Chemistry

'Bridging the Gap' Summer Homework

Name……..

Standard Form

Number	Number in standard form
0.008	8×10^{-3}
0.07	7×10^{-2}
0.55	5.5×10^{-1}
0.000052	
0.048	
0.0086	
0.00086	
0.000086	
0.0000000001	
0.000455	

Number in standard form	Number
8×10^{-3}	
6.2×10^{-4}	
9.3×10^{-3}	
8.82×10^{-4}	
3.56×10^{-5}	
1.6×10^{-7}	
4.4×10^{-4}	
8.01×10^{-3}	
1.11×10^{-8}	
9.9×10^{-2}	

Conversions

Mass

Convert the following into grams:

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

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

Volume

Convert the following into dm^3:

a) 100 cm^3
b) 25 cm^3
c) 50 m^3
d) 50000 cm^3

Moles

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

We count particles in MOLES because you get simpler numbers:

1 mole = 6.02×10^{23} particles

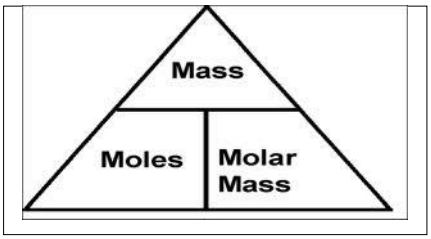
(6.02×10^{23} is known as Avogadro's number)

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?

Calculating Moles

a) From **MASS**:



number of moles = mass/molar mass

$n = m/m_r$

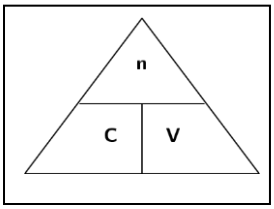
Mass MUST be measured in grams!

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 VOLUME:

concentration = moles ÷ volume

$C = n \div V$



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:

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

1. Calculate the number of moles of substance present in each of the following solutions:	**2. Calculate the concentration in $moldm^{-3}$ and gdm^{-3} 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

Balancing Equations

- **When balancing equations, you can only put big numbers in front of formulae – you cannot change the subscript numbers within formulae**
- **A big number in front of a formula belongs to all atoms within the formula**

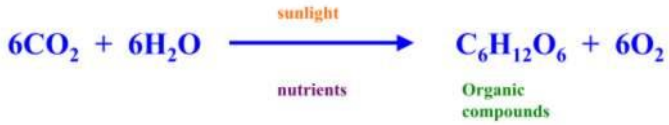
  e.g. $2MgCl_2$ contains 2xMg and 4xCl
- **Subscript numbers belong to the atom to the left** e.g. $MgCl_2$ contains 1xMg and 2xCl
- **Subscript numbers outside brackets belong to everything within the brackets**

  e.g. $Mg(OH)_2$ contains 1xMg and 2xO and 2xH

1) $H_2 + Cl_2 \rightarrow HCl$
2) $Zn + O_2 \rightarrow ZnO$
3) $Cl_2 + Al \rightarrow AlCl_3$
4) $Na + O_2 \rightarrow Na_2O$
5) $Mg + O_2 \rightarrow MgO$
6) $Mg + HCl \rightarrow MgCl_2 + H_2$
7) $Fe_2O_3 + Al \rightarrow Fe + Al_2O3$
8) $CaCl_2 + KOH \rightarrow Ca(OH)_2 + KCl$
9) $HCl + Na_2CO_3 \rightarrow NaCl + H_2O + CO_2$
10) $HNO_3 + NaOH \rightarrow NaNO_3 + H_2O$
11) $HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + H_2O$
12) $H_2SO_4 + KOH \rightarrow K_2SO_4 + H_2O$
13) $NaNO_3 \rightarrow NaNO_2 + O_2$
14) $KI + Pb(NO_3)_2 \rightarrow KNO_3 + PbI_2$
15) $CaCl_2 + Na_2SO_4 \rightarrow CaSO_4 + NaCl$
16) $HCl + K_2SO_3 \rightarrow KCl + H_2O + SO_2$
17) $KOH + MgSO_4 \rightarrow Mg(OH)_2 + K_2SO_4$
18) $K + H_2O \rightarrow KOH + H_2$
19) $NaOH + H_3PO_4 \rightarrow Na_3PO_4 + H_2O$
20) $Pb(NO_3)_2 \rightarrow PbO + NO_2 + O_2$

