(b.) THE SOURCE'S POWER WOULD BE $P_s = 4\pi r^2 I_{EARTH}$ (SINCE IT IS ISOTROPIC).

$$P_s = 4\pi r^2 I_E = \frac{P_E\, 4\cancel{\pi} r^2}{R_E^2\, \cancel{\pi}} \simeq \frac{(4\times10^{-12}\,W)}{(6400\text{ km})^2}\left[(2.2\times10^4\text{ lyr})(9.46\times10^{15}\text{ m})\right]^2$$

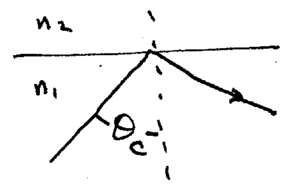
$\Rightarrow P_s \simeq 4.2\times10^{15}$ W - THAT'S REALLY LARGE !

* IF YOU TAKE " ALL OF EARTH'S SURFACE" LITERALLY THEN THE ANSWERS ARE (a.) 1.4×10^{-22} W (b.) 1.1×10^{15} W

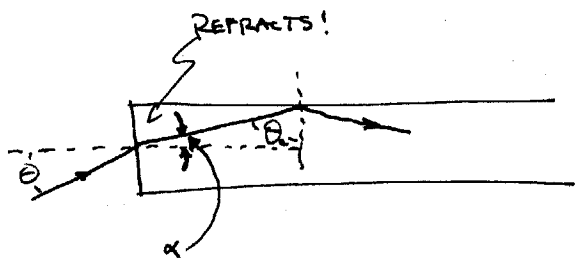
(6.) TO FIND THE CRITICAL ANGLE FOR TOTAL INTERNAL REFLECTION

$$n_1 \sin\theta_I = n_2 \overset{1}{\cancel{\sin(\tfrac{\pi}{2})}}$$

$$\Rightarrow \theta_c = \arcsin\left(\frac{n_2}{n_1}\right)$$



TO FIND θ WE NEED ANOTHER BOUNDARY, AND SO GEOMETRY



So $n_{air}\sin\theta = n_1 \sin\alpha \Rightarrow \alpha = \arcsin\left(\frac{\sin\theta}{n_1}\right)$. FROM THE GEOMETRY

$$\theta_c + \alpha = \frac{\pi}{2} \quad \text{OR} \quad \alpha = \frac{\pi}{2} - \theta_c$$

$$\Rightarrow \sin\theta = n_1\sin\alpha = n_1\cos\theta_c = n_1\sqrt{1-\sin^2\theta_c} = n_1\sqrt{1-\frac{n_2^2}{n_1^2}}$$

$$\Rightarrow \sin\theta = \sqrt{n_1^2 - n_2^2}$$

HENCE THE INCOMING ANGLE IS.

$$\theta = \arcsin\left(\sqrt{1.58^2 - 1.53^2}\right) \simeq 23.2^\circ$$