Your notes

GCSE Chemistry: revision notes

Exothermic and endothermic reactions

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Start here: reactions take in or give out energy

- Every reaction has an energy change, because bonds in the reactants are broken and new bonds are made in the products.
- If a reaction gives out energy to the **surroundings**, the temperature goes up: it is **exothermic**, like burning. If it takes energy in, the temperature goes down: it is **endothermic**, like a sports cold pack.
- The energy is not used up or created: it moves between the chemicals and the **surroundings**.

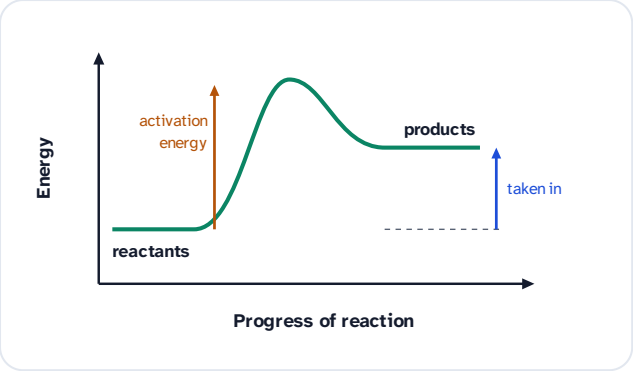
Exothermic reactions

- Energy is conserved in chemical reactions: the total energy of the universe is the same before and after.
- An **exothermic** reaction transfers energy to the **surroundings**, so the temperature of the **surroundings** increases.
- Examples: **combustion**, many oxidation reactions and neutralisation.
- Uses: self-heating cans and hand warmers.

Endothermic reactions

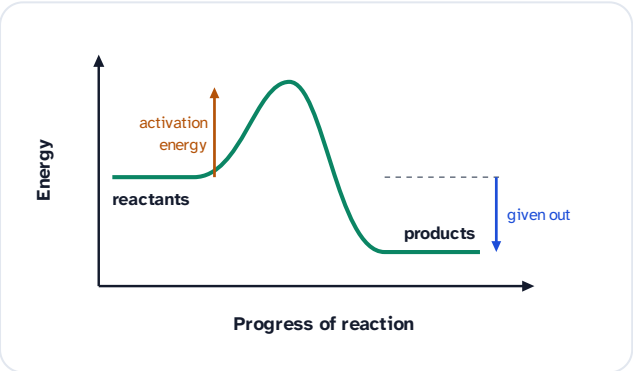
- An **endothermic** reaction takes in energy from the **surroundings**, so the temperature of the **surroundings** decreases.
- Examples: **thermal decomposition**, and the reaction of citric acid with sodium hydrogencarbonate.

- Uses: some sports injury packs (instant cold packs).



Reaction profiles

- Chemical reactions happen only when particles collide with enough energy. The minimum energy needed is the **activation energy**.
- A **reaction profile** shows the energy of the reactants and products, the **activation energy** (the 'hump') and the overall energy change.
- **Exothermic**: the products are lower in energy than the reactants. **Endothermic**: the products are higher in energy than the reactants.



Required practical: temperature changes

- Put a measured volume of one solution (such as hydrochloric acid) in a polystyrene cup inside a beaker, and record its starting temperature.
- Add the other reactant (such as sodium hydroxide solution, a metal or a carbonate), stir, and record the highest (or lowest) temperature.
- The polystyrene cup and a lid reduce energy transfer to or from the **surroundings**.
- Repeat, changing one variable (such as the volume of alkali added), and keep the others the same.

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Exam tip

- **Exothermic** reactions warm the **surroundings**, so the products are lower on an energy profile. The **activation energy** arrow goes from the reactants up to the peak.
- (Higher) For bond energies, do energy to break bonds minus energy released making bonds.

Common mistakes

- Saying breaking bonds releases energy. It takes energy in.
- Drawing the **activation energy** from the products or from zero.

Worked examples

During a reaction, the temperature goes from 21 °C to 29 °C. Is it exothermic or endothermic?

Work out the temperature change. **29 − 21 = +8 °C**

The temperature went up, so the reaction gave out energy to the surroundings. **energy given out**

Answer: Exothermic

Key terms

Exothermic	A reaction that transfers energy to the surroundings, so the temperature rises.
Endothermic	A reaction that takes in energy from the surroundings, so the temperature falls.
Activation energy	The minimum energy that particles must have to react when they collide.
Reaction profile	A diagram showing the energy of reactants and products during a reaction.
Combustion	Burning a substance in oxygen, an exothermic reaction.
Thermal decomposition	Breaking down a substance by heating it, an endothermic reaction.
Surroundings	Everything around the reacting chemicals, including the container and solvent.

Quick questions

Cover the answers and test yourself: remembering is what makes it stick.

1. What happens to the temperature of the surroundings in an exothermic reaction?
2. Which of these is an endothermic reaction?

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3. Which product uses an exothermic reaction?
4. Which product uses an endothermic reaction?
5. What is activation energy?
6. On a reaction profile for an exothermic reaction, where are the products?
7. Why is a polystyrene cup used in the temperature change practical?
8. Is neutralisation exothermic or endothermic?

Answers

1. It increases
2. Thermal decomposition
3. A hand warmer
4. An instant cold pack for sports injuries
5. The minimum energy particles need to react when they collide
6. Lower in energy than the reactants
7. To reduce energy transfer to or from the surroundings
8. Exothermic

What to do next

Practise 10 questions on this topic

Try 7 exam questions, with mark schemes

Read the lesson, one step at a time

Free revision for GCSE and KS3 at lycolearn.co.uk. Some notes are for one exam board only, and say so in brackets.

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