Practice 1; Phys 186 Name _____

1. (0 points) You have a mass m attached to a frictionless spring with spring constant k, and you set the mass oscillating. In the following list of variables that might describe the resulting motion, draw a circle around those that depend on the mass m:

amplitude, wavelength, period, phase, diffraction

Sketch a graph of this dependence (with m on the horizontal axis) for each variable you circle.

2. (0 points) In some fiction, the protagonists get shrunk to the size of insects, and try to talk with unshrunken people. Assuming the shrinking process involves nothing but a scaling down (there's no speeding up or anything), would the shrunken people's speech be understood by those who remain normal? Explain.

3. (0 points) A large refractive index lens on eyeglasses has $n \approx 1.7$, compared to about 1.5 for ordinary glass. Imagine that you read a website that says:

> You will never find glasses with lenses using a material with $n \geq 2$ due to total internal reflection. For such a large index of refraction, the critical angle beyond which light rays from air cannot enter the glass and are totally reflected back is relatively small. This severely restricts peripheral vision, and thus such materials are not suitable to make lenses for eyeglasses.

Does this seem correct, or is it yet another example of the sort of nonsense you can find on the web? Whatever your answer is, support it with a *quantitative* argument.

4. (0 points) You have an electric dipole arranged on the y-axis: a $+q$ charge at $x = 0$, $y = a$ and a $-q$ charge at $x = 0$, $y = 0$. The charges are connected by a rigid rod, so the distance between them never changes.

(a) Find an expression for the total electric field created by this dipole on a point on the x-axis, for $x > 0$. (Find the x- and y-components of this electric field.)

(b) Calculate the total force the first dipole exerts on another dipole further down the x-axis, with the $-q$ charge located at $x = 7a$ and the $+q$ charge at $x = 8a$. Express the x- and y-components of this total force as numbers multiplying kq^2/a^2—find these numbers.

Hint: The numbers you find should be between 10^{-3} and 10^{-4} and positive, for both the x- and y-components of the total force.

5. (0 points) Say you set up two finite metal plates and impose a 4V voltage difference between them, much like you did in your equipotential lines lab. For the following two plate arrangements, make qualitative drawings of the 0V, 1V, 2V, 3V, and 4V equipotential lines. Then add the electric field lines. Be sure to show what happens *outside* the plates.