

Flame Test - Lab Report

by Thomas Lumsden

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Flame Test – Lab Report

UWTSD
Chemistry

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1) Introduction

a) Purpose of experiment

In doing this flame test experiment, ^{it is expected} I'm hoping to produce accurate and coherent results in executing the process of heating unknown metal salts and being able to correctly identify what metals ^{are present} I am dealing with and give an educated answer as to what the wavelength of the flame given off is.

professional reports as this should be written in passive voice

b) Hypotheses undergoing testing

The identity of the metal being used will be clear when heated over a flame, as the colour of the flame given off when heating the metal will help identify which metal it is as different metals give off different colours of flames when heated up.

c) Variables and Equations

- $\Delta E = h \times f$ *all terms in these equations should be explained; E - energy, h - Planck constant, etc.*
- $c = f \times \lambda$ *variables are not specified; independent - salt solution, dependant - colour of the flame, controlled - Amount of sample used, Type and temperature of flame, Cleanliness of the wire loop, Distance from sample to flame, Environmental lighting*

2) Results

a) Experimental Data

Unknown metal salt	Colour of the flame	Identity of metal	Wavelength
DI water	No colour	-----	-----
1 M HCl	No colour	-----	-----
A	Orange	Calcium	590nm
B	Lavendar	Potassium	380-450nm
C	Orange	Calcium	590-620nm
D	Red	Strontium	620-720nm
E	Blue/Green	Copper	490nm
F	Red/Pink	Lithium	700-800nm
G	Green	Barium	460-570nm
H	Yellow	Sodium	590-620nm

b) Results in Graphs

N/A

c) Key Findings & Patterns

I was able to identify at where each of the metals I identified related to a certain wavelength based on the colour.

3) Discussion

a) Interpretation of experimental data

Overall, I think the data gathered while doing this experiment is positive and could somewhat correctly correspond to the metal salts supplied. I gathered results for every metal solution and was able to use the visible light spectrum to determine an accurate depiction of the wavelength for that colour of flame.

b) Relationship between E, f & λ

Using the two equations:

- $\Delta E = h \times f$
- $c = f \times \lambda$

These equations show that when the frequency is increased, the energy difference will increase, and the wavelength will decrease. Whenever the wavelength is increased, the frequency is increased and therefore the energy difference will increase. *excellent evaluation*

c) Relevance of experiment in OME

This experiment relates to the topic of OME in the sense that they both contain aspect of pyrotechnics & explosives. OME covers a wide range of different explosive and chemical reactions, and putting this experiment into practise can get OME students prepared for similar and more demanding experiments.

d) Alternate scenario this experiment can be applied

Another scenario where this experiment can be used is when dealing with stars. Some stars can contain certain metal salts, this means that when heat is applied, the valence electrons become excited and move to a higher energy level. The stars cannot maintain this energy and therefore photons are emitted when they return to their resting energy state.

e) Limitations or potential error

A thing I noticed when doing this experiment that could cause trouble in collecting accurate results, is the contamination of the metal rod and or the solutions being provided. The cross contamination of the metal rod being dipped into different solutions paired with ineffective cleaning of the rod would most likely result in skewed results. *good recognition of potential error*

4) Conclusions

a) Summary of main findings

My main findings in doing this was that this experiment is an effective way to identify certain metals, as long as there are no contamination issues or human errors, this method is reliable.

b) Future research

Another area for potential research for me in doing this experiment is how sodium and potassium can be hard to tell apart at times since the yellow flames coming off the potassium solution can make it look like sodium.

