First and foremost we must know the basics of electricity and usage in BOARDS NEET and
JEE

1. Concept of potential and potential difference
2. Unit and definition of 1 Volt
3. Potential energy of 2 charge system
4. Principle of superposition in potential and potential energy
5. Relation between electric field and potential difference
6. Concept of equipotential surface
7. Absolute potential and potential difference
8. Content 2.9 from NCERT
9. Electrostatic shielding concept
10. Capacitor basic principal
11. Definition and unit of Capacitance
12. Parallel plate capacitor
13. Dielectric insertion in Parallel plate capacitor
14. Energy of capacitor and Energy density
15. Concept of series and parallel combination
16. Battery connected and removed on addition of capacitor or dielectric

Electric Potential

1. Define electric potential. Is it a vector or a scalar quantity?
2. Draw two equipotentials due to a point charge.
3. Draw an equipotential surface for a point charge Q > 0
4. What would be the work done if a point charge $+q$, is taken from a point A to the point B on the circumference of a circle drawn with another point charge $+q$ at the centre?
5. Derive the expression for the electric potential at a distance 'r' from a point charge 'Q'.
6. What is an equipotential surface? Show that the electric field at a point on the surface of a charged conductor or just outside it is perpendicular to the surface?
7. Potential due to dipole on axial and equatorial line

1.Why do the electrostatic field lines not form closed loop?[All India 2014, Delhi 2012]
2.Why do the electric field lines never cross each other?[All India 2014]
3.Why must electrostatic field at the surface of a charge every point? Give reason. [Foreign 2014, Delhi 2012]
4.Two point charges q_1 and q_2 are placed at a distance d apart as shown in the figure. The electric field intensity is zero at the point P on the line joining them as shown. Write two conclusions that you can draw from this. [Delhi2014C]

5.Define dipole moment of an electric dipole. Is it a scalar quantity or a vector quantity? [Foreign 2012; All India 2011]

6.Draw a plot showing the variation of electric field (E) with distance r due to a point charge Q. [Delhi 2012]

7.A proton is placed in a uniform electric field directed along the position X-axis. In which direction will it tend to move? [Delhi 2011 C]

8. In which orientation, a dipole placed in a uniform electric field is in (i) stable (ii) unstable equilibrium?[Delhi 2011; All India 2008]

9.Two point charges having equal charges separated by lm distance experience a force of 8 N. What will be the force experienced by them if they are held in water at the same distance? (Given, $K_{water} = 80$).[Ail India 2010 C]

10.A metallic shpere is placed in a uniform electric field as shown in the figure. Which path is followed by electric field lines and why?[HOTS; Foreign 2010]
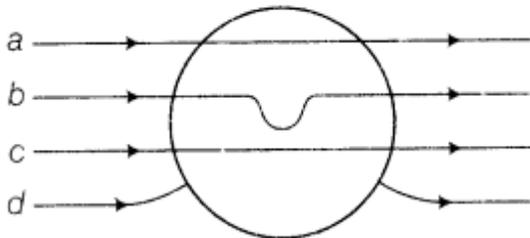
11.Point out right or wrong for the following statement. The mutual forces between two charges do not get affected by the presence of other charges.

12.A dipole of dipole moment p is present in a uniform electric field E . Write the value of the angle between p and E for which the torque experienced by the dipole, is minimum.   [Delhi 2009 c]

13.Two small identical dipoles AB and CD, each of dipole moment p are kept at an angle of 120° as
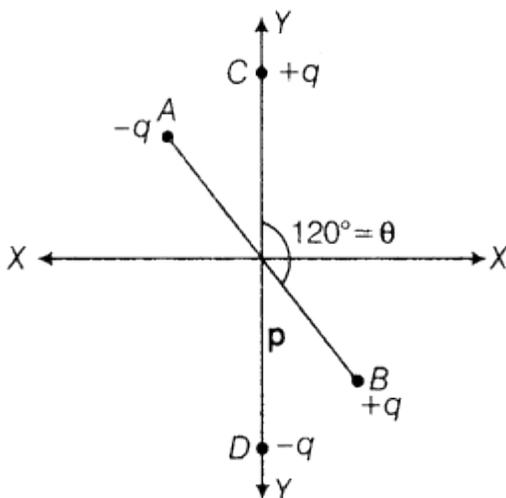
shown in the figure. What is the resultant dipole moment of this combination? If this system is subjected to electric field (E) directed along + X-direction, what will be the magnitude and direction of the torque acting on this? [Delhi 2008]

