# CHEM1 - Foundation Chemistry
# Definitions to Learn

## 1. Formulae & Equations

| | |
|---|---|
| Atomic number | number of protons in the nucleus of an atom |
| Mass number | sum of the protons and neutrons in the nucleus of an atom |
| Isotopes | atoms with the same number of protons but different numbers of neutrons |
| Empirical formula | simplest whole number ratio of the atoms of each element in a compound |
| Molecular formula | actual number of atoms of each element in a molecule |
| Atom economy | $\frac{\text{mass of desired product}}{\text{total mass of reactants}} \times 100\%$ |

## 2. Mass Spectrometry & Electronic Structure

| | |
|---|---|
| Relative atomic mass | average mass of an atom relative to 1/12 of the mass of a carbon-12 atom |
| Relative molecular mass | mass of a molecule relative to 1/12 of the mass of a carbon-12 atom |

## 3. Moles

| | |
|---|---|
| Mole | unit for amount of substance |
| Avogadro constant, $N_A$ | number of particles present in a mole ($6.02 \times 10^{23}$ $mol^{-1}$) |

## 4. Bonding & Periodicity

| | |
|---|---|
| Lattice | a regular 3-dimensional array |
| Ionic bond | electrostatic attraction between oppositely charged ions in a lattice |
| Covalent bond | a shared pair of electrons |
| Dative covalent bond | covalent bond formed by donation of a lone pair |
| Metallic bond | a lattice of positive ions surrounded by delocalised electrons |
| Electronegativity | ability of an atom to attract the electrons in a covalent bond |
| Polar bond | electrons are shared unequally (due to difference in electronegativity of atoms at either end) |
| 1st ionisation energy | energy change when one mole of electrons is removed from one mole of gaseous atoms |

## 5. Alkanes

| | |
|---|---|
| Homologous series | a series of organic compounds with:<br>• the same general formula<br>• difference of $CH_2$ between each member<br>• a trend in physical properties<br>• similar chemical properties |
| Functional group | a group of atoms responsible for the characteristic reactions of a compound |
| Structural isomers | same molecular formula, different structures |
| Hydrocarbon | a compound that contains hydrogen and carbon only |
| Saturated | contains only single C-C bonds |
| Fractional distillation | separates due to differences in boiling point |
| Fraction | mixture of compounds of similar boiling point |
| Cracking | breaking a long chain alkane into a shorter chain alkane and an alkene |

# CHEM1 - Foundation Chemistry Calculations

## 1. Formulae & Equations

| | |
|---|---|
| Molar mass* | Sum of masses of elements in formula<br>*e.g. 106.0 for $Na_2CO_3$ (always give to 1 dp)* |
| Percentage by mass | $\frac{\text{Mass of specified element}}{\text{Molar mass}} \times 100\%$<br>*e.g. 43.4% for Na in $Na_2CO_3$* |
| Empirical formula | For each element, divide percentage by relative atomic mass<br>Divide through by smallest<br>If result is, say, 1 1 1.5, then double to get whole numbers.<br>**Do not round 1.5 to 2** |
| Molecular formula | Divide relative molecular mass by mass of empirical formula to get multiplier. Multiply empirical formula by multiplier. |
| Atom economy | $\frac{\text{Mass of desired product}}{\text{Total mass of reactants}} \times 100\%$ |

* (also applies to relative atomic mass, relative molecular mass & relative formula mass)

## 2. Mass Spectrometry & Electronic Structure

| | |
|---|---|
| Relative atomic mass | For each isotope, calculate mass number x abundance.<br>Add results together.<br>Mass number may come from m/z scale of graph.<br>Abundance can be %/100 or line height/total line height. |

## 3. Moles

| | |
|---|---|
| Moles | If given mass in g, moles = mass/molar mass<br>If given concentration in mol $dm^{-3}$ and volume in **$dm^3$**, moles = concentration x volume<br>If given concentration in mol $dm^{-3}$ and volume in **$cm^3$**, moles = concentration x volume/1000 |
| Percentage yield | $\frac{\text{Actual moles}}{\text{Possible moles}} \times 100\%$ |
| Percentage purity | $\frac{\text{Mass of pure or desired}}{\text{Mass of impure or mixture}} \times 100\%$ |
| Concentration in g $dm^{-3}$ | Mol $dm^{-3}$ x molar mass |
| Dissolved mass | Concentration in g $dm^{-3}$ x volume in $dm^3$ |
| Ideal gas equation | $PV = nRT$<br>P=pressure in Pa, V=volume in $m^3$, n=number of moles, R=gas constant (8.31 J $K^{-1}$ $mol^{-1}$), T=temperature in K<br>1kPa = 1000 Pa, 1 $cm^3$ = $10^{-6}$ $m^3$, 1 $dm^3$ = $10^{-3}$ $m^3$,<br>K = °C+273 |