# Experiment No.7

## To estimate Copper in given sample Calorimetrically/ Spectrometrically


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- **AIM** : To estimate Copper in given sample Calorimetrically
- **APPARATUS** : Colorimeter/ Spectrometer, volumetric flasks etc.
- **REAGENTS**: Copper sulphate solution, Ammonia solution

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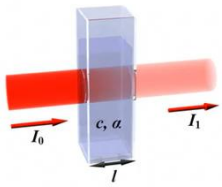


- The working of colorimeter/ Spectrometrically is based on ***Beer's- Lambert's law***.
- It state that,
- When beam of monochromatic light passing throw homogeneous absorbing medium, decrease in intensity of light is directly proportional to intensity of incident light as well as concentration of absorbing medium


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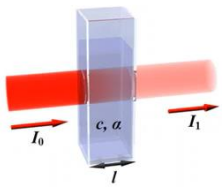


- **Transmission Or Transmittance: (T)**: It is simple ratio of intensity of transmitted light to incident light
- **i.e. T = It / Io**
- **Optical density (OD) or Absorbance (A)**: It is simple logarithmic ratio of intensity of incident light to transmitted light. **OD or A = log Io/It**

https://youtu.be/wxrAELeXlek link for UV-visible Spectrophotometer

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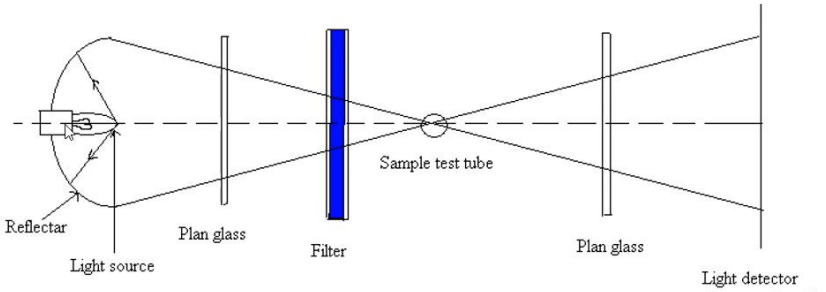


**Ray diadram for colorimeter**

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- **Applications of Colorimetry**
- Concentration of solution as low as $10^{-7}$ M which cannot determined by the conventional method like volumetric & gravimetric.
- Determination of iron.
- Determination of ammonia using Nessler's reagent.
- Determination of aluminum using Erio-chrome cyanine
- Determination of arsenic by molybdenum blue method.
- Simultaneous determination of chromium and manganese in steel.
- Analysis of ore, minerals, alloys & other industrial raw materials & finished products.
- Analysis of environmental samples.
- In determination of molecular composition of complexes.
- For studying Cis & Trans isomers.

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- **PROCEDURE**:
- **5.** Make a blank solution by diluting 5ml $NH_3$ solution in a 50 ml volumetric flask. Add distilled water up to the mark & mix well.
- **6.** Selection of **λ max** or filter: **a)** Select filter no.1, Insert blank solution test tube in a sample holder & Press % T button. Followed by pressing unlock button & then calibrate button. Observe 100 on display. Immediately remove blank test tube and insert test tube containing 100ppm solution from flask 5. Press **ABS** button and record reading in table 1. Repeat above procedure for all filters, and record readings.
- From table no. 1 find out filter at which **ABS** is maximum. Select that filter as **λ max.**

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- **PROCEDURE**:
- 7. Select this filter, calibrate with blank solution and record **ABS** for all solutions.( 2, 3, 4, 5, and unknown) using test tube used for blank solution. Record readings in table 2. .
- **c)** Plot a graph between ABS (OD) & Concentration. Find out unknown concentration graphically.
- X axis: Concentration of Cu in mg Y axis: OD
- Nature of graph: Straight line passing through origin.

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**OBSERVATION TABLE**

**Table No.1: For λ max**

| Sr. No. | Filter (nm) | Optical Density (ABS) |
|---|---|---|
| 1 | 400 | 0.01 |
| 2 | 420 | 0.01 |
| 3 | 470 | 0.04 |
| 4 | 500 | 0.08 |
| 5 | 530 | 0.08 |
| 6 | 620 λ max | 0.14 |
| 7 | 660 | 0.13 |
| 8 | 700 | 0.06 |


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**OBSERVATION TABLE**

**Table2 : For OD at 620 λ max**

| Vol. of std. Sol | Conc. mg/l | OD at 620 λ max |
|---|---|---|
| 05ml | 25 | 0.04 |
| 10ml | 50 | 0.08 |
| 15ml | 75 | 0.12 |
| 20ml | 100 | 0.16 |
| Test Solution | Unknown | 0.10 |
| Conc. Of Cu in unknown solution from Graph<br>62.5 mg/l | | |

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| Conc. mg/l | OD at 620 λ max |
|---|---|
| 0 | 0 |
| 25 | 0.04 |
| 50 | 0.08 |
| 75 | 0.12 |
| 100 | 0.16 |
| Unknown | 0.1 |