Old Exams-Chapter 22

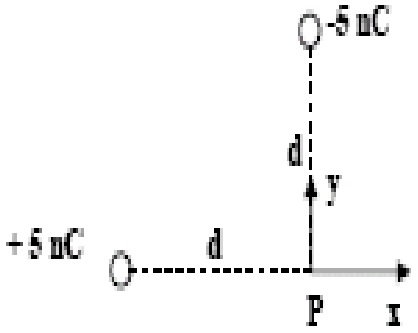
T081

Q3. Two identical charges each of charge Q are positioned at points A (5.0 m, 0.0 m) and B(-5.0 m, 0.0 m) to produce a net electric field of $\vec{E} = \left(-10\hat{j}\right)$ N/C at point C (0.0 m, 5.0 m). Find the value of Q.(Ans: –39 nC)

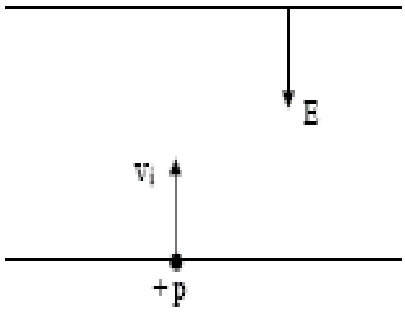
Q4. The dipole moment of a dipole in a 300-N/C electric field is initially perpendicular to the field, but it rotates so that it becomes in the same direction as the field. If the electric dipole moment has a magnitude of 2.0 x 10^{-9} C.m, the work done by the field is: (Ans: +6.0 x10^{-7} J)

T072

Q1. Two charges are arranged as shown in the figure 1. If d=7.2 cm, what is the resultant electric field at P? (Ans: 1.23 x 10^4 N/C making an angle of 45° with + x-axis)

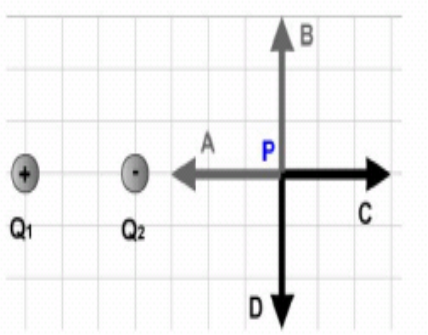


Q3. In the figure 2, a uniform electric field E = –18 j N/C exists between two plates that are 4 cm apart. A proton is fired from the lower plate with a velocity 8×103 j m/s. Find the distance from that plate at which the instantaneous velocity of the proton is zero.(ignore gravity) (Ans: 1.9 cm)



T071

Q17. Two charges Q1 and Q2 of equal magnitudes and opposite signs are positioned as shown in the figure 1. Which of the shown arrows represents correctly the electric field at point P. (Ans: A)



Q19. A uniform electric field has a magnitude of 2.0×10^4 N/C and points to the right. An electron is released from rest in this electric field. How far will the electron travel in two nanoseconds after its release? (Ans: 7.0 mm to the left)

Q20. Four equal negative point charges are located at the corners of a square centered at the origin, their positions in the xy plane are (1, 1), (–1, 1), (–1, –1), (1, –1). The direction of the electric field at (1, 0) is: (Ans: along the negative x axis)

T062

Q2. Three point charges q_1, q_2, and q_3 are fixed at the three corners of a right-angle triangle as shown in figure (1). Given that $q_1 = q_2 = +3.2\times10^{-19}$ C while $q_3 = -1.6\times10^{-19}$ C, and b = 5.0 cm. The magnitude of the net electric field at point P due to all the three point charges is: (Ans: 1.15 x 10^{-6} N/C)

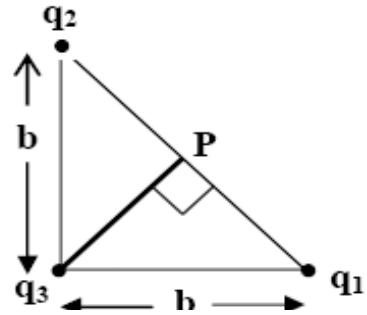


Figure (1)

Q3.Figure (2) shows a charged ball of mass m = 1.0 g is suspended by a light string in the presence of a uniform electric field**,** E= (–3.0 x 10^5 N/C) ***i***. In this field, the ball is in equilibrium at θ = 37 ^{0}. The charge "q" on the ball is**:** **(**Ans: –2.46 x10^{-8} C**)**

