BBC BITESIZE

Extracting aluminium

Big Manny: Have you ever wondered how the aluminium in drinks cans or foil like this is made?

It's produced using electrolysis, a process that uses electricity to break down a compound.

Aluminium is the most abundant metal in the Earth's crust, but it's never found as a pure metal.

It's locked up inside aluminium oxide.

And to extract it so that we can use it up, we need to remove the oxygen first.

And this is a process called reduction which takes up a lot of energy man.

This is the reactivity series.

It shows how reactive different metals are.

The more reactive ones are at the top and the least reactive ones are at the bottom.

Metals like zinc, iron, and copper can be extracted using carbon.

But carbon isn't reactive enough to displace aluminium though, that's why aluminium is extracted by electrolysis instead.

Now in electrolysis, we use an electrolyte, a substance that conducts electricity through free-moving ions.

Ionic compounds only conduct when molten or dissolved.

Pure aluminium oxide has an extremely high melting point, so we mix it with cryolite, which lowers the melting point and reduces energy use.

Let's look at how this works yeah.

Purified aluminium oxide is dissolved in the molten cryolite inside a steel case.

Both electrodes are made of graphite, a good conductor with a higher melting point.

As electricity flows at the cathode, which is the negative electrode, aluminium ions gain electrons and form aluminium metal.

The molten aluminium gathers at the bottom, ready to be tapped off as a pure liquid metal.

And at the anode - the positive electrode - oxide ions lose electrons and form oxygen.

This oxygen reacts with the carbon anode to make carbon dioxide.

The oxygen gradually burns away the anode, so it must be replaced regularly.

Balanced half equations show these electron transfers clearly.

Positive aluminium ions gain electrons at the cathode, while oxide ions lose electrons at the anode.

Now it's time for a quick challenge.

Over to you.

Why is aluminium oxide mixed with cryolite in the electrolysis process?

Is it A?

To lower its melting point and make it molten?

B?

To make it dissolve in water?

Or C?

To react with aluminium and produce carbon dioxide?

If you need a bit of time to think, you can pause the video now.

Let's check if you got it right.

So the answer was A.

Aluminium oxide has a very high melting point.

It's mixed with cryolite to lower the temperature.

This process makes it much more efficient, saving energy and that means less electricity required, which is also going to save on costs isn’t it.

Alright, cool.

So now it's time for the recap.

Carbon isn't reactive enough to displace aluminium so electrolysis is used.

Using a mixture of light and aluminium oxide means the electrolyte melts at a lower temperature.

The negative electrode is known as a cathode and is where aluminium ions gain electrons.

The positive electrode is known as an anode, and is where oxide ions lose electrons and form oxygen.

The anode burns away in the oxygen produced, so it must be replaced regularly.

So next time you open a drink, can or use a bit of kitchen foil, remember it all began with electrolysis and that innit.

You dun know, aluminium settings.