WJEC (Eduqas) Chemistry A-level

SP PI1.1 - Construction of Electrochemical Cells and Measurement of E_{cell}

Flashcards

What is an electrochemical cell?

What is an electrochemical cell?

An electrochemical cell can be set up between two different metals which are dipped in salt solutions of their own ions. They are connected by a wire and salt bridge. Electrons flow from the metal with a more negative electrode potential to the other more positive electrode potential, generating electricity.

What is a salt bridge?

What is a salt bridge?

A salt bridge connects the two solutions in an electrochemical cell. It allows the ions to move through it, completing the circuit and balancing out the charges.

What apparatus is required to determine E_{cell} for a copper/zinc electrochemical cell?

What apparatus is required to determine E_{cell} for a copper/zinc electrochemical cell?

- Wires
- Crocodile clips
- Voltmeter
- Two 100 cm^3 beakers
- Filter paper

What chemicals are required to determine E_{cell} for a copper/zinc electrochemical cell?

What chemicals are required to determine E_{cell} for a copper/zinc electrochemical cell?

- Cu foil strip
- Zn foil strip
- $CuSO_4$ solution
- $ZnSO_4$ solution
- KNO_3 solution

Outline an experimental procedure which can be used to determine E_{cell} for a copper/zinc electrochemical cell

Outline an experimental procedure which can be used to determine E_{cell} for a copper/zinc electrochemical cell

1. Measure 50 cm^3 of $CuSO_4$ into one of the beakers and 50 cm^3 of $ZnSO_4$ into the other beaker.
2. Place the copper foil in the $CuSO_4$ solution and the zinc foil in the $ZnSO_4$ solution.
3. Connect the zinc foil and copper foil to the ammeter.
4. Connect the voltmeter across the zinc foil and copper foil connections.
5. Place the two beakers directly next to each other.
6. Soak the filter paper in the KNO_3 and place it across the two beakers, ensuring that the ends of the filter paper are in direct contact with the solutions in the two beakers.
7. Measure the potential difference of the cell using the voltmeter.

Why is KNO_3 chosen for use in the salt bridge?

Why is KNO_3 chosen for use in the salt bridge?

The salt bridge must contain ions which do not react and interfere with the ions in each half cell. Therefore, KNO_3 is a suitable inert salt for use in the salt bridge.

Why must each end of the filter paper be submerged in one of the solutions?

Why must each end of the filter paper be submerged in one of the solutions?

It is important that the salt bridge completes the circuit, and for this to occur it must be submerged in each solution so that the ions can move through it.

Why might the zinc and copper foil need cleaning with emery paper before use?

Why might the zinc and copper foil need cleaning with emery paper before use?

Metals corrode over time and form oxides. The emery paper will remove the oxide layer, ensuring the pure metal is in contact with the electrolyte.

What should the concentration of the $CuSO_4$ and $ZnSO_4$ solutions be if the experiment is carried out under standard conditions?

What should the concentration of the $CuSO_4$ and $ZnSO_4$ solutions be if the experiment is carried out under standard conditions?

For the solutions to be in standard conditions, they must be of concentration 1.0 mol dm^{-3}.

What are the hazards associated with the solutions of $CuSO_4$, $ZnSO_4$ and KNO_3?

What are the hazards associated with the solutions of $CuSO_4$, $ZnSO_4$ and KNO_3?

$CuSO_4$ solution - harmful, dangerous to environment

$ZnSO_4$ solution - irritant, dangerous to environment

KNO_3 solution - oxidising (may intensify fire), irritant

Explain how the electrons flow in the copper/zinc electrochemical cell

Explain how the electrons flow in the copper/zinc electrochemical cell

Zinc has a more negative electrode potential compared to copper, so the zinc anode is oxidised and the copper cathode is reduced. This means the electrons flow from the zinc anode to the copper cathode.

Give the half equations for the reactions which take place in the copper/zinc electrochemical cell

Give the half equations for the reactions which take place in the copper/zinc electrochemical cell

In the copper/zinc cell, the copper is reduced:

$$Cu^{2+}_{(aq)} + 2e^- \rightarrow Cu_{(s)}$$

In the copper/zinc cell, the zinc is oxidised:

$$Zn_{(s)} \rightarrow Zn^{2+}_{(aq)} + 2e^-$$

Give the chemical equation for the overall reaction that takes place in the copper/zinc electrochemical cell

Give the chemical equation for the overall reaction that takes place in the copper/zinc electrochemical cell

Combine the two half equations and cancel out the electrons to obtain:

$$Cu^{2+}_{(aq)} + Zn_{(s)} \rightleftharpoons Cu_{(S)} + Zn^{2+}_{(aq)}$$