



Cambridge (CIE) A Level Chemistry



The Reactions of Chlorine

Contents

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Reaction of Chlorine

- A **disproportionation reaction** is a reaction in which the same species is both oxidised and reduced
- The reaction of **chlorine** with **dilute alkali** is an example of a disproportionation reaction
- In these reactions, the chlorine gets oxidised and reduced at the same time
- Different reactions take place at different **temperatures** of the dilute alkali

Chlorine in cold alkali (15 °C)

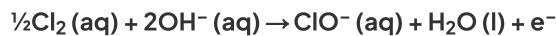
- The reaction that takes place is:



- The ionic equation is:



- The ionic equations show that the chlorine undergoes disproportionation, i.e. gets both oxidised and reduced
- Chlorine gets oxidised as there is an increase in oxidation number from 0 in $\text{Cl}_2(\text{aq})$ to +1 in $\text{ClO}^-(\text{aq})$
 - The half-equation for the oxidation reaction is:



- Chlorine gets reduced as there is a decrease in oxidation number from 0 in $\text{Cl}_2(\text{aq})$ to -1 in $\text{Cl}^-(\text{aq})$
 - The half-equation for the reduction reaction is:



Chlorine in hot alkali (70 °C)

- The reaction that takes place is:



- The ionic equation is:



- The ionic equations show that the chlorine undergoes disproportionation, i.e. gets both oxidised and reduced
- Chlorine gets oxidised as there is an increase in oxidation number from 0 in $\text{Cl}_2(\text{aq})$ to +5 in $\text{ClO}_3^-(\text{aq})$



Your notes

- The half-equation for the oxidation reaction is:
 $\frac{1}{2}\text{Cl}_2(\text{aq}) + 6\text{OH}^-(\text{aq}) \rightarrow \text{ClO}_3^-(\text{aq}) + 3\text{H}_2\text{O}(\text{l}) + \text{e}^-$
- Chlorine gets reduced as there is a decrease in oxidation number from 0 in $\text{Cl}_2(\text{aq})$ to -1 in $\text{Cl}^-(\text{aq})$
 - The simplified half-equation for the reduction reaction is:

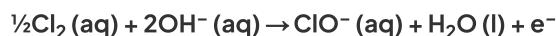


Chlorine in Water Purification

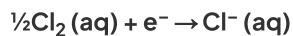
- Chlorine can be used to clean water and make it drinkable
- The reaction of chlorine in water is a **disproportionation reaction** in which the chlorine gets both **oxidised** and **reduced**



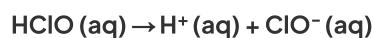
- The ionic equations show that the chlorine undergoes disproportionation, i.e. gets both oxidised and reduced
- Chlorine gets oxidised as there is an increase in oxidation number from 0 in $\text{Cl}_2(\text{aq})$ to +1 in $\text{ClO}^-(\text{aq})$
 - The half-equation for the oxidation reaction is:



- Chlorine gets reduced as there is a decrease in oxidation number from 0 in $\text{Cl}_2(\text{aq})$ to -1 in $\text{Cl}^-(\text{aq})$
 - The half-equation for the reduction reaction is:



- Chloric(I) acid (HClO) **sterilises** water by killing **bacteria**
- Chloric acid can further dissociate in water to form $\text{ClO}^-(\text{aq})$:



- $\text{ClO}^-(\text{aq})$ also acts as a **sterilising agent** cleaning the water



Examiner Tips and Tricks

Adding chlorine to a water supply is an effective way to make the water safe to drink as it forms the sterilising agent HClO which in turn dissociates in water into another sterilising agent, $\text{ClO}^-(\text{aq})$