STARTER FOR 10...

12.2. Standard electrode potentials

We can measure how readily something gives away electrons by measuring its standard electrode potential, $E^{\ominus}$.

1. Standard electrode potentials are measured by connecting a half cell containing the equilibrium, the potential of which is to be measured to a standard hydrogen electrode at 298 K.

(a) Label the diagram below showing the standard hydrogen electrode. (3 marks)

(b) Complete the diagram to show the complete cell you would use if you wished to measure $E^{\ominus}$ for a zinc electrode. (4 marks)

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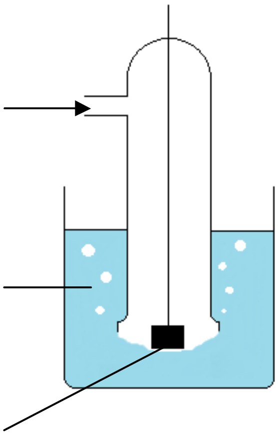


2. Cells can be represented in shorthand form using a series of standard conventions.

(a) Match up the symbol to its meaning when used to represent an electrochemical cell;

|	Shows a salt bridge
‖	Indicates a phase boundary

(1 mark)

(b) For each half cell, the species in the highest oxidation state in the redox equilibrium is written next to the salt bridge.

Use this convention to complete the shorthand representation of the cells produced when half cells containing each of the equilibria below are connected to a standard hydrogen electrode.

(i) $Fe^{2+}(aq) + 2\,e^- \rightleftharpoons Fe(s)$; Pt | H_2(g) | H^+(aq) ‖ ....(1 mark)

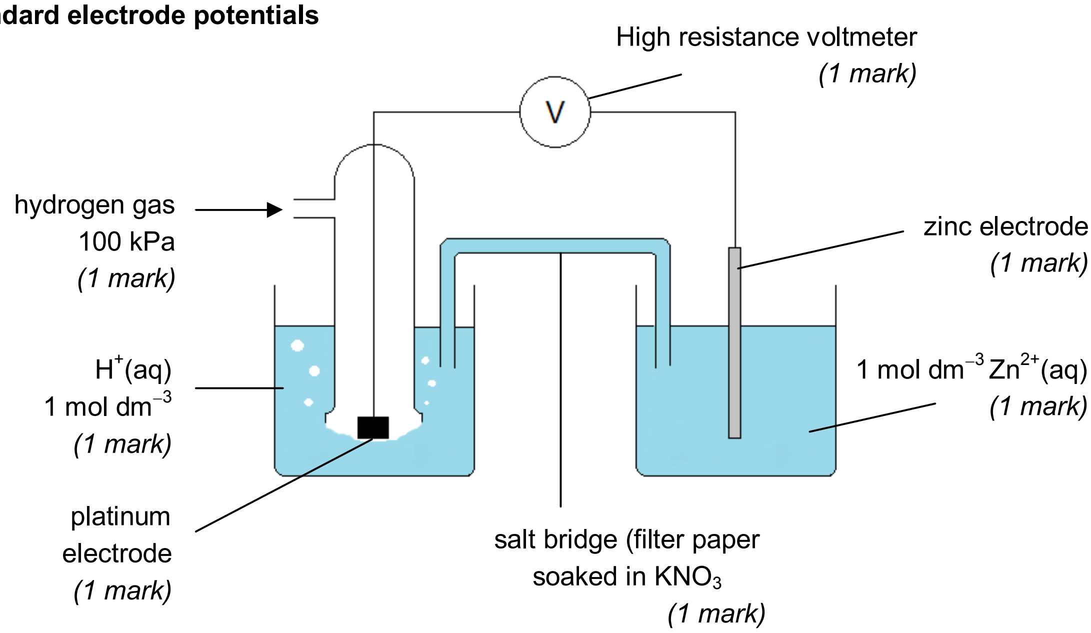
(ii) $MnO_4^-(aq) + 1\,e^- \rightleftharpoons MnO_4^{2-}(aq)$; Pt | H_2(g) | H^+(aq) ‖...(1 mark)

STARTER FOR 10...

12. Redox equilibria answers

12.2. Standard electrode potentials

1.



2. (a) | — Indicates a phase boundary

‖ — Shows a salt bridge *(1 mark)*

(b) (i) Pt | H_2(g) | H^+(aq) ‖ Fe^{2+}(aq) | Fe(s) *(1 mark)*

(ii) Pt | H_2(g) | H^+(aq) ‖ MnO_4^-(aq), MnO_4^{2-}(aq) | Pt *(1 mark)*

12.3. Calculations involving electrochemical cells

1. (a) $E^\ominus_{cell}$ = –0.76 – (–1.66) = <u>+0.90 V</u> *(1 mark)*

Positive electrode: Zn^{2+}(aq) + 2 e^- → Zn(s) × 3 *(1 mark)*

Negative electrode: Al(s) → Al^{3+}(aq) + 3 e^- × 2 *(1 mark)*

Overall cell reaction: 3 Zn^{2+}(aq) + 2 Al(s) → 3 Zn(s) + 2 Al^{3+}(aq) *(1 mark)*

(b) $E^\ominus_{cell}$ = –0.44 – (+1.36) = <u>–1.80 V</u> *(1 mark)*

Positive electrode: Cl_2(g) + 2 e^- → 2 Cl^-(aq) *(1 mark)*

Negative electrode: Fe(s) → Fe^{2+}(aq) + 2 e^- *(1 mark)*

Overall cell reaction: Cl_2(g) + Fe(s) → 2 Cl^-(aq) + Fe^{2+}(aq) *(1 mark)*

2. (a) +0.50 V = $E^\ominus_{RHS}$ – (+1.51 V), ∴ <u>$E^\ominus_{RHS}$ = +2.01 V</u> *(1 mark)*