Using Chemical Equations

Chemical equations show the ratio in which different species react in a chemical equation.



This equation shows that **6** moles of carbon dioxide react with **6** moles of water to produce **1** mole of glucose and **6** moles of oxygen.

6: 6: 1: 6

a) How many moles of water are needed to react with 0.03 moles of carbon dioxide?

b) How many moles of glucose can be made from 0.03 moles of carbon dioxide?

c) How many moles of oxygen can be made from 0.03 moles of carbon dioxide?

Equation 1: $Mg + 2HCl \rightarrow MgCl_2 + H_2$

a) How many moles of magnesium would be needed to react with 0.01 moles of hydrochloric acid?

b) How many moles of hydrogen could be produced from 0.01 moles of hydrochloric acid?

Equation 2: $2H_2S + 3O_2 \rightarrow 2SO_2 + 2H_2O$

a) How many moles of oxygen is needed to react with 0.5 moles of hydrogen sulphide?

b) How many moles of sulphur dioxide can be made from 0.5 moles of hydrogen sulphide?

Equation 3: $4K + O_2 \rightarrow 2K_2O$

a) How many moles of oxygen are needed to react with 0.05 moles of potassium?

b) How many moles of potassium oxide can be made from 0.05 moles of potassium?

Calculating Reacting Quantities from Chemical Equations

Do these calculations in 3 steps:

i) calculate the number of moles of one of the known substance

ii) use the balanced equation to work out the number of moles of the unknown substance

iii) calculate the mass of the unknown substance

1) What mass of hydrogen is produced when 192 g of magnesium is reacted with hydrochloric acid?

$$Mg + 2HCl \rightarrow MgCl_2 + H_2$$

2) What mass of oxygen is needed to react with 8.5 g of hydrogen sulphide (H_2S)?

$$2H_2S + 3O_2 \rightarrow 2SO_2 + 2H_2O$$

3) What mass of potassium oxide is formed when 7.8 g of potassium is burned in oxygen?

$$4K + O_2 \rightarrow 2K_2O$$

4) What mass of oxygen is required to oxidise 10 g of ammonia to NO?

$$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$$

5) What mass of aluminium oxide is produced when 135 g of aluminium is burned in oxygen?

$$2Al + 3O_2 \rightarrow Al_2O_3$$

6) What mass of iodine is produced when 7.1 g of chlorine reacts with excess potassium iodide?

$$Cl_2 + 2KI \rightarrow 2KCl + I_2$$

7) What volume of hydrogen is needed to react with 32 g of copper oxide?

$$CuO + H_2 \rightarrow Cu + H_2O$$

8) What volume of oxygen is formed when 735 g of potassium chlorate decomposes?

$$2KClO_3 \rightarrow 2KCl + 3O_2$$

9) What volume of hydrogen is produced when 195 g of potassium is added to water?

$$2K + 2H_2O \rightarrow 2KOH + H_2$$

10) What volume of carbon dioxide is produced when 5.6 g of butene (C_4H_8) is burnt?

$$C_4H_8 + 6O_2 \rightarrow 4CO_2 + 4H_2O$$

11) 25 cm^3 of a solution of sodium hydroxide reacts with 15 cm^3 of 0.1 mol/dm^3 HCl. What is the concentration (in $moldm^{-3}$) of the sodium hydroxide solution?

$$HCl + NaOH \rightarrow NaCl + H_2O$$