ELECTRIC CHARGES AND FIELDS

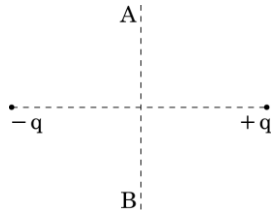
1 MARK QUESTION

1. A point charge +Q is placed at point O as shown in the figure. Is the potential difference $V_A - V_B$ positive, negative or zero? **(Delhi 2015,Forien 2016)**
   a. +Q•----------•----------•

2. How does the electric flux due to a point charge enclosed by a spherical Gaussian surface get affected when its radius is increased? (Delhi 2016)

3. Define Electric Flux. Write its SI unit. **(Foreign 2016)**

4. A charge is moved from a point a above a dipole of dipole moment P to a point B below the dipole in equatorial Plane without acceleration .find the work done in the process? **(Outside Delhi 2016)**



a.

5. What is the amount of work done in moving a point charge Q around a circular arc a the center at which another point charge q is located? **(Outside Delhi 2016)**
6. Why do the electrostatic field lines not form a closed loop? **(Delhi 2016)**
7. What is the electric flux through a cube of side 1cm which encloses an electric dipole? **(All India 2015)**
8. Why do electric lines of force never cross each other? **(All India 2014)**
9. Why must electrostatic field at the surface of a charged conductor be perpendicular to every point on it? **(Foreign 2014,Delhi 2012)**
10. Define dipole moment of an electric dipole.is it a scalar or vector quantity?
11. Draw a plot showing the variation of electric field E with distance r due to a point charge q.
12. A proton is placed in uniform electric field directed along positive X axis.in which direction will it tend to move? **(Delhi 2011)**
13. In which orientation, a dipole placed in a uniform electric field is in (1) stable (2) unstable equilibrium? **(Delhi 2011)**
14. Two point charge having equal charges separated by 1 m distance experiences a force of 8 N. What will be the force experience by them if they are held in water at the same distance?(given k_{water}=80), **(All India 2010)**

02 MARK QUESTION

1. Derive an expression for the work done in rotating a dipole from the angle α_o to α in a uniform electric field E? **(All India 2016)**

2. An electric dipole of length 4cm when placed with axis making an angle of 60^0 with a uniform electric field, experiences a torque of 4root3 Nm. calculate the potential if it has a charge ±8nC. **(Delhi 2014)**

3. An electric dipole of length 2cm when placed with its axis making an angle of 60^0 with uniform electric field experiences a torque of 8root3 Nm. Calculate the potential energy of the dipole if it has a charge of ±4nC. **(Delhi 2014)**

4. An electric dipole is placed in a uniform electric field E with its dipole moment P parallel to the field. Find

5. (a) the work done in turning the dipole till its dipole moment points in the direction opposite to E
(b) The orientation of the dipole for which the torque acting on it becomes maximum. **(All India 2014)**

6. A small metal sphere carrying a charge +Q is located at the center of a spherical cavity in a large uncharged metallic spherical shell. Write the charge on inner and outer surface of the shell .write the expression for the electric field at the point P inside the shell. **(Delhi 2014)**

7. (i) Point charge +Q is kept in the vicinity of an uncharged conducting plate .sketch the electric field lines between charge and plates.
(ii) Two infinitely large thin parallel sheets having surface charge density d_1 and d_2 as shown in figure write the magnitude and direction of net fields on the mark II and III. **(Foreign 2014)**

8. Calculate the amount of work done in turning an electric dipole of dipole moment 3×10^{-8} Cm, from its position of unstable equilibrium to stable equilibrium in a uniform electric field of intensity 10^3N/C. **(Foreign 2011)**

9. Plot graph showing the variation of coulomb force(F) versus $1/r^2$, where r is the distance between the two charges of each pair of charge (1 μC,2 μC) and (1 μC,-3 μC,),interpreted the graph obtained **(All India 2011)**

