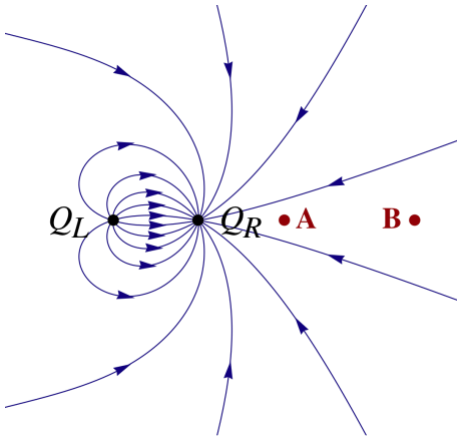
PHYS 2326 - Dr. Honan - Test 1 - A Name _____

Possibly Useful Information: $k = 9.0\times10^{9}$ 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 M = 10^6 k = 10^3 c = 10^{-2} m = 10^{-3} μ = 10^{-6} n = 10^{-9}

Problem_1 Multiple Choice - The diagram shows two point charges. Q_L and Q_R are the charges on the left and right respectively. (3 points each)



_____ [i] What is the sign of charge Q_L?
(a) positive (b) negative (c) zero (d) cannot be determined

_____ [ii] What is sign of the total net charge (Q_L+Q_R)?
(a) positive (b) negative (c) zero (d) cannot be determined

_____ [iii] Which point *A* or *B* is at higher electric potential?
(a) A (b) B (c) both are the same (d) cannot be determined

Problem 2
(a) A ring with a 15cm radius and with a uniform charge of 20μC is in the *yz*-plane with the origin at its center. What is the force on a –3μC charge on the *x*-axis at *x* = 5cm? (7 points)

(b) How many electrons must be removed from a conducting sphere with a 3cm radius to make the electric field at its surface 6000V/m? (6 points)

(c) Two electrons separated by 2×10^{-10}m are released from rest. What is the speed of each electron when they are a large distance apart. (Both electrons will have the same speed.) (6 points)

 Name _____

Problem 3 A charge -Q is at the origin and a 2Q charge is at (a, 0).
(a) What is the electric field at (0, b)? (6 points)

(b) Where along the x-axis is the electric potential zero? Give the coordinates of the position. (7 points)

(c) How much work does it take to move a charge q from infinity to (0,b)? (6 points)

Problem 4 Consider an electric field of $\vec{E} = \langle 4, -6, 9 \rangle \, \mathrm{N/C}$. (6 points each)
(a) What is the flux through a 3cm×3cm square in the yz-plane?

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

(c) What is the force on an electron at the origin?

 Name _____

Problem 5 A thin-shelled hollow sphere with a radius R has a uniform charge q. At the center is point charge Q. What are the *electric field* and *potential* as functions of position? Include answers for $r<R$ and $r>R$? (7 points)

Problem 6 A long hollow insulating cylinder has an inside radius a, outside radius b and a uniform charge density ρ. What is the electric field a distance r from the central axis? (Give answers for $r<a$, $a<r<b$ and $r>b$.) (7 points)

Problem 7 A thin rod runs along the x-axis from $x = -L/2$ to $L/2$. The rod is charged with a *varying* linear charge density $\lambda(x)$. What is potential at (x_0,y_0)? Leave your answer in the form of a well-defined definite integral. DO NOT INTEGRATE. (7 points)

Problem 8 A 7μC charge sits at the center of a hollow conducting sphere with concentric spherical surfaces with 3cm and 5cm radii. The conductor is given a net charge of -4μC.
(a) What is the electric field at r = 2 cm, r = 4 cm and r = 6 cm? (7 points)

(b) Given the charge configuration in part (a), what is the potential at r = 4 cm and 6 cm? Take the potential to be 0 at infinity. (7 points)