PHYS 212 Homework Assignment
## Chapters 7

Problem 1 Find the potential at the center of an octagon of eight charges q placed uniformly at the vertices.

Problem 2 In the octagon above, if the charges alternate in sign $\pm q$, draw the field lines and the equipotential surfaces (in 2D).

Problem 3 Two protons are launched with the same speed from point 1 between two charged plates as shown below. Points 2 and 3 are the same distance from the negative plate.

  (a) How do the potential differences ΔV_{12} and ΔV_{13} compare?

  (b) How does the change in potential energy of the proton compare for each path?

  (c) Is the proton's speed at point 2 larger than, smaller than, or equal to the speed at point 3? Explain.
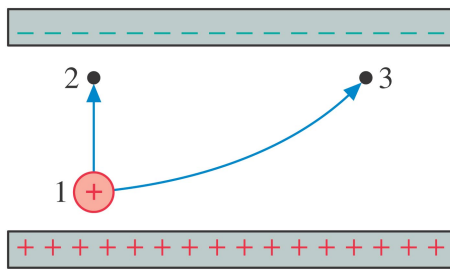
Problem 4 A proton is released from rest at the positive plate from problem 3. When it reaches the negative plate it has a speed of 65,000 m/s. The experiment is repeated with a Helium ion (He$^+$) with the same charge but a mass 4 times that of the proton. What is the ion's speed when it reaches the negative plate?

Problem 5 A proton's speed as it passes point A is 30,000 m/s. If it follows the trajectory in the figure below, what is its speed at point B?
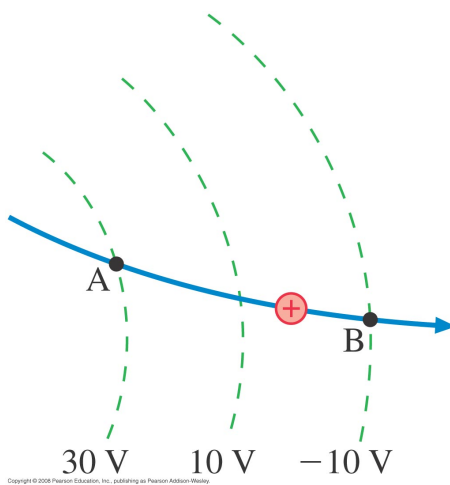
Problem 6 The electron gun in a TV picture tube accelerates electrons between two parallel plates 1.2 cm apart with a voltage of 15 kV across the plates. The electrons enter through a small hole in the negative plate, accelerate, then exit through a hole in the positive plate (the holes are so small that we can assume the plates are uniformly charged).

(a) What is the electric field strength between the plates?

(b) With what speed does an electron exit the electron gun if its entry speed is close to zero?

Problem 7

(a) Find the electric field given that $V(x, y, z) = V_0[x^2 + y^2 + \ln(z)]$.

(b) Find the potential difference between two points points $r_A = 5$ m and $r_B = 7$ m from the origin if the electric field is radial and given by $E = 17.3 \times 10^{-8}/r^4$.