10. Two identical metallic shell A and B having charges +4Q and -10Q are kept at certain distance apart \ a third identical uncharged sphere C is first placed in contact with sphere A and with sphere B , then sphere A and B are brought in contact and then separated .find the charge on sphere A and B . **(All India 2011)**

11. Given a uniform electric field $E=4\times10^3$i N/C .find the flux of this field through a square of 5cm on a side whose plane is parallel to the Y-Z plane .what would be the flux through the same square if the plane makes an angle 30^0 with X axis ? **(Delhi 2014)**

12. A thin straight infinitely long conduction wire having charge density λ is enclosed by a cylindrical surface of radius r and length l, its axis coinciding with the length of the wire. Find the expression of electric flux through the surface of the cylinder. **(All India 2011)**

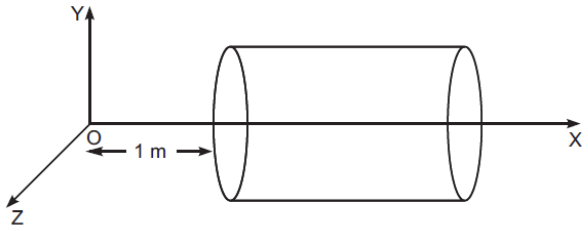
13. Two charged conducting sphere of radii r1 and r2 connected to each other by a wire. Find the ratio of electric field at the surface of the two spheres? **(Delhi 2011)**

14. A sphere S_1 of radius r_1 enclosed a net charge Q . if there is another concentric sphere S_2 of radius r_2 ($r_2 > r_1$)enclosing charge 2Q ,find the ratio of the electric flux through sphere S_1 and S_2 . How will the electric flux through S_1changes if a medium of dielectric constant K is introduced in the space inside S_2 in place of air? **(All India 2014)**

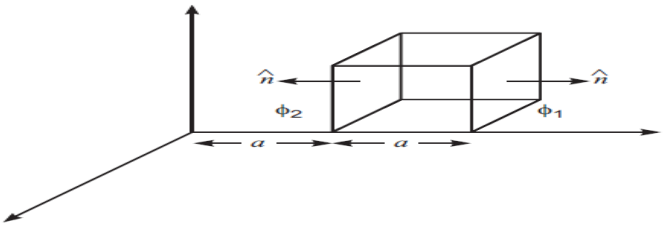
03 MARK QUESTION

1. 1 A charge is distributed uniformly over a ring of radius 'a'. Obtain an expression for the electric intensity E at a point on the axis of the ring. Hence show that for point's at large distances from the ring, it behaves like a point charge. **(Delhi 2016)**

2. (a) Define torque acting on a dipole of dipole moment p placed in a uniform electric field E. Express it in the vector form and point out the direction along which it acts. (b) What happens if the field is non-uniform? (c) What would happen if the external field Eis increasing (i) parallel to P and (ii) anti-parallel to P?
3. Define equipotential surface? draw equipotential surface (i) in case of a single point charge (ii) in a constant electric field in Z direction .why the equipotential surface about the a single charge are not equidistant ? (iii) Can electric field exist tangential to an equipotential surface? Give reason. **(All India 2016)**
4. Two point charge +q and -2q are placed at the vertices B and C of an equilateral triangle ABC of side a .obtain the expression for (i) magnitude and the direction of the resultant electric field at the vertex A due to these two charges**.** **(All India 2014).**
5. Define the term electric dipole moment. Is it a scalar or vector? Deduce an expression for the electric field at a point on the equatorial plane of an electric dipole of length 2a. **(All India 2013, Foreign 2009)**
6. Sketch the pattern of electric field lines due to (i) a conducting sphere having a negative charge on it. (ii) An electric dipole**.** **(All India 2011).**
7. A hollow cylindrical box of length 1m and area of cross section $25cm^2$ is placed in a 3-d coordinate system along x axis as shown in figure. The electric field in the region is given by E=50x i, where E is in N/C and x is in meter. Find (i) net flux through the cylinder. (ii) Charge close by the cylinder. **(Delhi 2013)**



8. State gauss' law in electrostatics a cube which each side a is kept in an electric field is given by E=Cx i as shown in figure where C is positive dimensional constant. Find out (i) the electric flux through the cube (ii) the net charge inside the cube**.** **(Foreign 2012).**



9. Using gauss' law obtain expression electric field due to uniformly charged spherical shell of radius R at point outside the shell .draw a graph showing variation of electric field with r, for r > R and r < R .

