

Naming organic compounds and their isomers

Chemistry grades 11-12 (A Level · IB · Class 11-12) · Lab

Name: _____ Date: _____ Class: _____

Can we measure how a chiral molecule bends light? In this lab you build a simple polarimeter from two polarising filters and measure how much a sugar solution rotates plane-polarised light at different concentrations, then use a calibration line to find an unknown concentration.

Level: Chemistry grades 11-12 (A Level · IB · Class 11-12) · **Curriculum:** IB S3.2

Aim

To show that a sugar solution rotates plane-polarised light, to find how the rotation depends on concentration, and to use the result to determine the concentration of an unknown solution.

Equipment

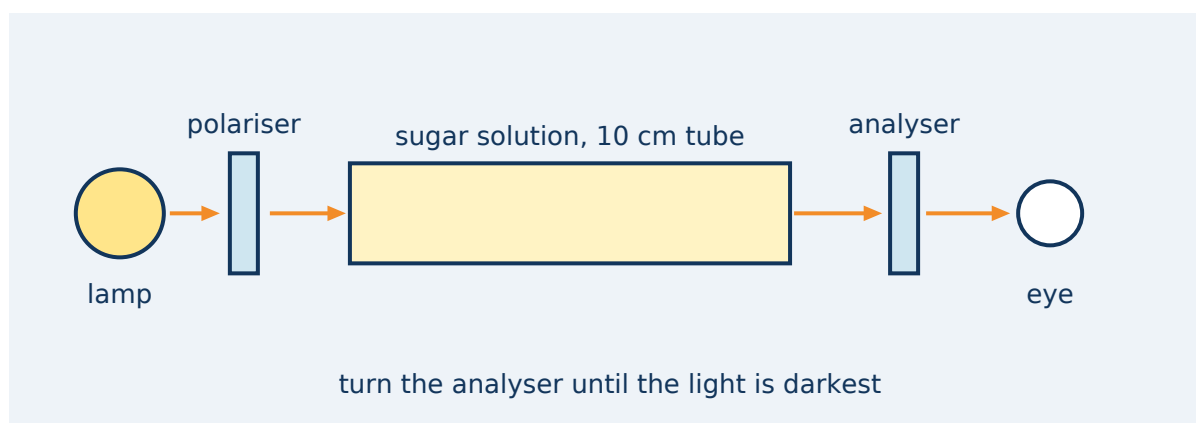
- Two polarising filters (for example from sunglasses or a lens kit) mounted in cardboard holders, one with a protractor scale
- White lamp or bright phone screen, clear tube or cuvette 10.0 cm long, caps
- Sucrose, balance, 100 cm³ beaker, measuring cylinder, stirring rod
- Standard solutions of 0.10, 0.20, 0.30 and 0.40 g cm⁻³ and an unknown

Safety

Safety

Do not look directly at a bright lamp. Wipe up sugar spills at once because they make floors slippery. Do not taste any laboratory solution.

Method



A simple polarimeter built from two polarising filters.

1. Fill the tube with water, place it between the two filters and rotate the analyser until the light is darkest. Record this as 0° .
2. Replace the water with each sugar solution in turn. Rotate the analyser until it is darkest again and record the angle turned.
3. Repeat each measurement three times and take the mean.
4. Measure the unknown solution in the same way.

Results

Concentration (g cm^{-3})	0	0.10	0.20	0.30	0.40	unknown
Rotation ($^\circ$)	0	7	13	19	27	16

Analysis questions

Question 1 Graph

Plot rotation against concentration and describe the graph.

Question 2 Specific rotation

The tube is 1.0 dm long. Calculate the slope of the best-fit line through the origin from these data and state its units; this is the specific rotation.

Question 3 Unknown concentration

Use the slope to find the concentration of the unknown solution.

Question 4 Longer tube

Predict the rotation for the 0.30 g cm^{-3} solution in a 2.0 dm tube.

Question 5 Enantiomers

Explain why a solution containing equal amounts of two enantiomers would give no rotation.

Question 6 Uncertainty

Estimate the percentage uncertainty in the 7° reading if the angle can be read to $\pm 1^\circ$.

Question 7 Improvement

Suggest two improvements that would make the measurements more reliable.