SCIENCE FOUNDATIONS

Introduction to electrochemistry

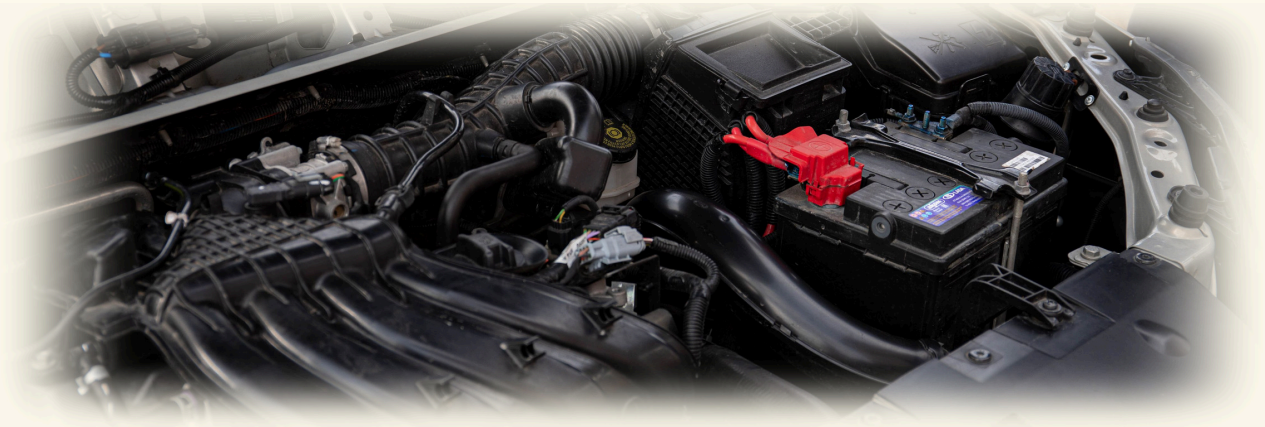
Difficulty level: Advanced

Science Foundations

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Overview of the concept

This is how a battery powers your phone and how charging it puts the energy back, because chemical reactions and electricity are two sides of the same electron flow. A car battery starts the engine by turning a chemical reaction into a surge of current. A metal fence post rusts where the chemistry and the current meet, which is why a zinc coating protects it. Knowing electrochemistry tells you why batteries run down, why some metals corrode and others do not, and how charging reverses the whole process.

