

LESSON NOTES

Year/Level: 11 C/D

week 13

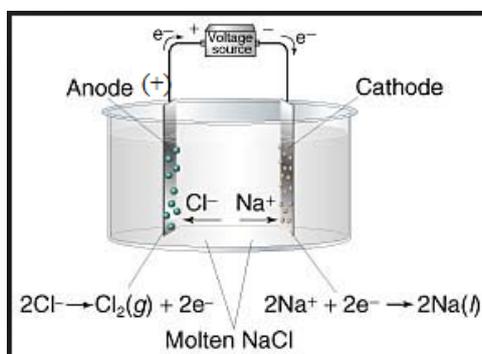
Subject: Chemistry

Strand	3 Reactions
Sub Strand	3.2 types of reactions
Content Learning Outcome	Distinguish and describe different types of reactions based on chemical statements and balanced chemical equations

**Electrolysis**

**Electrolysis of Molten Salt**

1. Salts are ionic compounds. Molten salts conduct electricity
2. When electricity flows through molten salt, a redox reaction occurs. This reaction is called electrolysis
3. The molten salt is called the electrolyte. The positive electrode is called the anode and the negative electrode is called the cathode.
4. Oxidation occurs at the anode and reduction occurs at the cathode



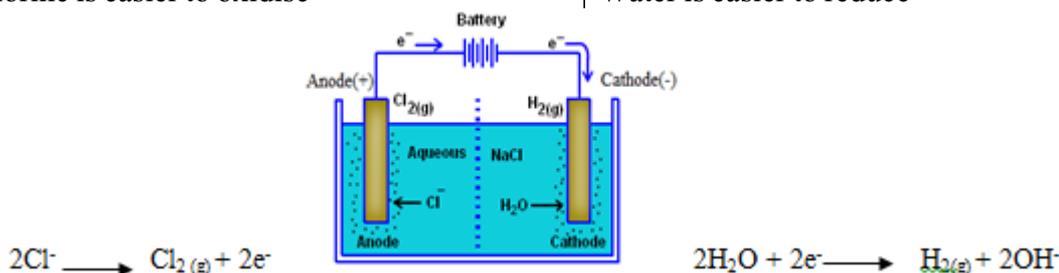
When electrolyte is molten NaCl, Cl<sup>-</sup> is oxidized at the anode and Na<sup>+</sup> is reduced at the cathode. Bubbles of Cl<sub>2</sub> gas comes from the anode, and sodium metal collects at the cathode.

**Electrolysis of Salt Solution**

1. When a concentrated salt solution is used as an electrolyte, both the salt and water may be oxidized or reduced.
2. If the anion is Cl<sup>-</sup>, Br<sup>-</sup> or I<sup>-</sup>, then the anion is oxidized (otherwise water is oxidised)
3. If the cation is below aluminium in the activity series, then the cation is reduced (otherwise water is reduced)

Possible half-equations in a concentrated solution of NaCl

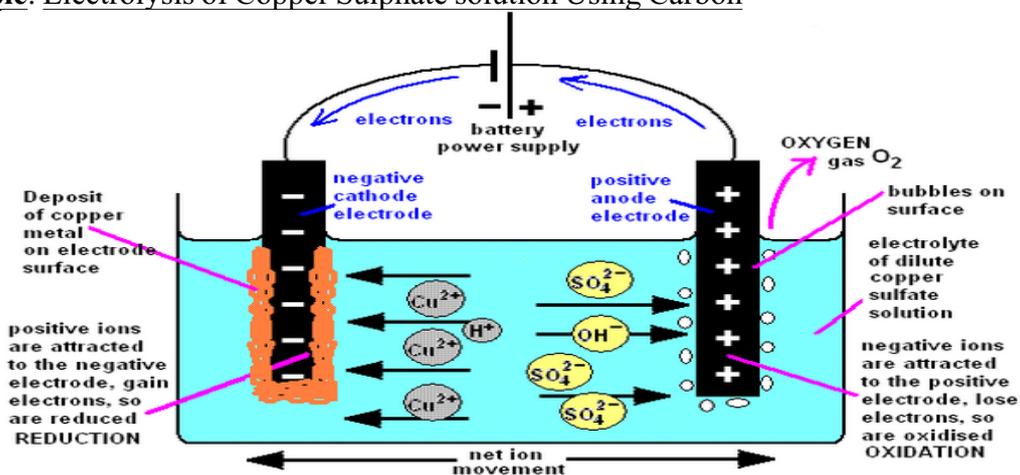
Oxidation (anode)	Reduction (cathode)
$2\text{Cl}^- \longrightarrow \text{Cl}_2(\text{g}) + 2\text{e}^-$	$\text{Na}^+ + \text{e}^- \longrightarrow \text{Na}(\text{s})$
$2\text{H}_2\text{O} \longrightarrow \text{O}_2(\text{g}) + 4\text{H}^+ + 4\text{e}^-$	$2\text{H}_2\text{O} + 2\text{e}^- \longrightarrow \text{H}_2(\text{g}) + 2\text{OH}^-$
Chlorine is easier to oxidise	Water is easier to reduce



A salt solution contains both water and salt. Which of these substances is oxidized and reduced depends on the salt. In a solution of sodium chloride, chlorine ions are oxidized at the anode and water is reduced at the cathode.

Anode		Cathode	
<i>Ion</i>	<i>Result</i>	<i>Ion</i>	<i>Result</i>
All other ions	Water is oxidized	Water is reduced	K
			Ca
Cl- Br- I-	Ion is oxidized	Ion is reduced	Na
			Mg
			Al
			Zn
			Fe
			Sn
			Pb
			H
			Cu
			Ag
Au			

**Example:** Electrolysis of Copper Sulphate solution Using Carbon



When a solution of copper sulphate is the electrolyte, copper ions ( $\text{Cu}^{2+}$ ) are reduced at the cathode instead of water. Copper ions are easier to reduced than water because copper is low in the activity series. The brown deposit that forms on the cathode is copper metal. Water is oxidized at the anode.

**Activity**

During the electrolysis of molten lead bromide, lead ions are reduced.

a. Draw laboratory apparatus for the electrolysis of molten lead bromide

- b. At which electrode are the lead ions reduced? \_\_\_\_\_
- c. What ions are oxidized in this experiment? \_\_\_\_\_
- d. At which electrode does oxidation occur? \_\_\_\_\_
- e. Write the balanced half-equations for the oxidation and reduction

