# Electrolysis and Electrolytic Cells

Student Worksheet | g10_u06_w23

**I can:** use a supplied electrolytic-cell model to track external power, electrode signs, electron transfer, ion migration, and charge-to-mole calculations.
**Supplied model:** Two Cu electrodes are in a $Cu^{2+}$ solution and connected to an external DC power source. Treat it as a data/model card only—do not assemble a cell, handle solutions/metals, or connect electrical equipment. In this electrolytic model: cathode (negative), $Cu^{2+} + 2e^- \rightarrow Cu(s)$; anode (positive), $Cu(s) \rightarrow Cu^{2+} + 2e^-$. Use $F = 96{,}500$ C mol$^{-1}$ e$^-$.

| power / transport card | quantitative run card |
|---|---|
| negative terminal delivers electrons to cathode | current $I = 1.93$ A for $t = 1000$ s |
| positive terminal withdraws electrons from anode | $Q = It$; 1 A = 1 C s$^{-1}$ |
| oxidation is at anode; reduction is at cathode | $n(e^-) = Q/F$; 2 mol e$^-$ per 1 mol Cu |

1. Why is an external power source required in this supplied electrolytic model?

2. Identify the cathode half-reaction and name the process occurring there.

3. Identify the anode half-reaction and name the process occurring there.

4. State the cathode sign in this electrolytic model.

5. State the anode sign in this electrolytic model.

6. Which durable conventions stay the same in both galvanic and electrolytic cells?

7. Trace electrons on the external circuit: from which power terminal do they reach the cathode, and where are they withdrawn from the cell?

8. Which charged ion in the supplied solution moves toward the cathode region in the model? Explain using charge/electron use.

9. In the simplified model, how is solution charge balance supported near the anode as $Cu^{2+}$ is produced?

10. Predict the cathode mass change and justify it with the half-reaction.

11. Predict the anode mass change and justify it with the half-reaction.

12. In the ideal equal-current model, what happens to the total amount of $Cu^{2+}$ in the full cell? State a local-concentration boundary.

13. Why does summing the two supplied half-reactions describe copper transfer between locations rather than a new net chemical species?

14. Calculate charge passed in the quantitative run card.

15. Calculate moles of electrons passed.

16. Calculate moles of Cu deposited at the cathode.

17. Calculate moles of Cu lost at the anode in the ideal model.

18. If the current doubles while time stays 1000 s, what happens to the model charge and moles of Cu transferred?

19. Critique: “Because the anode is positive here, oxidation must occur at positive electrodes in every electrochemical cell.”

20. Write a cautious CER statement using one electrode convention and one charge-to-mole result. Include a safety or model boundary.