

Chapter 3: Stoichiometry: Chemical Calculations

Atomic book keeping

Calculation Atomic mass and molecular/formula mass: separate all the atoms in the molecular formula and find atomic mass from periodic table and add the mass to obtain formula/molecular mass.

The Mole

1 mole = 6.02×10^{23} atoms = atomic mass of element (from the PT)

1 mol of Au atoms = 6.02×10^{23} atoms = 196.9665 g/mol

1 mol of Cl₂ = 6.02×10^{23} Cl₂ atoms = 79.906g /mol of Cl₂

1 mol of AlCl₃ = 6.02×10^{23} atoms

1 mol Al³⁺ ions and 3 mols Cl⁻ ions.

Mass percent composition

- 1) see molecular formula
- 2) add up all similar atoms
- 3) calculate mass of the different atom(s)
- 4) calculate formula mass
- 5) divide mass of different atoms by formula mass and multiply by 100%
- 6) add all %s to make sure you get hundred (there should be no other units left)

Other calculations using moles e.g. mass of an element in a given compound.

Elemental Analysis and Calculation of molecular formula.

Review: empirical formula and relationship to molecular formula.

Stoichiometry

Writing and balancing chemical equations

Reactant(s) \longrightarrow product(s)

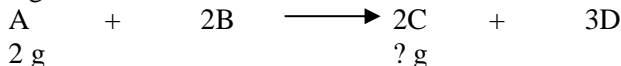
Solid (s), liquid (l), gas (g), aqueous (aq)

Coefficient – the number in front of compound or element after balancing the equation.

Calculations using stoichiometry:

- 1) write equation
- 2) balance equation
- 3) write quantities given under compounds/elements
- 4) start with what you know!!!!
 - a. Calculate mols of given quantity
 - b. Find the mol ratio of given to needed from the balanced equation
 - c. Convert mol to gram of the answer.

e.g.



$$\frac{2 \text{ g } A}{g \text{ } A} \times \frac{1 \text{ mol } A}{g \text{ } A} \times \frac{2 \text{ mol } C}{1 \text{ mol } A} \times \frac{g \text{ } C}{1 \text{ mol } C} = g \text{ } C$$

Limiting reagent: need to calculate mols of all starting materials to find out which is less, that will be the limiting reagent.

Percent yields:

Percent Yield = actual/theoretical x 100%

(Theoretical – from stoichiometric calculations and Actual – after performing experiment in the lab)

