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

(a) Unpolarized light goes through three polarizing sheets in succession. Sheet 1 is oriented vertically. Sheet 2 is oriented 30° from the vertical and sheet 3 is 90° from the vertical. If light of intensity \( S_0 \) is incident on the first, calculate the intensity of light leaving sheet 3.

\[ S = S_0 \times \frac{1}{2} \times \cos^2 30° \times \cos^2 60° = \frac{3S_0}{32} = 0.0938 \, S_0 \]

(b) Calculate the time constant for the current in the circuit after the switch is closed.

\[ R = 150 \, \text{V}; \, \tau = L/R = 6.46 \times 10^{-5} \, \text{s} \]

(c) A diamond \( (n = 2.49) \) is immersed in water \( (n = 1.33) \). Determine the polarizing angle for polarizing light in water reflected off the diamond.

\[ \theta_0 = \frac{1}{2} \sin^{-1} \left( \frac{1.33}{2.49} \right) = 61.0° \]

(d) For the system in (c), calculate the critical angle for total internal reflection for light emerging from the diamond into the water.

\[ \theta_c = \sin^{-1} \left( \frac{1.33}{2.49} \right) = 39.7° \]

(e) Calculate the focal length, with sign, for the lens shown. The lens is made of glass with \( n = 1.55 \).

\[ f = \frac{1}{n-1} \left( \frac{1}{R_1} - \frac{1}{R_2} \right)^{-1} = 148.8 \, \text{cm} \]

(f) If the earth's magnetic field is \( 1.20 \times 10^{-4} \, \text{T} \), oriented at 65° to the horizontal, find the magnetic flux through an area 50 m wide by 100 m long.

\[ \Phi = 1.20 \times 10^{-4} \, \text{T} \times 5 \times 10^3 \, \text{m}^2 \times \cos 25° \times 0.54 \times 0.54 \, \text{Wb} = 0.544 \, \text{Wb} \]