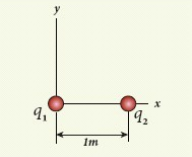
Visit QB365-SLMS - https://www.qb365.in/slms/ Complete Questions and Answers

Questions:

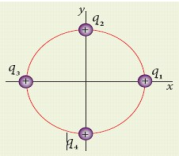
III. Three Marks:

1. Consider two point charges q_1 and q_2 at rest as shown in the figure.

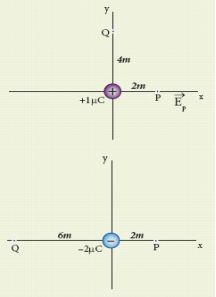


They are separated by a distance of 1m. Calculate the force experienced by the two charges for the following cases:
(a) q_1 = +2μC and q_2 = +3μC
(b) q_1 = +2μC and q_2 = -3μC
(c) q_1= +2μC and q_2 = -3μC kept in water (ε_r = 80)

2. Consider four equal charges q_1, q_2, q_3 and q_4 = q = +1 μC located at four different points on a circle of radius 1m, as shown in the figure. Calculate the total force acting on the charge q_1 due to all the other charges.



3. Calculate the electric field at points P, Q for the following two cases, as shown in the figure.
(a) A positive point charge +1 μC is placed at the origin.
(b) A negative point charge -2 μC is placed at the origin.

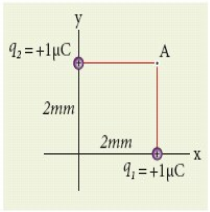


4. A parallel plate capacitor has square plates of side 5 cm and separated by a distance of 1 mm.
(a) Calculate the capacitance of this capacitor.
(b) If a 10 V battery is connected to the capacitor, what is the charge stored in any one of the plates? (The value of ε_0 = 8.85 x 10^{-12} Nm^2 C^{-2})

5. A parallel plate capacitor filled with mica having ε_r = 5 is connected to a 10 V battery. The area of the parallel plate is 6 cm^2 and separation distance is 6 mm.
(a) Find the capacitance and stored charge.
(b) After the capacitor is fully charged, the battery is disconnected and the dielectric is removed carefully.
Calculate the new values of capacitance, stored energy and charge.

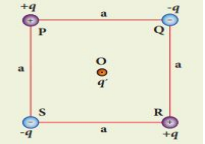
II. Two Marks:

6. Consider the charge configuration as shown in the figure. Calculate the electric field at point A. If an electron is placed at points A, what is the acceleration experienced by this electron? (mass of the electron = 9.1 x 10^{-31} kg and charge of electron = -1.6 x 10^{-19} C)



7. A sample of HCl gas is placed in a uniform electric field of magnitude 3 x 10^4 NC^{-1}. The dipole moment of each HCl molecule is 3.4 x 10^{-30} Cm. Calculate the maximum torque experienced by each HCl molecule.

8. Four charges are arranged at the corners of the square PQRS of side an as shown in the figure.
(a) Find the work required to assemble these charges in the given configuration.
(b) Suppose a charge q is brought to the center of the square, by keeping the four charges fixed at the corners, how much extra work is required for this?

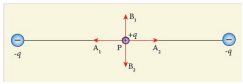


9. Dielectric strength of air is 3 x 10^6 V m^{-1}. Suppose the radius of a hollow sphere in the Van de Graff generator is R = 0.5 m, calculate the maximum potential difference created by this Van de Graaff generator.

10. When two objects are rubbed with each other, approximately a charge of 50 nC can be produced in each object. Calculate the number of electrons that must be transferred to produce this charge.

I. Multiple Choice Question:

11. Two identical point charges of magnitude −q are fixed as shown in the figure below. A third charge +q is placed midway between the two charges at the point P. Suppose this charge +q is displaced a small distance from the point P in the directions indicated by the arrows, in which direction(s) will +q be stable with respect to the displacement?



(a) A_1 and A_2 (b) B_1 and B_2 (c) both directions (d) No stable

12. Which charge configuration produces a uniform electric field?

(a) point charge (b) uniformly charged infinite line (c) uniformly charged infinite plane (d) uniformly charged spherical shell

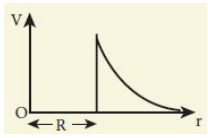
13. An electric dipole is placed at an alignment angle of 30^o with an electric field of 2×10^5 NC^{-1}. It experiences a torque equal to 8 N m. The charge on the dipole if the dipole length is 1 cm is

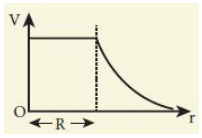
(a) 4 mC (b) 8 mC (c) 5 mC (d) 7 mC

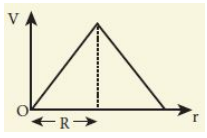
14. An electric field $\vec{E} = 10x\hat{i}$ exists in a certain region of space. Then the potential difference $V = V_o - V_A$, where V_o is the potential at the origin and V_A is the potential at x = 2 m is _____.

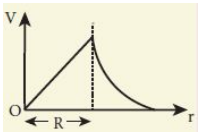
(a) 10 V (b) -20 V (c) +20 V (d) -10 V

15. A thin conducting spherical shell of radius R has a charge Q which is uniformly distributed on its surface. The correct plot for electrostatic potential due to this spherical shell is _____.

(a) 

(b) 

(c) 

(d) 

QB 365 TM Study Material
QUESTION BANK 365