POLARISATION

Optical Activity

- When a beam of plane polarised light is passed through certain substances, then the plane of polarisation of the beam is rotated about the direction of propagation of the beam through a certain angle.
- This Phenomenon of rotating the plane of polarisation by certain substances is known as optical activity and the material is known as optically active substance.
- The examples of optically active substances are sugar crystals, sugar solution, sodium chlorate etc. There are two types of optically active substances; one rotates the plane of polarisation to the right and the other rotates this plane to the left.
- The substances that rotate the plane of polarisation to the right are known as dextro-rotatory or right handed, i.e. plane of polarisation is rotated in clock wise direction from the point of view of the observer.
- The substances that rotate the plane of polarisation to the left are known as leavo-rotatory or left handed, i.e. plane of polarisation is rotated in anticlockwise direction from the point of view of the observer.

POLARISATION

Specific Rotation

- It is an intrinsic property of a pure material at a given wavelength and temperature.
- The plane of the linearly polarised light is rotated when it is passed through liquids containg an optically active substance, for example *sugar solution, sodium chlorate, cinnabar, camphor in alcohol, etc.).*
- *The specific rotation S is defined as the observed angle of optical rotation θ when plane polarised light is passed through a sample with a path length of 1 decimetre and a sample concentration of 1 gram per 1 millilitre. Therefore*

$$S = \frac{\theta}{l \times c} = \frac{\theta}{l \times (m/V)} = \frac{\theta V}{l \times m}$$

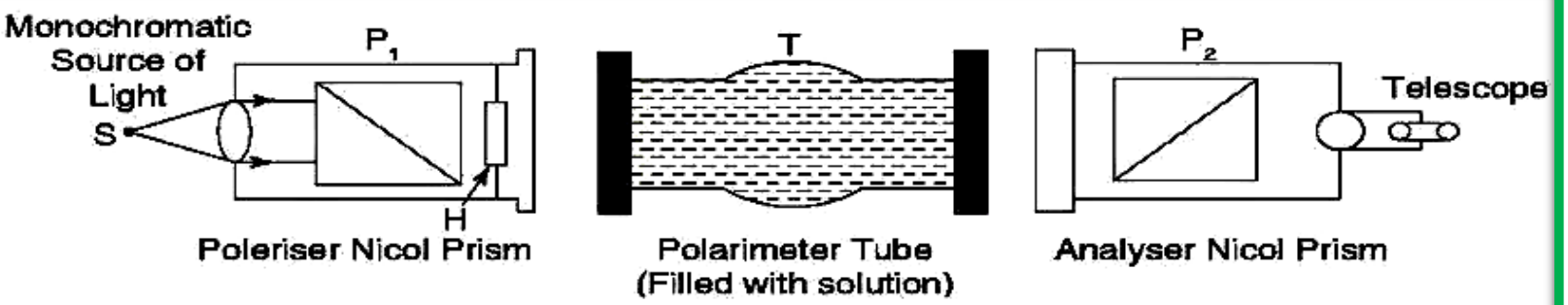
- In this equation, *l is the path length in decimetres, and c is the concentration of the liquid in g/ml, for a sample at a temperature T (given in degrees Celsius) and wavelength λ (in nanometers).*
- *The formal unit for specific rotation is deg cm² g-1 but scientific literature uses just degrees.*

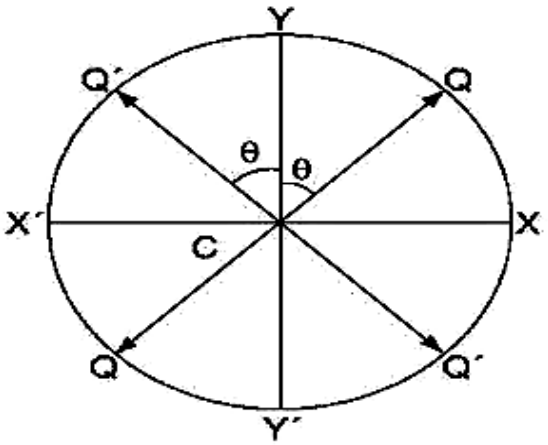
POLARISATION

Laurent's Half-Shade Polarimeter

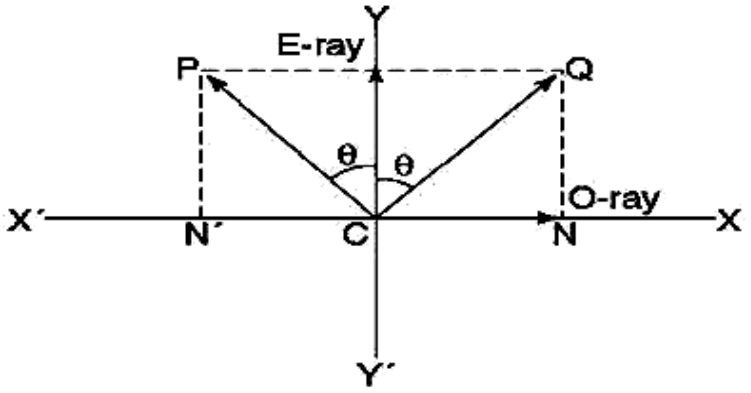
- It consists of two nicol prisms P1 and P2 as shown in Fig. 3.17.
- The nicol prism P1 acts as a polariser and P2 acts as an analyser.
- The half wave plate H is placed between nicol prism P1 and P2.
- This plate consists of two semi-circular plates, one half of which is made of glass and the other half of quartz and both halves are attached together as shown in Fig. 3.18a.
- The thickness of the quartz plate is kept such that it introduces a phase difference of π between the ordinary and extraordinary vibrations.

POLARISATION





(a)



(b)

POLARISATION

- The monochromatic light from the source S is incident on convex lens, from which it emerges as parallel beam and falls on the polarising nicol prism P1.
- The light emerging from the polariser P1 is plane polarised and falls on the half shade plate H and then on a polarimeter tube T filled with optically active solution.
- Finally the light emerged from tube falls on the analyser. Then we see emergent light with the help of a telescope.
- The analysing nicol prism can be rotated about its axis. Its rotations are measured in term of angle θ by using circular scale.