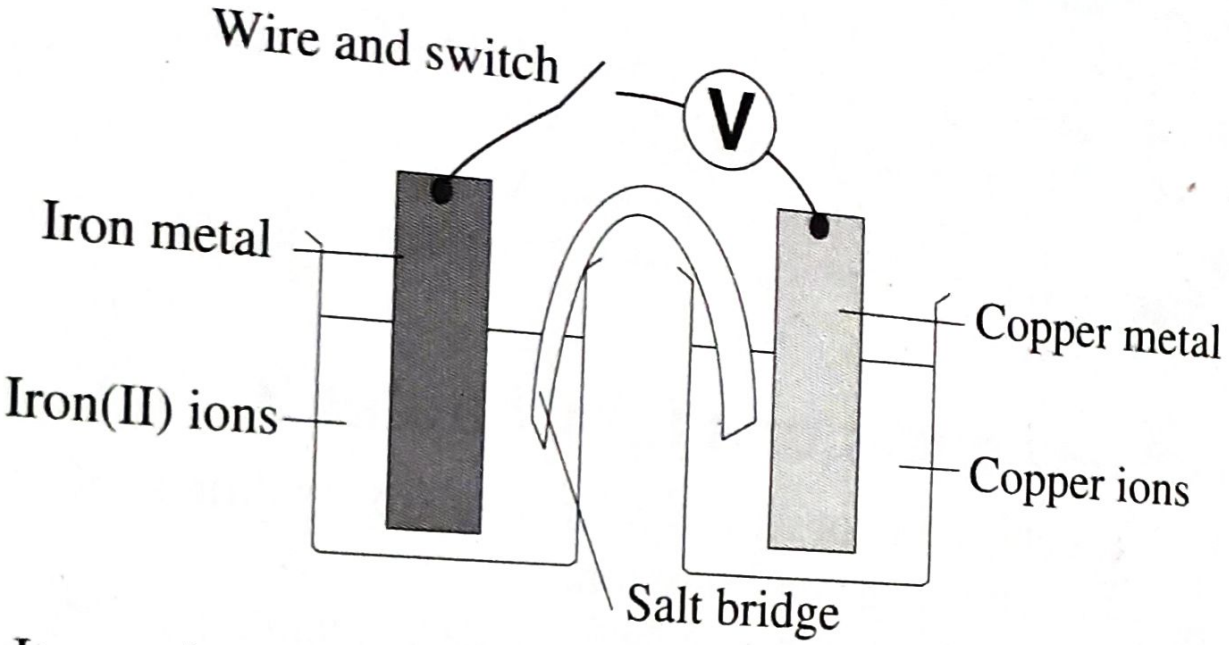
Test yourself 3A

1



2 It completes the circuit by allowing the movement of ions.

3 Temperature of 25 °C (298 K); all solutions at 1.0 mol L^{-1}; gas pressures of 1 atmosphere or 101.3 kPa.

4 $Fe(s) / Fe^{2+}(aq) // Cu^{2+}(aq) / Cu(s)$

5 $C(s) / Fe^{2+}(aq), Fe^{3}(aq) // Cu^{2+}(aq) / Cu(s)$

6 LHE $2Cl^- \longrightarrow Cl_2 + 2e^-$

RHE $MnO_4^- + 8H^+ + 5e^- \longrightarrow Mn^{2+} + 4H_2O$

$2MnO_4^- + 16H^+ + 10Cl^- \longrightarrow 2Mn^{2+} + 8H_2O + 5Cl_2$

$10Cl^- \longrightarrow 2Mn^{2+} + 8H_2O + 5Cl_2$

Test yourself 3B

1 a $E^\circ_{cell} = E^\circ_{RHE} - E^\circ_{LHE}$
$= +0.34\ V - (-2.36\ V)$
$= +2.70\ V$

b $E^\circ_{cell} = E^\circ_{RHE} - E^\circ_{LHE}$
$= -1.66\ V - (+1.50\ V)$
$= -3.16\ V$

c $E^\circ_{cell} = E^\circ_{RHE} - E^\circ_{LHE}$
$= +1.51\ V - (+0.77\ V)$
$= +0.74\ V$

2 a $Mg(s) + Cu^{2+}(aq) \longrightarrow Mg^{2+}(aq) + Cu(s)$

b $Al(s) + Au^{3+}(aq) \longrightarrow Al^{3+}(aq) + Au(s)$

c $5Fe^{2+} + MnO_4^- + 8H^+ \longrightarrow 5Fe^{3+} + Mn^{2+} + 4H_2O$

3 a When the Cl_2,Cl^- and Al^{3+} / Al half-cells are combined, will reduction occur in the Al^{3+} / Al cell and oxidation in the Cl_2 / Cl^- cell?

$E^\circ_{cell} = E^\circ_{Red} - E^\circ_{Ox}$
$= -1.66\ V - (+1.40\ V)$
$= -3.06\ V$

The E°_{cell} is negative, so the Cl^- will not reduce Al^{3+} to Al.

b Is Cl^- oxidised and Au^{3+} reduced when the Cl_2 / Cl^- and Au^{3+} / Au half-cells are combined?

$E^\circ_{cell} = E^\circ_{Red} - E^\circ_{Ox}$
$= +1.50\ V - (+1.40\ V)$
$= +0.10\ V$

The E°_{cell} is positive, so Cl^- will be oxidised by Au^{3+}.

c Is I^- oxidised and MnO_4^- reduced when the I_2 / I^- and MnO_4^- / Mn^{2+} half-cells are combined?

$E^\circ_{cell} = E^\circ_{Red} - E^\circ_{Ox}$
$= +1.51\ V - (+0.54\ V)$
$= +0.97\ V$

The E°_{cell} is positive, so MnO_4^- will oxidise I^- to I_2.

4 a Au
b MnO_4^-
c Cl^-
d Cl_2
e Fe^{2+}
f Na^+

Test yourself 3C

1 a Pb(s)
b $PbO_2(s)$

2 Because water is produced in the reaction and this dilutes the acid.

3 **a** Zn(s) **b** MnO_2

c It acts as the positive electrode.

4 **a** $Zn(s) / Zn^{2+}(aq) // Ag^{+}(aq) / Ag(s)$

b $2Ag(s) + Zn^{2+}(aq) \longrightarrow 2Ag^{+}(aq) + Zn(s)$

Review questions