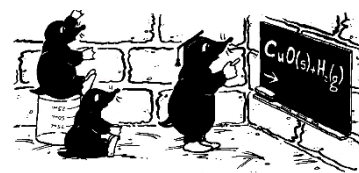


# Atoms and Reactions 1



The key areas of study in this topic are:

- Writing formulae and equations
- Calculating chemical quantities

By the end of this topic I should be able to:

	Start	End
Define isotopes as atoms of the same element with different numbers of neutrons and different masses		
Describe atomic structure in terms of the numbers of protons neutrons and electrons for atoms and ions, given the atomic number, mass number and any ionic charge.		
Define the terms <ul style="list-style-type: none"> <li>• <i>relative isotopic mass</i></li> <li>• <i>relative atomic mass</i></li> </ul>		
Use mass spectrometry in <ul style="list-style-type: none"> <li>• The determination of relative isotopic masses and relative abundances of the isotope</li> <li>• Calculating the relative atomic mass of an element from the relative abundances of its isotopes.</li> </ul>		
Use the terms <i>relative molecular mass</i> , $M_r$ , and <i>relative formula mass</i> and calculate these from relative atomic masses.		
Predict the charge on an ion from the position of the element in the periodic table.		
Recall the names and formulae of the following ions: <ul style="list-style-type: none"> <li>• <math>\text{NO}_3^-</math>, <math>\text{CO}_3^{2-}</math>, <math>\text{SO}_4^{2-}</math>, <math>\text{OH}^-</math>, <math>\text{NH}_4^+</math>, <math>\text{Zn}^{2+}</math> and <math>\text{Ag}^+</math></li> </ul>		
Write the formulae of ionic compounds from ionic charges		
Construct balanced chemical equations (including ionic equations), including state symbols, for reactions studied and for unfamiliar reactions given appropriate information.		
Explain and use the terms <ul style="list-style-type: none"> <li>• amount of substance</li> <li>• mole (symbol 'mol'), as the unit for amount of substance</li> <li>• the Avogadro constant, <math>N_A</math> (the number of particles per mole, <math>6.02 \times 10^{23} \text{ mol}^{-1}</math>)</li> <li>• molar mass (mass per mole, units <math>\text{g mol}^{-1}</math>)</li> <li>• molar gas volume (gas volume per mole, units <math>\text{dm}^3 \text{ mol}^{-1}</math>)</li> </ul>		

Use the terms:		
<ul style="list-style-type: none"> <li>• <i>empirical formula</i> (the simplest whole number ratio of atoms of each element present in a compound)</li> <li>• <i>molecular formula</i> (the number and type of atoms of each element in a molecule)</li> </ul>		
Calculate empirical and molecular formulae, from composition by mass or percentage compositions by mass and relative molecular mass (including from elemental analysis data).		
Use the terms <i>anhydrous</i> , <i>hydrated</i> and <i>water of crystallisation</i> .		
Calculate the formula of a hydrated salt from given percentage compositions, mass compositions or data based on experimental results.		
Carry out calculations, using amount of substance in mol, involving		
<ul style="list-style-type: none"> <li>• mass</li> <li>• gas volume</li> <li>• solution volume and concentration (in mol dm<sup>-3</sup> and g dm<sup>-3</sup>)</li> </ul>		
Use the ideal gas equation, $pV = nRT$ , in calculations		
Use stoichiometric relationships in calculations.		
Carry out calculations to determine:		
<ul style="list-style-type: none"> <li>• the percentage yield of a reaction or related quantities</li> <li>• the atom economy of a reaction</li> </ul>		
Understand the benefits for sustainability of developing chemical processes with a high atom economy.		
Understand the techniques and procedures required during experiments requiring the measurement of mass, volumes of solutions and gas volumes		

**In all topic areas you should be able to demonstrate and apply your knowledge and understanding.**

