Energy Change

Parvez Bohoran

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Topic-Energy Change

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Exothermic and Endothermic

Introduction

When a chemical reaction takes place, energy is either released into the surroundings or taken from the reaction. These are known as exothermic and endothermic reactions.

CONSERVATION OF ENERGY

Energy is never created or destroyed, it is only conserved.

Exothermic

In an exothermic reaction, the temperature around the reaction **increases** as energy is being **released into** the surroundings. This means there is an **increase in heat energy** which can be measured.

Examples:

- Combustion
- Respiration

Endothermic

In an endothermic reaction, the temperature around the reaction **decreases** as energy is being **taken from** the surroundings. This means there is a **decrease in temperature**.

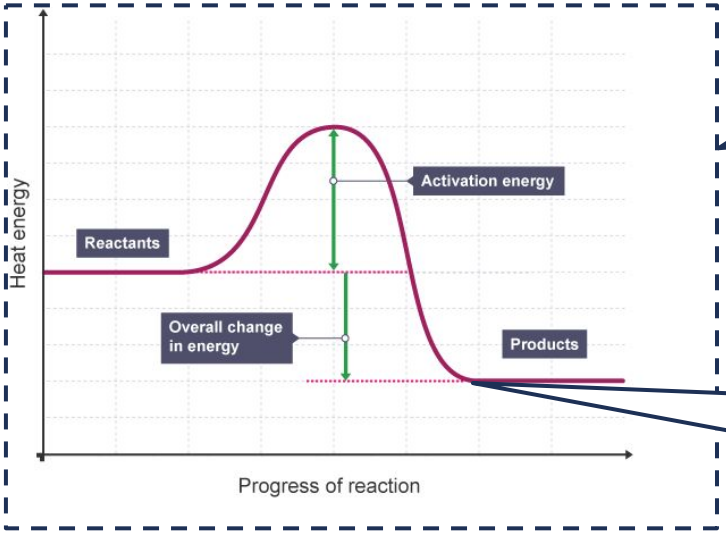
Examples:

- Thermal decomposition
- the reaction of citric acid and sodium hydrogen carbonate

Reaction Profiles

Reaction profiles are **energy level diagrams** which show whether a reaction is Endothermic or Exothermic. It shows the **energy in the reactants and products during the reaction.**

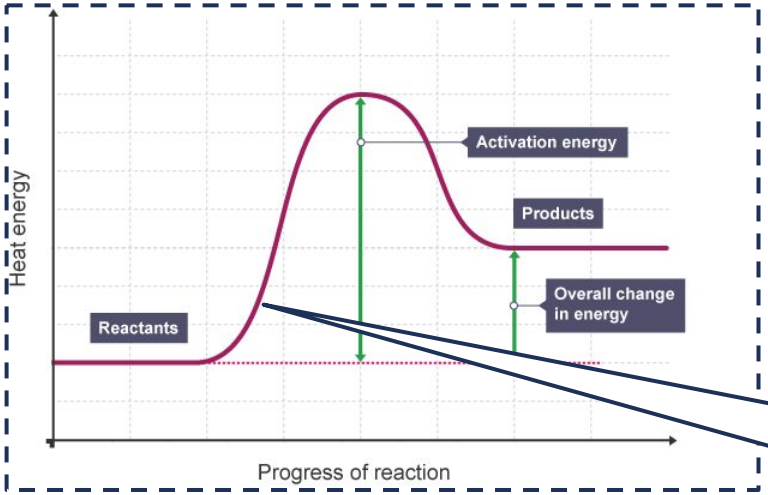
Exothermic



This shows the reaction profile for an exothermic reaction

More energy goes into the product(energy being released)

Exothermic



This shows the reaction profile for an endothermic reaction

More energy goes into the reactant(energy being taken in)

Temperature Change

Required Practical: Temperature Change

In this practical, we investigate the variables that affect temperature changes in a reacting solution:

Sodium hydroxide+hydrochloric acid→sodium chloride + water

$$HCl_{(aq)}+NaCl_{(aq)}\rightarrow NaCl_{(aq)}+H_2O_{(aq)}$$

Independent variable=volume of sodium hydroxide
Dependant variable=maximum temperature reached
Control variable=volume of hydrochloric acid

This reaction is a neutralisation practical

Method

1. Start by measuring 30 cm cubed of dilute hydrochloric acid
2. Pour this into the polystyrene cup
3. Record start temperature
4. Add 5 cm cubed of sodium hydroxide solution to the cup
5. Then measure the temperature of this reaction until it has reached maximum temperature

Why a polystyrene cup?

It is a good insulator so the results are more accurate

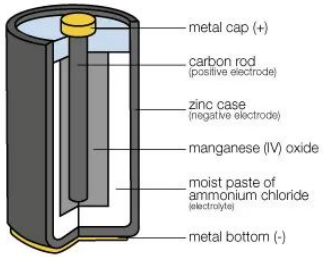
Cells and Batteries

Cells and Batteries

- Cells contain chemicals which **react to produce electricity**
- A simple cell can be made by connecting two different metals in contact with an electrolyte.
- Connecting 2 or more cells together creates a battery
- In Non rechargeable cells and batteries, once the **chemical reactants have run up, the battery 'goes flat'**

Factors affecting the voltage:

★ The difference in reactivity between the reactants
★ What the electrodes are made from
★ Substance used for electrolyte



Fuel Cells

Fuel cells produce a voltage continuously, as long as they are supplied with:

- a constant supply of a suitable fuel
- oxygen

The fuel is **oxidised** electrochemically rather than being burned so energy can be released as electrical energy, not thermal energy.

Hydrogen fuel cells

- Oxygen and hydrogen are used to create a voltage.This makes water the only product:
  Hydrogen +oxygen→Water
- **In this, Hydrogen is being used as the fuel**
- **Oxygen is being taken in**
- **Water is produced**