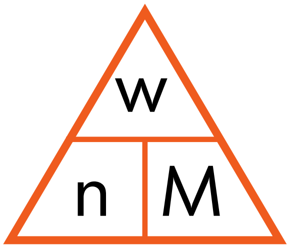
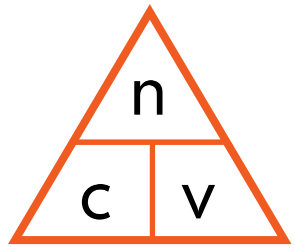
YEAR 1 CHEMISTRY EQUATIONS (AQA)

MOLE CALCULATIONS

number of moles = mass / molar mass
(g) ($g.mol^{-1}$)

number of moles = concentration x volume
($mol.dm^{-3}$) (dm^3)

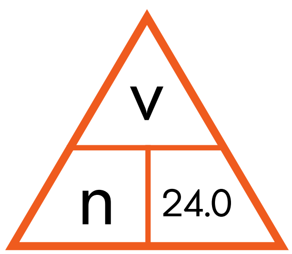




Avogadro's Constant = 6.02 x 10^{23} atoms or molecules = **1 mole**

MOLAR GAS CONSTANT

1 mole of ANY gas occupies 24.0 dm^3 at room temperature & pressure



IDEAL GAS EQUATION

P = Pressure (pa) **V** = volume (m^3) **n** = no. of moles

R = Gas Constant (8.314 $J.K^{-1}.mol^{-1}$) **T** = Temperature (K)

$$PV = nRT$$

$$P = \frac{nRT}{V} \qquad V = \frac{nRT}{P} \qquad n = \frac{PV}{RT} \qquad T = \frac{PV}{nR}$$

For changes in conditions:

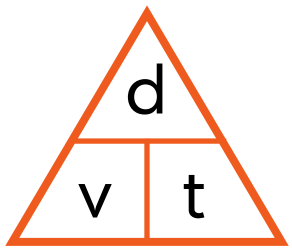
$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

MASS SPECTROSCOPY

K.E. = Kinetic Energy (J)   m = mass of ONE ion (Kg)   v = velocity ($m.s^{-1}$)

$$K.E. = \frac{1}{2}\, m.v^2 \qquad v = \sqrt{\frac{2K.E.}{m}} \qquad m = \frac{\sqrt{2K.E.}}{v}$$

d = distance **or** length of flight tube (m)   t = time (s)   v = velocity ($m.s^{-1}$)



$$\textbf{Relative Atomic Mass (Ar)} = \frac{(\text{mass isotope 1 x abundance}) + (\text{mass isotope 2 x abundance}) + \ldots}{\sum \text{abundance}}$$

OTHER EQUATIONS

$$\% \text{ by mass} = \frac{\text{mass of element in 1 mole}}{Mr}$$

$$\text{Empirical formula} = \frac{M1}{Mr1} : \frac{M2}{Mr2} : \frac{M3}{Mr2}$$

Where M1, M2 etc is the mass or % composition of element 1, 2 etc

then divide each by the smallest number to give empirical formula

$$\% \text{ Atom Economy} = \frac{\text{mass of desired product}}{\text{total mass of all products}} \times 100$$

You can use mass or number of moles here!

$$\% \text{ Yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100$$

You can replace masses with Mr values here too!

ENTHALPY

Q = energy transferred (J)
m = mass of **solution** (g)
c = specific heat capacity ($J.K^{-1}.mol^{-1}$)
$\triangle T$ = **change** in temperature (^{o}C **or** K)

$$Q = m.c.\triangle T$$

$$\underset{(J.mol^{-1})}{\triangle H} = \frac{Q}{n}$$

Don't forget to add a sign for $\triangle H$!

