PHYS 2326 - Dr. Honan - Test 1 - B Name _____

Possibly Useful Information: $k_e = 9.0\times10^9$ N·m^2 / C^2 $\varepsilon_0 = 8.85\times10^{-12}$ C^2/(N·m^2) $e = 1.60\times10^{-19}$ C
$m_{electron} = 9.11\times10^{-31}$ kg $m_{proton} = 1.67\times10^{-27}$ kg

Problem 1 Consider an electric field of $\langle 2, -3, 5\rangle$ N/C. (6 points each)
(a) What is the flux through the hemisphere $x^2 + y^2 + z^2 = (6\text{cm})^2$, $z > 0$. This has a 6cm radius and sits above the *xy*-plane with its center at the origin?

(b) What is the potential difference when a particle moves from (3m,0,-4m) to the origin?

Problem 2 A long hollow thin-shelled insulating cylinder has a radius *R* and a uniform surface charge density σ. At the center is an infinite line of charge with linear charge density λ. What is the electric field a distance *r* from the central axis? (Give answers for $r<R$ and $r>R$.) (8 points)

Problem 3
(a) A uniform ring of charge *Q* and radius *R* is in the *yz*-plane with the origin at its center. How much work is required to move a charge *q* along the *x*-axis from $x = d$ to the origin? (6 points)

(b) How many electrons must be removed from a conducting sphere with a 5cm radius to make the electric field at its surface 5000V/m? (6 points)

Problem 4 A -9μC charge is at the origin and a 6μC charge is at (-3m, 2m,1m).
(a) What is the electric field at (0,-3m,0)? (6 points)

(b) How much work is required to move a -8μC charge from ∞ to (0,-3m,0)? (7 points)

Problem 5 The is a voltage of 50V between a pair of conducting plates. If an electron is released from rest from the negative plate then what is its speed when it hits the positive plate?

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Problem 6 A uniformly charged disk with charge Q and radius R sits in the xy-plane with its center at the origin. Take z_0 to be some point on the positive z-axis.
(a) What is the electric field at z_0? Leave your answer in the form of a well-defined definite integral. DO NOT INTEGRATE. (7 points)

(b) Describe the electric field for $z_0 << R$. (5 points)

(c) Describe the electric field for $z_0 >> R$. (5 points)

Problem 7 A solid conducting sphere with a 2cm radius sits inside a hollow conductor with concentric spherical surfaces with 4cm and 6cm radii
(a) Suppose the inside conductor is given a net charge of 6μC and the outside conductor is given a net charge of -9μC. What is the electric field at r = 3 cm, 5 cm and 9 cm? (7 points)

(b) Given the charge configuration in part (a), what is the potential at 5cm and 9cm? Take the potential to be 0 at infinity. (7 points)