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* Specific rotation :-

The optical activity of a substance is defined by its specific rotation at a given temperature and wavelength of light. The specific rotation of an optically active liquid is equal to the angle of rotation of the plane of vibration produced by a decimeter column of pure liquid divided by its density. Thus specific rotation, $S = \frac{\theta}{l.d}$

where l = length of liquid. Column expressed in decimeter, d = density and θ = observed rotation.

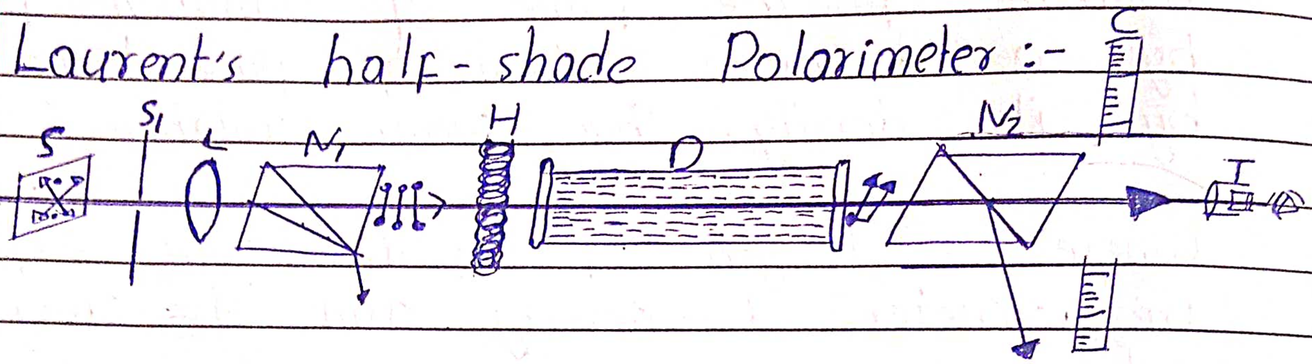
In the case of optically active solutions e.g. suger dissolved in distilled water, the specific rotation is the rotation produced by one decimeter of the solution divided by the number of groms of active substance per c.c. of solution. We may express as $S = \frac{\theta}{l\,m/v}$

$= \frac{\theta v}{l m}$ where m is in groms the mass of active substance present in Vcc of solution.

For solid crystalline substance, the specific rotation is merely the angle of rotation produced by one millimeter thickness of the crystal in the direction of optic axis.

The specific rotation is not constant. It varies with the wave-length being greater for light of short wave-length than for light of longer wave-length, with the nature of optically inactive solvent and with the concentration of the solution and its temperature.

* Laurent's half-shade Polarimeter :-

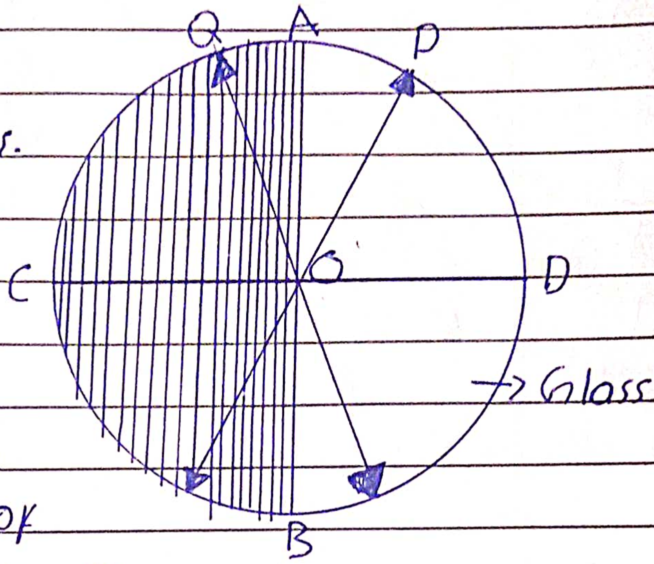


The experimental arrangement is shown in fig. Monochromatic light from source S, falls on a collimator slit S_1 and rendered parallel by Lens L and then it is plane polarised by Nicol prism N_1. This plane polarised light enters half shade plate H and then tube D containing the experimental solution. The light is then analysed by the second nicol prism N_2 and finally seen by a telescope T. The telescope and the analysing Nicol are contained in a single tube, capable of rotation by milled head, its position being determined by means of a vernier and a graduated circle C. Means are provided by which the line of demarcation of the two portions of the half shade plate can be rotated through a small angle and

