C3 Quantitative Chemistry – Knowledge organiser
Foundation Separate Chemistry GCSE

4.3.1	Chemical measurements
Conservation of mass and **balanced chemical equations**	- **no atoms are lost or made** during a chemical reaction so **the mass of the products equals the mass of the reactants.** - This is why symbol equations must be **balanced**, so that there is the same number of atoms on both sides of the equation. e.g. CH_4 + **2**O_2 → CO_2 + **2**H_2O (now each side has 1 C, 4 H's and 4 O's)
Relative formula mass (M_r)	- This is the **sum of all the atomic masses** (A_r)of the atoms in a molecule/compound. e.g. M_r of H_2O= 2x1 + 1x16 = 18; M_r of $CaCO_3$= 1x40 + 1x12 + 3x16 = 100 - In a balanced symbol equation: **M_r of the reactants = M_r of the products**
Explaining mass changes (when a reactant or product is a gas)	- **State symbols** in an equation show the state of the substance: **(s)** solid; **(l)** liquid; **(g)** gas; **(aq)** aqueous (=dissolved in water) - If there appears to be a change in mass in a reaction this is usually because **one of the reactants or products is a gas** whose mass has not been included. e.g. 2Mg $_{(s)}$ + O_2 $_{(g)}$ → 2MgO $_{(s)}$: the **mass** will appear to **increase**, because the magnesium is **gaining** the atoms of oxygen **gas**. e.g $CaCO_3$ $_{(s)}$ → CO_2 $_{(g)}$ + CaO $_{(s)}$: the **mass** appears to **decrease**, because carbon dioxide **gas** is made and **escapes into the air**.
Uncertainty in chemical measurements	- Whenever a measurement is made there is always some **uncertainty** about the result obtained. This can be represented on a graph by plotting the **range** of repeats as well as the **mean**. **The bigger the range around the mean, the more uncertainty there is** about the results.
4.3.2	**Moles, masses and concentrations**
Concentrations of solutions	- The concentration of a solution (aq) can be measured in **g/dm^3** (mass/volume) **Concentration = mass ÷ volume**
4.3.3	**Yield and atom economy**
Percentage Yield	**% yield = actual mass of product made ÷ expected mass of product (×100)** - It is not always possible to get all of the expected amount of a product because: • the reaction may not finish completely because it is a **reversible reaction** • **some of the product may be lost** when it is separated from the reaction mixture • some of the **reactants may react differently** to the expected reaction
Atom economy	**% atom economy = M_r of useful product ÷ total M_r of all reactants (x100)** - This is a measure of the percentage of starting reactants that end up as useful products. - It is important for **economic reasons** and for **sustainable development** to use reactions with a **high atom economy**.