Edexcel GCSE Chemistry

Topic 7: Rates of reaction and energy changes

Heat energy changes in chemical reactions

Notes

7.9 Recall that changes in heat energy accompany the following changes: salts dissolving in water, neutralisation reactions, displacement reactions, and precipitation reactions and that, when these reactions take place in solution, temperature changes can be measured to reflect the heat changes

- Salts dissolving in water is either exothermic or endothermic
- Neutralisation reaction is exothermic
- Displacement is an exothermic or endothermic reaction
- Precipitation is an exothermic reaction

- if these reactions take place in a solution, you can carry them out in a polystyrene cup with a lid, and measure the temperature change using a thermometer

7.10 Describe an exothermic change or reaction as one in which heat energy is given out

- An exothermic reaction is one that transfers energy to the surroundings so the temperature of the surroundings increases.
- Examples of exothermic reactions include; combustion, many oxidation reactions and neutralisation.
- Everyday examples of exothermic reactions include; self-heating cans (e.g for coffee) and hand warmers.

7.11 Describe an endothermic change or reaction as one in which heat energy is taken in

- An endothermic reaction is one that takes in energy from the surroundings so the temperature of the surroundings decreases.
- 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.

7.12 Recall that the breaking of bonds is endothermic and the making of bonds is exothermic

- During a chemical reaction:
  - Energy must be SUPPLIED to BREAK bonds in the reactants
  - Energy is RELEASED when bonds in the products are FORMED

7.13 Recall that the overall heat energy change for a reaction is: exothermic if more heat energy is released in forming bonds in the products than is required in breaking bonds in the reactants and endothermic if less heat energy is released in forming bonds in the products than is required in breaking bonds in the reactants

- 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)

7.14 (HT only) Calculate the energy change in a reaction given the energies of bonds (in kJ mol^{-1})

- 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
- If the energy out > energy in, the energy change will be negative showing an exothermic reaction and if the energy out < energy in, the energy change will be positive showing an endothermic reaction

7.15 Explain the term activation energy

- 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

7.16 Draw and label reaction profiles for endothermic and exothermic reactions, identifying activation energy

- 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.
- for the exothermic diagram, the products have less energy than the reactants, because the energy has been released to the surroundings
- for the endothermic diagram, the reactants have less energy than the products, because the energy has been taken in from the surroundings