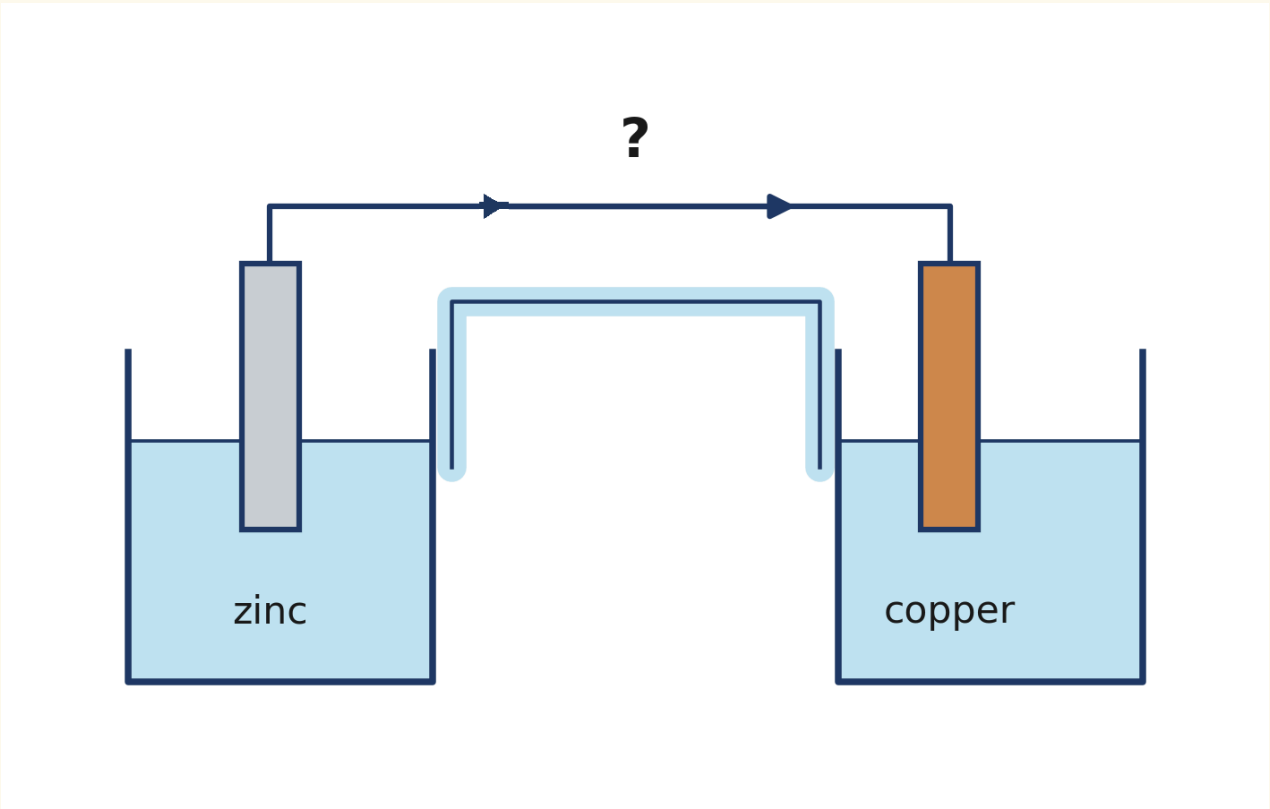


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Worked examples

EXAMPLE 1

Q In a zinc-copper cell, zinc is oxidized and copper ion is reduced. Label the electrodes.



SOLUTION

Find oxidation: zinc loses electrons, so zinc is the anode.

Find reduction: copper ion gains electrons, so copper is the cathode.

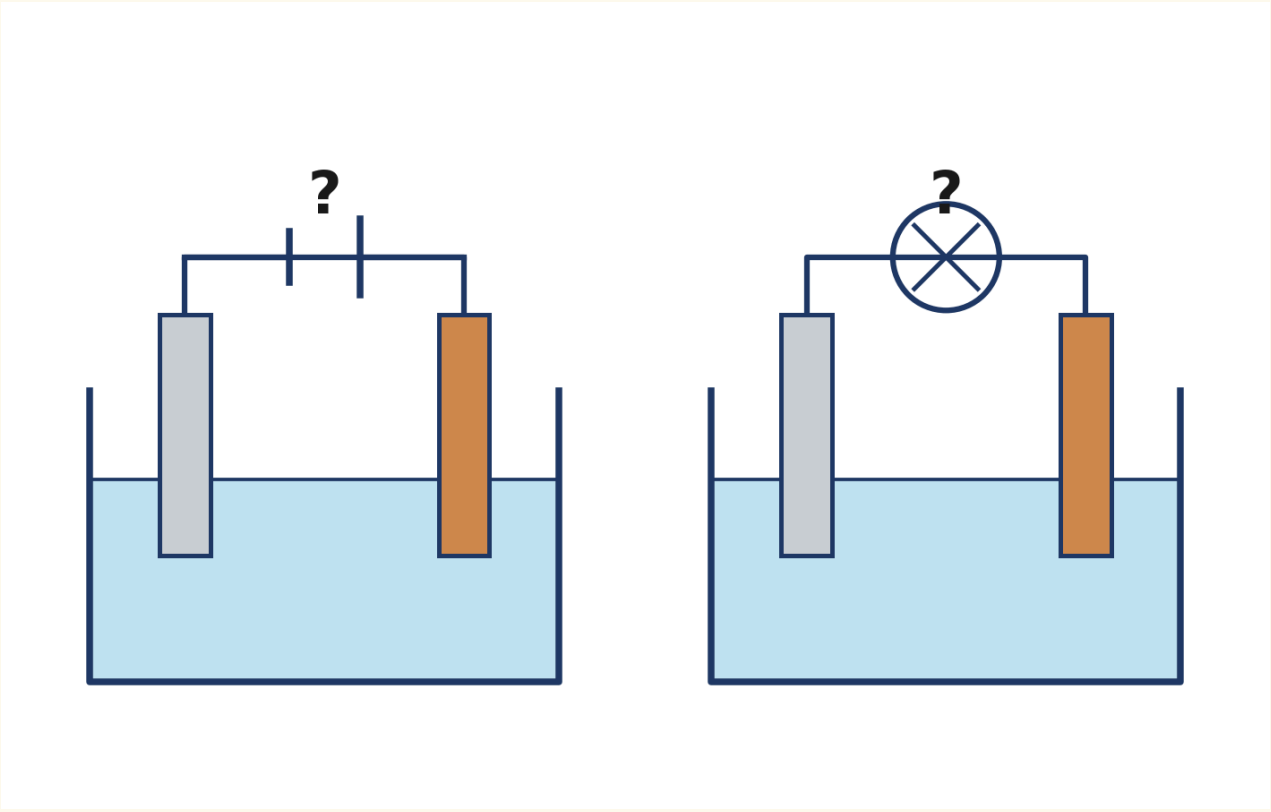
State electron flow: from zinc anode to copper cathode.

