NAME _____

Please do not open until instructed to do so.
Make sure you have filled out your SCAN CARD as instructed.

$c = 3 \times 10^8$ m/s

$\lambda f = v$ $\quad n = c/v$ $\quad n_1 \sin\theta_1 = n_2 \sin\theta_2$

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Lens sign convention

i is + if located in back of the lens

o is + if located in front of the lens

f is + if lens is converging

$1/i + 1/o = 1/f$

M= image height/object height

$M = -i/o$

$f = R/2$

Mirror sign convention

i is + if located in front of the mirror

o is + if located in front of the mirror

f is + if mirror is concave

"front" is the side from which the light is coming

Sinusoidal Waves

$E(x,t) = E_{max}\cos(kx - \omega t)$

$k = \frac{2\pi}{\lambda}$ $\quad \omega = 2\pi f$ $\quad f = \frac{1}{T}$

$$\text{Intensity} = \frac{\text{Power}}{\text{Area}} = S_{AVG} = \frac{E_{max}B_{max}}{2\mu_0} = \frac{E_{max}^2}{2\mu_0 c} = \frac{cB_{max}^2}{2\mu_0}$$

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

$\frac{E}{B} = c$

$\mu_0 = 4\pi \times 10^{-7}$

$\varepsilon_0 = 8.854 \times 10^{-12}$

$\lambda_n = \frac{\lambda_0}{n}$ ('short cut' to wavelength in medium)

$n = \frac{c}{v}$

Interference

$\Delta L = 0, \lambda, 2\lambda, 3\lambda, \ldots$

$\Delta L = \frac{\lambda}{2}, \frac{3\lambda}{2}, \frac{5\lambda}{2}, \ldots$

λ is wavelength in the medium where the ΔL occurs.

Phase changes when reflected from medium of higher index of refraction

$$V_{\text{pt. charge}} = \frac{kq}{r}$$

$$\vec{E} = -\nabla V = -\frac{\partial}{\partial x} V \hat{i} - \frac{\partial}{\partial y} V \hat{j} - \frac{\partial}{\partial z} V \hat{k}$$

$$\Delta V = -\int \vec{E} \cdot d\vec{s}$$

$$PE_{\text{electric}} = q \Delta V$$

$$Q = CV$$

$$\frac{1}{C_{\text{series}}} = \frac{1}{C_1} + \frac{1}{C_2} + \cdots \qquad C_{\text{series}} = R_1 + R_2 + \cdots$$

$$C_{\text{II}} = C_1 + C_2 + \cdots \qquad \frac{1}{R_{\text{II}}} = \frac{1}{R_1} + \frac{1}{R_2} + \cdots$$

$$V = IR \qquad P = IV = I^2R = \frac{V^2}{R}$$

$$\vec{F} = q\vec{v} \times \vec{B} \qquad \vec{F} = I\vec{\ell} \times \vec{B}$$

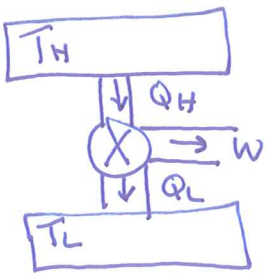
$$|\vec{B}_{\text{wire}}| = \frac{\mu_0 I}{2\pi R} \qquad \mu_0 = 4\pi \times 10^{-7} \frac{Tm}{A}$$

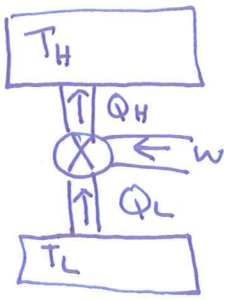
$$d\vec{B} = \frac{\mu_0 I}{4\pi r^2} d\vec{\ell} \times \hat{r}$$

$Q = mc\Delta T$

$Q = mL$

Heat Engine





efficiency = $\frac{\text{get}}{\text{pay}}$

$\varepsilon_{\text{carnot heat engine}} = 1 - \frac{T_L}{T_H}$

$$|\vec{F}| = \frac{k|q_1||q_2|}{r^2} \qquad k = 8.99 * 10^9 \frac{N_m^2}{c^2} \qquad \left(\text{Note: } k = \frac{1}{4\pi\varepsilon_0}\right)$$

$$|\vec{E}_{\substack{pt. \\ charge}}| = \frac{k|q|}{r^2}$$

$$\vec{F} = q\vec{E}$$

$$\Phi = \int \vec{E} \cdot d\vec{A}$$

$$\oint \vec{E} \cdot d\vec{A} = \frac{Q_{enclosed}}{\varepsilon_0} \qquad \varepsilon_0 = 8.85 * 10^{-12} \frac{c^2}{N_m^2}$$

$$\text{Work} = \int \vec{F} \cdot d\vec{s}$$