AQA GCSE Chemistry

Topic 5: Energy changes

Exothermic and endothermic reactions

Notes

(Content in bold is for Higher Tier only)

Energy transfer during exothermic and endothermic reactions

- When chemical reactions occur, energy is conserved.
    - The amount of energy in the universe at the beginning is the same as at the end.
    - this means if a reaction transfers energy to the surroundings, the product molecules must have less energy than the reactants, by the amount transferred

Exothermic reactions

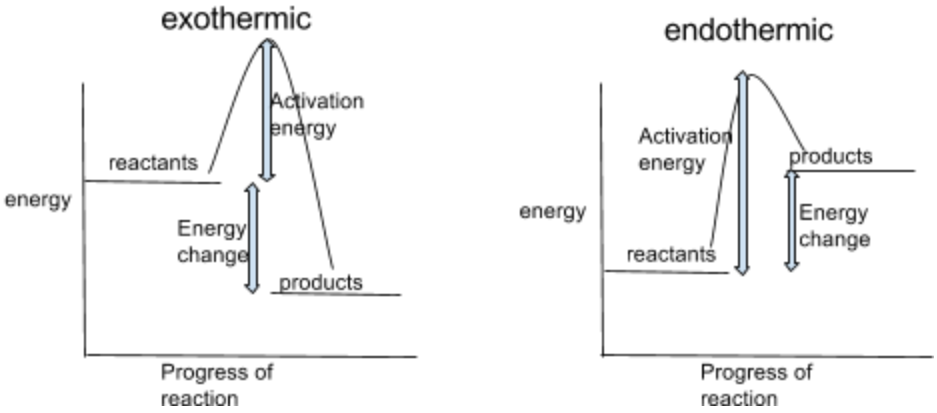
- An exothermic reaction is one that transfers energy to the surroundings so the temperature of the surroundings increases.
    - Product molecules must have less energy than the reactants, by the amount transferred.
- Examples of exothermic reactions include; combustion, many oxidisation reactions and neutralisation.
- Everyday examples of exothermic reactions include; self-heating cans (e.g for coffee) and hand warmers.

Endothermic reactions

- An endothermic reaction is one that takes in energy from the surroundings so the temperature of the surroundings decreases.
    - product molecules must have more energy than reactants
- Examples of endothermic reactions are thermal decomposition and the reaction of citric acid and sodium hydrogencarbonate.
- Some sports injury packs are based on endothermic reactions.

Reaction profiles

- Chemical reactions can occur only when reacting particles collide with each other and with sufficient energy.
    - Activation energy = minimum amount of energy that particles must have to react



- Reaction profiles can be used to show the relative energies of reactants and products, the activation energy and the overall energy change of a reaction:
- you can tell which reaction is exothermic or endothermic by looking at whether the reactants or products have more energy (higher up energy scale=higher energy)
    - exothermic: heat released to the surroundings, so products have less energy than reactants
    - endothermic: heat taken in from surroundings, so products have more energy than reactants

The energy change of reactions

- **During a chemical reaction:**
    - **Energy must be SUPPLIED to BREAK bonds in the reactants**
    - **Energy is RELEASED when bonds in the products are FORMED**
- **The energy needed to break bonds and energy released when bonds are formed can both be calculated from bond energies**
    - **Sum of energy taken in to break bonds – sum of energy released to form bonds = overall energy change**
- **Energy taken in to break > energy released when formed = ENDOTHERMIC (because overall energy has been taken in)**
- **Energy taken in to break < energy released when formed = EXOTHERMIC (because overall energy has been released)**