TRANSITION PACK

MEASURING AMOUNT OF SUBSTANCE

MASS **VOLUME** **MOLAR MASS**
AVOGADRO

CONCENTRATION **ATOM** **ION** **MOLECULE**

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

Tip – always use standard form for very large and very small numbers!

What is a mole?

Atoms and molecules are very small – far too small to count individually!

It is important to know how much of something we have, but we count particles in MOLES because you get simpler numbers

$$1 \text{ mole} = 6.02 \times 10^{23} \text{ particles}$$

(6.2 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?

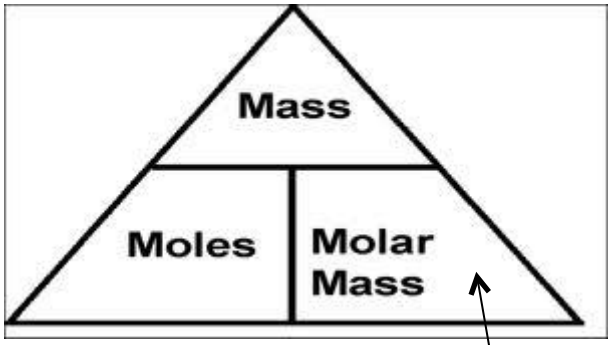
How can you work out how many moles you have?

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



This value is found in the periodic table

Mass MUST be measured in grams!

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

To calculate the **molar mass** of CO_2 add together the masses of each element e.g.

Oxygen = mass of 16 g mol

Carbon = mass of 12 g mol

16	x	2	= 32
12	x	1	= 12
			44

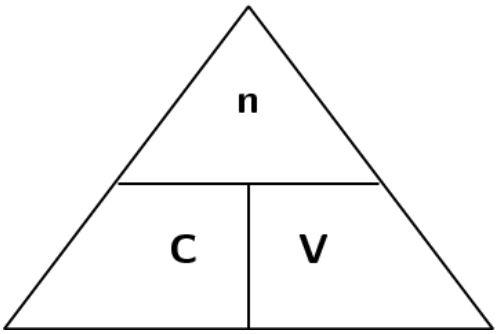
1. Calculate the number of moles present in:	2. Calculate the mass of:	3. Calculate the molar mass of the following substances:
a) 2.3 g of Na	a) 0.05 moles of Cl_2	a) 0.015 moles, 0.42 g
b) 2.5 g of O_2	b) 0.125 moles of KBr	b) 0.0125 moles, 0.50 g
c) 240 kg of CO_2	c) 0.075 moles of $Ca(OH)_2$	c) 0.55 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 x molar concentration

n = V x 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 ($moldm^{-3}$) x 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

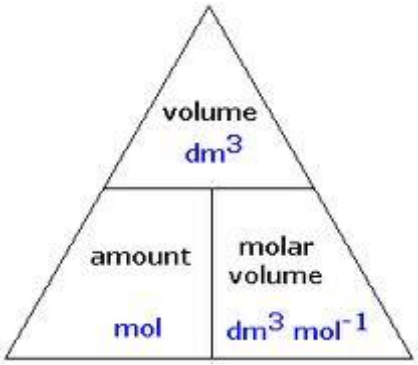
c. From a measurement of GASEOUS VOLUME:

You can find the number of moles of a gas if you are given the **volume** of the gas:

number of moles = volume / 24

n = V / 24

24 dm^3 is the volume occupied by 1 mole of any gas at room temperature and pressure



Volume MUST be measured in dm^3!

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	a) 0.05 moles of Cl_2	a) 48 dm^3 of O_2
b) 1.2 dm^3 of CO_2	b) 0.25 moles of CO_2	b) 1.2 dm^3 of CO_2
c) 200 cm^3 of N_2	c) 28 g of N_2	c) 200 cm^3 of N_2
d) 100 dm^3 of Cl_2	d) 3.2 g of O_2	d) 100 dm^3 of Cl_2
e) 60 cm^3 of NO_2	e) 20 g of NO_2	e) 60 cm^3 of NO_2