

**Guiding Question revisited**

What happens when electrons are transferred?

In this chapter we have explored electron transfer or redox reactions.

- ☐ Oxidation is electron loss and reduction is electron gain. The two processes can be shown in terms of half-reactions.
- ☐ Oxidation and reduction can be identified by changes in oxidation state. A species with an element whose oxidation state is increased is oxidized. A species with an element with a decreased oxidation state is reduced.
- ☐ The oxidizing agent is the species that is reduced, and the reducing agent is the species that is oxidized.
- ☐ When the electron transfer in a spontaneous reaction occurs via an outside circuit, it can be used to produce an electric current. Electrons flow from anode to cathode in the external circuit and ions move between the electrodes in the electrolyte.
- ☐ Only reactive metals with negative electrode potentials produce hydrogen gas when added to dilute acids.
- ☐ A primary cell produces electricity from reagents which are used up in an irreversible chemical reaction. A secondary cell can be recharged as the cell reaction is reversible. In a fuel cell the reagents are supplied as it operates.
- ☐ Electricity can be used to drive non-spontaneous reactions.
- ☐ Electrolysis can be used to break down stable compounds in the molten state. It is used to extract reactive metals and non-metals and for electroplating.
- ☐ Reduction occurs at the cathode and oxidation occurs at the anode in both voltaic and electrolytic cells.
- ☐ Oxidation reactions in organic chemistry involve the addition of oxygen or the removal of hydrogen. Alcohols and aldehydes are oxidized by oxidizing agents. When oxidizing agents contain a transition metal, there is a colour change as the oxidation state changes.
- ☐ Reduction reactions in organic chemistry involve the addition of hydrogen or the removal of oxygen. The alkenes and alkynes are reduced by H_2 adding across a $C=C$ bond. The aldehydes, ketones and carboxylic acids are reduced by reducing agents with the H^- ion, which react with the partially positive charge of the carbon atom in the carbonyl group.