Chemistry 3: Quantitative Chemistry

Section 1:Moles

Name	Definition	Example
Mass number (relative atomic mass)	Amount of protons and neutrons – the bigger number on the element symbol	
Relative formula mass	All of the relative atomic masses added up in a compound.	$CaCO_3$ = 40+12+(16x3) = 100
Percentage mass of a compound	$\frac{Ar\ x\ number\ of\ atoms\ of\ that\ element}{Mr\ of\ the\ compound}$ x 100	% of Na in NaCl = $\frac{23\ x\ 1}{23+35.5}$ x 100 = 39.3%
Mole	An amount of a substance. One mole of **any** substance contains $6.02x10^{23}$ atoms. Moles = $\frac{mass\ (g)}{Mr}$	Number of moles in 66g of CO_2 = $\frac{66}{12+16+16}$ = 1.5 mol
Balancing equations with moles	1.Calculate the moles of each substance. 2. Dive the number of moles of each substance by the smallest number of moles in the reaction. 3. Multiply if you don't have whole numbers. 4. Write the balanced equation by putting these numbers at the front	
Limiting reactant	The reactant that is used up first and causes the reaction to stop. The amount of product is directly proportional to the amount of this.	
Reacting masses (calculating how much product you can make)	Write out the balanced symbol equation. Work out relative formula mass. Work out number of moles of reactants . Use molar ratios to work out moles of product. Multiply the number of moles by the RFM of the product you're trying to find and this is your answer in g.	. Calculate the mass of aluminium oxide formed when 135 g of aluminium is burned in air. $4Al + 3O_2 \rightarrow 2Al_2O_3$ 1. Number of moles of Al = mass/M_r 135/27 = 5 moles. 2. Ratio from the equation shows that 4 moles of Al produce 2 moles of Al_2O_3 so 5 moles of Al produce 2.5 moles of Al_2O_3. 3. Mass of 2.5 moles of Al2O3 = moles x M_r = 2.5 x 102 = 255 g.
Conservation of mass	No atoms are destroyed or created during a chemical reaction – no mass is lost.	In a chemical reaction the mass may increase which is probably due to one of the reactants being a gas. In a chemical reaction the mass may appear to change which is probably due to a gas being given off as a product in the reaction.
Concentration	How much solute is dissolved in a certain volume. Unit =g/dm^3 Concentration= $\frac{mass\ of\ solute\ (g)}{volume\ of\ solvent\ (dm^3)}$	What is the concentration of a solution containing 30g of NaCl dissolved in 0.2dm^3 of water? 30/0.2 = 150g/dm^3
Concentration (Chemistry only)	How many moles are dissolved in a certain volume. Unit =mol/dm^3 Concentration= $\frac{number\ of\ moles\ of\ solute\ (mol)}{volume\ of\ solvent\ (dm^3)}$ Converting mol/dm3 to g/dm3 = multiply the moles by the Mr.	What is the concentration of a solution containing 1 mol of NaCl dissolved in 0.2dm^3 of water? 1/0.2 = 5 mol/dm^3

Chemistry 3: Quantitative Chemistry – Chemistry only

Section 1:Moles Name	Definition	Example
Molar gas volume	At the same temperature and pressure, equal numbers of moles of any gas will occupy the same volume. At room temperature this is $24dm^3$)	
Volume of gas	Volume of gas = $\frac{MAss\ of\ gas(g)}{Mr\ of\ gas}$ x 24	What's the volume of 319.5g of chlorine at r.t.p = $\frac{319.5}{71}$ x 24 = $108dm^3$
Atom economy	A Measure of how "green a process is" The higher the atom economy the more green the process. Atom economy = $\frac{relative\ formula\ mass\ of\ the\ desired\ product\ from\ the\ equation}{sum\ of\ the\ relative\ formula\ masses\ of\ the\ reactants\ from\ the\ equation}$ x100 100% atom economy only one product. Low atom economy – use up resources quickly, lots of waste, unsustainable, less profitable.	Calculate the atom economy for the production of CaO. $CaCO_3 \rightarrow CaO + CO_2$ $\frac{(40+16)}{(40+16+12+16+16)}$ x 100 = 56%
% Yield	Atom economy = $\frac{Mass\ of\ product\ actually\ made}{Maxiumum\ theoretical\ mass\ of\ product}$ x100 100% yield = All product you expected to get. 0% yield = no product.	Zn + 2HCl →ZnCl2 + H2. The theoretical yield of zinc chloride is 2.72g but after purification the sample weighed 2.31g. What was the % yield? $\frac{2.31}{2.71}$ x 100 = 84.9%
Reasons for yield not being 100%	Not all reactants react to make a product.	Reversible reactions – the products can return back to reactants
	There might be side reactions.	Reactants may react with other things in the air or impurities in the reaction mixture.
	May lose product whilst separating	When you filter a liquid you will always leave a bit of solid on the paper. Some of the liquid is absorbed onto the paper. Transferring liquids also causes a reduction in yield – you can never get all of the liquid out.