BBC BITESIZE

Flame tests for metal ions

Big Manny: Alright, cool.

Fireworks get their amazing colours from chemistry, innit.

When metal ions are heated to really high temperatures, they produce their own distinctive colours.

That's what creates the reds, greens, and blues you see when fireworks explode in the sky.

In the lab, scientists use the same principle in something called a flame test for metal ions.

It's a safe, and controlled way to identify metal ions by the colour they produce in the flame.

So in this experiment, we're going to be testing five common metal ion compounds.

We've got some potassium, lithium, copper, calcium and some sodium.

Now all of them are positive ions, also known as cations.

Each one produces its own distinctive flame colour, which we will observe and record as we go along in a table, like this.

But before we start, what equipment are we going to need?

We need to make sure that we're wearing eye protection and that the nichrome wire is clean and in a loop.

We'll be using this for each test.

Now, we're going to light the Bunsen burner.

Now, when we do this, we have to make sure that the air hole is closed, so that we get the yellow safety flame.

We need to open up the Bunsen burner air hole so that we can let some oxygen gas in and get a nice blue flame.

So, we're going to get our nichrome wire.

And then we're just going to dip it into the water to make sure that it's clean.

Now we're going to go to our potassium solution, and we're going to dip it into the test tube like this so that we can pick up some of the potassium ions.

We're going to put it into the flame.

So we're getting a little lilac flame from the potassium there.

But I can't really see it too well.

But you know what we can do?

Lights.

Yeah, look at that, you can see that lilac there.

Next thing, we have to clean the nichrome wire again, because we don't want to cross contaminate between the different metal samples.

So we're going to dip it into our lithium solution, yeah.

Let's go.

We're going to pick up some lithium ions and let's test it in the flame.

Oh, look at that.

A lovely crimson flame.

But before that, we have to clean the nichrome wire.

We have to do this in between each metal test.

Okay so now, we're going to dip our wire into the blue copper solution.

And we're going to pick up some of the copper ions.

Let's put it into the flame and see what colour we get.

So we can see that we're getting a lovely green flame there.

Now the copper is one of the easiest ones to identify because the green flame stands out.

So obviously, we've got to clean the wire, innit.

You can't forget that step man.

All right, so I've picked up some of the calcium ions and we're going to put it into the flame.

Let's go.

So we can see that the calcium is burning with a nice orange flame, similar to the crimson red from the lithium.

But the calcium is more like an orange-red.

Alright, so it's time for the final test, yeah.

We're going to test for the sodium ions.

The wire's clean now.

So I'm going to dip the wire into the sodium solution, like that.

Pick up some ions, and we're going to put it into the flame.

Now the thing with sodium, yeah, the flame colour is very bright and it can overpower the other colours.

So, it's best to leave this one till last.

Alright, so we've tested all of our metal cations now so we can just clean the nichrome wire one more time and then turn off our Bunsen burner and the gas.

Let's recap with our completed table.

So potassium produces a lilac flame that can be quite faint.

Lithium compounds produce a crimson flame.

Copper ions produce a green flame.

And calcium ions produce an orange-red flame.

A bit similar to lithium, but not as red.

And the most intense is sodium, whose ions produced a bright yellow flame.

And that's the flame test.

A simple, but powerful method that scientists use to identify metal ions.

It's also what gives fireworks their unique colours and that, innit.