CIE Chemistry IGCSE

Topic 5 - Electricity and Chemistry

Flashcards

What does the term electrolysis mean?

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The breakdown of a molten or aqueous ionic compound using electricity.

What is the cathode and anode?

What is the cathode and anode?

Cathode - negative electrode

Anode - positive electrode

What is formed at each electrode in electrolysis?

What is formed at each electrode in electrolysis?

Positive electrode: Non metal

Negative electrode: Metal or hydrogen

How can you predict whether a metal or hydrogen will form at the negative electrode during electrolysis of an aqueous compound?

How can you predict whether a metal or hydrogen will form at the negative electrode during electrolysis of an aqueous compound?

If hydrogen is above the metal in the reactivity series then the metal will form. If the metal is more reactive than hydrogen then hydrogen will form.

What forms at each electrode during the electrolysis of molten lead(II) bromide?

What forms at each electrode during the electrolysis of molten lead(II) bromide?

Positive electrode: Bromine

Negative electrode: Lead

What forms at each electrode during the electrolysis of concentrated hydrochloric acid?

What forms at each electrode during the electrolysis of concentrated hydrochloric acid?

Positive electrode: Chlorine

Negative electrode: Hydrogen

What forms at each electrode during the electrolysis of concentrated sodium chloride solution?

What forms at each electrode during the electrolysis of concentrated sodium chloride solution?

Positive electrode: Chlorine

Negative electrode: Hydrogen

What forms at each electrode during the electrolysis of dilute sulfuric acid?

What forms at each electrode during the electrolysis of dilute sulfuric acid?

Positive electrode: Oxygen

Negative electrode: Hydrogen

How can the products of electrolysis of molten electrolytes be predicted?

How can the products of electrolysis of molten electrolytes be predicted?

Positive electrode: non-metal element

Negative electrode: metal element

Predict what forms at each electrode during the electrolysis of molten zinc chloride

Predict what forms at each electrode during the electrolysis of molten zinc chloride

Positive electrode: Chlorine

Negative electrode: Zinc

What forms at each electrode during the electrolysis of copper sulfate solution using inert electrodes?

(extended only)

What is formed at each electrode during the electrolysis of copper sulfate solution using inert electrodes? (extended only)

Positive electrode: Oxygen

Negative electrode: Copper

What forms at each electrode during the electrolysis of copper sulfate solution using copper electrodes?

(extended only)

What is formed at each electrode during the electrolysis of copper sulfate solution using copper electrodes? (extended only)

Positive electrode: Copper ions (Cu^{2+})

Negative electrode: Copper

Describe the electrolysis of copper (II) sulfate solution using carbon electrodes (extended only)

Describe the electrolysis of copper (II) sulfate solution using carbon electrodes (extended only)

- Place the inert carbon electrodes into a beaker of copper sulfate solution.
- Connect the electrodes to a power supply.
- Copper ions gain electrons at the cathode to form pure copper. Oxygen ions lose electrons at the anode to form oxygen gas.

How can impure copper be purified using copper sulfate solution and copper electrodes?

(extended only)

How can impure copper be purified using copper sulfate solution and copper electrodes? (extended only)

Electrolysis:

- The anode is made of impure copper and the cathode is made of pure copper.
- The electrodes are placed in a solution of copper sulfate.
- The copper ions from the impure anode move to the cathode where they gain electrons and form pure copper.
- Impurities form as sludge below the anode.

Where do ions in the electrolyte move to during electrolysis?

(extended only)

Where do ions in the electrolyte move to during electrolysis? (extended only)

Cations (positive ions) move towards the cathode (negative electrode).

Anions (negative ions) move towards the anode (positive electrode).

What happens at the anode during electrolysis?

(extended only)

What happens at the anode during electrolysis? (extended only)

The anions (negatively charged ions) lose electrons to form their elements. This is oxidation.

What happens at the cathode during electrolysis?

(extended only)

What happens at the cathode during electrolysis? (extended only)

Cations (positively charged ions) gain electrons to form their elements. This is reduction.

