1. **2.6** A mode is propagating in a planar waveguide as shown with $\beta_m = 0.8kn_2$. How many reflections at the $n_1 - n_2$ interface does the ray experience in traveling a distance of 1 cm in the $z$ direction?

![Diagram of a planar waveguide with reflections]

2. **2.7** Show that the Goos-Hänchen phase shift goes to zero as the cutoff angle is approached for a waveguided optical mode.

3. Find the total phase shift of the light passing through a symmetric slab with $n_1 = 1.453$, $n_s = 1.447$ of 1 cm length if orientation of E field changes from TE position from 0° to 90°.

\[
\chi = 1.55 \mu\text{m}
\]

Core thickness 5 μm