11.

$$E_Z = 2\cos\left[\pi \times 10^{15}\left(t - \frac{x}{c}\right)\right]$$

B must have only y – component.

$$E = cB \Rightarrow B_Y = \frac{E}{c}$$

$$B_Y = .67 \times 10^{-8} \cos\left[\pi \times 10^{15}\left(t - \frac{x}{c}\right)\right]$$

13.

$$I = 1.4{*}10^3 \frac{W}{m^2}$$

$$I = \frac{E^2}{c\mu_0}$$

$$E_{RMS} = \left[3{*}10^8 (4\pi{*}10^{-7})(1.4{*}10^3)\right]^{\frac{1}{2}}$$

$$= 726 \frac{V}{m}$$

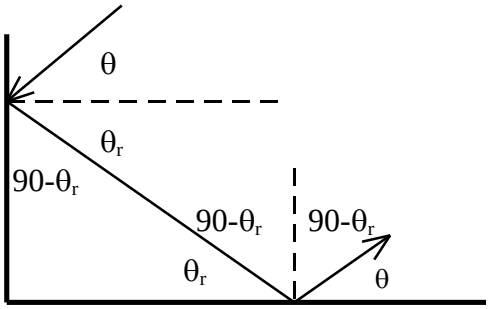
note answer = E_{MAX}

$$\therefore E_{MAX} = \sqrt{2} E_{RMS}$$

$$= 1.03{*}10^3 \frac{V}{m}$$

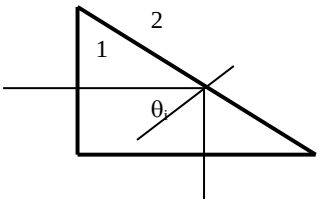
$$B = \frac{E}{c} = \frac{1.03{*}10^3}{3{*}10^8} = 3.43\mu T$$

49.



Problem says what is the angle between incident and reflected ray.
Last angle here is θ so answer must be 180 degrees

59.



$$\sin\phi_i = \frac{\eta_2}{\eta_1} = \frac{1.0}{1.52}$$

$$\phi_i = 41.1^\circ$$

complement 49°

b) In water

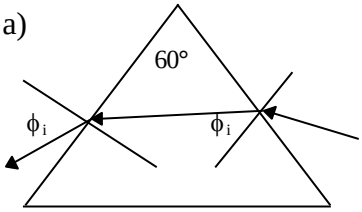
$$\sin\phi_i = \frac{1.33}{1.52}$$

$$\phi_i = 61^\circ$$

complement 29°

64.

a) $\sin\phi_c = \frac{1.0}{1.6}$, $\phi_c = 38.7^\circ$, **complement** 51.3° a)



third angle of triangle $180 - 111.3 = 68.7$

$$\sin\phi_i = 1.6\sin 21.3^\circ$$

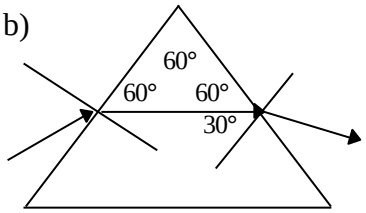
$$\phi_i = 35.5^\circ$$

b) for symmetry

$$\sin\phi_i = 1.6\sin 30^\circ$$

$$\phi_i = 53^\circ$$

b)



75.

don't know θ

do know at second interface

$$\eta_2 \sin\theta_i = \eta_1 \sin 90^\circ$$

$$\therefore \eta_2 \sin\theta_i = 1$$

where $\theta_i = 90^\circ - \theta$

$$\text{so } \sin(90^\circ - \theta) = \frac{1}{\eta_2} = \cos\theta$$

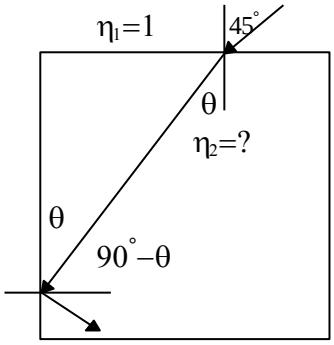
$$\text{at top } \sin 45^\circ = \eta_2 \sin\theta$$

$$\therefore \frac{\sin\theta}{\cos\theta} = \frac{\frac{.707}{\eta_2}}{\frac{1}{\eta_2}} \rightarrow \tan\theta = .707$$

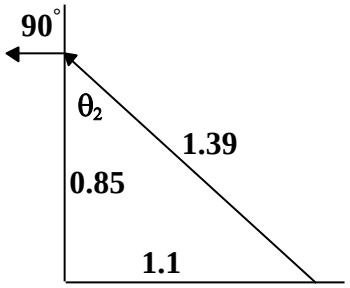
$$\therefore \theta = 35^\circ$$

$$.707 = \eta_2 \sin 35^\circ$$

$$\eta_2 > 1.22$$



92.



$$\sin 90 = \eta_2 \sin\theta_2$$

$$\sin\theta_2 = \frac{1.1}{1.39}$$

$$\therefore \eta_2 = \frac{1.39}{1.1} = 1.26$$

Additional Problems

98.

$$E = 100\,\frac{V}{m}$$

$$B = \frac{100\,\frac{V}{m}}{3*10^{8}\,\frac{m}{s}} = 0.33*10^{-6}$$

$$\text{units?}\quad \frac{\text{volt sec}}{m^2} = \frac{\text{joule}}{\text{coul}}\,\frac{\text{sec}}{m^2} = \frac{\text{joule}}{\text{amp m}} = \text{Tesla}$$

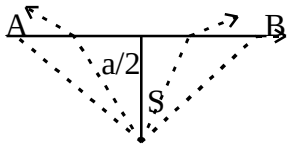
110.

distance $\overline{AB} = a$

spot @ $\frac{a}{2}$

rays leaving at angles greater than

$\theta = \sin^{-1}\left(\frac{1}{n}\right)$ will under go total internal reflection



consider circular area of radius r

$$\tan\theta = \frac{r}{a/2} \Rightarrow r = \frac{a}{2}\tan\theta = \frac{1}{2}a(n^2-1)^{\frac{-1}{2}}$$

for a = 1cm, n = 1.5

r = .45cm

$$\text{fraction}\ \frac{6\pi r^2}{6a^2} = \frac{\pi}{4(n^2-1)} = .63$$