5) References

N/A

you should always support your professional writing with literature; for example when you talk about absorption-emission in stars, find a paper, web site, book that discuss this as well. use IEEE format to reference the source

6) Appendix

a) Materials & Methods

i) Materials and Equipment

Includes:

- Bunsen Burner
- Heat-resistant mat
- Matches
- Metal rod
- 1 M solutions of unknown metal salts labelled A-H
- Beaker with deionised water (DI water)
- Blue cobalt glass

ii) Experimental Procedure

- Use Bunsen burner on a heat-resistant mat and turn to the non-luminous flame with two blue cones.
- Proceed to clean the metal rod by dipping it into 1M HCl and heat it in the hottest part of the flame. Repeat until there is no colour when the rod is burned.
- Dip the metal rod into the DI water and heat to remove any previous HCl.
- Wait until the rod is cool and then proceed to dip it into one of the unknown metal salt liquids. Then put the rod into the hottest part of the flame (which is the top of the first blue cone inside the flame)
- Record the colour of flame given off and determine which metal solution it is.

iii) Why do we use cobalt glass?

The cobalt glass is used to differentiate between the colours of the sodium and potassium flame and to filter out the unwanted yellow light when using either of the solutions.

b) original data sheet

DATA SHEET to RECORD OBSERVATIONS, CALCULATIONS and RESULTS

STUDENT'S NAME: Thomas Lawler

PARTNERS' NAMES: Jack Treadle

REPORT IS DUE MARCH 14th (21st with DD), 2025 submitted via Moodle

Observations and Identification:

Complete the table below. Based on the observed colour of the flame and Table 1, identify the metal ion in each unknown salt. Using the electromagnetic spectrum in Fig 2, estimate and report with the appropriate unit the wavelength for each observed colour. Identify the solution containing mixture of sodium and potassium:

Unknown metal salt	Colour of the flame	Identity of metal	Wavelength
DI water		-----	-----
1 M HCl		-----	-----
A	Orange	Calcium	540nm
B	Lavender	Potassium	380-450nm
C	Orange	Calcium	540-620nm
D	Red	Strontium	620-720nm
E	Blue/green	Copper	440nm
F	Red/pink	Lithium	400nm
G	Green	Barium	460-520nm
H	Yellow	Sodium	540-620nm

Flame Test - Lab Report

GRADEMARK REPORT

FINAL GRADE

39/100

GENERAL COMMENTS

GENERAL FEEDBACK: READ THE GUIDANCE FOR THE LAB REPORT CAREFULLY AND ADDRESS ALL PONTS.

Engagement with Literature Skills 2/15

The structure of the report suggests awareness of key sections where literature should be applied. However, no references are provided, and OME relevance is not supported by any source. The report lacks citations entirely, which undermines the credibility of the findings and discussion.

Feedback: Include peer-reviewed references to support both theoretical content and the OME context. Proper referencing is essential in scientific writing.

Knowledge and Understanding Skills 7/20

Basic equations ($E = hf$, $c = f\lambda$) are correctly included, but terms in equations are not explained (e.g., E , h , f , λ). Variables are not identified. The absorption-emission process is not explained. There is no calculation or detailed explanation of the relationship between energy, frequency, and wavelength for any metals, which is a critical omission. Feedback: Explain key terms and relationships in detail, and include calculations for two metals to demonstrate understanding of core concepts.

Cognitive and Intellectual Skills 10/25

The report shows some critical thinking by identifying contamination as a potential error and discussing flame test applications in astronomy. However, energy, frequency, and wavelength calculations for two metals are missing, and their interrelationship is not discussed. Multiple errors in metal identification are present, and analysis is superficial with no data validation or error analysis beyond one point.

Feedback: Include quantitative analysis for two metals and relate E , f , and λ . Discuss data accuracy, sources of error.

Practical Application Skills 12/25

The procedure is detailed and well-organised, showing a sound understanding of experimental steps. However, errors in metal ion identification undermine precision.

Transferable Skills 8/15

The report includes an excellent table of contents, and sectioning is clear and logical. However, there is no title page, and the report uses first person throughout, which is inappropriate for formal lab reports. Tone and phrasing occasionally lack professionalism.

Feedback: Use passive voice consistently, include a title page, and maintain formal scientific language for clarity and professionalism.

PAGE 1

PAGE 2

Text Comment. excellent table of content

PAGE 3

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PAGE 5

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PAGE 6

PAGE 7
