1. Consider the situation shown below:

Determine the smallest incident angle $\theta_i$ from water to glass for which the glass/air boundary exhibits total internal reflection.
2. Consider the following space-time field where $t$ and $z$ have units of seconds and meters, respectively:

$$s(r, t) = \cos (50t - 32z).$$

(a) Determine the temporal period in seconds.

(b) Determine the spatial period in meters.
3. Consider an optical fiber whose core is glass, and whose shell has the refractive index shown below:

Determine a requirement for the incident angle such that the ray will propagate with total internal reflection.
4. A telescope on Earth forms an image of the moon, and this image is recorded by a charge-coupled device (CCD) detector.

(a) Determine whether this image is real or virtual.

(b) Determine whether the image is real or virtual if, instead of a detector, the telescope’s image is viewed by an observer through a traditional eyepiece.