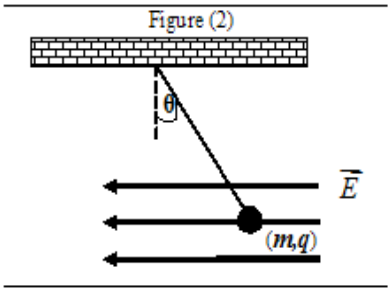


Figure (2)

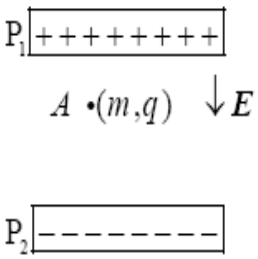
Q4.The electric field between two long and parallel charged plates is uniform, and is equal to E= (240 N/C)***j***. An electron with velocity components v_x = 3.0x10^5 m/s and v_y = 2.0x10^3 m/s enters the region between these plates. The acceleration of the electron when its x-coordinate has changed by 2 cm is: (Ans: –4.2 x 10^{13} **j** m/s)

T061:

Q3. Three electric charges $Q_A = Q_B = q$, and $Q_C = -2q$ are located at the points A (x = + a, y = 0), B (x = –a, y = 0), and C (x = 0, y = +2a), respectively. What is the electric field at the origin? (Ans: k q/2a^2 toward Q_C)

Q4. A proton with a speed of 3.0×10^{5} m/s moves in uniform electric field of 1.9×10^{3} N/C. The field is acting to decelerate the proton. How far does the proton travel before it is brought to rest? (Ans: 0.25 m)

Q14. A particle, of mass *m* and charge *q*, is placed at rest at point *A* in a uniform electric field ***E***, as shown in the figure 1. If the particle is released, then the kinetic energy it attains after moving a distance y is: (Ans: *qEy)*



T052

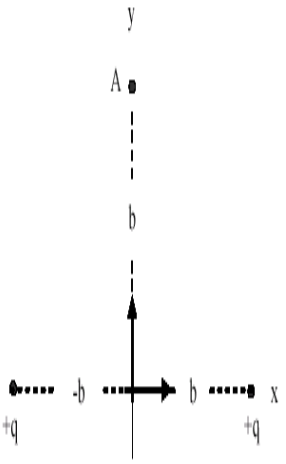
Q4. A charged particle with a mass of $2x10^{-4}$ kg is held suspended (stationary) by a downward electric field of 300 N/C. The charge on the particle is: (Ans: -6.5×10^{-6} C)

Q9. In figure 2, two charges $q_1 = -5.0$ μC, $q_2 = 10$ μC, are fixed on the x-axis. At what distance, measured from q_1, the electric field will be zero? (Ans: 2.4 m to the left of q_1)

Q12. Two small identical conducting spheres, initially uncharged are separated by a distance of 1.0 m. Find the number of electrons that must be transferred from one sphere to the other in order to produce an attractive force of $2x10^{4}$ N between the spheres. (Ans: 9.3×10^{15})

T051

Q3. What is the electric field on the y-axis at a distance b from the origin due to two identical positive point charges, each of charge q, located on the x-axis one at a distance b and the other a distance –b from the origin, as shown in Fig. 1? (Ans; $k\,q/(\sqrt{2}\,b^2)$ in the positive y-direction.)



Q4. Six point charges are placed on the corners of a regular hexagon as shown in the figure 2. Five of them have a charge of +1.0 μC and the sixth has a charge of – 1.0 μC. If the distance from the center of the hexagon to its corner is 1 cm, what is the electric field at the center? (Ans: 1.8 x 10^8 N/C.)

