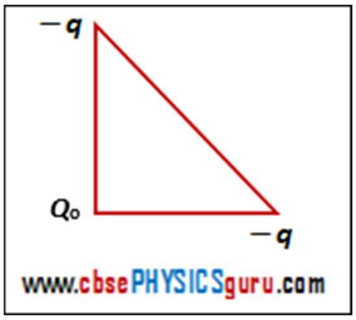
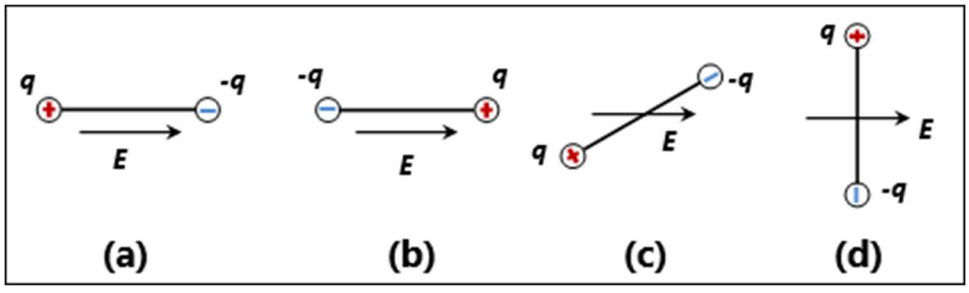
EQUIPOTENTIAL SURFACES AND ELECTRICAL POTENTIAL ENERGY

1. The electric potential V at any point (x m, y m, z m) in space is given by V= $4x^2$ V. The electric field (in V/m) at the point (1 m, 1m, 1 m) is:
   (a) $-8\hat{\imath}$ (b) $-4\hat{\imath}$ (c) $-16\hat{\imath}$ (d) $8\hat{\imath}$
2. The electric potential at a point (x, y) in the xy-plane is given by V = –Kxy. The electric field intensity at a distance r from the origin varies as:
   (a) r (b) r^2 (c) $r^{1/2}$ (d) r^3
3. A conducting sphere of radius R is charged to a potential of V volt. Then the electric field and potential at a distance r (> R) from the centre of the sphere would be:
   (a) $\frac{RV}{r}, \frac{RV}{r^2}$ (b) $\frac{rV}{R^2}, \frac{rV}{R}$ (c) $\frac{rV}{R}, \frac{rV}{R^2}$ **(d)** $\frac{RV}{r^2}, \frac{RV}{r}$
4. The electric potential on the surface of a sphere of radius R due to a charge 3 x 10^{-6} C is 500 V. The intensity of electric field on the surface of the sphere in (N/C) is:
   (a) Zero **(b)** < 10 (c) > 20 (d) between 10 and 20
5. The electric potential at a point in free space due to a charge q coulomb is q x 10^{11} volts. The electric field at that point is:
   (a) $8\pi\varepsilon_0 q \times 10^{20}$ V/m (b) $12\pi\varepsilon_0 q \times 10^{22}$ V/m **(c)** $4\pi\varepsilon_0 q \times 10^{22}$ V/m (d) $4\pi\varepsilon_0 q \times 10^{20}$ V/m
6. Three charges Q_o, –q and –q are placed at the vertices of an isosceles right angled triangle as in the figure. The net electrostatic potential energy is zero if Q_o is equal to:
   (a) $\frac{q}{\sqrt{8}}$ (b) $\frac{q}{\sqrt{12}}$ (c) $\frac{q}{4}$ (d) $\frac{q}{2}$



7. A particle of mass 40 mg and carrying a charge 5 x 10^{-9} C is moving towards a fixed charge of magnitude 10^{-8} C. When it is at a distance of 10 cm from the fixed charge, it has a velocity of 50 cm/s. At what distance from the fixed charge will the particle come momentarily to rest?
   (a) 23.5 mm **(b)** 47 mm (c) 39 mm (d) 4.7 mm
8. In a field free region, two electrons are released to on a line towards each other with velocities 10^6 m/ distance of their closest approach will be nearer to:
   (a) 0.128 nm (b) 0.184 nm **(c)** 0.256 nm (d) 3.84 nm
9. In which of the following states is the potential energy of an electric dipole maximum?



10. An electric dipole of moment p is placed in a electric field E. Then (i) the torque on the dipole is $\vec{p} \times \vec{E}$ (ii) the potential energy of the system is $\vec{p} \bullet \vec{E}$ (iii) the resultant force on the dipole is zero. The correct statements are:
    (a) (i), (ii) and (iii) are correct **(b)** (i) and (iii) are correct and (ii) is wrong (c) only (i) is correct (d) (i) and (ii) are correct and (iii) is wrong