Phys 132 - Fund Phys 2 - Homework 19 Name: Solutions
Due: Monday, April 23, 2007

1. Chapter 24, Problem 2a: Neil Armstrong was the first person to walk on the moon. The distance between the earth and the moon is 3.85×10^8 m. (a) Find the time it took for his voice to reach Earth via radio waves.
A) 0.781 s B) 1.03 s (C) 1.28 s D) 2.06 s E) 2.56 s

$v = \frac{d}{t} \rightarrow t = \frac{d}{v} = \frac{3.85\times10^8 \text{ m}}{3\times10^8 \text{ m/s}}$

2. Chapter 24, Problem 2b: (b) Someday a person will walk on Mars, which is 5.6×10^{10} m from Earth at the point of closest approach. Determine the minimum time that will be required for that person's voice to reach Earth.
A) 110 s B) 130 s C) 150 s D) 170 s (E) 190 s

$\frac{d}{v} = \frac{5.6\times10^{10} \text{ m}}{3\times10^8 \text{ m/s}}$

3. Chapter 24, Problem 10: MRI and PET Scans are two medical diagnostic techniques. Both employ electromagnetic waves. For these waves, find the ratio of the MRI wavelength (frequency = 6.38×10^7 Hz) to the PET Scanning wavelength (frequency = 1.28×10^{20} Hz).
A) 5.18×10^{11} (B) 1.93×10^{12} C) 4.17×10^{12} D) 9.05×10^{12} E) 1.40×10^{13}

$\frac{f_1}{f_2} = \frac{\lambda_2}{\lambda_1}$

4. Chapter 24, Problem 26: The intensity of sunlight at the top of the earth's atmosphere is about 1390 W/m^2. The distance between the sun and earth is 1.50×10^{11} m, while that between the sun and Mars is 2.28×10^{11} m. What is the intensity of sunlight at the surface of Mars?
(A) 602 W/m^2 B) 758 W/m^2 C) 914 W/m^2 D) 1130 W/m^2 E) 2110 W/m^2

$\frac{I_{mars}}{I_{earth}} = \left(\frac{R_{earth}}{R_{mars}}\right)^2$

5. Chapter 24, Problem 34a: Unpolarized light whose intensity is 1.10 W/m^2 is incident on the polarizer in Figure 24.21. (a) What is the intensity of the light leaving the polarizer?
A) 1.10 W/m^2 B) 0.27 W/m^2 C) 0.73 W/m^2 (D) 0.55 W/m^2 E) 0.83 W/m^2

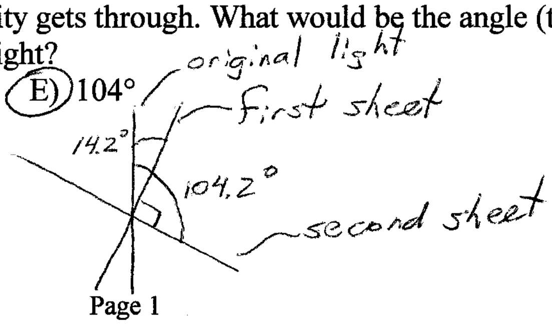
6. Chapter 24, Problem 34b: (b) If the analyzer is set at an angle of $\theta = 75°$ with respect to the polarizer, what is the intensity of the light that reaches the photocell?
A) 1.8×10^{-2} W/m^2
B) 1.4×10^{-1} W/m^2
(C) 3.7×10^{-2} W/m^2
D) 4.9×10^{-2} W/m^2
E) 7.4×10^{-2} W/m^2

$I = (0.55 \text{ W/m}^2)(\cos 75°)^2$

7. Chapter 24, Problem 36. (For one approach, consult Interactive LearningWare 24.1 on www.wiley.com/college/cutnell.) For each of the three sheets of polarizing material shown in the drawing, the orientation is labeled with respect to the vertical. The incident beam is unpolarized and has an intensity of 1260.0 W/m^2. What is the intensity of the beam that is transmitted if $\theta_1 = 19.0°$, $\theta_2 = 55.0°$, and $\theta_3 = 100.0°$? Use $\Delta\theta$ for each stage.
A) 79 W/m^2 B) 140 W/m^2 (C) 206 W/m^2 D) 320 W/m^2 E) 410 W/m^2

$\frac{1260}{2} = 630 \rightarrow 630\cos^2(55°-19°) = 412 \rightarrow 412\cos^2(100°-55°) = 206 \text{ W/m}^2$

8. Chapter 24, Problem 38. Light that is polarized along the vertical direction is incident on a sheet of polarizing material. 94% of the intensity gets through. What would be the angle (to vertical) of another polarizer that would block all of this light?
A) 14° B) 110° C) 95° D) 28° (E) 104°



$94\% = 0.94$

$\sqrt{0.94} = 0.970$

$\cos^{-1} 0.970 = 14.2°$