Student 4: High Achieved

NZQA Intended for teacher use only

Electrochemical Cell

Reduction at the cathode:

$H_2O_2 + e \rightarrow 2H_2O$

The reaction remains colourless.

This is a reduction reaction as the oxidation number of O decreases from -1 in H_2O_2 to -2 in H_2O. A decrease in oxidation number corresponds to reduction. (1)

Oxidation at the anode:

$Fe^{2+} \rightarrow Fe^{3+} + e$

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

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

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

E^o

For this reaction:

E^0 for H_2O_2 is the most positive (1.77) so it will be reduced. (3)

The reaction is spontaneous creating electrical energy.

Electolytic 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)

$Cu^{2+} + 2e \rightarrow Cu$

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

Each Cu^{2+} gains 2 electrons.

Oxidation at the anode (positive electrode)

$O^{2-} \rightarrow O_2 + 4e$

The bubbles of colourless gas are oxygen.

Each O^{2-} loses 2 electrons. (2)

This process requires electrical energy.