2 Marks Questions

14. An electric dipole of length 4 cm when placed with its axis making an angle of 60° with a uniform electric field, experiences a torque of $4\sqrt{3}$ Nm . Calculate the potential energy of the dipole if it has charge ± 8 nC.[Delhi 2014]

15. An electric dipole of length 2 cm when placed with its axis making an angle of 60° with a uniform of electric field,experiences a torque of $3\sqrt{3}$ Calculate the potential energy of the dipole if it has charge of ± 4 nC.[Delhi 2014]

16. An electric dipole of length 1cm which placed with its axis making an angle of 60° with a uniform electric field,experiences a torque of $6\sqrt{3}$ Calculate the potential energy of the dipole if it has charge ± 2 nC. [Delhi 2014]

17. Two point charges q and – 2 q are kept d distance apart, find the location of the point relative to charge to q at which potential due to this system is zero.[All India 2014]

18. An electric dipole is placed in a uniform electric field E with its dipole moment p parallel to the field. Find (i)the work done in turning the dipole till its dipole moment points in the direction opposite to E. (ii)the orientation of the dipole for which the torque acting on it becomes maximum.[All India 2014 C]

19. A small metal sphere carrying a charge +0 is located at the centre of a spherical cavity in a large uncharged metallic spherical shell. Write the charges on the inner and outer surfaces of the shell. Write the expression for the electric field at the point P_x. [Delhi 2014 C]
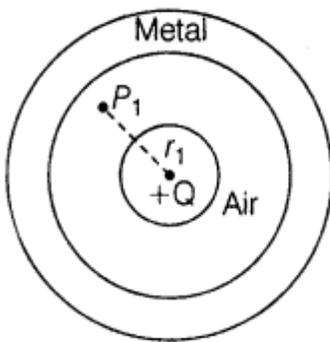

20. (i) Point charge (+Q) is kept in the vicinity of and uncharged conducting plate. Sketch electric field lines between the charge and the plate.
(ii)Two infinitely large plane thin parallel sheets having surface charge densities sigma1 and sigma2 (sigma1>sigma2) are shown in the figures. Write the magnitude and directions of net fields on the marked II and III. [Foreign 2014]
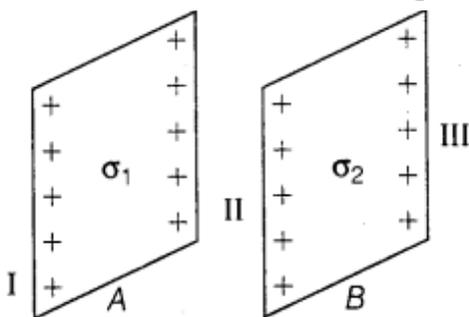
21. Calculate the amount of work done in turning an electric dipole of dipole moment 3×10^{-8} cm from its position of unstable equilibrium to the position of stable equilibrium in a uniform electric field of intensity 10^3 N/C. [Foreign 2011]

22. Plot a graph showing variation of coulomb Force (F) versus $(1/r^2)$ where r is the distance between the two charges of each pair $(1\mu C, 2\mu C)$ and $(1\mu C, -3 \mu C)$

23. Two identical metallic spherical shells A and B having charges $+40Q$ 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 charge on the spheres A and B.[All India 2011 C]

