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Name: _____

Physics 4B
Winter 2018
EXAM 1

Partial credit will be given, so do what you can, and show all your work in complete detail with appropriate units. NO CREDIT WILL BE GIVEN IF NO WORK IS SHOWN!

1. Define the following terms without any mathematical definitions: (2 pts each)

   a) Electric Potential Energy –

   b) Electric Potential –

   c) Net flux –

   d) Electrostatic Equilibrium –

   e) Equipotential Surface –

   f) Potential Difference –

Conceptual Short-Answer Questions: (3 pts each)

1. Explain under what condition(s) is Gauss's Law is applicable in practical situations.

2. If the net flux through a Gaussian Surface is zero, thus this imply that the E-field is also zero on the Gaussian Surface? Clearly explain your reasoning by drawing an appropriate diagram.

3. Prove that the E-field at a point on the surface of a charged conductor is perpendicular to the surface and had magnitude σ/ε_0.

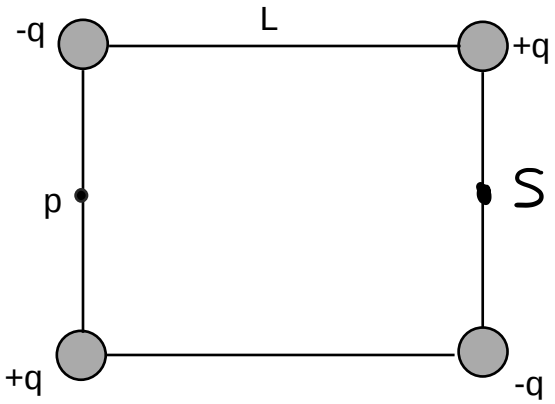
4. Prove that if a charged conductor has a cavity, with no charge enclosed, the E-field must be zero everywhere inside and that there can be NO charge on the surface of the cavity.

5. What is "zero" reference point for electric PE between two point charge? Why was such a reference point chosen?

Problems:

1. Four charges of equal magnitude are arranged at the corners of a square of side L as shown below. Point p and S are at the *midpoint* of one of the sides of the square. (15 ps)

   a) Find the magnitude and direction of the electric field at point *p.*



b) Find the electric potential at point *p*.

c) If a charge +Q of mass *m* is place at point p, what is the PE of the charge?

d) What is the work required to move the charge Q from point p to point s?

e) If the charge Q is released from rest, find the speed when it reaches infinity.

2. A non-conducting sphere of radius R has volume charge density ρ=B/*r* where B is a constant. (15 pts)

a) Use Gauss's Law to calculate the E-field at all points in space.

b) Using the results of the previous problem calculate the electric potential at all points in space. You may take V = 0 when $r \to \infty$.

c) Skech the graph of E vs.r and V vs. r.