# Scheme of work

## Combined Science: Trilogy - Foundation

## Chemistry – Quantitative chemistry

This resource provides guidance for teaching the Quantitative chemistry topic from our new GCSE Combined Science: Trilogy specification (8464). It has been updated from the draft version to reflect the changes made in the accredited specification. These changes are also reflected in the learning outcomes with some additions to the resources.

The scheme of work is designed to be a flexible medium term plan for teaching content and development of the skills that will be assessed.

It is provided in Word format to help you create your own teaching plan – you can edit and customise it according to your needs. This scheme of work is not exhaustive; it only suggests activities and resources you could find useful in your teaching.

### 5.3 Quantitative chemistry

#### 5.3.1 Conservation of mass and the quantitative interpretation of chemical equations

| **Spec ref.** | **Summary of the specification content** | **Learning outcomes**  *What most students should be able to do* | **Suggested timing (hours)** | | **Opportunities to develop Scientific Communication skills** | | **Opportunities to develop and apply practical and enquiry skills** | | **Self/peer assessment**  **Opportunities and resources**  *Reference to past questions that indicate success* | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 5.3.1.1 | The law of conservation of mass states that no atoms are lost or made during a chemical reaction so the mass of the products equals the mass of the reactants.  This means that chemical reactions can be represented by symbol equations which are balanced in terms of the numbers of atoms of each element involved on both sides of the equation. | Understand the use of the multipliers in equations in normal script before a formula and in subscript within a formula.  WS 1.2 | 2 | | Describe the meaning of the law of conservation.  Write simple word equations.  Write simple symbol equations.  Balance symbol equations for:  Al + O2 → Al2O3  4Al + 3O2 → 2Al2O3  MgO → Mg + O2  2MgO → 2Mg + O2  Fe + O2 → Fe2O3  4Fe + 3O2 → 2Fe2O3  H2 + O2  → H2O  2H2 + O2 → 2H2O  Fe + CuCl2 → FeCl2 + Cu  Equation is balanced. | | React solutions of copper sulfate and sodium hydroxide in a closed container on a balance.  Measure mass of reactants and products.  React iron filings with sulfur to form iron sulfide.  Measure mass of reactants and product.  Use jellybeans (four colours for four elements) and cocktail sticks. Each toothpick represents a molecule of each compound in the equation.  Students then put the correct number of each colour of jellybean atoms on the toothpick ie Ca(OH)2 equals 1 Ca, 2 Os, and 2 Hs.  To balance the equations, more of the same molecules are built, rather than adding single jellybeans (no changing of subscript).  Pupils must balance each equation by adding additional molecules until colours are equal on both sides. | | [Exampro user guide PowerPoint](http://filestore.aqa.org.uk/resources/science/AQA-GCSE-SCIENCE-EXAMPRO-UG.PPTX)  Video clips:  [BBC Bitesize Conservation of mass in chemical reactions](http://www.bbc.co.uk/education/clips/z8rtfg8)  YouTube:  [The law of conservation of mass](https://www.youtube.com/watch?v=2S6e11NBwiw)  [Law of Conservation of Mass Experiment](https://www.youtube.com/watch?v=mcnga-bbNXk) | |
| 5.3.1.2 | The relative formula mass (*M*r) of a compound is the sum of the relative atomic masses of the atoms in the numbers shown in the formula.  In a balanced chemical equation, the sum of the relative formula masses of the reactants in the quantities shown equals the sum of the relative formula masses of the products in the quantities shown. | Use relative atomic masses in the calculations specified in the subject content.    Be able to calculate the relative formula mass (*M*r) of a compound from its formula, given the relative atomic masses.  MS 3a | 1 | | Recall the definition of relative atomic mass.  Recall how to find the relative atomic mass from the periodic table.  Define the relative molecular mass. | | Give students formula of different compounds (ie CaCO3, Ba(OH)2, H2SO4, SO2, H2O, CuSO4)  Ask them to model the atoms in each molecule using balls of plasticine, including the numbers of particles for each.  Use the mass numbers on a periodic table to calculate the relative formula mass for each compound. | |  | |
| 5.3.1.3 | Some reactions may appear to involve a change in mass but this can usually be explained because a reactant or product is a gas and its mass has not been taken into account.  For example: when a metal reacts with oxygen the mass of the oxide produced is greater than the mass of the metal or in thermal decompositions of metal carbonates carbon dioxide is produced and escapes into the atmosphere leaving the metal oxide as the only solid product. | Explain any observed changes in mass in non-enclosed systems during a chemical reaction given the balanced symbol equation for the reaction and explain these changes in terms of the particle model. | | 1 | | Write out the balanced equation for magnesium oxide reaction.  Write out the balanced equation for calcium carbonate decomposition.  Describe the changes by using a series of diagrams to show the particle model. | | Use magnesium ribbon to produce magnesium oxide. Measure the mass of the ribbon at the start and end of the experiment.  Heat CaCO3 (chalk) strongly in a Bunsen flame. Compare masses before and after.  Demonstrate combustion of paper in a large beaker to show mass may decrease because products are released to the air as gases. | | Video clip  YouTube:  [BBC Chemical reactions](https://www.youtube.com/watch?v=6td9NZ-YRjE)  Burning iron wool experiment at 7 minutes in | |
| 5.3.1.4 | Whenever a measurement is made there is always some uncertainty about the result obtained. |  | | 0.5 | |  | | Class thiosulfate ‘disappearing cross’ experiment at a single fixed concentration using (a) pre-printed computer generated crosses (b) hand drawn crosses using different pens/pencils. | |  | |

#### 5.3.2 Use of amount of substance in relation to masses of pure substances

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| 5.3.2.5 | Many chemical reactions take place in solutions. The concentration of a solution can be measured in mass per given volume of solution, eg grams per dm3 (g/dm3). | Calculate the mass of solute in a given volume of solution of known concentration in terms of mass per given volume of solution.  MS 1c, 3c | 0.5 | Explain the meaning of concentration and the unit grams per dm3  Be able to convert cm3 into dm3  Use the equation:    to calculate the concentration of a solution. | To demonstrate the idea of concentration pupils could make different concentrations of tea, coffee or a dark squash like blackcurrant. | Video clip  YouTube:  [Concentration formula and calculations](https://www.youtube.com/watch?v=XCX0PkZdUjM) |