Your notes

GCSE Chemistry: revision notes

Reversible reactions and equilibrium

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Reversible reactions

- In some reactions, the products can react to produce the original reactants. These are **reversible reactions**, shown by ⇌.
- Example: ammonium chloride ⇌ ammonia + hydrogen chloride. Heating breaks it down; cooling makes it reform.
- If a **reversible reaction** is exothermic in one direction, it is endothermic in the other, and the same amount of energy is transferred each way.
- Example: **hydrated** copper sulfate (blue) ⇌ **anhydrous** copper sulfate (white) + water. Heating is endothermic; adding water is exothermic and turns the white solid blue.

Dynamic equilibrium

- When a **reversible reaction** happens in a **closed system**, where nothing can escape, **equilibrium** is reached.
- At **equilibrium**, the forward and reverse reactions happen at exactly the same rate, so the amounts of reactants and products stay constant.
- It is called **dynamic** because both reactions are still happening.

Le Chatelier's principle (Higher)

- If a system at **equilibrium** is subjected to a change in conditions, the system responds to counteract the change.
- Concentration: increasing the concentration of a reactant makes more product form, until **equilibrium** is reached again.
- Temperature: increasing the temperature favours the endothermic direction; decreasing it favours the exothermic direction.

- Pressure (for gases): increasing the pressure favours the side with fewer molecules of gas.

The Haber process example (Higher)

- $N_2 + 3H_2 \rightleftharpoons 2NH_3$. The forward reaction is exothermic, and there are 4 molecules of gas on the left and 2 on the right.
- High pressure moves the **equilibrium** to the right, giving more ammonia.
- Low temperature would give more ammonia but a slow rate, so a compromise temperature (about 450 °C) is used with an iron catalyst.

Key terms

Reversible reaction	A reaction in which the products can react to reform the reactants.
Equilibrium	The state in a closed system when the forward and reverse reactions happen at the same rate.
Dynamic	Still happening; at dynamic equilibrium both reactions continue.
Closed system	A system where no reactants or products can escape.
Le Chatelier's principle	A system at equilibrium responds to a change in conditions to counteract the change.
Anhydrous	Without water.
Hydrated	Containing water molecules within its crystals.
Haber process	The industrial process that makes ammonia from nitrogen and hydrogen.

Quick questions

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

1. What does the symbol $\rightleftharpoons$ mean?
2. What colour is anhydrous copper sulfate?
3. If a reversible reaction is exothermic forwards, what is the reverse reaction?
4. When is dynamic equilibrium reached?
5. Where can equilibrium be reached?
6. What happens when water is added to anhydrous copper sulfate?
7. Increasing the temperature favours which direction? (Higher)
8. Increasing the pressure favours which side? (Higher)

Answers

1. A reversible reaction
2. White
3. Endothermic

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4. When the forward and reverse reactions happen at the same rate
5. In a closed system
6. It turns blue and gets warm
7. The endothermic direction
8. The side with fewer molecules of gas

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

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