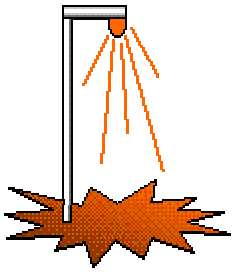
Flame Tests

What do the **street lamp**, **salt** and **fireworks** have in common?

They all contain **sodium**, which gives off a unique **orange** flame when heated.

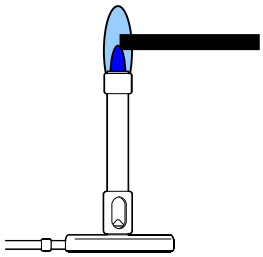


You are going to find out what colour **flame** six different known metal solutions make. You will then use your results to work out which metals are in four unknown samples.

Job 1

The first job is to make sure that you have a clean flame test wire.

Check that your flame test wire is **clean**.
Do this by holding the metal loop in the hottest part of the Bunsen burner flame. If it is clean, there should be no change in the colour of the flame when the metal loop is put in the flame.



If the metal loop is **not clean**, clean it by dipping it into the concentrated acid provided, then holding the loop in the Bunsen burner flame. Repeat this cleaning until there is no more change in the colour of the flame.

Job 2

The next job is to do your flame tests. Dip the flame test loop into one of the known test solutions, then hold the metal loop in the hottest part of the Bunsen burner flame.
Make a note of the **colour** of the flame on your **Flame Test Chart**.

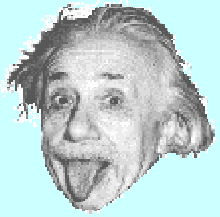
Clean the flame test wire as you did in Job 1, then test another known test solution. Keep going until you have recorded the colour of all of the known solutions.

Ask one of the teachers to check your Results before going onto the next Job.

Job 3

Repeat Job 2, but this time with the four unknown test solutions.

Can you work out which metals are in each of these solutions?



Every atom consists of a nucleus with tiny electrons whizzing round it. The further away from the nucleus they are, the more energy the electrons have. If a metal atom is heated, the electrons get enough energy to jump higher away from the nucleus. When they fall back closer to the nucleus, they give off this extra energy as light.

Different metals produce different coloured light. If we look at the colour of the light made when a solution of metal is heated in a flame, we can tell which metal is there.

Flame Test Chart

Your name:

.....

Record your results during Job 2 in the table below.

barium	calcium	copper	lead	potassium	sodium

Record your results during Job 3 in the table below.

	Sample …….	Sample …….	Sample …….	Sample …….
flame colour				
metal				

Use the first table to work out the metals in the unknown samples, and then fill in the bottom row.

Flame Test Chart

Your name:

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Record your results during Job 2 in the table below.

barium	calcium	copper	lead	potassium	sodium

Record your results during Job 3 in the table below.

	Sample …….	Sample …….	Sample …….	Sample …….
flame colour				
metal				

Use the first table to work out the metals in the unknown samples, and then fill in the bottom row.

Teacher Guide for Flame Tests

Contents:

Activity notes

Flame tests have found their way out of the GCSE Science curriculum, yet students enjoy doing them and quickly grasp the connections to sodium street lamps, fireworks and identification of unknown metal solutions. We investigate barium, calcium, copper, lead, potassium and sodium, as they give readily identifiable colours. The flame test wires should be cleaned between each test by dipping in nitric acid and heating, but it works best if each solution has its own labelled flame test wire. Sodium in particular is difficult to remove, and students will end up thinking everything contains sodium or makes an orange flame! The expected colours are shown in the table below:

metal	**flame colour**
barium	light green
calcium	brick red
copper	blue/green
lead	blue/white
potassium	lilac
sodium	bright orange

Flame Tests

Students' checklist

Check you have:

- 1 x Bunsen burner
- Flame test wires
- Test tube of concentrated hydrochloric acid (**Corrosive**)
- 6 x named metal solutions
- 4 x unknown metal solutions (1, 2, 3 and 4)

Flame Tests

Technicians' notes

In the lab:

Test tube racks
Bench mats

In tubes labelled with the name of the metal, approx. 0.5M solutions of:

- barium chloride
- calcium chloride
- copper(II) sulphate
- lead(II) nitrate
- potassium nitrate
- sodium chloride

(Maintain stocks for replenishment)

5M hydrochloric acid in labelled test tubes
5 x Bunsen burners
Minimum of 10 flame test wires (cleaned)

Four of the six solutions as unknowns, in test tubes labelled 1, 2, 3 or 4 (with stock for replenishment)