PHYSICS 261 ***Midterm Exam* #1** **SPRING 2001**

NAME _____ DATE _____

1. A string of length *L*, mass per unit length μ, and tension *T* is vibrating at its fundamental frequency. Describe the effect that each of the following conditions has on the fundamental frequency (*your answer should be the factor by which this frequency increases or decreases*): (a) The length of the string is doubled, but all other factors are held constant. (b) The mass per unit length is doubled, but all other factors are held constant. (c) The tension is doubled but all other factors are held constant.

2. At a beach the light is generally partially polarized owing to reflections off sand and water. At a particular beach on a particular day near sundown, the horizontal component of the electric field vector is 2.3 times the vertical component. A standing sunbather puts on polarizing sunglasses; the glasses eliminate the horizontal field component. (a) What fraction of the light intensity received before the glasses were put on now reaches the sunbather's eyes? (b) The sunbather, still wearing the glasses, lies on his side. What fraction of the light intensity received before the glasses were put on now reaches his eyes?

3. A small underwater pool light is 1.00 m below the surface. The light emerging from the water forms a circle on the water's surface. What is the diameter of this circle? The index of refraction of water is 1.33.

4. When white light shines upon a prism or a soap bubble, bands of different colors are observed. However, two very different physical mechanisms are responsible for the colors in each of these two situations. Explain.

5. State three *distinct* mechanisms by which two light beams produced by the same incident beam may be out of phase. Explain how a phase shift of 180^o occurs in each of the three cases.

6. Two narrow parallel slits separated by 0.850 mm are illuminated by 600-nm light, and the viewing screen is a distance D=2.80 m away from the slits. (a) What is the phase difference between the two interfering waves on a screen at a point y_P = 2.50 mm from the central bright fringe? (b) What is the phase difference if the top slit is covered with a piece of glass (n=1.50) 400-nm thick?

7. Consider monochromatic red light of wavelength λ = 630 nm illuminating a double-slit setup with slit spacing *d* and slit width *a*.

1. Imagine we were to significantly decrease the width *a* of both slits, while keeping the spacing *d* constant, would the number of bright fringes inside the central peak of the diffraction envelope

    a. increase,
    b. decrease, or
    c. stay the same?

2. If we were to use blue light instead of red light, would the number of bright fringes inside the central peak of the diffraction envelope

    a. increase,
    b. decrease, or
    c. stay the same?

Explain your answers and be specific.