AQA Trilogy-Chemistry key terms – Quantitative Chemistry

CONSERVATION OF MASS & RELATIVE FORMULA MASS	
CONSERVATION OF MASS 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.	**CONSERVATION OF MASS EXPERIMENTS** Experiments don't always show the conservation of mass. 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.
To find the relative formula mass (*Mr*) of a compound add all the relative atomic masses of the atoms in the formula. E.g. *M*r of CO2 = 12+16+16 = 44.	A particular element always has a fixed number of protons (its atomic number). Isotopes are atoms of the same element with different numbers of neutrons.
Mass number (*Ar*) (protons + neutrons) → Proton number (protons) → $^{23}_{11}Na$ Relative masses: proton=1, neutron =1 and electron = almost zero.	Calculate the percentage of an element in a compound from the formula and relative masses. E.g. Percentage C in CO_2 = $\frac{12}{44}$ X 100= 27%
MOLES (HT ONLY)	
One mole of any substance is its relative formula mass, in grams. The number of atoms, molecules or ions in a mole of a given substance is the Avogadro constant. The value of the Avogadro constant is 6.02×10^{23} per mole.	**We compare the masses of atoms by measuring them relative to atoms carbon-12.** One mole of carbon (C) the number of atoms is the same as the number of molecules in one mole of carbon dioxide (CO_2).
Balanced symbol equations tell us the number of moles of substances involved in a chemical reaction. $Mg + 2HCl\ MgCl_2 + H_2$ shows that one mole of magnesium reacts with two moles of hydrochloric acid to produce one mole of magnesium chloride and one mole of hydrogen gas.	The balancing numbers in a symbol equation can be calculated from the masses of reactants and products by converting the masses in grams to amounts in moles and converting the numbers of moles to simple whole number ratios.
The concentration of a solution can be measured in mass per given volume of solution, eg grams per dm3 (g/dm3) or mol/dm3.	**LIMITING REACTANTS (HT ONLY)** In a chemical reaction involving two reactants, it is common to use an excess of one of the reactants The reactant that is completely used up is called the limiting reactant because it limits the amount of products
PERCENTAGE YIELD / ATOM ECONOMY	

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The yield of a chemical reaction is how much product is made.	**Percentage yield =** $\dfrac{\textbf{Actual yield}}{\textbf{Theoretical yield}} \times 100$ **%**
It is not always possible to make the calculated yield - some product may be left in the apparatus or it may be hard to separate the product from other chemicals.	In a reversible reaction the products can react to make the original reactants. $A + B \rightleftharpoons C + D$
Reversible reactions may not have a high yield as the reactants may not have all reacted.	E.g. ammonium chloride $\rightleftharpoons$ ammonia + hydrogen chloride
The atom economy (atom utilisation) is a measure of the amount of starting materials that end up as useful products. It is important for sustainable development and for economic reasons to use reactions with high atom economy.	The percentage atom economy of a reaction is calculated using the balanced equation for the reaction as follows: $\dfrac{\text{Relative formula mass of desired product from equation}}{\text{Sum of relative formula masses of all reactants from equation}} \times 100$