REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

5 (a) Calculate the critical angle for total internal reflection for a high-index glass with index of refraction \( n = 1.75 \).

\[
\frac{\sin \Theta_c}{\sin \Theta_i} = \frac{n_1}{n_2} = 1.35 \\
\sin \Theta_c = \frac{1}{1.35} = 0.741 \quad , \quad \Theta_c = 44.8^\circ
\]

5 (b) A green laser has a wavelength of 500 nm in air. Calculate the wavelength of this light in a diamond \( n = 2.42 \).

\[
\frac{\lambda_2}{\lambda_1} = \frac{n_1}{n_2} \\
\lambda_2 = \frac{500 \text{ nm}}{2.42} \approx 207 \text{ nm}
\]

5 (c) Light approaches the surface of a diamond from inside the diamond at an angle of incidence of 18.0°. At what angle does it leave the diamond in air \( n = 2.42 \)?

\[
\frac{\sin \Theta_2}{\sin \Theta_1} = \frac{2.42 \times 18^\circ}{\sin 18^\circ} \approx 0.748 \quad , \quad \Theta_1 = 48.4^\circ
\]

5 (d) A diffraction grating has 6000 lines/cm. Green laser light \( (\lambda = 500 \text{ nm}) \) is sent through this grating at normal incidence. At what angle does the third order bright spot come out?

\[
d = \frac{1}{6000} = 1.67 \times 10^{-4} \text{ m} \\
\sin \Theta = \frac{3 \lambda}{d} = \frac{3 \times 500 \times 10^{-9}}{1.67 \times 10^{-4}} = 0.898 \\
\Theta = 63.9^\circ
\]

5 (e) Calculate the polarizing angle at the glass-water interface for glass \( n = 1.55 \) immersed in water \( n = 1.33 \).

\[
f \sin \Theta_p = \frac{n_2}{n_1} = \frac{1.55}{1.33} = 1.165 \\
\Theta_p = 49.4^\circ
\]