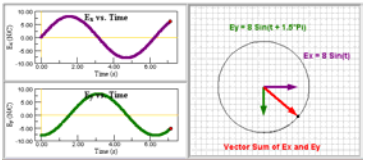
Worksheet for Exploration 39.1: Polarization Tutorial



The animation shows the result of adding two perpendicular electric fields together. Each field is part of an electromagnetic wave traveling along the z axis. Each electric field is shown separately on the two graphs on the left. The graphs show the electric field at one point on the z axis for various times. On the right, the animation shows both electric fields and their sum at the same point on the z axis and at the same times as the graphs on the left. It is as if you are looking down the z axis at the electric fields. Restart.

You can change the electric fields and the phase difference between the two fields and see the resulting waves.

Enter the following values: E_x = 8 N/C, E_y = 0 N/C, and phase difference = 0* π radians. You have created a light wave, traveling along the z-axis, with its electric field in the x direction.

a. What kind of polarized light did you create?

b. What is the vector equation of the wave you just created? (**E = Ex + Ey**)

c. The wave you just specified is polarized in the x direction. What equations for E_x and E_y would result in light that is linearly polarized along a plane 45º above the +x axis?

E_x =________

E_y =________

d. What equations for E_x and E_y would result in light that is linearly polarized along a plane less than 45º above the +x axis?

E_x =________

E_y =________

Light is linearly polarized when its electric field is in a plane. Circular and elliptical polarization occurs when two or more linearly polarized waves add together such that the electric field of the wave rotates in the plane perpendicular to the direction of propagation. For circularly polarized light the direction of the electric field rotates but its magnitude stays the same. For elliptically polarized light both the magnitude and the direction of the electric field vary. For example, if you enter the following values, E_x = 8 N/C, E_y = 8 N/C, and phase difference = 0.5* π radians, a wave that is right-circularly polarized will result. Now consider the values needed to answer the following questions.

e. What equations for E_x and E_y would result in light that is left-circularly polarized?

E_x =________

E_y =________

f. What equations for E_x and E_y would result in light that is right-elliptically polarized?

E_x =

E_y =