PHYSICS 132 **MIDTERM EXAM #1** **Lecturer: Schumacher**

100 points
4 Problems on 4 Pages
48 minutes

Student Name: _____

Recitation Instructor (circle one): Dick Jane Sally Spot Pete

Write your name and circle the name of your recitation instructor on every page. The pages of this exam will be separated and each page graded by a different instructor. You must have your name on each sheet to receive a grade.

Problem 1 _____

Problem 2 _____

Problem 3 _____

Problem 4 _____

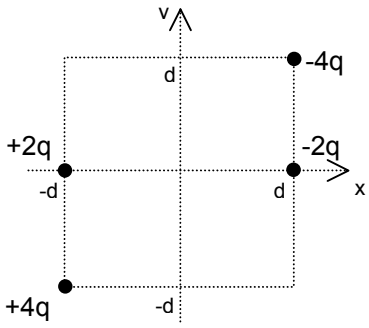
Total _____

Physics 132, Midterm Exam #1 Page Score _____

Name: _____

Recitation Instructor: **Dick** **Jane** **Sally** **Spot** **Pete**

Problem 1, 30 points total. Consider the four charges shown in the figure. The value of each charge and its position are labeled.



(a) 15 points. What is the electric field, $\vec{E}$, at the origin?

(b) 5 points. What is the potential, V, at the origin? [Take V=0 at infinity.]

(c) 5 points. What would be the force, $\vec{F}$, on a charge -Q at the origin?

(d) 5 points. What would be the potential energy, U, of a charge -Q at the origin? [Take U=0 at infinity.]

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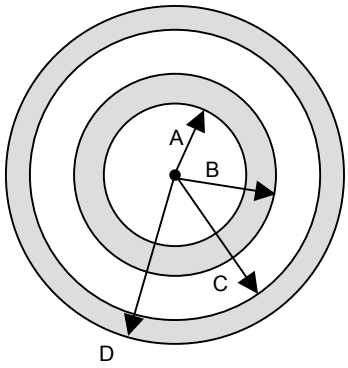
Problem 2, 30 points total. The figure shows a concentric arrangement of: a point charge; a thick, charged, conducting, spherical shell; and, a thick shell of charge. They have these specifications:

point charge: -2q
thick conducting shell: +4q, inner and outer radii of A and B.
thick charged shell: charge density +ρ, inner and outer radii of C and D.



(a) 5 points. What is $\vec{E}$ for r < A?

(b) 5 points. What is $\vec{E}$ for A < r < B?

(c) 10 points. What is $\vec{E}$ for r > D?

(d) 10 points. What is the charge on the inner and outer surfaces of the conductor?

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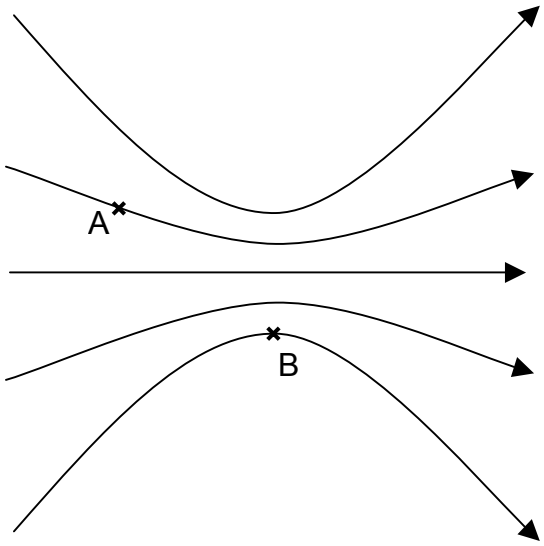
Problem 3, 20 points. The figure shows 5 field lines in a region of space. Two locations in space are indicated with x's and labeled A and B.

(a) 6 points. Draw arrows at locations A and B to indicate the direction of the force on a *negative* charge, if one was placed there.



(b) 4 points. Would the force on the negative charge be larger at A or B?

(c) 6 points. Sketch equipotential lines with the same potential difference between them for this region of space. Use at least four equipotential lines distributed over the region.

(d) 4 points. Is the potential higher at A or B?

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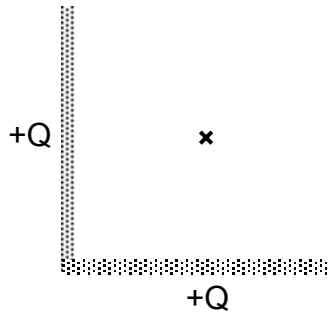
Problem 4, 20 points. Following are four unrelated short answer questions. Each is worth 5 points.

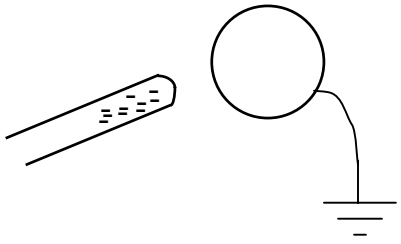
(1) The figure shows two line charges. Use an arrow to indicate the direction of the electric field at the location marked with an 'x'.



(2) How many electrons are in 2.2 μC of charge?

(3) A negatively charged plastic rod is brought close to a grounded conducting ball. The ground connection is broken, after which the rod is removed.

Is the sphere: positively charged, neutral, negatively charged?



(4) The equipotential lines for a region of space are shown in the figure. The lines are a distance d = 2.0 m apart and the potentials are given. What is the electric field magnitude, E, in the region?