

Answers to Oxidation and reduction

- H(+1), Xe(+6), O(-2)
 - Mn(+7), O(-2)
 - Fe(+6), O(-2)
 - Co(+3), Cl(-1)
- $$6\text{Fe}^{2+}(\text{aq}) + \text{Cr}_2\text{O}_7^{2-}(\text{aq}) + 14\text{H}^+(\text{aq}) \rightarrow 6\text{Fe}^{3+}(\text{aq}) + 2\text{Cr}^{3+}(\text{aq}) + 7\text{H}_2\text{O}(\text{l})$$
- $$3\text{MnO}_4^-(\text{aq}) + 5\text{W}^{3+}(\text{aq}) + 8\text{H}_2\text{O}(\text{l}) \rightarrow 3\text{Mn}^{2+}(\text{aq}) + 5\text{WO}_4^{2-}(\text{aq}) + 16\text{H}^+(\text{aq})$$
- $$\text{BrO}_3^-(\text{aq}) + 6\text{H}^+(\text{aq}) + 6\text{e}^- \rightarrow \text{Br}^-(\text{aq}) + 3\text{H}_2\text{O}(\text{l})$$

$$\text{Tl}^+(\text{aq}) \rightarrow \text{Tl}^{3+}(\text{aq}) + 2\text{e}^-$$
- 0.34 V is the EMF of the cell made from a standard copper and a standard hydrogen electrode. The copper electrode is positive.
 - The reference is a standard hydrogen electrode. Hydrogen gas at 1 atm and 298 K, $[\text{H}^+(\text{aq})] = 1 \text{ mol dm}^{-3}$, Pt electrode. Copper solid, $[\text{Cu}(\text{aq})] = 1 \text{ mol dm}^{-3}$. Salt bridge. Voltmeter shown.
 - The EMF of a cell is the maximum pd across its electrodes, measured when it is not supplying any current.
 - High resistance voltmeter, takes very little current, pd measured is close to the EMF of the cell.
- Pt electrode dipping into a solution of $\text{Fe}^{2+}(\text{aq}) / \text{Fe}^{3+}(\text{aq})$; 1 mol dm^{-3} for both ions.
- 0.15 V, Ni positive.
 - 2.71 V, Cu positive.
 - +0.80 V
 - AgBr(s) would precipitate, lowering $[\text{Ag}^+(\text{aq})]$. This encourages the production of more e^- in the Ag electrode, bringing its E value closer to that of the Cu electrode and so reducing the E_{cell} value.
 - $$\text{Cu}(\text{s}) + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Cu}^{2+}(\text{aq}) + 2\text{Ag}(\text{s})$$
 - Nickel has a more negative E^\ominus value and so can displace copper from a solution of its ions.
 - Acidified $\text{MnO}_4^-(\text{aq})$.

$$2\text{MnO}_4^-(\text{aq}) + 16\text{H}^+(\text{aq}) + 10\text{Cl}^-(\text{aq}) \rightarrow 2\text{Mn}^{2+}(\text{aq}) + 5\text{Cl}_2(\text{aq}) + 8\text{H}_2\text{O}(\text{l})$$
 - Predictions only valid for standard conditions. A predicted reaction may have such a high activation energy that it would be too slow to occur.
- $$2\text{H}_2\text{O} \rightarrow 4\text{H}^+ + \text{O}_2 + 4\text{e}^-$$

$$\text{CO}_2 + 4\text{H}^+ + 4\text{e}^- \rightarrow (\text{CH}_2\text{O}) + \text{H}_2\text{O}$$
 - Chlorophyll *a* plays a part in carrying the electrons from one half reaction to the other.
- Must absorb the Sun's visible radiation.
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|---|--------------------------------|
| $\text{X}^+ + \text{e}^- = \text{X}^*$ | E more negative than -0.42 V |
| $2\text{H}^+(\text{aq}) + 2\text{e}^- = \text{H}_2(\text{g})$ | $E = -0.42 \text{ V}$ |
| $\frac{1}{2}\text{O}_2(\text{g}) + 2\text{H}^+(\text{aq}) + 2\text{e}^- = \text{H}_2\text{O}(\text{l})$ | $E = +0.81 \text{ V}$ |
| $\text{X}^+ + \text{e}^- = \text{X}$ | E more positive than +0.81 V |