10^{23} atoms

4 mol of hydrogen weighs 4 g and has 24.08×10^{23}atoms

1 mol of chlorine weighs 35.5 g and has 6.02×10^{23} atoms

2 mol of chlorine weighs 71 g and has 12.04×10^{23} atoms

4 mol of chlorine weighs 116.5 g and has 24.08×10^{23}atoms

Show 1 mole of a few substances (in jars)