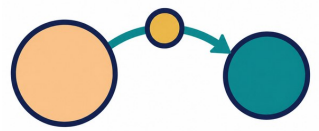
Electrode Potentials Map

OCR A Level Chemistry A · 5.2.3A Electrode potentials and cells

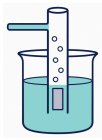
1 Redox and half-equations 5.2.3(a)–(c)

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



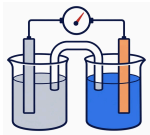
2 Standard electrode potentials 5.2.3(f)

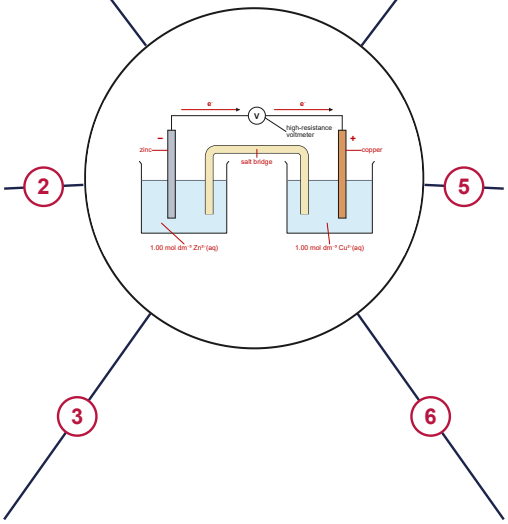
- SHE: H_2 100 kPa, 1.00 mol dm^{-3} H^+, Pt
- **298 K**; E⊖(SHE) = 0.00 V
- E⊖: emf against the SHE
- Written as **reductions**



3 Cells and E⊖cell 5.2.3(g)–(h)

- Salt bridge KNO_3: **ions** move
- E⊖cell = E⊖(+) − E⊖(−)
- Ion pairs: Pt, both ions 1.00 mol dm^{-3}
- Gases over Pt at 100 kPa





4 Series and feasibility 5.2.3(c), (i)

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



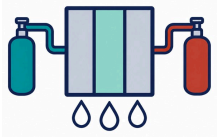
5 The limits of predictions 5.2.3(i)

- Concentration shifts E (Le Chatelier)
- **Kinetic stability**: high E_a
- Small E⊖cell: **reversed** by concentration
- Non-standard: MnO_2 + conc. HCl



6 Storage and fuel cells 5.2.3(j)–(k)

- Recharging **reverses** both reactions
- EMF = E(+) − E(−) from given data
- Fuel + O_2 supplied **continuously**
- Alkali: $H_2 + 2OH^- \rightarrow 2H_2O + 2e^-$



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 and Cu half-cells
- +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 5.2.3B; transition-element redox returns in 5.3.1.

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