

4.1 Electrolysis

Name: _____ Class: _____ Date: _____

Total: 11 marks

Objective

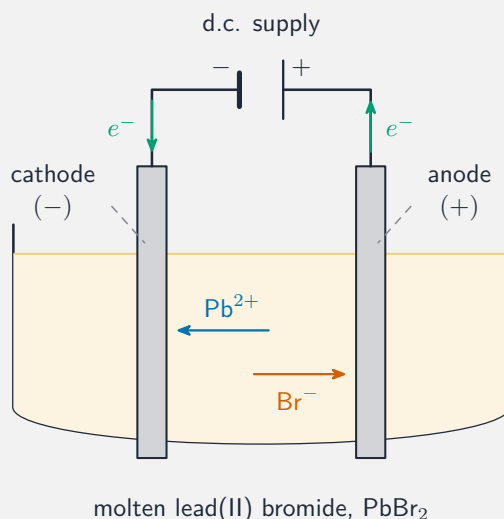
Build the skills to answer exam questions on **electrolysis** 电解—the **electrolytic cell** 电解池, products at each electrode, **half-equations** 半反应式, and **electroplating** 电镀.

You must be able to:

- name the anode/cathode and explain why the substance must be molten/aqueous
- predict the products and write half-equations (reduction at cathode, oxidation at anode)
- describe electroplating

1 Worked examples

■ Electrolysis of molten PbBr



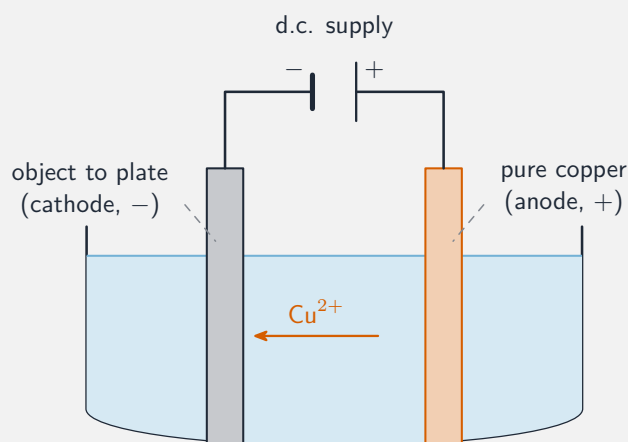
cathode: $\text{Pb}^{2+} + 2\text{e}^- \rightarrow \text{Pb}$ (silvery lead)

anode: $2\text{Br}^- \rightarrow \text{Br}_2 + 2\text{e}^-$ (red-brown bromine)

Positive ions go to the cathode (reduction), negative ions to the anode (oxidation)

- **cathode (-):** $\text{Pb}^{2+} + 2\text{e}^- \rightarrow \text{Pb}$ (reduction).

- **anode (+):** $2\text{Br}^- \rightarrow \text{Br}_2 + 2e^-$ (oxidation).
- needs molten/aqueous so the ions are free to move.



electrolyte: copper(II) sulfate solution

copper coats the object at the cathode; the copper anode slowly dissolves to replace it

To electroplate: object = cathode, plating metal = anode, in a solution of the plating-metal ions

2 Practice

2.1 State why solid sodium chloride cannot be electrolysed.

[1]

2.2 Name the products at each electrode when molten lead(II) bromide is electrolysed.

[2]

3 Exam-style questions

3.1 At the cathode during electrolysis, positive ions:

[1]

- **A** lose electrons (oxidation)
- **B** gain electrons (reduction)
- **C** stay unchanged
- **D** become anions

3.2 Concentrated aqueous sodium chloride is electrolysed with inert electrodes.

(a) Name the gas formed at the anode and at the cathode. [2]

(b) Write the half-equation for the reaction at the cathode. [2]

3.3 Describe how you would electroplate an iron spoon with silver. [3]

4 Go further

You are now ready for the real exam questions on this subtopic. Open the **4.1 Electrolysis** past-paper sheet in the Library, or try these in **Practice mode**:

- 0620/21 N25 —Q12 (electrolysis)
- 0620/21 N25 —Q13 (electrode products)

Solutions

2.1 its ions are locked in place and cannot move to carry the charge.

2.2 lead at the cathode; bromine at the anode.

3.1 B. At the cathode, positive ions gain electrons (reduction).

3.2 (a) chlorine at the anode; hydrogen at the cathode.

(b) $2\text{H}^+ + 2e^- \rightarrow \text{H}_2$.

3.3 make the spoon the cathode; make silver the anode; use a solution containing silver ions as the electrolyte.