(All India 2011)

04 MARK QUESTION

1 Meeta's father was driving her to the school. At the traffic signal she noticed that each traffic light was made of many tiny lights instead of a single bulb. When Meeta asked this question to her father, he explained the reason for this.

Answer the following questions based on above information:

(i) What were the values displayed by Meeta and her father?

(ii) What answer did Meeta's father give?

(iii) What are the tiny lights in traffic signals called and how do these operate? **(Delhi VBQ 2016)**

2 Gautam went for a vacation to the village where his grandmother lived. His grandmother took him to watch 'nautanki' one evening. They noticed a black box connected to the mike lying nearby. Gautam's grandmother did not know what that box was. When she asked this question to Gautam, he explained to her that it was an amplifier.

(i) Which values were displayed by the grandmother? How can inculcation of these values in students be promoted?

(ii) What is the function of an amplifier?

(iii) Which basic electronic device is used in the amplifier? **(Foreign 2016 VBQ)**

05 MARK QUESTION

1.(i) An electric dipole of dipole moment P consists of point charges +q and –q separated by a distance 2α apart. Deduce an expression for the electric field E due to the dipole at distance x from the center of the dipole atr its axial line in terms of dipole moment P, hence show that in the limit x>>α—>2P/4π€x^3.

(ii)Given the electric field in the region E=2x Î ,find the net electric flux through the cube and the charge enclose by it. **(All India 2015)**

2. (i)Define electric flux .write its SI unit. Gauss' law in electrostatic is true for any closed surface, no matter what its shape or size is. Justify this statement with the help of a suitable example.

(ii) Use Gauss' law to prove that the electric field inside a uniformly charged spherical shell is zero.

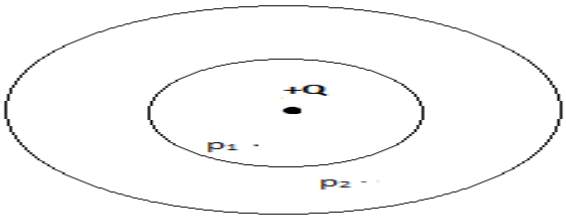
(Delhi 2015).

03. Using Gauss' law, deduce the expression for the electric field due to a uniformly charged spherical conducting shell of radius R at a point (i) outside the shell (ii) inside the shell. Plot a graph showing variation if electric field as a function of r>R and r<R. (r being the distance from the center of the shell)

(All India 2013)

4. (i)Define electric flux. Write its SI unit.

(ii)A small metal sphere carrying charge +Q is located at the center of spherical cavity inside a large uncharged metallic spherical shell as shown in figure. Use Gauss' law to find the expression for the electric field at point



P_1 and P_2 .

(iii) Draw the pattern of electric field lines in this arrangement. **(Delhi 2012 C)**

5. (i) Define electric flux .write its SI unit.

(ii)Using gauss' law prove that the electric field at a point due to a uniformly charged infinite plane sheet is independent of distance from it .How is the field directed if

(a) The sheet is positively charged. (b) Negatively charged. **(Delhi 2012)**

6. (i) state gauss' law use it to deduce the expression for the electric due to a uniformly charged thin spherical shell at points (a) inside the shell and (b) outside the shell.

(ii) Two identical metallic spheres a and b having charges +4Q and -10Q are kept a certain distance apart. a third identical uncharged sphere c is first placed in contact with sphere A and then with sphere B. then , spheres A and B are brought in contact and then separated . Find the charges on the spheres A and B.

(All India 2011 C)