The result is zinc anode, copper cathode.

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EXAMPLE 2

Q Which cell type uses electricity to drive a reaction?



SOLUTION

Ask the direction: is electricity the input or the output?

If electricity is the input driving the reaction, it is electrolytic.

If the reaction makes the electricity, it is galvanic.

The result is electrolytic cell.

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Practice questions

1 **In an iron-copper cell, iron is oxidized and copper ions are reduced. Which electrode is the anode, which is the cathode, and which way do electrons flow?**

- **A** Iron is the anode, copper is the cathode, electrons flow from the iron anode to the copper cathode
- **B** Copper is the anode, iron is the cathode, electrons flow from the copper anode to the iron cathode
- **C** Iron is the cathode, copper is the anode, electrons flow from the copper cathode to the iron anode
- **D** Copper is the cathode, iron is the anode, electrons flow from the copper cathode to the iron anode

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2

In a cell, the anode is where oxidation happens. If zinc is the anode, what happens to the zinc?

- A It loses electrons
- B It gains electrons
- C It gains protons
- D It loses protons

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Electricity splits water into hydrogen and oxygen. Which cell type is this?

- A Electrolytic cell
- B Galvanic cell
- C Solar cell
- D Fuel cell

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4

Is electroplating galvanic or electrolytic? Explain why.

A. Electrolytic, because electricity is the input that drives the reaction

B. Galvanic, because electricity is the input that drives the reaction

C. Electrolytic, because the reaction makes electricity

D. Galvanic, because the reaction makes electricity

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5 Galvanic cell: what does it do?

- **A** Chemical reaction makes electricity
- **B** Electricity drives a chemical reaction
- **C** Electricity makes a chemical reaction stop
- **D** A chemical reaction stores electricity as heat

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6 Electrolytic cell: what does it do?

- **A** Electricity drives a chemical reaction
- **B** Chemical reaction makes electricity
- **C** Electricity is stored without a reaction
- **D** A chemical reaction stops electricity flowing

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7 Anode: oxidation or reduction?

- **A** Oxidation
- **B** Reduction
- **C** Both oxidation and reduction
- **D** Neither oxidation nor reduction

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8 Cathode: oxidation or reduction?

A Reduction

B Oxidation

C Both oxidation and reduction

D Neither oxidation nor reduction

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9 Electrons flow from where to where?

A Anode to cathode

B Cathode to anode

C Anode to anode

D Cathode to cathode

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10

Is a battery galvanic?

A Yes

B No

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ANSWER KEY

1. Iron is the anode, copper is the cathode, electrons flow from the iron anode to the copper cathode
2. It loses electrons
3. Electrolytic cell
4. Electrolytic, because electricity is the input that drives the reaction
5. Chemical reaction makes electricity
6. Electricity drives a chemical reaction
7. Oxidation
8. Reduction
9. Anode to cathode
10. Yes

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