Worksheet 9.2

Chapter 9: Oxidation and reduction – fast facts

9.1 Introduction to oxidation and reduction

- Oxidation = loss of electrons
  Reduction = gain of electrons
- Oxidation number increases during oxidation.
  Oxidation number decreases during reduction.

9.2 Redox equations

- Half-equations show the electrons lost/gained in oxidation/reduction and can be used as a step in balancing a redox equation.
- Oxidising agents oxidize other species and themselves get reduced.
  Reducing agents reduce other species and themselves get oxidized.

9.3 Reactivity

- The more reactive a metal, the stronger it is as a reducing agent.
  The more reactive a non-metal, the stronger it is as an oxidizing agent.
- More reactive metals are able to reduce the ions of less reactive metals.
  More reactive non-metals are able to oxidize the ions of less reactive non-metals.

9.4 Voltaic cells and 19.1 Standard electrode potentials

- The higher the $E^\circ$ value of a cell the greater its tendency to be reduced.
- The lower the $E^\circ$ value of a cell the greater its tendency to be oxidized.
- The standard hydrogen electrode is used as the reference standard for voltaic cells, and is assigned a value of 0V.
- Using reduction potentials (with the signs as given):
  \[ E^\circ_{\text{cell}} = E^\circ_{\text{half-cell where reduction occurs}} - E^\circ_{\text{half-cell where oxidation occurs}} \]
- $E^\circ_{\text{cell}}$ must be positive for a spontaneous reaction.
- In all cells, oxidation occurs at the anode and reduction occurs at the cathode.
  In all cells, electrons flow from the anode to the cathode.
- In voltaic cells a spontaneous redox change is used to generate an electric voltage.

9.5 Electrolytic cells and 19.2 Electrolysis

- In electrolytic cells an electric voltage is used to drive non-spontaneous chemical change.
- The electrolyte is a molten salt or aqueous solution which undergoes the chemical change.
- In an electrolytic cell, current is supplied through a power source, and enters and leaves the electrolyte at the electrodes. It is carried through the electrolyte by mobile ions.
- Oxidation of anions occurs at the anode and reduction of cations occurs at the cathode. Neutral products are discharged from each electrode.
- The products of electrolysis in aqueous solution depend on:
  i) the \( E^\circ \) values
  ii) the concentration of electrolyte
  iii) the nature of the electrode.
- The amount of product in electrolysis depends on:
  i) the ion charge
  ii) the current
  iii) the time.
  \[
  \text{Charge (C)} = \text{current (A) x time (s)}
  \]
- Equation for discharge \( \Rightarrow \) moles of electrons (C) required.
  e.g. \( 2\text{Cl}^- \rightarrow \text{Cl}_2 + 2e^- \) : 1 mole \( \text{Cl}_2 \) product requires 2 moles electrons.

*Get it straight*
- In voltaic cells the anode is negative and the cathode is positive.
  
  In electrolytic cells the anode is positive and the cathode is negative.