Analytical treatment →

(9) For calcite crystal which is optically inactive

When linearly plane polarised light enters a calcite crystal it get resolved into two circularly polarised vibration. one is moving anticlockwise other in clockwise direction with some angular frequency or velocity. As each circularly polarised vibration further consist of two rectangular components having zero phase differences.

So, for clockwise circular vibration

$$x_1 = a\sin\theta = a\sin\omega t$$

$$y_1 = a\cos\theta = a\cos\omega t$$

For anticlockwise circular vibration

$$x_2 = -a\sin\theta = -a\sin\omega t$$

$$y_2 = a\cos\theta = a\cos\omega t$$

From above the resultant displacement of vibrations along x-axis and y axis respectively are given as

$$x = x_1 + x_2 = a\sin\theta - a\sin\theta = 0$$

$$y = y_1 + y_2 = a\cos\omega t + a\cos\omega t = 2a\cos\omega t$$

Hence resultant vibration has amplitude 2a and its plane is y axis i.e along original direction ACB. Hence two oppositely circularly polarised vibrations give rise to a plane polarised vibration.