T042:

Q3. Three charges +2.00x10^{-8} C, +2.00x10^{-8} C and –4.00x10^{-8} C are respectively arranged at the corners F, G, and H of a right-angle triangle as shown in figure 2. Find the magnitude and direction of the resultant electric field at point P due to the three charges.
(Ans: 2.88x10^3 N/C towards H)

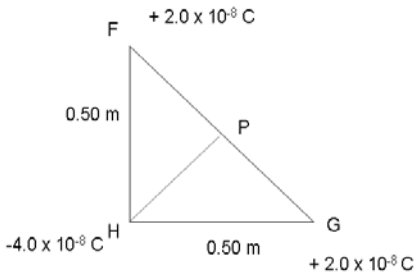


Figure 2

Q4. In figure 9, a small ball of mass m=2.0 g is hanging from a fixed point by a non-conducting string of length 1.00 m. The ball carries a charge q=25.0x10^{-9} C. The mass of the string is negligible. An electric field E with magnitude E=2.0x10^5 N/C, in the positive x-direction, causes the ball to be in an equilibrium position with an angle Theta. Find the angle Theta. [Take g = 9.80 m/s^2]. [Ans: 14.3^0]

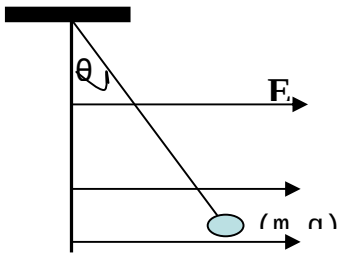


Figure 9

Q5. A uniform electric field is set up between two large charged plates, see Figure 3. An electron is released from the negatively charged plate, and at the same time, a proton is released from the positively charged plate. They cross each other at a distance of 5.00x10^{-6} m from the positively charged plate. If only the field due to the charged plates is considered, find the distance between the two plates. [Take the ratio mass of the electron: mass of the proton = 1:1833] (Ans: 9.19 mm.)

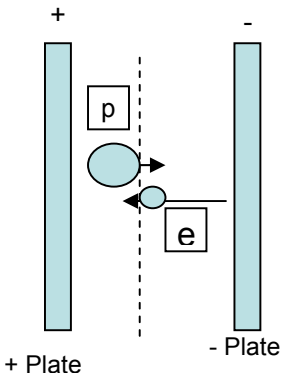


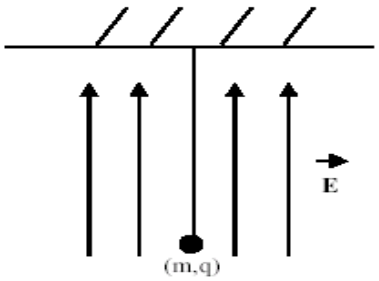
Figure 3

T041

Q1. The electric field produced by a +3.0 C charge at a point 1000 m to the left of the charge is (Ans: A1 2.7×10^4 N/C toward the left)

T032

Q1. In figure 4, a 0.3 g metallic ball hangs from an insulating string in a vertical electric field of 4000 N/C directed upward as shown. If the tension in the string is 0.005 N, then the charge on the ball is: (Ans: –0.52 μC)



Q2. In figure 5, four charges are placed on the circumference of a circle of diameter 2 m. If an electron is placed at the center of the circle, then the electron will [Take Q = 60 μC, q = 20 μC] (Ans: stay at the center.)

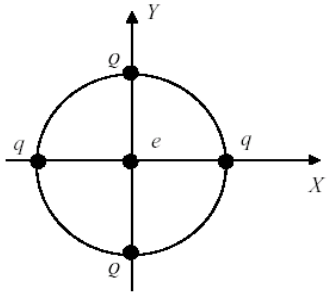


Figure 5

Q3. A particle of mass 5.0 g and charge 40 mC moves in a region of space where the electric field is uniform and given by E = –5.5 i (N/C). If the velocity of the particle at t = 0 is given by v = 50 j (m/s), find the speed of the particle at t = 2 s. [i, and j are the unit vectors in the directions of x, and y respectively]. (Ans: 101 m/s.)

Q4. At which point can the electric field due to the two charges shown in figure 6 be zero? (Ans: point E.)

T031

Q1. A particle, of mass m and charge q, is released from rest at point A in a uniform electric field, see figure (2). The kinetic energy, due to the electric field, it attains after moving a distance y is: (Ans: qEy.)

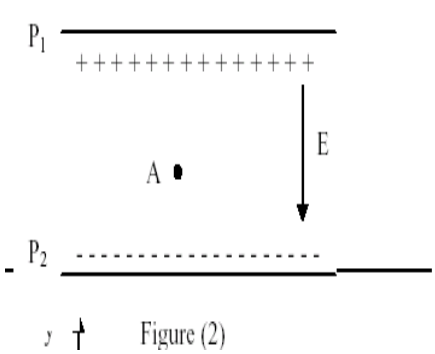


Figure (2)