# Lesson 7
# Galvanic Cells

## Learning Goals

- ❏ I will be able to analyse the processes in galvanic cells, and draw labelled diagrams of these cells showing the half-reaction occurring in each half-cell, the direction of electron flow, the anode and cathode, the cell potential, and the direction of ion migration.


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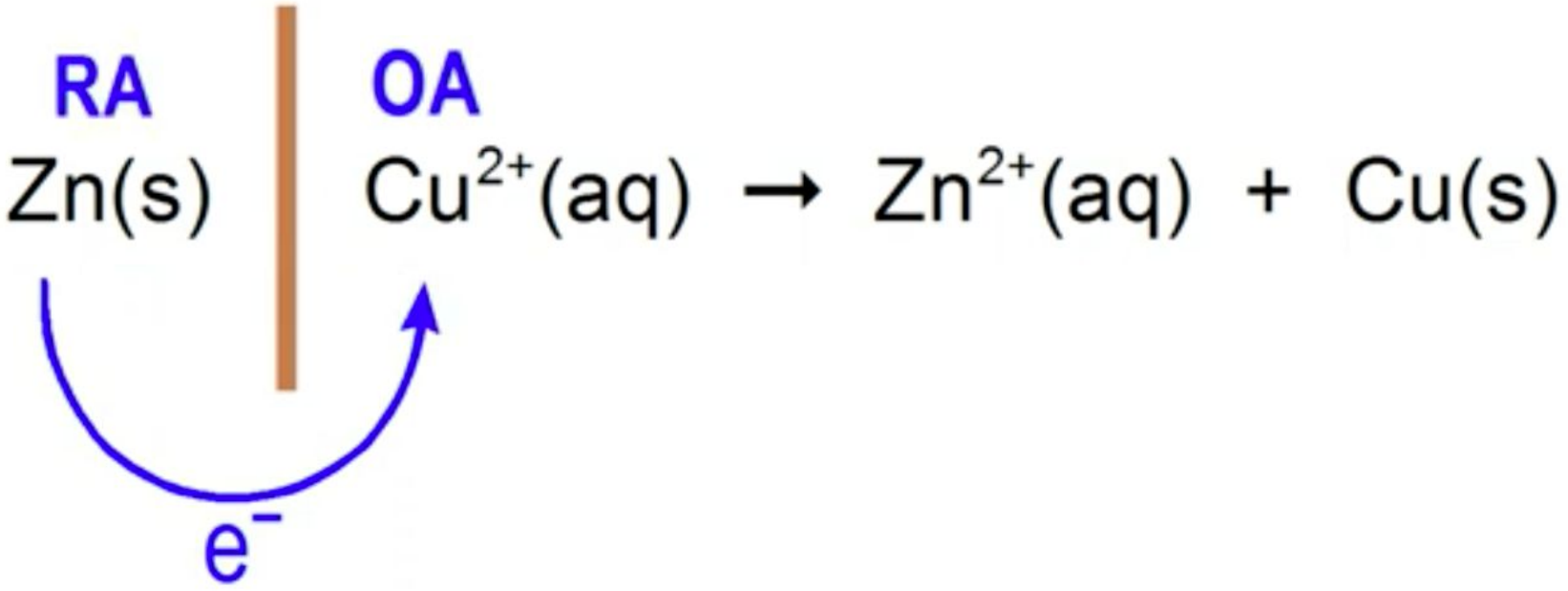
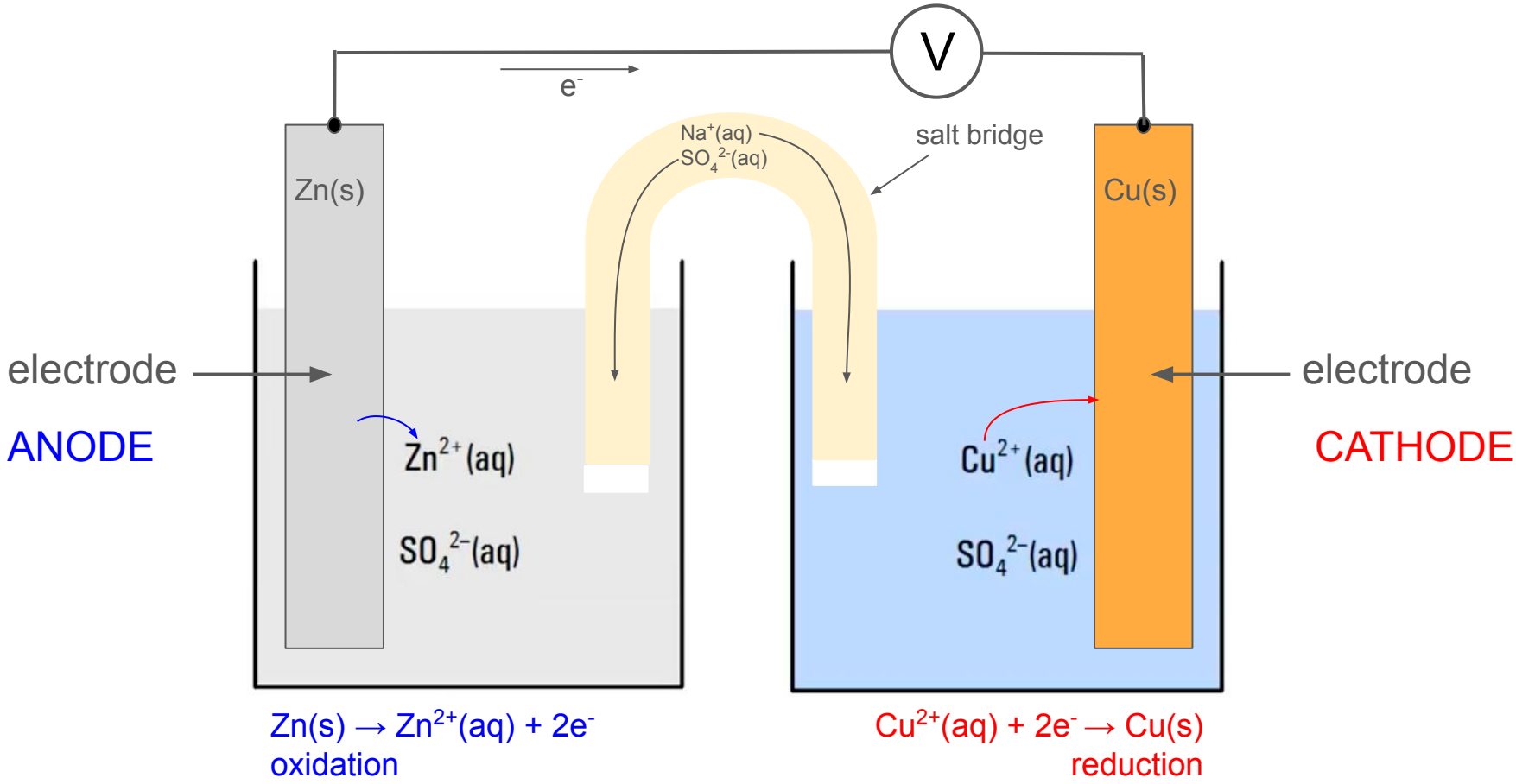
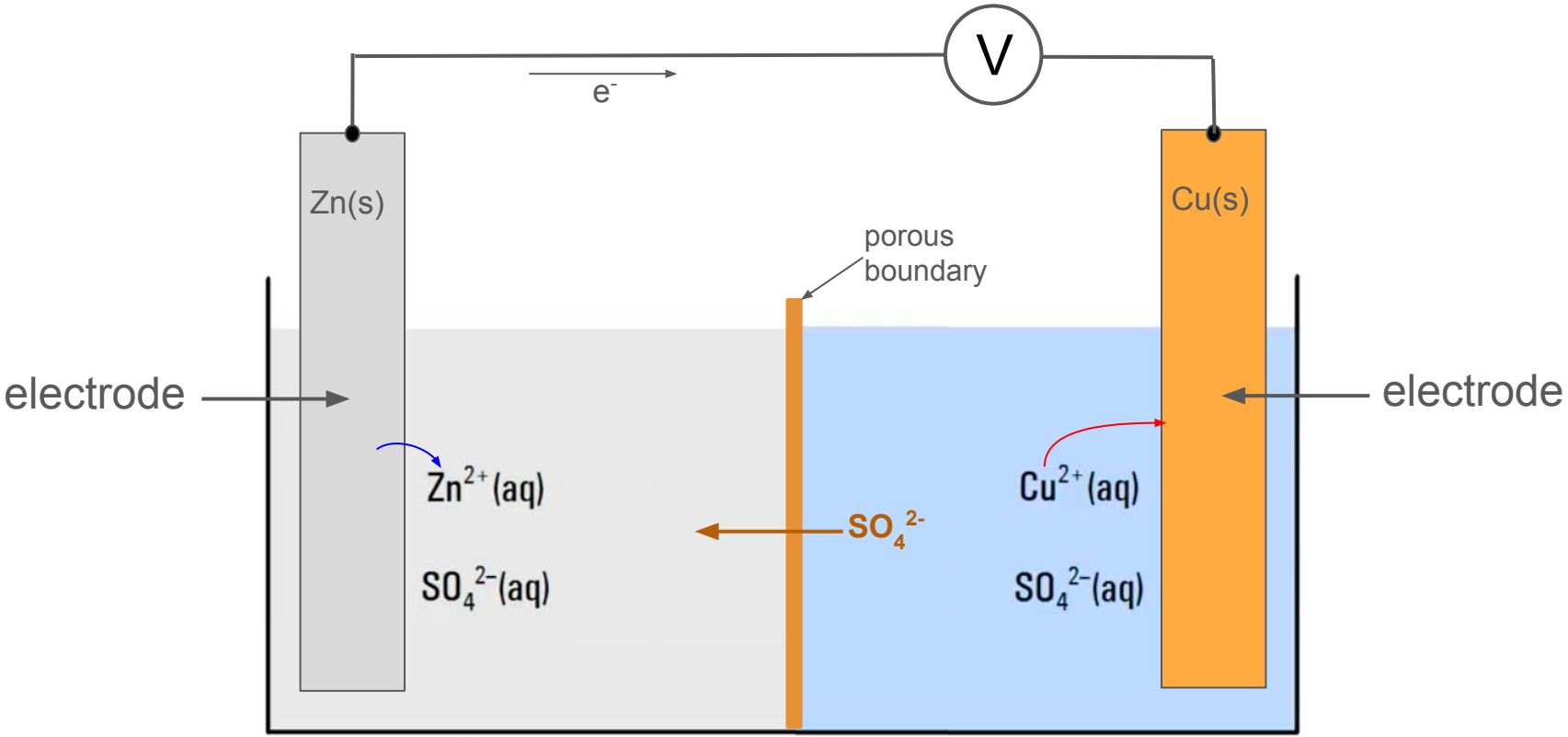

