Massachusetts Institute of Technology
Department of Physics
Physics 8.022 - Fall 2002

Assignment #1
Introduction and Review
Coulomb's Law, Superposition, Electric Fields

Reading Handout #1, *Purcell* Chapter 1.

Problem Set #1
Work on **all** problems. Not all problems receive equal points. Total points for this set is 100.

- **(10 points) [1]** A force $\mathbf{F} = A(y^2\hat{x} + 2x^2\hat{y})$ is acting on a particle which is initially at the origin of the (x, y) plane. We transport the particle on a square path defined by the points (0,0), (1,0),(1,1),(0,1) in the counterclockwise direction. A is a positive constant.
    - What are the units of A?
    - How much work does the force do when the partilce travels around the path?
    - Suppose that the particle is released at (1,1) and that only the force given is acting on it. The particle is not constrained to move along the square path considered initially. Give a *qualitative* description of its motion. Will it ever reach the origin? (assume that no other forces act on the particle).
- **(10 points) [2]** Find the force from the following potentials: (a) $U = Ax^2 + By^2 + Cz^2$, $U = Aln(x^2 + y^2 + z^2)$ and (c) $U = A\frac{cos(\phi)}{r^2}$.
- **(10 points) [3]** *Purcell* Problem 1.1 (p.34): Relative strength of Electrostatic and Gravitational forces.
- **(15 points) [4]** *Purcell* Problem 1.3 (p.34): Two charged volley balls.
- **(10 points) [5]** *Purcell* Problem 1.4 (p.34): Charges on corners of a square.
- **(10 points) [6]** *Purcell* Problem 1.5 (p.34): A charged semicircle.
- **(10 points) [7]** *Purcell* Problem 1.11 (p.35): Electric field by two point charges.
  Optional: Plot the value of E(x) along the x axis (i.e., where **E**(x)=E(x) $\hat{i}$).

- **(10 points) [8]** *Purcell* Problem 1.24 (p.37): Electric field from continuous charge distribution (finite rod).
- **(15 points) [9]** *Purcell* Problem 1.26 (p.37): Electric field from continuous charge distribution (hairpin).

Erik Katsavounidis