TEST # 1. PHYS 204. SPRING 2005. 03/08/05

NAME:

1. (20 points) One of the harmonics on a string 1.30m long has a frequency of 15.6 Hz. The next higher harmonic has a frequency of 23.4 Hz. Find (a) the fundamental frequency, and (b) the speed of waves on this string. (c) Supposed that the tension in the string is increased until the speed of the waves is 22 m/s. What are the frequencies of the first three harmonics in this case?

2. (30 points) Point charges of $+4.1\mu$C and -2.2μC are placed on the x axis at (11m,0) and (-11m,0), respectively. (a) Sketch the electric potential on the x axis for this system. (b) Your sketch should show one point on the x axis between the two charges where the potential vanishes. Is this point closer to the positive or negative charge? Explain. (c) Find the point referred to in part (b). (d) Supposed a small positive test charge is released from rest at $x = 0$. In which direction will it move? Explain.

3. (30 points) Electric field.

In a (x, y) coordinate system a positive point charge $q = 2 \times 10^{-8}$C is placed at the point $x = 0.1$m, $y = 0$, and an identical charge is placed at $x = -0.1$m, $y = 0$. Find the magnitude and direction of the electric field at the origin and at $x = 0$, $y = 0.1$m.

4. (20 points) Electric potential

The potential at a certain distance from a point charge is 452 V, with the potential taken to be zero at infinity, and the electric field is 226 N/C. Calculate the distance to the point charge, and the magnitude of the charge. Is the electric field directed toward or away from the point charge?

5a. (optional) Two point charges of equal magnitude are 8.0 cm apart. At the midpoint of the line connecting them, their combined electric field has a magnitude of 25 N/C. Find the magnitude and sign of the charges.

5b. (optional) Make a qualitative sketch of the electric field lines and equipotential lines produced by a point charge, a dipole, and a parallel capacitor.