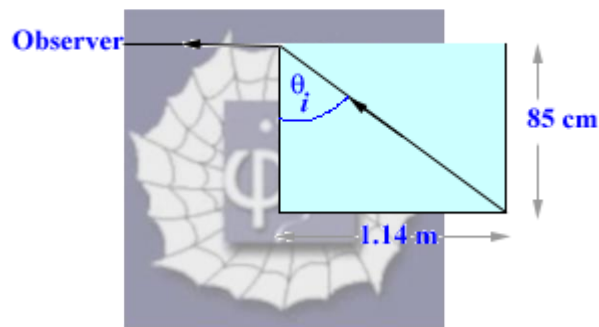


588.

Problem 43.7 (RHK)

When the rectangular tank, as shown in the figure, is filled to the top with an unknown liquid, an observer with eyes level with the top of the tank can just see the corner E . We have to find the index of refraction of the liquid.



Solution:

As shown in the figure for an observer with eyes level with the top of the tank will be able to just see the corner E of the tank if the index of refraction of the liquid n is such that for the angle of incidence θ_i the angle of refraction is 90° . Applying the Snell's law

$$\sin \theta_i = \frac{1}{n} \sin \theta_r,$$

as the light is refracted from the liquid into air, and using that $\theta_r = 90^\circ$, we get

$$n = \frac{1}{\sin \theta_i}.$$

From the geometry of the tank we note that

$$\sin \theta_i = \frac{1.14}{\sqrt{0.85^2 + 1.14^2}} = 0.801.$$

Therefore, the index of refraction of the liquid in the tank will be

$$n = \frac{1}{0.801} = 1.25.$$

