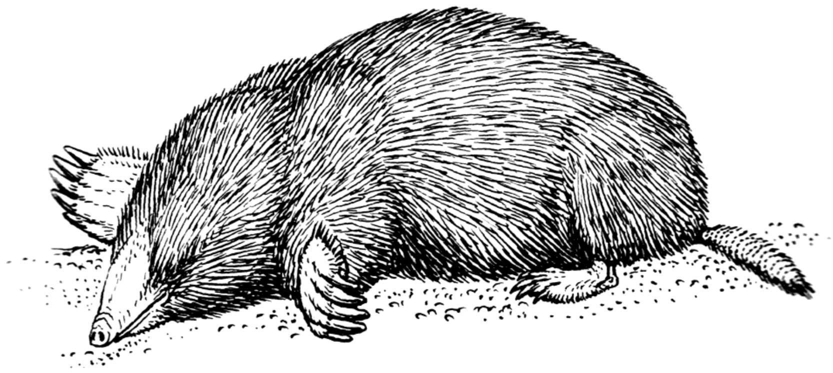
AS TRANSITION

PART 1: MEASURING AMOUNT OF SUBSTANCE



MEASUREMENTS IN CHEMISTRY

Mass

Convert the following into grams:

a) 0.25 kg
b) 15 kg
c) 100 tonnes
d) 2 tonnes

Volume

Convert the following into dm^3:

a) 100 cm^3
b) 25 cm^3

c) 50 m^3
d) 50000 cm^3

What is a mole?

Atoms and molecules are very small – far too small to usefully count.

It is important to know how much of something we have, but we count particles in MOLES because you get simpler numbers believe it or not.

So: 1 mole = 6.02×10^{23} particles

(6.02×10^{23} is known as Avogadro's number)

a) If you have 2.5×10^{21} atoms of magnesium, how many moles do you have?

b) If you have 0.25 moles of carbon dioxide, how many molecules do you have?

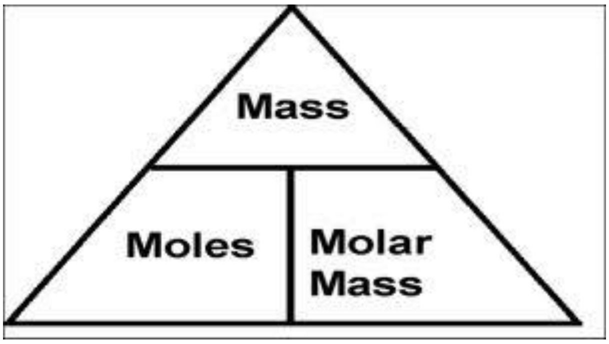
Q. How can you work out how many moles you have?

a) From a measurement of **MASS**:

You can find the number of moles of a substance if you are given its **mass** and you know its **molar mass**:

number of moles = mass/molar mass

n = m/m_r



Mass MUST be measured in grams!

Molar mass has units of $gmol^{-1}$

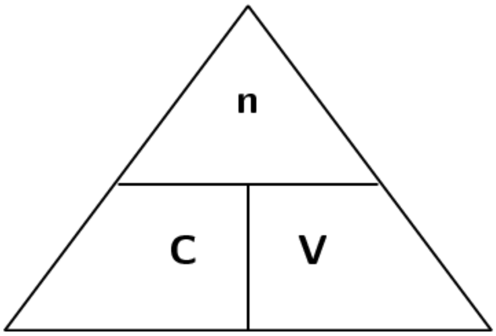
1. Calculate the number of moles present in:	2. Calculate the mass of:	3. Calculate the molar mass of the following substances:
a) 2.3 g of Na	a) 0.05 moles of Cl_2	a) 0.015 moles, 0.42 g
b) 2.5 g of O_2	b) 0.125 moles of KBr	b) 0.0125 moles, 0.50 g
c) 240 kg of CO_2	c) 0.075 moles of $Ca(OH)_2$	c) 0.55 moles, 88 g
d) 12.5 g of $Al(OH)_3$	d) 250 moles of Fe_2O_3	d) 2.25 moles, 63 g
e) 5.2 g of PbO_2	e) 0.02 moles of $Al_2(SO_4)_3$	e) 0.00125 moles, 0.312 g

b)From a measurement of AQUEOUS VOLUME:

You can find the number of moles of a substance dissolved in water (aqueous) if you are given the **volume** of solution and you know its **molar concentration**:

number of moles = aqueous volume × molar concentration

n = V × C



Aqueous volume MUST be measured in dm^3!

concentration has units of $moldm^{-3}$

If you know the molar mass of the substance, you can convert the molar concentration into a mass concentration:

Molar concentration ($moldm^{-3}$) × m_r = mass concentration (gdm^{-3})

1. Calculate the number of moles of substance present in each of the following solutions:	2. Calculate the molar concentration and the mass concentration of the following solutions:	3. Calculate the molar concentration and the mass concentration of the following solutions:
a) 25 cm^3 of 0.1 $moldm^{-3}$ HCl	a) 0.05 moles of HCl in 20 cm^3	a) 35 g of NaCl in 100 cm^3
b) 40 cm^3 of 0.2 $moldm^{-3}$ HNO_3	b) 0.01 moles of NaOH in 25 cm^3	b) 20 g of $CuSO_4$ in 200 cm^3
c) 10 cm^3 of 1.5 $moldm^{-3}$ NaCl	c) 0.002 moles of H_2SO_4 in 16.5 cm^3	c) 5 g of HCl in 50 cm^3
d) 5 cm^3 of 0.5 $moldm^{-3}$ $AgNO_3$	d) 0.02 moles of $CuSO_4$ in 200 cm^3	d) 8 g of NaOH in 250 cm^3

e) 50 cm^3 of 0.1 $moldm^{-3}$ H_2SO_4	e) 0.1 moles of NH_3 in 50 cm^3	e) 2.5 g of NH_3 in 50 cm^3

c) From a measurement of GASEOUS VOLUME:

You can find the number of moles of a gas if you are given the **volume** of the gas and its **pressure** (in kPa) and **absolute temperature (in K)**:

$$\textbf{number of moles} = \frac{\textbf{pressure x volume}}{\textbf{R x temperature}} = PV/RT$$

Volume of gas must be in m^3

Pressure must be in Pa

Temperature must be in K

R is the molar gas constant (8.31 $Jmol^{-1}K^{-1}$)

1. Calculate the number of moles present in:	2. Calculate the volume of gas occupied by:	3. Calculate the mass of the following gas samples:
a) 48 dm^3 of O_2 at 298 K and 100 kPa	a) 0.05 moles of Cl_2 at 298 K and 100 kPa	a) 48 dm^3 of O_2 at 298 K and 100 kPa
b) 1.2 dm^3 of CO_2 at 298 K and 100 kPa	b) 0.25 moles of CO_2 at 298 K and 100 kPa	b) 1.2 dm^3 of CO_2 at 298 K and 100 kPa
c) 200 cm^3 of N_2 at 273 K and 250 kPa	c) 28 g of N_2 at 273 K and 250 kPa	c) 200 cm^3 of N_2 at 273 K and 250 kPa
d) 100 dm^3 of Cl_2 at 30 °C at 100 kPa	d) 3.2 g of O_2 at 30 °C at 100 kPa	d) 100 dm^3 of Cl_2 at 30 °C at 100 kPa
e) 60 cm^3 of NO_2 at 25 °C and 100 kPa	e) 20 g of NO_2 at 25 °C and 100 kPa	e) 60 cm^3 of NO_2 at 25 °C and 100 kPa