

# 19.1 Redox and electrolysis

Name: \_\_\_\_\_ Class: \_\_\_\_\_ Date: \_\_\_\_\_

Total: 10 marks

KEY WORDS oxidation • reduction

## Objective

Redox and electrolysis. Supported SL concept preparation; original classroom practice, not an official IB paper or assessed learner work.

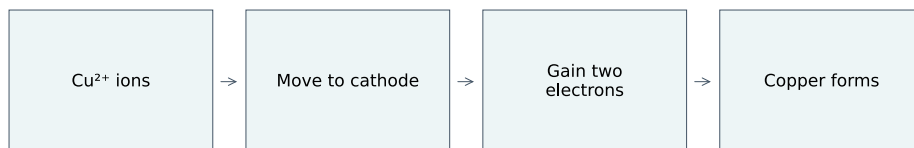
## 1 Key knowledge and worked examples

### ■ What would explain this observation?

- An aqueous salt solution can produce different electrode products from the molten salt. Water introduces competing species into the system.
- Start with a prediction. State the quantities or features you would compare, then decide what evidence could distinguish two explanations.

### ■ Build the model

- **Oxidation** is loss of electrons and **reduction** is gain of electrons. In electrolysis, cations move toward the cathode and anions toward the anode. Reduction occurs at the cathode.
- oxidation: Loss of electrons; reduction: Gain of electrons.



### ■ Choose evidence that can test it

- Predict products using the specified electrolyte and electrode material. In an aqueous solution, hydrogen or oxygen may form because water-related species compete. Molten salts contain only the ions of the salt.
- Use a low-voltage direct-current supply, approved electrodes, and the school risk assessment. Collect gases only by an approved method. Keep chlorine demonstrations teacher-controlled; do not ask students to generate hazardous gases independently.

### ■ Work from known quantities

- State the known values and their units. Choose the relation because its assumptions fit this case, then rearrange before substitution.
- Known: a copper ion gains two electrons. Half-equation:  $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$ . One mole of  $\text{Cu}^{2+}$  requires two moles of electrons. For 0.050 mol of copper, electron amount =  $2 \times 0.050 = 0.100$  mol.

### Example:

How many moles of electrons reduce 0.20 mol of  $\text{Cu}^{2+}$  to copper? Use the same sequence: known quantities → model → relation → substitution → unit and interpretation.

### ■ Check the conclusion and its limits

- Electrode signs depend on the cell type. In an electrolytic cell the cathode is negative; reduction remains the defining process at a cathode in every cell.
- Return to the original observation. Explain what the result supports, which conditions it assumes, and one way to test a competing explanation.

### Warn:

Reduction means loss of electrons. This claim is false: Electrode signs depend on the cell type. In an electrolytic cell the cathode is negative; reduction remains the defining process at a cathode in every cell.

### Key:

Redox and electrolysis: Predict products using the specified electrolyte and electrode material. In an aqueous solution, hydrogen or oxygen may form because water-related species compete. Molten salts contain only the ions of the salt.

## 2 Practice

2.1 What happens to  $\text{Cu}^{2+}$  at the cathode? Choose one answer.

- **A** It gains electrons
- **B** It loses two protons
- **C** It gains neutrons

**2.2** How many moles of electrons reduce 0.20 mol of  $\text{Cu}^{2+}$  to copper? Show the relation, substitution and units. [2]

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**2.3** Decide whether this claim is true and justify: Reduction means loss of electrons. [2]

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**2.4** Loss of electrons: write the technical term. [1]

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### 3 Exam-style questions

**3.1** A fictional electrolytic cell deposits 0.15 mol Cu from  $\text{Cu}^{2+}$ . Find electron amount and write the half-equation. Explain whether cathode sign defines reduction. [4]

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