Divide by 1000 for $kJ.mol^{-1}$

$$\underset{(kJ.mol^{-1})}{\triangle H \text{ reaction}} = \underset{(kJ.mol^{-1})}{\sum \text{reactant mean bond enthalpies}} - \underset{(kJ.mol^{-1})}{\sum \text{product mean bond enthalpies}}$$

EQUILIBRIA

$$aA + bB \rightleftharpoons cC + dD$$

$$Kc = \frac{[C]^c \; [D]^d}{[A]^a \; [B]^b}$$

Where:
[A] = concentration ($mol.dm^{-3}$)
a = no. of moles from equation

COMMON IONS

POSITIVE

GROUP 1 = +
GROUP 2 = 2+
H^+
Ag^+
Zn^{2+}
Pb^{2+}
Al^{3+}
(Transition metals are variable)
e.g. Fe^{2+}, Fe^{3+}

NEGATIVE

GROUP 7 = -
GROUP 6 = 2-
GROUP 5 = 3-

MOLECULAR IONS

NH_4^+ ammonium	OH^- hydroxide	NO_3^- nitrate	CN^- cyanide
H_3O^+ hydronium	CO_3^{2-} carbonate	SO_4^{2-} sulfate	PO_4^{3-} phosphate

ACIDS & BASES

ACIDS

HCl	hydrochloric acid
HNO_3	nitric acid
H_2SO_4	sulphuric acid
H_3PO_4	phosphoric acid
CH_3COOH	ethanoic acid

BASES

$NaOH$	sodium hydroxide
KOH	potassium hydroxide
$Ca(OH)_2$	calcium hydroxide
CuO	copper (II) oxide

COMMON OXIDATION STATES

POSITIVE

GROUP 1 = +I

GROUP 2 = +II

H = +I

Ag = +I

Zn = +II

Pb = +II or +IV

Al = + III

(Transition metals are variable)

Fe = +II or +III

Cu = +II (sometimes +I)

C = +II or +IV

NEGATIVE

F = -I

O = -II

Cl = -I

Br = -I

I = -I

N = -III

S = -II

P = -III

Most common oxidation states, but may be positive when covalently bonded to more highly electronegative elements. i.e. F or O

GROUP 1 SALTS: ALL SOLUBLE

NITRATE SALTS = ALL SOLUBLE

GROUP 2 SALTS:

HYDROXIDES INCREASE IN SOLUBILITY DOWN THE GROUP

SULFATES DECREASE IN SOLUBILITY DOWN THE GROUP

CARBONATES ARE NOT SOLUBLE

Ag SALTS: ALL INSOLUBLE EXCEPT $AgNO_3$

Pb SALTS ALL INSOLUBLE EXCEPT $Pb(NO_3)_2$

GROUP 7 SALTS: ALL SOLUBLE EXCEPT AgX and PbX_2

CO_3 SALTS: ALL INSOLUBLE EXEPT GROUP 1

YEAR 1 CHEMISTRY PRACTICALS (AQA)

No.	Practical	Detail	Done?
1a	Make a standard solution	Prepare a 250cm^3 sample of a solution (e.g. NaOH) to a known concentration using the standard method.	
1b	Perform a simple acid-base titration	Titrate an acid of known concentration against an alkali. Deduce the concentration of the alkali using a the mean titre. e.g. HCl + NaOH	
2a	Measure the enthalpy change of combustion of a fuel (ΔHc)	Use a calorimeter to experimentally determine the energy released by a fuel and the ΔH for the reaction.	
2b	Measure the enthalpy change of neutralisation (ΔHn)	Use a calorimeter to experimentally determine the energy released by a neutralisation reaction and the ΔH for the reaction.	
3	Measure temperature affects the rate of a reaction	Use the initial rate method to determine the effect of increasing temperature ion the rate of a reaction. e.g. HCl + Sodium Thiosufate	
4	Testing for ions in solution	Use chemical tests to identify Group 2, Group 7, OH^-, CO_3^{2-} and SO_4^{2-} ions in solution	
5	Distillation of an organic product	Produce a liquid organic compound and use distillation to separate and purify. e.g. Aldehyde or Ester	
6	Testing for organic functional groups	Use chemical tests to identify a carboxylic acid, an alcohol and an aldehyde.	