Answer on Question#37479 - Physics - Other

Do all type of electromagnetic waves propagate with same speed? What is the phase difference between electric field and magnetic field vibrations? Does the direction of electromagnetic wave propagation same as the direction of vibration of electromagnetic waves?

Solution:

a) In a vacuum, speed is the same as the speed of light, 299 792 458 m / s. Except in a vacuum, electromagnetic waves don't propagate with same speed. Depending on the frequency, there is a slight variation in speed proportional to the refractive index (n) of the medium they are travelling through.

b) Electric field and magnetic field vibrate perpendicular to the propagation direction (fields have no component along propagation direction), and there are equal phases of the vibrations. Hence, the phase difference between electric field and magnetic field vibrations is equal to zero (travelling wave). For the standing wave phase difference equals to $\pi/2$.

c) Electric field and magnetic field vibrate perpendicular to the propagation direction, so the direction of the electromagnetic wave propagation is the same as the direction of vibration of electromagnetic waves.