Chemistry 3: Quantitative Chemistry

Section 1: Bonding Key Terms

1 Law of conservation of mass	**No atoms** are **lost** or **gained** during a **chemical reaction**. The mass of the products is the same as the mass of the reactants. Some reactions **appear to give a change in mass**, but this is because a **gas may have escaped** from the reaction container.
2 Relative atomic mass (A_r)	The **average mass** of an **atom of an element** compared to Carbon-12.
3 Relative formula mass (M_r)	The **sum** of **all the atomic masses** of the atoms in a **formula** (e.g. H_2O).
4 Uncertainty	The **interval** within which the **true value** can be **expected to lie**. E.g. 25°C $\pm$ 2°C – the true value lies between 23°C and 27°C.
5 Mole (HT)	A measurement for the amount of a chemical. It is the **mass** (in grams) of **6.02×10^{23}** (the Avogadro constant) **atoms of an element**. Symbol: mol.
6 Balanced equation (HT)	Balanced symbol equations show **the number of moles that react**. e.g. $Mg + 2HCl \rightarrow MgCl_2 + H_2$ Shows one mole of magnesium reacting with two moles of hydrochloric acid to form one mole of magnesium chloride and one mole of hydrogen.
7 Limiting reactant (HT)	The **reactant** that is **completely used up** in a chemical reaction. It **limits the amount of product** formed.
8 Excess reactant (HT)	The reactant that is **not completely used up** in a chemical reaction. There is some reactant left at the end.
9 Concentration	A measure of the **number of particles** of a chemical in a **volume**. Can be measured in **g/dm^3**.
10 Decimetre^3 (dm^3)	A **measurement of volume**. Contains **$1000cm^3$**.

Section 2: Calculations and Examples

11 Calculating relative formula mass (M_r)	Add up all the atomic masses in a formula. e.g. H_2O. Mass of hydrogen = 1. Mass of oxygen = 16. (2x1) + 16 = 18
12 Percentage uncertainty	Percentage uncertainty $= \frac{\text{Uncertainty}}{\text{Quantity being measured}} \times 100$ e.g. What is the percentage uncertainty of a $50cm^3$ measuring cylinder accurate to $\pm 2cm^3$? Percentage uncertainty $= \frac{2}{50} \times 100 = 4\%$
13 Number of moles	Number of moles $= \frac{\text{Mass of chemical}}{\text{Relative formula mass}}$ e.g. How many moles of water are there in 36g of H_2O? Number of moles $= \frac{36}{18} = 2$ moles
14 Volume in dm^3	Volume in $dm^3 = \frac{\text{volume of liquid}}{1000cm^3}$ e.g. What is the volume in dm^3 of $500cm^3$ of hydrochloric acid? Volume in $dm^3 = \frac{500}{1000} = 0.5dm^3$
15 Concentration of a solution	Concentration $= \frac{\text{Mass of solute}}{\text{Volume (in } dm^3)}$ e.g. What is the concentration of a solution of hydrochloric acid which contains 100g of hydrochloric acid in $500cm^3$? Concentration $= \frac{100}{0.5} = 200g/dm^3$