RA
OA
Zn(s)
Cu2+(aq) → Zn2+(aq) + Cu(s)
e−

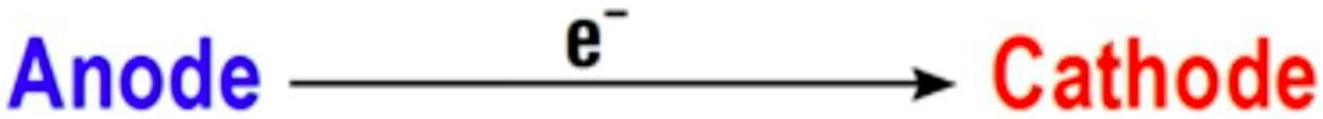
# The Zinc-Copper Cell (The Daniell Cell)




V
e⁻
Zn(s)
Cu(s)
porous
boundary
electrode
electrode
Zn²⁺(aq)
SO₄²⁻(aq)
SO₄²⁻
Cu²⁺(aq)
SO₄²⁻(aq)
Zn(s) → Zn²⁺(aq) + 2e⁻
oxidation
Cu²⁺(aq) + 2e⁻ → Cu(s)
reduction

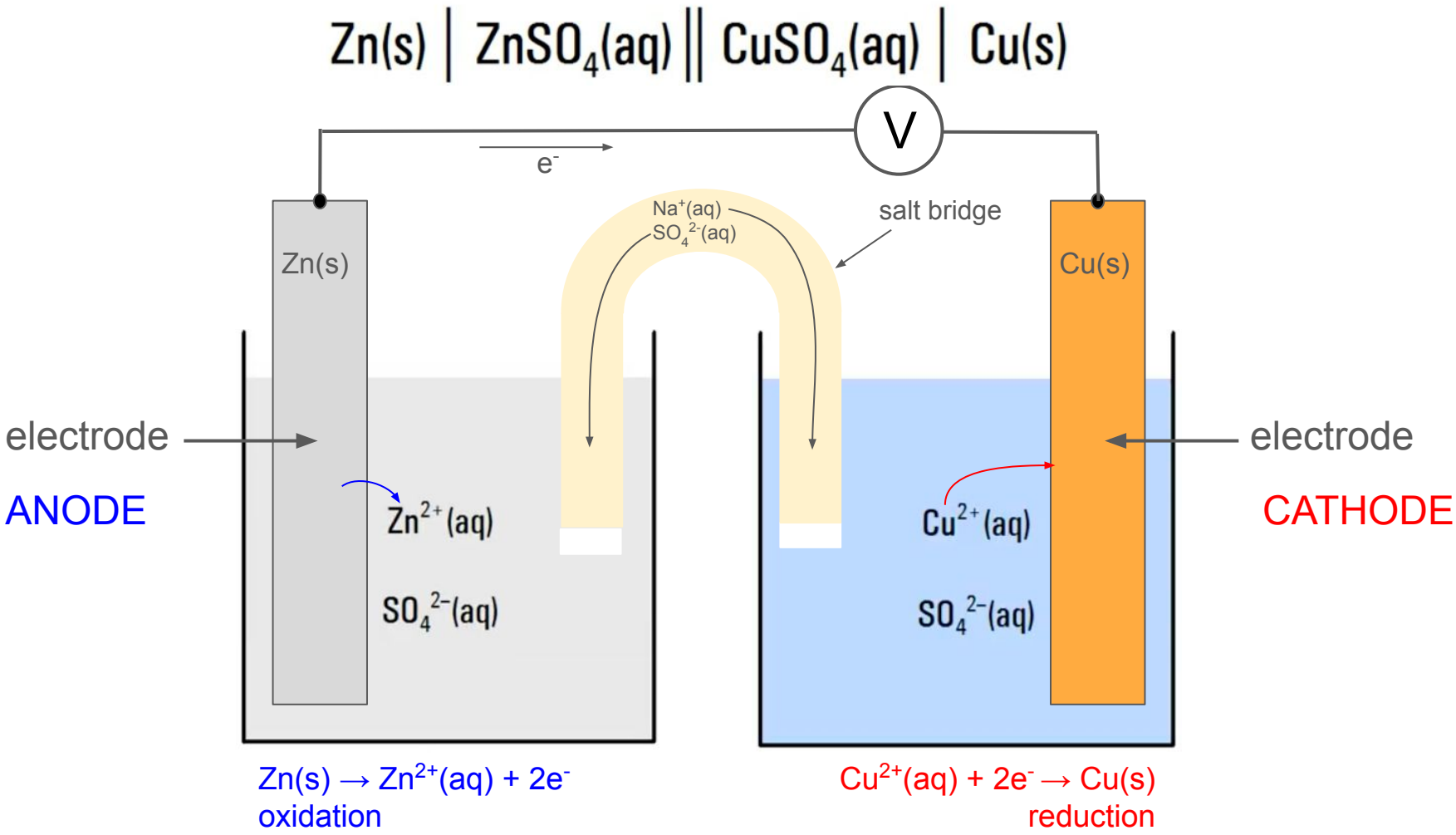
# Galvanic Cells (Voltaic Cells)

- chemical energy is converted to electrical energy by a spontaneous redox reaction
- reduction and oxidation half reactions are separated (half-cells) such that electron transfer must occur through an external circuit
- a salt bridge or porous boundary allows ions to migrate between the half-cells preventing polarization




- electrode where **oxidation** occurs.
- strongest **reducing** agent (SRA) is **oxidized** at the anode
- electrons flow **away** from the anode through external circuit
- **anions** migrate through the solutions toward anode