24. A dipole with a dipole moment of magnitude p is in stable equilibrium in an electrostatic field of magnitude E. Find the work done in rotating this dipole to its position of unstable equilibrium.   [All India 2010C]

25. A dipole is present in an electrostatic field of magnitude 10^6N/C. If the work done in rotating it from its position of stable equilibrium to its position of unstable equilibrium is 2×10^{-23}J, then find the magnitude of the dipole moment of this dipole.[All India 2010 C]

26. Deduce the expression for the electric field E due to a system of two charges q_1 and q_2 with position vectors r_1 and r_2 at a point r with respect to common origin. [Delhi 2010C]

27. The sum of two point charges is 7 microC. They repel each other with a force of 1 N when kept 30 cm apart in free space. Calculate the value of each charge.   [Foreign 2009]

28. Figure shows two large metal plates and P_2 tightly held against each other and placed between two equal and unlike point charges perpendicular to the line joining them.
(i)What will happen to the plates when they are released? (ii)Draw the pattern of the electric field lines for the system.[Foreign 2009]
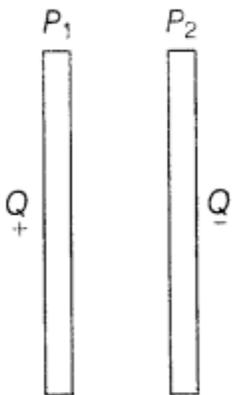
Ans.(i) By electrostatic induction, charge induces on the plates and opposite nature of charge

29. Two charges $+Q$ and $-Q$ are kept at points $(-x_2,0)$ and $(x_t, 0)$ respectively, in the XY-plane. Find the magnitude and direction of the net electric field at the origin (0,0). [All India 2009 C]

30. Two point charges 4Q and Q are separated by 1 m in air. At what point on the line joining of charges, is the electric field intensity zero? [All India 2008]

3 Marks Questions

31. Two point charges $+q$ and $-2q$ are placed at the vertices B and C of an equilateral triangle ABC of side a as given in the figure. Obtain the expression for (i) the magnitude and (ii) the direction of the resultant electric field at the vertex A due to these two charges.
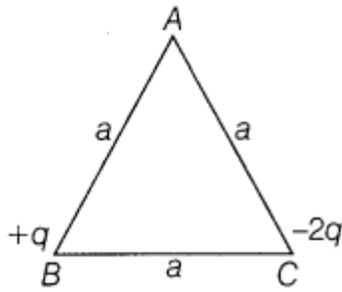
[All India 2014 C]

32.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]

33.Sketch the pattern of electric field lines due to (i) a conducting sphere having negative charge on it. (ii) an electric dipole.[All India 2011 C]

34.A positive point charge (+ q) is kept in the vicinity of an uncharged conduction plate. Sketch electric field lines originated from the point on to the surface Of the plate. [All India 2009;]

4 Marks Questions

35.Deduce the expression for the torque acting on a dipole of dipole moment p in the presence of a uniform electric field E.[All India 2014; Delhi 2008]

36.While travelling back to his residence in the car, Dr. Pathak was caught up in a hunderstorm. It became very dark. He stopped driving the car and waited for thunderstorm to stop. Suddenly, he noticed a child walking alone on the road. He asked the boy to come inside the car till the thunderstorm stopped Dr.Pathak dropped the boy at his residence. The boy insisted that Dr. Pathak should meet his parents. The parents expressed their gratitude to Dr. Pathak for his concern for safety of the child.

Answer the following questions based on the above information

(i)Why is it safer to sit inside a car during a thunderstorm?

(ii)Which two values are displayed by Dr. Pathak in his action?

(iii)Which values are reflected in parents response to Dr. Pathak?

(iv)Give an example of similar action on your part in the past from everyday life.[Delhi 2013; VBQ].

37.An electric dipole moment p is held in a uniform electric field E. (I Prove that no translation force acts on the dipole. (ii)Hence, prove that the torque acting on the dipole is given by pE sin θ indicating the direction along which it acts. [Foreign 2008]