

Phys 375 HW 1
Fall 2005
6 Problems Due 12 / 13 September, 2005

1. **Error analysis.** For the following list of data, calculate (“by hand” – i.e. use a calculator and show your work) the mean, mode, median, standard deviation, variance, and standard deviation of the mean. Please do the analysis “by hand” – just this once.

{7.127, 7.125, 7.041, 6.963, 7.125, 6.820, 7.027, 6.843, 7.067, 7.084}

2. **Error propagation.** You are trying to determine the acceleration due to gravity g by measuring the period of a pendulum, T , of length L using the relation $T = 2\pi\sqrt{\frac{L}{g}}$.

The summary of measured data is $T = 3.818 \pm 0.009 \text{ sec}$, and $L = 361.58 \pm 0.40 \text{ cm}$. By propagating errors, determine the best value and uncertainty in g . If you could go back and revise the experiment, which quantity would you want to measure more precisely?

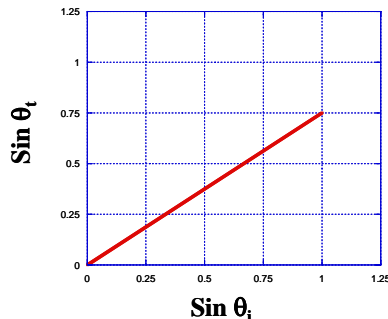
3. Hecht, 4th edition, problem 3.2. Write an expression for the \vec{E} - and \vec{B} -fields that constitute a plane harmonic wave traveling in the $+z$ -direction. The wave is linearly polarized with its plane of vibration at 45° to the yz -plane.

4. Hecht, 4th edition, problem 3.5. An electromagnetic wave is specified (in SI units) by the following function:

$$\vec{E} = (-6\hat{i} + 3\sqrt{5}\hat{j})(10^4 \text{ V/m}) \exp[i\{\frac{1}{3}(\sqrt{5}x + 2y)\pi \times 10^7 - 9.42 \times 10^{15} t\}]$$

Find (a) the direction along which the electric field oscillates, (b) the scalar value of amplitude of electric field, (c) the direction of propagation of the wave, (d) the propagation number and wavelength, (e) the frequency and angular frequency, and (f) the speed.

5. Hecht, 4th edition, problem 4.11. Figure P.4.11 is a plot of the sine of the angle-of-incidence versus the sine of the transmission angle measured as light passed from air into a more optically dense medium. Discuss the curve. What is the significance of the slope of the line? Guess at what the dense medium might be.



6. Hecht, 4th edition, problem 4.17. An underwater swimmer shines a beam of light up toward the surface. It strikes the air-water interface at 35° . At what angle will it emerge into the air?