OCR A GCSE Chemistry

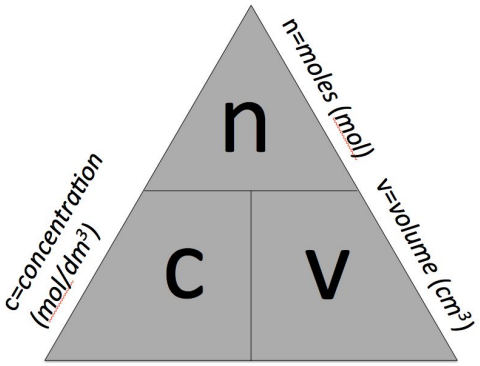
Topic 5: Monitoring and controlling chemical reactions

Monitoring chemical reactions

Notes

C5.1a (HT only) explain how the concentration of a solution in mol/dm^3 is related to the mass of the solute and the volume of the solution

- Concentration of a solution can be measured in moles per given volume of solution e.g. moles per dm^3 (mol/dm^3)
- To calculate moles of solute in a given volume of a known concentration use moles = conc x vol i.e. mol = mol/dm^3 x dm^3 (think about the units!)
- a smaller volume or larger number of moles of solute gives a higher concentration
- a larger volume or smaller number of moles of solute gives a lower concentration



C5.1b describe the technique of titration

The volumes of acid and alkali solutions that react with each other can be measured by titration using a suitable indicator.

method:

1. add acid to burette using a funnel, record the volume in the burette to start
2. add known volume of alkali to a conical flask and add some indicator
3. place conical flask on white tile (so you can see colour change clearly)
4. add acid to alkali until you reach the end point
5. calculate how much acid has been added (titre)
6. repeat until you get concordant titres

C5.1c (HT only) explain the relationship between the volume of a solution of known concentration of a substance and the volume or concentration of another substance that react completely together

- $1dm^3 = 1000cm^3$
- One mole of a substance in grams the same as its relative atomic mass in grams.

- once you have carried out a titration, you know the exact volume of an acid that reacts with the exact volume of an alkali

- if you only knew the concentration of the acid and wanted to calculate the concentration of the alkali:
    - calculate moles of acid using moles = concentration x volume
    - calculate the mole ratio of acid to alkali using the equation for the reaction
    - work out how many moles of alkali you have using the mole ratio and moles of acid (e.g. if you have 5 moles of acid and the ratio of acid to alkali is 1:2, you will have 10 moles of alkali)
    - calculate the concentration of the alkali using concentration = mol ÷ volume
- follow the same method for if you have both concentrations but only one volume

C5.1d (HT only) describe the relationship between molar amounts of gases and their volumes and vice versa

- Equal amounts in mol. of gases occupy the same volume under the same conditions of temperature and pressure (e.g. RTP)
- Volume of 1 mol. of any gas at RTP (room temperature and pressure: 20 degrees C and 1 atmosphere pressure) is 24 dm^3
- This sets up the equation:

Volume (dm^3) of gas at RTP = Mol. x 24
Volume (cm^3) of gas at RTP = mol x 24,000

- Use this equation to calculate the volumes of gaseous reactants and products at RTP
    - e.g. if you had 6 moles of O_2, at RTP you would have a volume of 6 x 24 = 144 dm^3 of O_2

C5.1e (HT only) calculate the volumes of gases involved in reactions using the molar gas volume at room temperature and pressure (assumed to be 24dm^3)

- see C5.1d

C5.1f (HT only) explain how the mass of a solute and the volume of the solution is related to the concentration of the solution

concentration = mass of solute ÷ volume of solution

- smaller mass or larger volume → smaller concentration
- larger mass or smaller volume → larger concentration

C5.1g calculate the theoretical amount of a product from a given amount of reactant

- if you are given a balanced equation, the mass/volume of a reactant and are asked to calculate the theoretical mass/volume of a product:
    - calculate moles of the reactant
      if given a mass: moles=mass ÷ molar mass
      if given a volume: moles = volume ÷ 24
    - work out the mole ratio and so work out how many moles of the product you have
    - calculate mass/volume using moles
      for calculating mass, mass=moles x molar mass
      for calculating volume, volume=moles x 24

C5.1h calculate the percentage yield of a reaction product from the actual yield of a reaction

$$\text{Percentage yield} = \frac{\text{Amount of product produced}}{\text{Maximum amount of product possible}} \times 100$$

C5.1i define the atom economy of a reaction

- A measure of the amount of reactants that become useful products (or of the efficiency of a reaction)

C5.1j calculate the atom economy of a reaction to form a desired product from the balanced equation

- atom economy = (Mr of desired product from reaction / sum of Mr of all reactants) x 100

C5.1k (HT only) explain why a particular reaction pathway is chosen to produce a specified product given appropriate data

- Be prepared to give reasons why a particular reaction pathway is chosen, in reference to information given in the question regarding atom economy, yield, rate, equilibrium position and usefulness of by-products