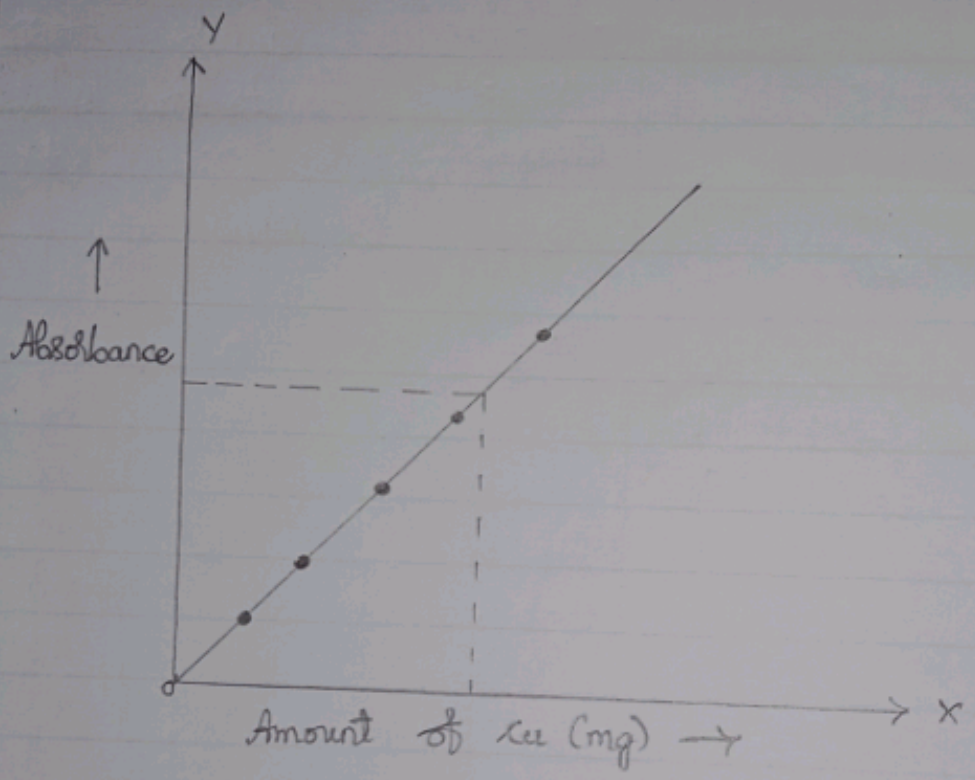
observation :

graph :



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Experiment No : 01

Estimation of copper colorimetrically and verification of Beer - Lambert's law.

Aim : Estimation of copper colorimetrically and verification of Beer - Lambert's law.

Principle : When a monochromatic radiation of intensity $I_0$ is incident on a transparent medium a part of the intensity is absorbed ($I_a$), a part of it is reflected ($I_r$) and the remaining part is transmitted ($I_t$). $I_0 = I_a + I_r + I_t$, for a glass - air interface $I_r$ is negligible. $\therefore I_0 = I_a + I_t$, $I_t/I_0 = T$ called the transmittance. $\log 1/T = \log I_0/I_t$ is called the absorbance (or) optical density A. The relation between absorbance A and concentration c (in mol/lit) and path length t (in cm) is given by Beer-Lambert's law : $A = \log I_0/I_t = \varepsilon ct$ where, $\varepsilon$ is the molar extinction co-efficient, t is the path length and $\varepsilon$ is a constant for a given substance at a given path length. If t, path length is kept constant then $A \propto c$. Hence, a plot of absorbance against concentration

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Tabular Column :

| Test tube No. | Volume of standard $CuSO_4$ solution ($cm^3$) | Amount of Copper Sulphate (mg) | Amount of Copper (mg) | Volume of Ammonium solution ($cm^3$) | Volume of water ($cm^3$) | Absorbance (O.D) at 620 nm |
|---|---|---|---|---|---|---|
| 01 | 0 | 0 | 0 | 2 | 18 | |
| 02 | 2 | 3.929 | 1 | 2 | 16 | |
| 03 | 4 | 7.858 | 2 | 2 | 14 | |
| 04 | 6 | 23.574 | 3 | 2 | 12 | |
| 05 | 8 | 31.432 | 4 | 2 | 10 | |
| 06 | 10 | 39.929 | 5 | 2 | 8 | |
| 07 | Test solution | | | 2 | | |

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gives a straight line. A series of standard solution of copper is treated with ammonia to get blue cuprammonium sulphate complex and is diluted to a definite volume. The absorbance of each of these solution is measured at 620 nm. Since the complex shows maximum absorbance at this wavelength. The absorbance values are plotted against concentration to get a colibration curve. A known volume of the test solution is treated with strong ammonia and diluted to the same volume as above. The absorbance of this solution at 620 nm is measured and its concentration is determined from the colibration curve.

## Procedure:

0.3929 g of AR $CuSO_4 \cdot 5H_2O$ crystals is dissolved in 100 ml of distilled water, which acts as the stock containing 1 mg of copper in 1 $cm^3$. The stock solution prepared is filled in a cleaned and rinsed burette. 2, 4, 6, 8 and 10 $cm^3$ of this are transfered into 20 $cm^3$ standard flasks (or) long glass test tubes 2 $cm^2$ of ammonia solution is added

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to each of them and diluted up to the mark (or) mole up to 20 $cm^3$ with ion exchange water, the flasks & tubes are shaken well. The test solution is taken in another 20 ml standard flask, 2 $cm^3$ of ammonia is added, diluted to 20 ml using ion-exchange water and mixed well. A blank solution is prepared by diluting 2 $cm^3$ of ammonia solution. After 10 minutes the absorbance is measured for each solution against blank at 620 nm using a photo-electric colorimeter. A calibration curve is drawn by plotting absorbance against concentration of copper (in mg/ml) using the calibration curve the concentration of copper in the test solution and the amount present in 100 $cm^3$ of the given solution can be calculated.

Results:

1. The amount of copper present in 100 $cm^3$ of given solution is _____.

2. $A = \varepsilon ct$, absorbance versus concentration plot gives straight line passing through the origin verifies Beer-Lambert's law.

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