Subjective Sheet No 1

N.C.E.RT | +2

ELECTROSTATIC FORCE

Q1) Which is bigger ,a coulomb or charge on an electron ? How many electronic charges form one coulomb of charge. **[Sol : 0.625×10^{19}]**

Q2) Calculate force between two charges of 1 C each separated by 1 m in vacuum. **[sol: 9×10^9 N]**

Q3) Two charged particles having charge of $2 * 10^{-8}$ C are joined by an insulating string of length 1 m and the system is kept in horizontal table. Find the tension in the string ? **[Sol : 3.6×10^{-6} N]**

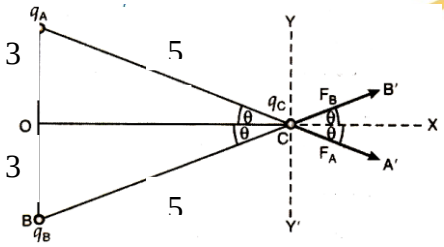
Q4) The electrostatic force on a small sphere of charge 0.4 μ C due to another small sphere of charge -0.8 μ C in air is 0.2 N. (a) What is the distance between two spheres ? **[Sol : 0.12 m]**
(b) What is force on the second sphere due to first ? **[Sol: 0.2 N]**

Q5) Two insulated charged copper spheres A and B have their centers separated by a distance of 50 cms. What is the mutual force of repulsion if charge on each is $6.5 * 10^{-7}$ coulombs. The radii of A and B are negligible compared to the distance of separation . **[sol : 1.521×10^{-2} N]**
What is the force of repulsion if
(1) Each sphere is charged double the above amount and distance between them is halved? **[Sol : 0.24 N]**
(2) the two spheres are placed in water of dielectric constant 80. **[Sol :1.9×10^{-4}N]**

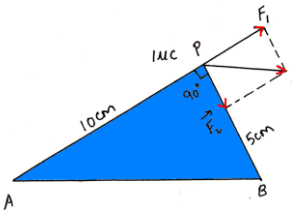
Q6) Two fixed point charges + 4e and +e units are separated by distance a. where should the third point charge be placed for it to be in equilibrium ? **[Sol :2a/3 from 4e]**

Q7) A charge q is placed at the centre of the line joining two equal charges Q. Show that the system of three charges will be in equilibrium if q = - Q/4 **[Sol: - Q/4]**

Q8) Two equal positive charges , each of 2 μC interact with a third positive of 3 μ C situated as shown in the fig .Calculate the magnitude of the force on 3 μ C charge. **[3.45×10^{-3}]**



Q9) Find the magnitude of the resultant force on the charge of 1 μ C held at P due to two charges of $+2 * 10^{-8}$ C and -10^{-8} C at A and B respectively. G iven AP = 10 cms and BP =5 cms . $\angle$ APB = 90
[sol : 4.024×10^{-2} N]



Q10) What equal charges would have to be placed on earth and moon to neutralize their gravitational attraction ? Given ,mass of earth = 10^{25} Kg. mass of moon = 10^{23} Kg **[Sol : 8.6×10^{13}C]**

Q11) Two equally charged particles, held $3.2 * 10^{-3}$ m apart , are released from rest. The initial acceleration of the first particle to be 7 m/sec^2 and that of the second to be 9 m/ sec^2 .If the mass of the first is $6.3 * 10^{-7}$ kg. what are (a) the mass of the second particle (b) the magnitude of the charge of each particle ?
[Sol : 4.9×10^{-7} Kg , 7.08×10^{-11} C]

Q12) Two positive point charges which are 0.1 m apart repel each other with a force of 18 N. If the sum of the charges be 9 μ C. Calculate their separate value. **[Sol: 5 μC & 4 μC]**

Q13) A particle of mass m and carrying charge $-q_1$ starts moving around the first charge $+q_2$ along the circular path of radius r. Prove that period of revolution T is given by $T = \sqrt{\frac{16 * pi^3 * \varepsilon_0 m r^3}{q_1 q_2}}$

Q14) A free pith ball of 8 gram carries a positive charge of 5 * 10^{-8} C . what must be the nature and magnitude of charge that would be given to a second pith ball fixed 5 cm vertically below the former so that the upper pith ball is stationary. **[Sol : 4.36 x 10^{-7} C (+ve)]**

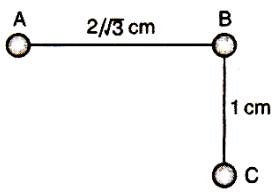
Q15) a) Two insulated charged copper spheres A and B have their centers separated by a distance of 50 cms . What is the mutual force of electrostatic repulsion if charge on each is 6.5 * 10^{-7} C? The radii of A and B are negligible as compared to the distance of separation.
b) What is the force of repulsion if 1) each sphere is charge to double the above amount and the distance between them is halved. 2) The spheres are placed in water.
(Dielectric constant of water is 80) Suppose in the above problem (a) the spheres A and B have identical sizes . The third sphere of same size but uncharged is brought in contact with the first , then brought in contact with the second and finally removed from the both. What is the new force of repulsion between A and B.
[Sol : Same as Q5 (a) and (b) , $5.70 \times 10^{-3} N$ **]**

Q16) Estimate the no free electrons in 1 gram of water and the negative charge possessed by them . Given that Avogadro no is 6.02 * 10^{23} and molecular weight of water is 18. **[Sol: 5.35 x 10^4 C]**

Q17) The force between two equal charges placed in medium at distance of 9 cms from each other is 16 dynes. On increasing one of the charges by 56 stat C , it is found that the distance between the charges must be changed by 3 cms , In order to keep force between them the same. Calculate the magnitude of the charges and the dielectric constant of the medium. Given 1 C = 3 * 10^9 stat C. **[Sol :72 Stat C,k= 4]**

Q18) The distance between two equal balls having unlike charges is 2 cms . The radii of the balls are much less than the distance between them . The ball attract each other with the force of 36 * 10^{-5} N. After the balls have been connected by the wire and the latter has been removed the balls repel each other with force of 20.25 * 10^{-5} N. Find the original charges on the ball. **[Sol : 8x10^{-9} C , 2x10^{-9} C]**

Q19) Three small charged spheres with equal charges on them are placed as shown in the fig. A and C are fixed in position and B can move. C exerts a force of 4 * 10^{-6} N on B .



a) What force A exerts on B.
b) What is the net force on B.

[Sol : 3 x 10^{-6} N, 5 x 10^{-6} N , $Tan^{-1}(0.75) = 36.9^0$ (east of north)]

Q20) four charges +q ,+ q , -q and –q are p[laced respect at the four corners A , B , C and D of a square of side 'a'. Calculate the force on charge Q placed at the centre of the square.

[Sol : $\frac{1}{4\pi\varepsilon_0} \frac{4\sqrt{2} qQ}{a^2}$ **(along ON)]**