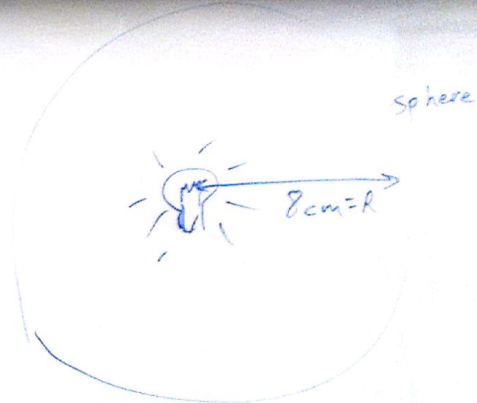
Newton's Law

$$\text{Power} = \frac{dW}{dt} = \frac{d}{dt}\int_{path} \vec{F}\cdot d\vec{x} = \int_{path} d\vec{F}\cdot\frac{d\vec{x}}{dt} = \vec{F}\cdot\frac{d\vec{x}}{dt} = \vec{F}\cdot\vec{v}$$

$$P = \vec{F}\cdot\vec{v}$$

$$\frac{P}{v} = F = \frac{dp}{dt} = \text{rate of change of momentum}$$

Problem #34



$$\text{pressure} = \frac{\text{force}}{\text{area}} = \frac{2 S_{avg}}{c}$$

$$S_{avg} = \frac{\text{power}}{\text{area}}$$ (averaged over cycle of wave)

power = 75 W

area = $4\pi R^2$

$$\text{pressure} = \frac{2(75\,W)/(4\pi(8_{cm})^2)}{3.00\times10^8\,m/s}$$

Force on finger tip

$\approx 1\,cm^2 \times$ pressure

$$\text{Force} = \frac{150\,W}{32\pi(m/s)\cdot 3.00\times10^8}$$

$\approx 5\times10^{-9}\,N$

Next test Nov. 1.

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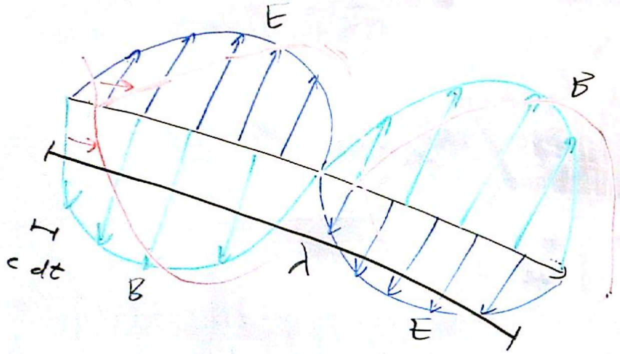


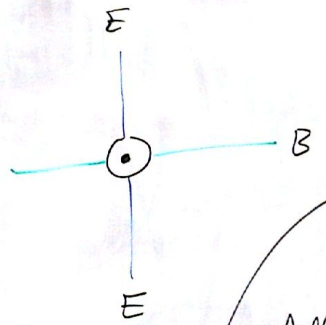
Later Time dt passed

T = period $\lambda = cT = c/f$ λ = wavelength

f = frequency $= \frac{1}{T}$ $\lambda f = c$

ω = angular freq. $= \frac{2\pi}{T}$ $\lambda\omega = 2\pi c$

direction of wave travel = direction of $\vec{E} \times \vec{B}$ at any instant and any point



c = speed of wave propogation

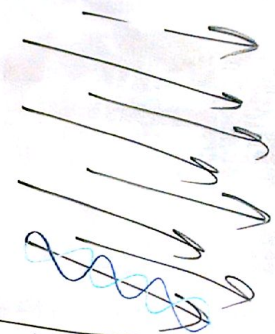
AM radio wave:

$\lambda = ?$

$f \sim 10^6 Hz = 10^6/s$

$\lambda = c/f = \frac{3\cdot10^8 m/s}{10^6/s} \sim 300m.$

Plane wave



What is frequency of EM wave with $\lambda \sim 1m$?

About $10^8/s = 100 MHz$

More precisely,

$f = \frac{c}{\lambda} = 300MHz$

Poynting vector

$\vec{S} = \frac{1}{\mu_0}\vec{E} \times \vec{B}$

$|\vec{S}| = S = \frac{\text{power}}{\text{area}}$ = intensity

power = energy/time

$\hat{S}$ = direction of energy transfer

EM waves transfer momentum too.

$p = \frac{2 S_{avg}}{c}$

= momentum of plane wave per area transfer rate