

SIXTH MIDTERM

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Name: _____

Discussion Instructor (circle): Billeter Blake Herring Young

Discussion Section # _____

Student ID #: _____

REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!

Use the conversion constants and data given on the front page.

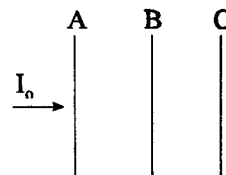
- (a) [5 pts.] Calculate the critical angle for total internal reflection for a diamond ($n = 2.42$) immersed in water ($n = 1.33$).

$$\theta_c = \sin^{-1}\left(\frac{1.33}{2.42}\right) = 33.3^\circ$$

- (b) [5 pts.] Calculate the polarizing angle for light incident from air onto water ($n = 1.33$).

$$\theta_p = \tan^{-1}\left(\frac{1.33}{1}\right) = 53.1^\circ$$

- (c) [5 pts.] Unpolarized light is incident on three polarizing sheets, such as shown in class. The axis of B is at 20° with respect to the axis of A. The axis of C is at 40° with respect to the axis of B. If I_0 is the incident intensity, what is the intensity after passing C?

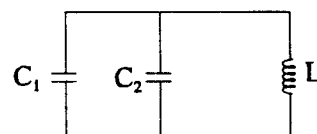


$$I = I_0 \cdot \frac{1}{2} \cos^2 20^\circ \cos^2 40^\circ = 0.259 I_0$$

- (d) [5 pts.] Sunlight is incident on a solar sail with an intensity of 600 W/m^2 . If you assume perpendicular incidence and complete reflection, what is the pressure on the sail (in N/m^2).

$$p = \frac{2 \times 600}{c} = 4.00 \times 10^{-6} \text{ N/m}^2$$

- (e) [5 pts.] If $C_1 = 6.00 \mu\text{F}$, $C_2 = 9.00 \mu\text{F}$ and the inductor is 1.25 mH , calculate the oscillation frequency of the system shown.



$$f = \frac{1}{2\pi\sqrt{LC}} = 1.16 \times 10^3 \text{ Hz}$$