

**Electrochemical Cell****Reduction at the cathode:**

The solution remains colourless as  $\text{H}_2\text{O}_2$  and  $\text{H}_2\text{O}$  are both colourless.

This is a reduction reaction as the oxidation number of O decreases from -1 in  $\text{H}_2\text{O}_2$  to -2 in  $\text{H}_2\text{O}$ . A decrease in oxidation number corresponds to reduction.

Each  $\text{H}_2\text{O}_2$  gains two electrons. Gaining of electrons corresponds to reduction.

**Oxidation at the anode:**

The solution turns from pale green  $\text{Fe}^{2+}$  to orange  $\text{Fe}^{3+}$ .

This is an oxidation reaction as the oxidation number of Fe increases from +2 in  $\text{Fe}^{2+}$  to +3 in  $\text{Fe}^{3+}$ . An increase in oxidation number corresponds to oxidation.

Each  $\text{Fe}^{2+}$  loses 1 electron, losing electrons corresponds to oxidation.

 **$E^\circ$** 

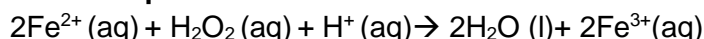
An electrochemical cell is an apparatus that uses a spontaneous oxidation-reduction reaction to produce an electric current. It consists of two half cells connected by a conducting wire and a salt bridge. The reaction is spontaneous creating electrical energy.

For this reaction:

$$E^\circ_{\text{cell}} = E^\circ_{\text{red}} - E^\circ_{\text{ox}} = +1.77 \text{ V} - 0.77 \text{ V} = +1.00 \text{ V}$$

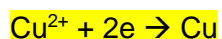
As  $E^\circ_{\text{cell}}$  is positive, the reaction is spontaneous.

The most positive  $E^\circ$  value will be the reduction reaction as these are reduction potentials

**Overall equation:****Electrolytic cell**

From observations: The electrolysis of molten copper oxide produces bubbles of a colourless gas at one electrode and an orange solid is deposited at the other electrode.

Colourless gas is oxygen at the positive anode. Orange solid is copper and it is deposited at the negative cathode.

**Reduction at the cathode (negative electrode)**

The oxidation number of Cu decreases from +2 in  $\text{Cu}^{2+}$  to 0 in Cu.

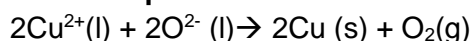
Each  $\text{Cu}^{2+}$  gains 2 electrons.

**Oxidation at the anode (positive electrode)**

The bubbles of colourless gas are oxygen.

The oxidation number of O increases from -2 in  $\text{O}^{2-}$  to 0 in  $\text{O}_2$ .

Each  $\text{O}^{2-}$  loses 2 electrons.

**Overall equation****Energy requirements**

The battery provides push for electrons to move in the reverse direction to their natural tendency. The non-spontaneous reaction is forced to occur and electrical energy is consumed in order to produce a chemical reaction.