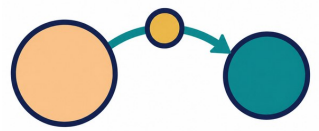
Electrode Potentials Map

Edexcel International A Level Chemistry · Unit 5 · Topic 16A Electrode Potentials and Cells

1 Redox and half-equations 16.1

- Oxidation: **loss** of e^-, ox. no. up
- Balance O with H_2O, H with H^+
- Balance charge with e^-
- Match electrons, then add



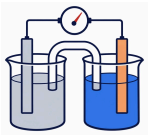
2 Standard electrode potentials 16.2–16.5

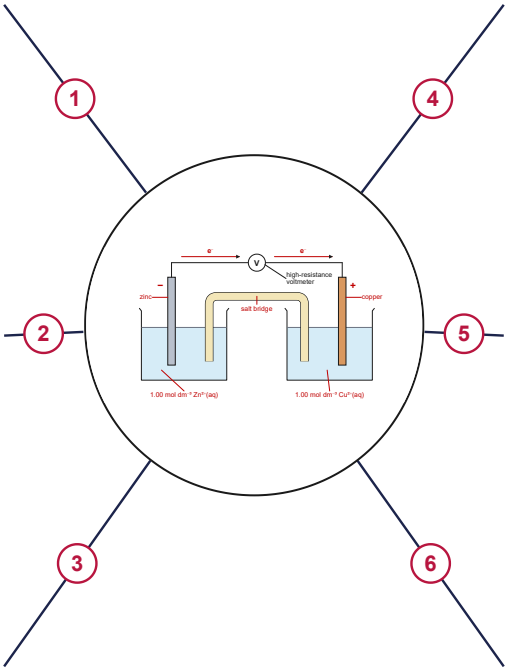
- SHE: H_2 100 kPa, 1.00 mol dm^{-3} H^+, Pt
- **298 K**; E⊖(SHE) = 0.00 V
- E⊖: emf against the SHE
- Written as **reductions**



3 Cells and E⊖cell 16.6–16.8

- Salt bridge KNO_3: **ions** move
- E⊖cell = E⊖(right) − E⊖(left)
- Zn | Zn^{2+} ‖ Cu^{2+} | Cu
- Pt for gases and ion pairs





4 Series and feasibility 16.10, 16.13, 16.14

- Most positive: best **oxidising** agent
- Most negative: best **reducing** agent
- E⊖cell **positive**: feasible
- $2Cu^+ \rightarrow Cu + Cu^{2+}$: +0.37 V



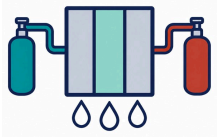
5 Limits, entropy and K 16.9, 16.11, 16.12

- E⊖cell ∝ ΔS_{total} ∝ **ln K**
- Concentration shifts E (Le Chatelier)
- **Kinetic stability**: high E_a
- Non-standard: MnO_2 + conc. HCl



6 Fuel cells 16.18, 16.19

- Fuel + O_2 supplied **continuously**
- Alkali: $H_2 + 2OH^- \rightarrow 2H_2O + 2e^-$
- Acid: $O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$
- Methanol: a liquid fuel



Some standard electrode potentials data booklet values, 298 K

Half-equation	E⊖ / V	Strongest
$F_2 + 2e^- \rightleftharpoons 2F^-$	+2.87	oxidising agent
$Cl_2 + 2e^- \rightleftharpoons 2Cl^-$	+1.36	
$Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$	+0.77	
$Cu^{2+} + 2e^- \rightleftharpoons Cu$	+0.34	
$2H^+ + 2e^- \rightleftharpoons H_2$	0.00	reference
$Zn^{2+} + 2e^- \rightleftharpoons Zn$	−0.76	reducing agent

Worked examples

Cell potential

- Zn | Zn^{2+} ‖ Cu^{2+} | Cu
- +0.34 − (−0.76)
- **+1.10 V**

Feasible?

- $Cl_2 + 2Fe^{2+}$
- 1.36 − 0.77 = +0.59 V
- **feasible**

Half-equation

- $MnO_4^- \rightarrow Mn^{2+}$
- $+ 8H^+ + 5e^-$, $+ 4H_2O$
- **balanced**

Redox titrations with manganate(VII) and thiosulfate follow in Topic 16B; transition-metal redox returns in Topic 17.

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