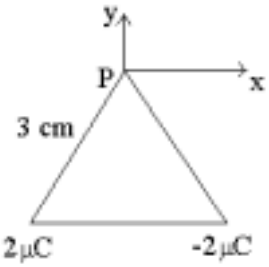
PHYSICS 2220 - PRACTICE EXAM #1

1. Two charges are placed at the bottom corners of an equilateral triangle. What is the electric field (unit vector notation) at the top corner, point P?




2. An electron is placed at point P, and then released. Find the acceleration (unit vector notation) of the electron.

3. Two point charges of 2 μC and 5 μC are placed on the opposite ends of a cord 50 cm long. What is the tension in the cord?

4. A solid conducting sphere has radius a and carries charge +Q. It is inside a hollow conducting sphere of inner radius b and outer radius c that carries a charge +Q. Find the electric field for i) $r < a$; ii) $a < r < b$; iii) $b < r < c$; iv) $r > c$.

5. In problem 4, how much charge is on the inner surface of the hollow sphere? On the outer surface of the hollow sphere?

6. A giant solid spherical conductor is the size of the Earth (radius = $6.37 \times 10^6$ m). Just above its surface is a downward electric field of 100 N/C. What is the charge per unit area on the surface?

7. An electric field passes radially outward through the surface of a sphere of radius 1.5 m. At the surface of the sphere the electric field strength is 5000 N/C. What is the flux through the surface of the sphere? Find the charge inside the sphere.

8. An electron is released from rest in an electric field of 2700 N/C. How much time passes before the electron reaches a speed of 0.1 c, where c = speed of light = $3 \times 10^8$ m/s?

9. Four charges Q are at the corners of a square of side L. Find the potential energy of the four charges, and find the electric potential (voltage) at the center of the square.

10. Two large conducting plates are separated by 1.5 cm and have a constant electric field of 400 N/C between them, directed toward the left-hand plate. The left-hand plate is grounded, and so has an electric potential of 0 V. What is the electric potential of the right-hand plate?

11. A proton initially at rest at the right plate in problem 10 is accelerated by the electric field. At what speed does the proton hit the left plate?

12. A thin conducting ring of radius R contains a net charge Q. Find an equation for the electric potential (voltage) at the center of the ring.

13. In problem 12, find an equation for the electric potential (voltage) on the axis of the ring a distance R from the center.

14. If the electric potential (voltage) at the ring's center is $5 \times 10^5$ V, how much work must an external agent do to move a 6 μC charge from an infinite distance to the center of the ring?

Answers: (1) $2 \times 10^7$ N/C **i** (2) $-3.51 \times 10^{18}$ m/s$^2$ **i** (3) 0.36 N

(4) i) 0; ii) $kQ/r^2$ ; iii) 0; iv) $2kQ/r^2$

(5) -Q inner, +2Q outer (6) $-8.85 \times 10^{-10}$ C/m$^2$

(7) $1.41 \times 10^5$ Nm$^2$/C, $1.25 \times 10^{-6}$ C (8) $6.33 \times 10^{-8}$ s

(9) $U = 5.41\ kQ^2/L$ joules and $V = 5.66\ kQ/L$ volts

(10) 6 V (11) $3.39 \times 10^4$ m/s (12) $V = kQ/R$ (13) $V = kQ/1.41R$

(14) 3 J