

# Flame Colours – Technician's Notes



## Advance Preparation

### **Chemicals**

Calcium acetate

Lithium chloride (LiCl)

Copper(II) chloride (CuCl<sub>2</sub>)

Sodium chloride (NaCl)

### **Equipment**

3 x Spray bottles

### **Preparation Instructions**

1. Make up a solution of saturated calcium acetate (**NB – MUST be saturated!**)
2. Make up a solution of lithium chloride (a spatula in 100 ml water is about right though the stronger the solution the better colour)
3. Make up a solution of copper chloride (a spatula in 100 ml water is about right though the stronger the solution the better colour)
4. Make up a solution of sodium chloride (a spatula in 100 ml water is about right though the stronger the solution the better colour)
5. Fill the three spray bottles with the three chloride solutions.

## Preparation for Demo

### **The Teacher Will Need...**

Saturated calcium acetate solution

Lithium chloride (LiCl) solution in spray bottle



Copper(II) chloride ( $\text{CuCl}_2$ ) solution in spray bottle

Sodium chloride ( $\text{NaCl}$ ) solution in spray bottle

Ethanol

2 Heatproof mats

Spatula

Beaker (250 ml)

***Preparation...***

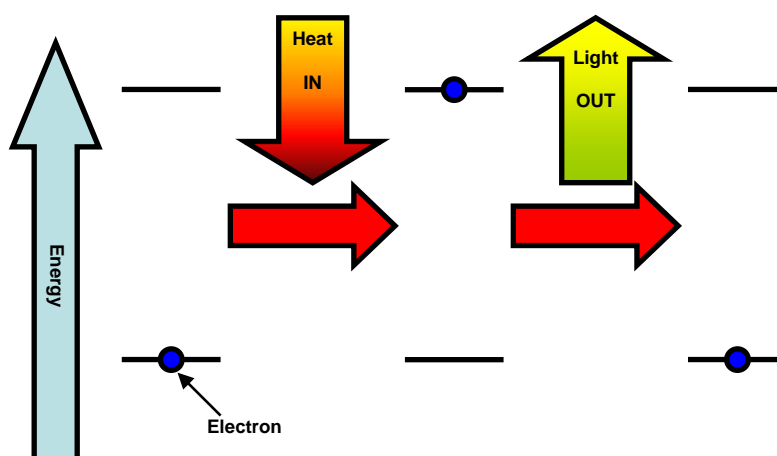
1. Make sure all the equipment is available



# Explanation – Flame Colours

Different metals produce different colours in a flame.

The solid you have made is a firelighter – similar to the white blocks that are often used to get a barbeque going on a rainy Scottish summer day! When you spray on a metal salt, the flame gives the electrons in the metal energy (**excitation**). This energy can then be lost again in the form of light (**emission**). The colour of the light depends on the metal: Lithium(I) gives a pink flame, Copper(II) gives a green flame and Sodium(I) gives a yellow flame.



This process is used extensively in Chemistry to determine what type and concentration of atoms a substance contains. Chemists basically burn the substance and measure the frequency (*i.e.* colour) of the light that's given out. This process is called “Atomic Emission Spectroscopy”.

These colours are also often used in fireworks to give the different colours that amaze audiences at a firework display. The yellow colour for sodium should be particularly familiar as this is the same colour that comes from the sodium bulbs in streetlamps.

# Experiment – Flame Colours

This experiment is relevant to:



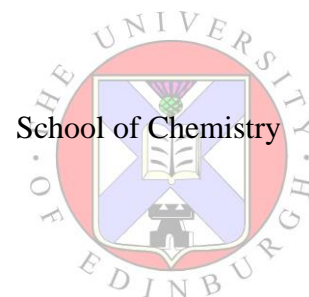
*Colour Chemistry*

*Electrons and Energy Levels*

*Metal Chemistry*

*Energy Changes*

*Alkali Metals*



## RISK ASSESSMENT (inc COSHH)

(Section 2.3)

Lab No. N2.6/Public

Ref. PRM PUBSCI Flame Colours

Title Flame Colours

Specific

Generic

Please Tick

Date: 02/04/15

Attach additional sheets if required at any section.

Substances Involved and Hazards Identified: e.g. Biological\* (Sect. 4.1); Radioactive\* (Sect. 4.2); Toxic, Explosive, Inflammable, Carcinogenic (Sect. 4.3)

Substance	Hazard
Calcium Acetate	May act as an eye, skin or respiratory irritant. Ingestion of large amounts may lead to gastrointestinal irritation.
Ethanol	Flammable. May be harmful by inhalation, ingestion or skin absorption. May act as an irritant.
Lithium Chloride	Harmful if swallowed, inhaled or absorbed through skin. May cause harm to breastfed babies.
Copper(II) Chloride	Harmful by inhalation and ingestion.
Sodium Chloride	No significant risk

Equipment used & Hazards Identified (Please Tick)

Apparatus	Cryogenic	Electrical	Laser*	X-Ray*	Vacuum Pressure	Lifting Gear	VDU
4.4	4.6	4.7	4.8	4.9	4.10	4.12	4.13

### Scheme of Work/Procedure

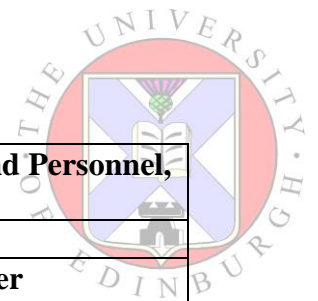
About 50 ml of saturated calcium acetate solution is added to the beaker. Ethanol is added and the solution stirred until a solid is formed. The solid is scooped out and placed on a heatproof mat. The solid is lit. The solid is sprayed with lithium salt solution (pink flame), copper salt solution (green flame) and sodium salt solution (yellow flame). Flame can be extinguished with liquid nitrogen, or left to burn out.

Overnight permit required

(3.7)

All Numbers refer to appropriate section in School Safety Handbook

\* Additional Documentation needed



<b>Particular Control/Safety Measures to be Adopted: Both Engineering and Personnel, e.g. Fume Cupboard, Gloves, Blast screen</b>	
Safety goggles, lab coat.	
<b>EMERGENCY PROCEDURES (a) Spillage (b) Fire (c) Other</b>	
Wipe up and rinse affected area	
Extinguish fire with media appropriate to it's nature	
<b>First Aid Treatment</b>	
In case of contact, immediately flush eyes or skin with copious amounts of water.	
<b>Waste Disposal Procedures 4.11</b>	
Wash down sink with plenty water.	
<b>Information Sources</b>	
Material Safety Data Sheets	
<b>Name of Assessor</b> Paul Murray	<b>Signature</b>
<b>Supervision Required</b>	<b>Experienced Worker</b>
<b>Section 2.4</b>	<b>A B C D</b>
<b>Please circle →</b>	<b>← Please circle</b>
<b>Supervisor to be present</b>	<b>No supervision required</b>
<b>Please circle →</b>	<b>← Please circle</b>
	<b>Novice Worker</b>
<b>Name of Supervisor</b> Lesley Yellowlees	<b>Signature</b>
<b>Date</b> Thursday, 02 April 2015	