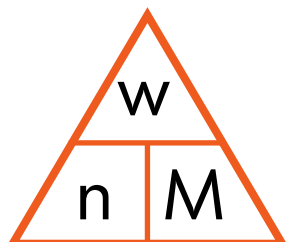


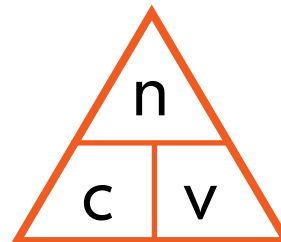


MOLE CALCULATIONS

number of moles = mass / molar mass
(g) (g.mol⁻¹)



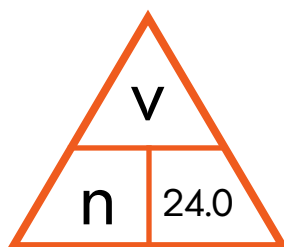
number of moles = concentration x volume
(mol.dm⁻³) (dm³)



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

MOLAR GAS CONSTANT

1 mole of ANY gas occupies 24.0 dm³ at room temperature & pressure



IDEAL GAS EQUATION

P = Pressure (pa) **V** = volume (m³) **n** = no. of moles
R = Gas Constant (8.314 J.K⁻¹.mol⁻¹) **T** = Temperature (K)

$$PV = nRT$$

$$P = \frac{nRT}{V}$$

$$V = \frac{nRT}{P}$$

$$n = \frac{PV}{RT}$$

$$T = \frac{PV}{nR}$$

For changes in conditions:

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

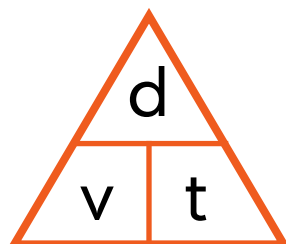


MASS SPECTROSCOPY

K.E. = Kinetic Energy (J) m = mass of ONE ion (Kg) v = velocity (m.s⁻¹)

$$\text{K.E.} = \frac{1}{2} m.v^2 \quad v = \frac{\sqrt{2\text{K.E.}}}{m} \quad m = \frac{\sqrt{2\text{K.E.}}}{v}$$

d = distance or length of flight tube (m) t = time (s) v = velocity (m.s⁻¹)



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

OTHER EQUATIONS

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

$$\text{Empirical formula} = \frac{M_1}{M_{r1}} : \frac{M_2}{M_{r2}} : \frac{M_3}{M_{r3}}$$

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 ($\text{J.K}^{-1}.\text{mol}^{-1}$) ΔT = **change** in temperature ($^{\circ}\text{C}$ or K)

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

$$\Delta H = \frac{Q}{n}$$

(J.mol^{-1})

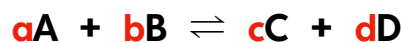
Don't forget to add a sign for ΔH !

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

$$\Delta H_{\text{reaction}} = \sum_{\text{reactant}} \text{mean bond enthalpies} - \sum_{\text{product}} \text{mean bond enthalpies}$$

(kJ.mol^{-1})
 (kJ.mol^{-1})
 (kJ.mol^{-1})

EQUILIBRIA



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

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



COMMON IONS

POSITIVE

GROUP 1 = +

GROUP 2 = 2+

H⁺

Ag⁺

Zn²⁺

Pb²⁺

Al³⁺

(Transition metals are variable)

e.g. Fe²⁺, Fe³⁺

NEGATIVE

GROUP 7 = -

GROUP 6 = 2-

GROUP 5 = 3-

MOLECULAR IONS

NH₄⁺
ammonium

H₃O⁺
hydronium

OH⁻
hydroxide

CO₃²⁻
carbonate

NO₃⁻
nitrate

SO₄²⁻
sulfate

CN⁻
cyanide

PO₄³⁻
phosphate

ACIDS & BASES

ACIDS

HCl hydrochloric acid

HNO₃ nitric acid

H₂SO₄ sulphuric acid

H₃PO₄ phosphoric acid

CH₃COOH 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

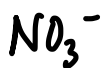
NITRATE SALTS = ALL SOLUBLE

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 AgNO₃

Pb SALTS ALL INSOLUBLE EXCEPT Pb(NO₃)₂

GROUP 7 SALTS: ALL SOLUBLE EXCEPT AgX and PbX₂

CO₃ SALTS: ALL INSOLUBLE EXCEPT GROUP 1



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 (ΔH_c)	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 (ΔH_n)	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.	