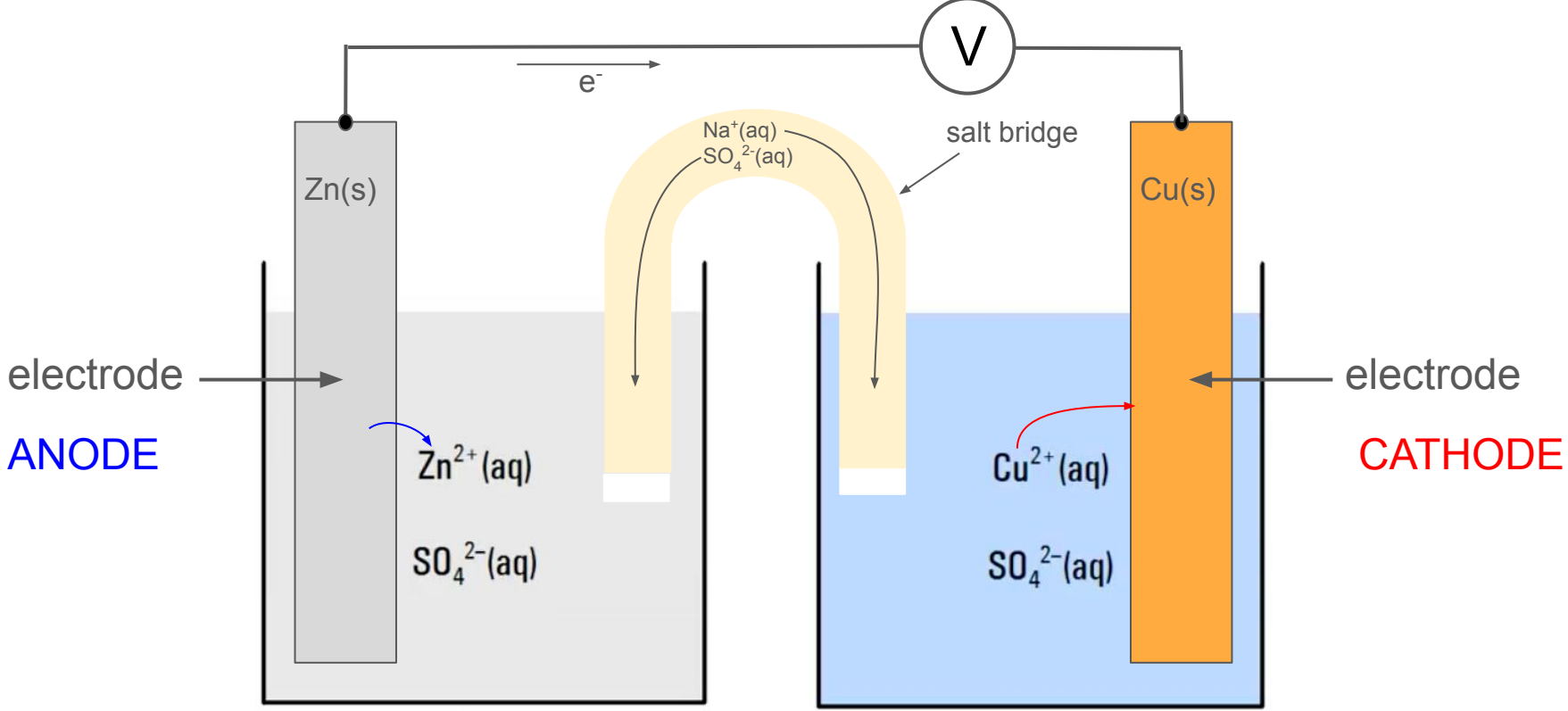
- electrode where **reduction** occurs.
- strongest **oxidizing** agent (SOA) is **reduced** at the cathode
- electrons flow **toward** the cathode through external circuit
- **cations** migrate through the solutions toward cathode


Zn(s) | ZnSO4(aq) || CuSO4(aq) | Cu(s)
V
e-
Na+(aq)
SO4 2-(aq)
salt bridge
Zn(s)
Cu(s)
electrode
ANODE
Zn2+(aq)
SO4 2-(aq)
Cu2+(aq)
SO4 2-(aq)
electrode
CATHODE
Zn(s) → Zn2+(aq) + 2e-
oxidation
Cu2+(aq) + 2e- → Cu(s)
reduction

# Cell Potential, $\Delta E_{cell}$ (Cell Voltage)

- Calculated from the reduction potentials of the two half-cells

$$\Delta E_{(cell)} = E_{r\ (cathode)} - E_{r\ (anode)}$$




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

oxidation

$E_r = -0.76\ V$

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

reduction

$E_r = +0.34\ V$

$$\Delta E_{(cell)} = E_{r\,(cathode)} - E_{r\,(anode)}$$
$$= (+0.34\ V) - (-0.76\ V)$$
$$= +1.10\ V$$

# Success Criteria

- ❏ I can analyse the processes in galvanic cells, and draw labelled diagrams of these cells showing the half-reaction occurring in each half-cell, the direction of electron flow, the anode and cathode, the cell potential, and the direction of ion migration.

**WORK:**

- Read **section 10.1** in textbook.
- Do PRACTICE: **GALVANIC CELLS**
- Check your **answers** and review as necessary.