Student Colorimeter ©1991

A colorimeter may be used to determine the concentration of a particular coloured solution by comparing the intensity of its colour with that of a solution of known concentration. By transmitting a light beam through a coloured solution and then measuring the amount of transmitted light (the greater the intensity of colour the greater the absorbency), the user can determine the concentration of the solution.

Although the *Student Colorimeter* is not of an analytical standard, it is suitable for simple experiments of detecting and measuring changes in intensity of colour of a liquid. A multimeter (not supplied) is required to measure the resistance of the internal light dependent resistor, the resistance being proportional to the percentage of the light absorbed by the liquid.

Directions

The unit comes complete with two AA (1.5 volt) batteries already fitted. To remove or replace batteries, use a screwdriver to remove the four feet and base. Connect a digital multimeter to the colorimeter (as in diagram 1) and set it to measure resistance (kΩ).

A plastic sample tube plus three spare tubes are supplied with each unit.
Semi fill one of the sample tubes with a coloured liquid. Liquids that will react (eg acids) with plastic should not be used. Insert the sample tube fully into the chamber of the colorimeter.

Press the momentary on/off switch and hold down whilst the multimeter is adjusted to an appropriate resistance range. Record the resistance once it has stabilised. Repeat for solutions of different concentrations.

Ensure the plastic sample tubes are rinsed thoroughly after each use.

Typical uses for the Student Colorimeter

Prepare a pale blue solution of $CuSO_4$ (about 0.5M). Place at least $5cm^3$ of the solution in one of the sample tubes. Insert the tube fully into the colorimeter, press and hold the switch and measure and record the resistance of the sample.
Make up five other samples by diluting the solution to 80%, 60%, 40%, 20% and 0% (pure water).
Measure the resistance for each sample.
To ensure continuity between tests, it is advisable to use the same sample tube for each test.
Plot a graph of absorbency (kΩ) versus % concentration and draw a line of best fit.

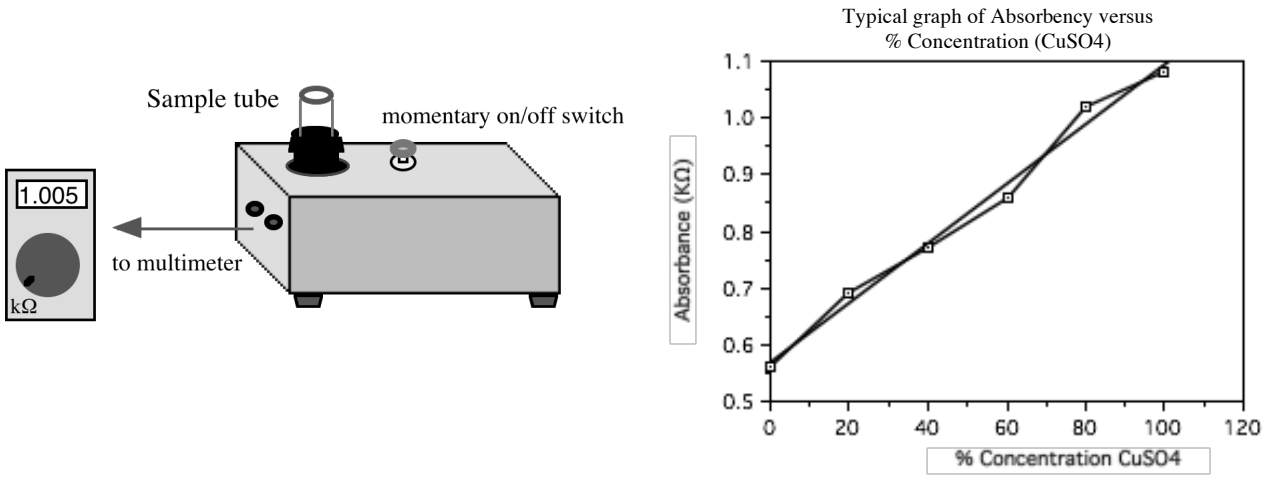

Diagram 1.

Students can now place a $CuSO_4$ sample of unknown concentration into the *Student Colorimeter* and obtain from the graph a value of its % concentration and thus can calculate the number of mole of $CuSO_4$ present.

The colorimeter could also be used for experiments such as analysing the concentration of iron in foods or be used to show the presence of metal cations and ions by converting them to coloured compounds.

Reasons for erratic results

- Insufficient quantity of solution in the sample tube (at least $5cm^3$ required).
- The sample tubes may vary fractionally in size. Use the same sample tube for the whole experiment.
- Calibration samples not prepared accurately enough.
- Sample tube not fully inserted into the colorimeter.
- Flat batteries. Look down the sample chamber and check the internal light is visible when the momentary on/off switch is pressed. Hold the switch down and measure the output resistance of the unit (with an empty sample chamber) – there should be a resistance reading of less than 5kΩ. Replace batteries if the resistance is greater than this.
- Multimeter not set to an appropriate resistance setting.

Caution

The *Student Colorimeter* is not designed to be used with acids and other corrosive chemicals. If spillage occurs, wipe off immediately.

Remove the batteries if the unit will not be used for a long period of time.