ESTIMATE THE METAL ION CONCENTRATION USING COLORIMETER

AIM:

To estimate the amount of copper in the given solution by colorimetric method

APPARATUS:

Colorimeter, Standard volumetric flask, Test tubes, Measuring jar, Cuvettes etc.

CHEMICALS REQUIRED:

Copper Sulphate, H_2SO_4 soln…

PRINCIPLE:

Colorimetric method depends on the measurements of quantity of light absorbed by a coloured solution according to Beers law

$$\text{i.e. } \log (I_o/I_t) = \in .c.l \text{ (or) } A = \in .c.l \text{ (or) } O.D = \in .c.l$$

Where

A or O.D = absorbents
I_o = intensity of incident light
I_t = intensity of transmitted light
$\in$ = Molar absorption co-efficient
L = path length or thickness of the medium
C = Concentration of solution
Since $\log(I_o/I_t)$ = absorbents or Optical density of medium

PROCEDURE:

Take 11 clean test tubes and all the test tubes are labeled as A,B,C,D,E,F,G,H,I,J,K. Now the standard Copper sulphate solution (0.5M) and distilled water are taken into test tubes by using 10ml measuring jar as indicated in the table. Now the solutions are ready for measuring the absorbents value.

In Measurement of absorbents a blank solution is used. The blank solution consists of all reagents used in developing color expect the one responsible for color. The measurement with colorimeter is done by first adjusting the absorbents to zero with the blank solution in the path of light. Now replace the blank solution with sample solutions and absorbents will be displayed. Follow the same procedure for every measurement

(1) Determination of absorbents:

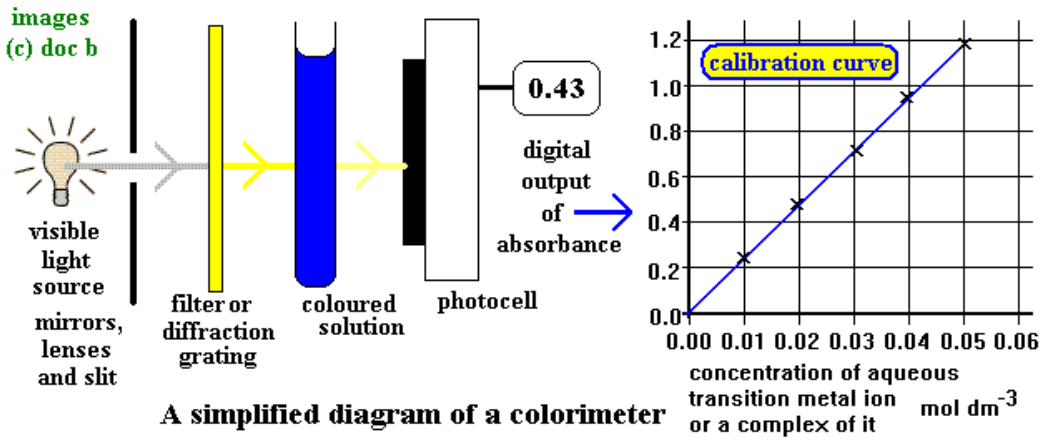
Initial reading of colorimeter of the selected filter (i.e 620 nm for $CuSO_4$) is adjusted to zero absorbance (100% Transmittance) with the distilled water as blank solution in the cuvettes, now measure the absorbance of sample solutions at the same filter. The results are incorporated in the table.

Taking the concentration of copper sulphate on X-axis and volume of absorbance on Y-axis a graph is plotted. It is a straight line.

Measurement of absorbance for unknown sample solution:

Measures the absorbance for unknown sample solution at the same filter from the graph using absorbance determine the concentration of unknown solution.

GRAPH:



A simplified diagram of a colorimeter

TABLE-I
DETERINATION OF ABSORBENTS:

Test Tube label	(Volume of $CuSO_4$) + (Volume of distilled water)	Absorbance
A	(0+10)ml (0M)	
B	(1+9)ml (0.05M)	
C	(2+8)ml (0.10M)	
D	(3+7)ml (0.15M)	
E	(4+6)ml (0.20M)	
F	(5+5)ml (0.25M)	
G	(6+4)ml (0.30M)	
H	(7+3)ml (0.35M)	
I	(8+2)ml (0.40M)	
J	(9+1)ml (0.45M)	
K	(10+0)ml (0.50M)	

RESULT:

Weight of copper present in given unknown solution =_____

i.e. $\frac{M \times M.Wt \text{ of } CuSO_4 \times V}{1000}$