In measuring optical rotation, plane-polarized light travels down a long tube containing the sample. If it is a liquid, the sample may be placed in the tube as a pure liquid (its is sometimes called a neat sample). Usually, the sample is dissolved in a solvent and the resulting solution is placed in the tube. There are important factors affecting the outcome of the experiment.

- Optical rotation depends on the number of molecules encountered by the light during the experiment.
- Two factors can be controlled in the experiment and must be accounted for when comparing an experimental result to a reported value.

![Figure 1](image1.png)

**Figure 1**: The effect of concentration on optical rotation.

- The more concentrated the sample (the more molecules per unit volume), the more molecules will be encountered.
- Concentrated solutions and neat samples will have higher optical rotations than dilute solutions.
- The value of the optical rotation must be corrected for concentration.

![Figure 2](image2.png)

**Figure 2**: The effect of path length on optical rotation.

- The longer the path of light through a solution of molecules, the more molecules will be encountered by the light, and the greater the optical rotation.
- The value of the optical rotation must be corrected for the length of the cell used to hold the sample.

**Summary**

\[
\langle \alpha \rangle = \frac{\alpha}{c l}
\]

- \(\langle \alpha \rangle\) is the measured optical rotation.
- \(\langle c \rangle\) is the sample concentration in grams per deciliter (1 dL = 10 mL), that is, \(c = m / V\) (\(m = \text{mass in g}\), \(V = \text{volume in dL}\)).
- \(\langle l \rangle\) is the cell length in decimeters (1 dm = 10 cm = 100 mm)
- The square brackets mean the optical rotation has been corrected for these variables.
Exercise \(\PageIndex{1}\))

A pure sample of the naturally-occurring, chiral compound A (0.250 g) is dissolved in acetone (2.0 mL) and the solution is placed in a 0.5 dm cell. Three polarimetry readings are recorded with the sample: 0.775°, 0.806°, 0.682°.

1. What is \([a]\)?
2. What would be the \([a]\) value of the opposite enantiomer?

Answer

TBA

Exercise \(\PageIndex{2}\))

A pure sample of the (+) enantiomer of compound B shows \([a] = 32^\circ\). What would be the observed \([a]\) if a solution of the sample was made by dissolving 0.150 g in 1.0 mL of dichloromethane and was then placed in a 0.5 dm cell?

Answer

TBA

Contributors

Chris P. Schaller, Ph.D., (College of Saint Benedict / Saint John's University)