Predict the products of electrolysis of concentrated potassium bromide solution (extended only)

Predict the products of electrolysis of concentrated potassium bromide solution (extended only)

Positive electrode: Bromine

Negative electrode: Hydrogen

Predict the products of electrolysis of concentrated copper iodide solution (extended only)

Predict the products of electrolysis of concentrated copper iodide solution (extended only)

Positive electrode: Iodine

Negative electrode: Copper

Predict the products of electrolysis of dilute zinc chloride solution (extended only)

Predict the products of electrolysis of dilute zinc chloride solution (extended only)

Positive electrode: Oxygen

Negative electrode: Zinc

What is electroplating?

What is electroplating?

A process in which a metal is coated with a layer of another metal.

What are two reasons for using electroplating?

What are two reasons for using electroplating?

- To increase resistance to corrosion.
- To improve appearance (e.g. silver plated cutlery).

Explain how the process of electroplating works

Explain how the process of electroplating works

Similar setup to electrolysis:

The metal being coated is the cathode. The metal that will form the exterior layer is the anode. The electrolyte solution must contain ions of the metal which will form the outer coating. A power supply is connected to both electrodes.

Write half equations for the reactions that occur at the electrodes when aqueous NaCl is electrolysed (extended only)

Write half equations for the reactions that occur at the electrodes when aqueous NaCl is electrolysed (extended only)

Cathode: $2H^+ + 2e^- \rightarrow H_2$

Anode: $2Cl^- \rightarrow Cl_2 + 2e^-$

Write half equations for the reactions that occur at the electrodes when molten lead(II) bromide is electrolysed (extended only)

Write half equations for the reactions that occur at the electrodes when molten lead(II) bromide is electrolysed (extended only)

Cathode: $Pb^{2+} + 2e^{-} \rightarrow Pb$

Anode: $2Br^{-} \rightarrow Br_2 + 2e^{-}$

Why are copper and steel-cored aluminium used in cables?

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Aluminium and copper are both good conductors of electricity. Aluminium is commonly used in overhead wires and copper is used in electrical wiring.

Why are plastics and ceramics used as insulators?

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Plastics and ceramics both do not conduct electricity. They are used as insulators as they prevent the flow of electricity.

Compare the movement of electrons to the movement of ions in electrolysis (extended only)

Compare the movement of electrons to the movement of ions in electrolysis (extended only)

Electrons move through the metallic conductor meaning they move through the wire from the positive electrode to the negative electrode.

Ions move through the electrolyte. Positive ions move to the negative electrode and negative ions move to the positive electrode.

How can electrical energy be produced from simple cells?

(extended only)

How can electrical energy be produced from simple cells? (extended only)

- Two different metal electrodes are placed in an electrolyte and connected with a wire.
- A current of electrons is created so electrical energy is produced.
- The more reactive metal will lose electrons and the less reactive metal will gain electrons.

During the extraction of aluminium, why is aluminium oxide dissolved in molten cryolite?

(extended only)

During the extraction of aluminium, why is aluminium oxide dissolved in molten cryolite?
(extended only)

Aluminium oxide has a very high melting point. Dissolving it in molten cryolite reduces the melting point of the electrolyte, reducing energy usage and cost.

Why does the positive electrode need to be replaced regularly during the electrolysis of aluminium oxide?

(extended only)

Why does the positive electrode need to be replaced regularly during the electrolysis of aluminium oxide? (extended only)

The oxygen formed at the positive electrode reacts with the carbon electrode to form carbon dioxide. The carbon in the rod will be used up so it will need replacing.

Describe how chlorine, hydrogen and sodium hydroxide can be manufactured from the electrolysis of a concentrated solution of sodium chloride

(extended only)

Describe how chlorine, hydrogen and sodium hydroxide can be manufactured from the electrolysis of a concentrated solution of sodium chloride (extended only)

- Inert electrodes are placed in upside down tubes so that any gas is collected.
- The electrolyte is sodium chloride.
- Chlorine gas formed in the tube at the positive electrode.
- Hydrogen gas formed in the tube at the negative electrode.
- The solution left at the end is sodium hydroxide.