Homework #10
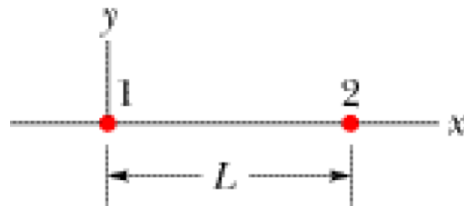
1- Two charges, q_1 = -1 C and q_2 = -4 C (or vice versa), are placed along the x-axis a distance L apart with charge q_1 at the origin and q_2 at x=L (see figure). A third charge, q_3 = +4/9 C, is also placed along the x-axis such that there is no net Coulomb force on any of the charges. What is position of this charge along the x axis in units of L, i.e. what is x/L?

   (1) 1/3   (2) 2/3   (3) ½   (4) 4/3   (5) -2/3

2. Three charges form an equilateral triangle of side length d = 20cm as shown in the figure. If q_A = -1 nC, q_B=+2nC, and q_C=+1nC what is the horizontal x component (or y component) of the net electrostatic force on particle A?

   (1) -1.13 × 10-7 N
   (2) -5.85 × 10-7 N
   (3) -1.95 × 10-7 N
   (4) -2.25 × 10-7 N
   (5) 0 N
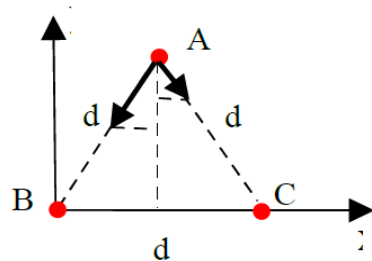
3- Two electrons each with mass me = 9.11×10^{-31} kg are spaced 1mm apart. What is the magnitude of the acceleration for one of the electrons?

   (1) 2.5 x 108 m/s²
   (2) 2.3 x 10-22 m/s²
   (3) 1.25 x 108 m/s²
   (4) 2.5 x 1046 m/s²
   (5) 250 m/s²

4- What is the x component (or the y component) of the electric field at the origin (center) of the hexagonal array of charged particles. The side length s=20cm and q=5 x 10-9C.

   (1) 1130 N/C
   (2) 2250 N/C
   (3) 3380 N/C
   (4) -1950 N/C
   (5) 0
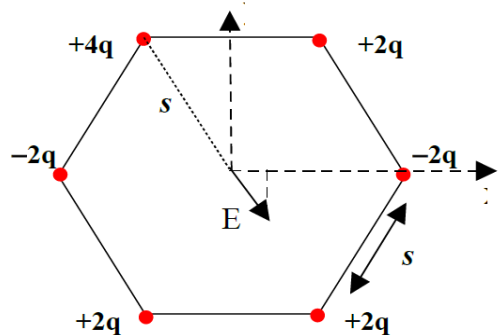
5- A cube of side 2 m has one corner at the origin as shown in the figure. If $\bar{E} = (1 + x^2)\hat{\imath} + (2 + 2y^2)\hat{\jmath} + (3 + 3z^2)\hat{k}$ V/m when x, y, and z are measured in meters, what is the flux through the top face?
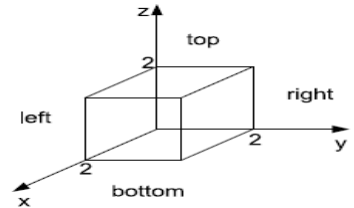
6- A conducting sphere is inside a conducting shell as shown in the figure. The net charge on the sphere is -3μC , and the net charge on the shell is 5μC . If a = 1 m, b = 2 m, and c = 2.5 m, what is the magnitude and direction of the electric field at r = 1.5 m?
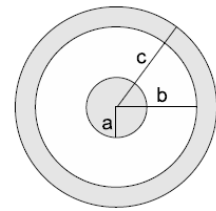
7- The electric field in the x direction is plotted in the figure. If V (0) = 2 V and E_s = 6 V/m, what is the voltage at x = 2 m?
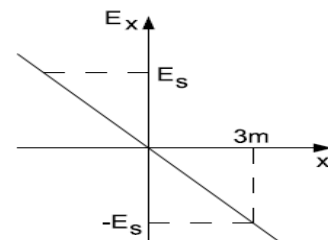
8- Two protons are initially at rest and separated by a distance of 1 cm. They are both released and move away from each other. What is the speed of one of the protons when they are infinitely far away?