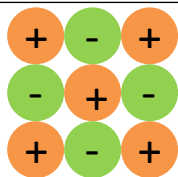


# C6: Electrolysis

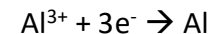


Electrolysis splits up ionic substances. The ionic substance needs to be molten or dissolved in a liquid so the ions are free to move and conduct electricity. The liquid of the dissolved/molten ionic compound is called an electrolyte.

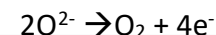
## Extracting Aluminium

Found in as an ore called bauxite which is purified to aluminium oxide,  $\text{Al}_2\text{O}_3$ . Electrolysis is then used to extract the aluminium. Cryolite is added to reduce the melting point of aluminium from  $2000^\circ\text{C}$  to  $900^\circ\text{C}$ .

Aluminium forms at the negative electrode:



and oxygen at the positive electrode:



## What happens in Electrolysis?

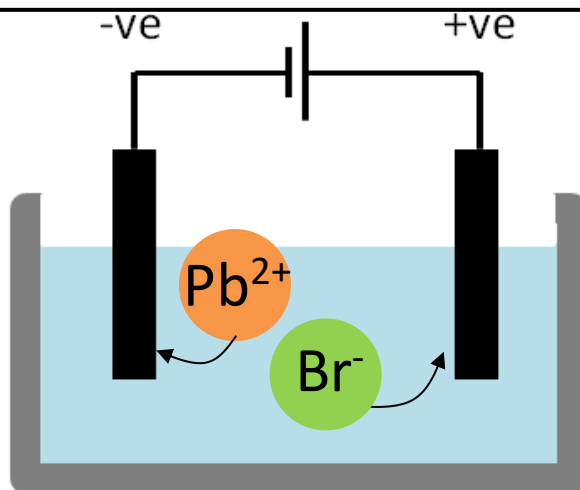
Lead bromide can be separated but first it has to be melted. This means the ions to move.

$\text{Pb}^{2+}$

The positive ions move to the negative electrode. They **gain electrons**.  $\text{Pb}^{2+}$  would gain **two** electrons to form one Lead **atom**, Pb.

## Half Equations

-ve electrode:  $\text{Pb}^{2+} + 2\text{e}^- \rightarrow \text{Pb}$       The equation must balance. There are two  
 +ve electrode:  $2\text{Br}^- \rightarrow \text{Br}_2 + 2\text{e}^-$       Br ions on the left and  
 or:  $2\text{Br}^- - 2\text{e}^- \rightarrow \text{Br}_2$       two Br atoms on the right.



The negative ions move to the positive electrode. They lose electrons.  $\text{Br}^-$  would lose one electron.

Bromine is  $\text{Br}_2$  (two bromine atoms) so for this to balance two  $\text{Br}^-$  ions are needed to form one chlorine,  $\text{Br}_2$  molecule.



## Oxidation and Reduction

**Oxidation** is the **loss** of electrons. In lead bromide Bromine is oxidised.

**Reduction** is the **gain** of electrons. Lead ions are reduced.

## Remember OIL RIG

Oxidation	Reduction
Is	Is
Loss	Gain

## Importance of Reactivity

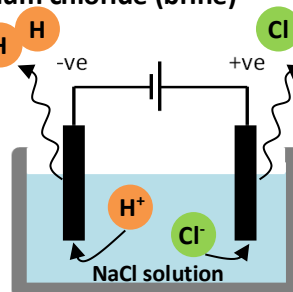
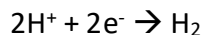
If a salt is dissolved in water then there are more than just two ions as water contains the ions  $\text{H}^+$  and  $\text{OH}^-$ .

At the **negative electrode**, if the metal is more reactive than  $\text{H}^+$  it will stay in solution, if not  $\text{H}_2$  will form.

At the **positive electrode**, the group 7 element will always form. If there is no group 7 element present then oxygen will form (from the  $\text{OH}^-$  ions).

## Electrolysis of sodium chloride (brine)

$\text{H}_2$  gas produced. Tested for with the squeaky pop test.



$\text{Cl}_2$  gas produced. Tested for with damp litmus paper, which will be bleached. Is used in bleach.

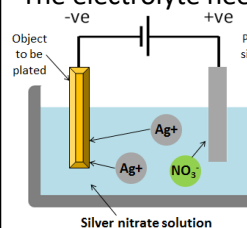


$\text{Na}^+$  and  $\text{OH}^-$  ions left in solution, which form the alkali NaOH, sodium hydroxide. This is used in industry to make soap.

## Electroplating

Electrolysis is used to coat the surface of a metal with another metal, eg. plating (cheap) brass with silver (expensive).

The electrolyte needs to contain the ions of the plating material.



Brass is made negative to attract the positive silver ions.