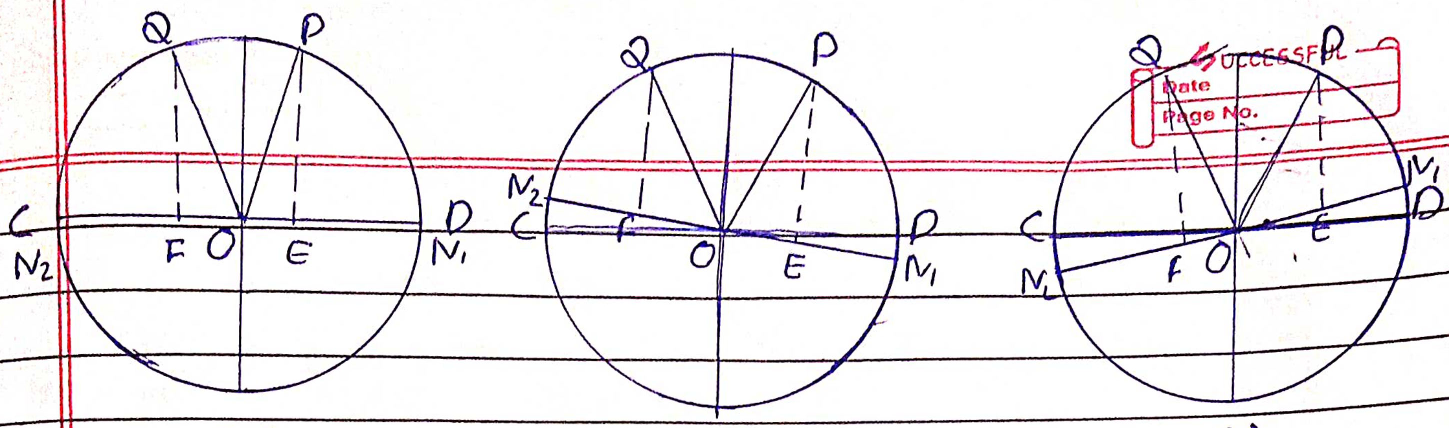
Thus θ may be calculated.

* Half - shade plate :-

Laurent's half-shade plade plate is a circular plate formed by two semi-circular pieces of quartz and glass, cementing together along their diameters. Semicircular plate of quartz ACB (Fig.) is cut with faces parallel to the optic axis and is of such a thickness that a relative phase difference of π or a path difference of λ/2 is introduced between the ordinary and extra ordinary rays in transmission normally through it. A semi-circular sheet of glass ADB whose optical thickness is equal to that of the quartz plate constitutes the other half of the Laurent's plate. Consequently, the transmitted light through it has the same intensity as that emergent from the quartz portion.



The plane polarised light coming from M_1 falls perpendicular on H. Let its plane of vibration is along OP. In quartz it is divided into E - ray and O - ray while through glass it emerges as it was.



(a) (b) (c)

Now plane of vibrations of emergent lights from quartz and glass are respectively along OQ and OP. If principal section $N_2 ON_2$ of analysing Nicol N_2 is parallel to COD (Fig (a)) then in the field of view both portions of the circular plate H are seen of equal illumination.

If N_2 is rotated slightly clockwise (Fig (b)) then component OE < component OF. Hence right half portion of H becomes more illuminated than its left half portion. Similarly if N_2 is rotated anti clockwise (Fig (c)) reverse effect is observed.

For empty tube D the N_2 is adjusted as in ~~Fig (a))~~ Fig (a). The reading is noted on scale C. Now D is filled with the suger solution. N_2 is again adjusted as in Fig (a). Reading of C is again noted. The difference of these two readings gives the value of specific rotation.