

Exercise walk-through

Galvanic (Voltaic) and Electrolytic Cells ■ 9.8

eXercise

You must be able to

- distinguish a **galvanic (voltaic)** 原电池 cell from an **electrolytic** 电解池 cell
- identify the **anode** (oxidation) and **cathode** (reduction)
- state the direction of electron flow

Method — Two kinds of cell

- **Galvanic (voltaic)** cell — a **favorable** redox reaction produces electricity ($\Delta G < 0$, $E_{\text{cell}} > 0$).
- **Electrolytic** cell — electricity **drives** an unfavorable reaction ($\Delta G > 0$, needs an external power source).

Method — Anode and cathode

In **both** cells: **oxidation** happens at the **anode**; **reduction** at the **cathode** (remember “an ox, red cat”). Electrons flow from anode to cathode through the wire.

Method — A worked galvanic cell

$\text{Zn}|\text{Zn}^{2+}||\text{Cu}^{2+}|\text{Cu}$: Zn is oxidized (anode), Cu^{2+} is reduced (cathode); electrons flow
 $\text{Zn} \rightarrow \text{Cu}$.

Method — The salt bridge

A **salt bridge** keeps each half-cell electrically neutral by letting ions move, completing the circuit.

Practice 2.1 ■ 1 mark

At which electrode does oxidation occur?

Solution 2.1

Worked steps

The anode **B1**.

Practice 2.2 ■ 1 mark

Which cell produces electricity from a favorable reaction?

Solution 2.2

Method: Two kinds of cell

Worked steps

A galvanic (voltaic) cell **B1**.

Practice 2.3 ■ 1 mark

In which direction do electrons flow in a galvanic cell?

Solution 2.3

Method: A worked galvanic cell

Worked steps

From the anode to the cathode **B1**.

Exam-style 3.1 ■ 1 mark

In any electrochemical cell, reduction occurs at the

- A** anode
- B** cathode
- C** salt bridge
- D** wire

Solution 3.1

A anode

B cathode 

C salt bridge

D wire

Worked steps

B — the cathode.

Exam-style 3.2 ■ 2 marks

A galvanic cell uses $\text{Zn}|\text{Zn}^{2+}||\text{Cu}^{2+}|\text{Cu}$.

- (a) Identify the anode and cathode.
- (b) State the direction of electron flow.

Solution 3.2

Method: A worked galvanic cell

Worked steps

(a) Anode: Zn (oxidized); cathode: Cu (where Cu^{2+} is reduced) **M1** **A1**. (b) From the Zn electrode to the Cu electrode **B1**.

Exam-style 3.3 ■ 2 marks

Explain the difference between a galvanic and an electrolytic cell in terms of ΔG and energy.

Solution 3.3

Method: Two kinds of cell

Worked steps

A galvanic cell runs a favorable reaction ($\Delta G < 0$) and **releases** electrical energy; an electrolytic cell uses an external power source to drive an unfavorable reaction ($\Delta G > 0$) **M1** **A1**.