OCR A GCSE Chemistry

Topic 5: Monitoring and controlling chemical reactions

Controlling reactions

Notes

C5.2a suggest practical methods for determining the rate of a given reaction

- Use equations below to find the rate of reaction to compare the effect of changes in surface area/particle size, concentration, temperature, use of a catalyst etc...
- Rates of reactions can be measured using the amount of product used, or amount of product formed over time:

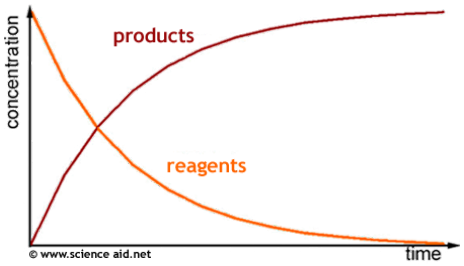
$$\text{Rate of reaction} = \frac{\text{amount of reactant used}}{\text{Time}}$$

$$\text{Rate of reaction} = \frac{\text{amount of product formed}}{\text{Time}}$$

  - Quantity of reactant or product can be measured by the mass in grams or by a volume in cm^3
  - Units of rate of reaction may be given as g/s or cm^3/s
  - Use quantity of reactants in terms of moles and therefore, units for rate of reaction in mol/s
- You would want to do multiple experiments changing the variable e.g. if it was temperature do the experiment at 20˚C, 25˚C, 30˚C etc... measuring the rate each time to then compare (possibly graphically)
- If a gas is produced from a reaction...
  - Measure the volume of a gas (if the gas is a product) using a gas syringe or an upside down measuring cylinder or burette
  - Record the total volume of gas collected at regular intervals and plot a graph
  - Use the rate of reaction equation above
    - In the example of production of a gas, you would do: volume of gas / time taken to find the rate at the specific time

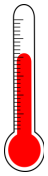
C5.2b interpret rate of reaction graphs

- Concentration of products increases as the reaction proceeds
- Concentration of reactants decreases as the reaction proceeds
- The gradient of the line/slope = the rate of reaction
- 1/t is proportional to rate and gradients of graphs



C5.2c describe the effect of changes in temperature, concentration, pressure, and surface area on rate of reaction

- increasing temperature, pressure or concentration increases the rate of reaction



C5.2d explain the effects on rates of reaction of changes in temperature, concentration and pressure in terms of frequency and energy of collision between particles

- Increasing the temperature increases the rate of reaction. As increasing temperature increases the speed of the moving particles, so they collide more frequently and energetically.
- Increasing concentration of reacting solutions increases the rate of reaction, as it increases the frequency of collisions.
- Increasing pressure of reacting gases increases the rate of reaction, as it increases the frequency of collisions.

C5.2e explain the effects on rates of reaction of changes in the size of the pieces of a reacting solid in terms of surface area to volume ratio

- A greater surface area to volume ratio means a greater rate of reaction
- Look at the pictures of cubes above – from left to right surface area to volume ratio is increasing
- As this increases, there are more surfaces for a reaction to occur – increasing frequency of collisions and therefore increasing the rate

C5.2f describe the characteristics of catalysts and their effect on rates of reaction

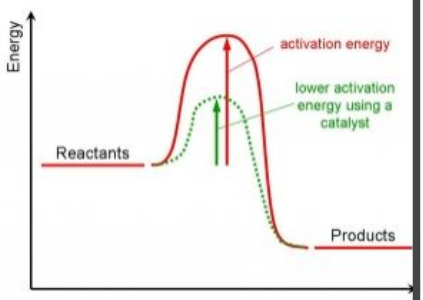
- Catalysts are substances that speed up chemical reactions without being changed or used up during the reaction, (enzymes are biological catalysts).

C5.2g identify catalysts in reactions

- Remain unchanged throughout the reaction, so is not included in the reaction equation (if they were they'd be the same on both sides)

C5.2h explain catalytic action in terms of activation energy

- Catalysts increase rate of reaction by providing an alternative pathway, which has a lower activation energy – therefore there are now more particles / reactants with an energy greater than that of the activation energy, meaning rate of reaction increases



C5.2i recall that enzymes act as catalysts in biological systems