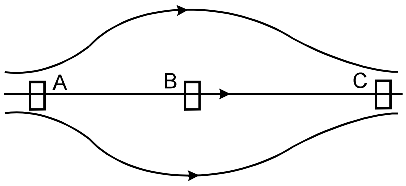
OBJECTIVE – I

1. Fig. shown some of the electronic field lines corresponding to an electric to an electric field. The figure suggests that -



(A) $E_A > E_B > E_C$ (B) $E_A = E_B = E_C$
(C*) $E_A = E_C > E_B$ (D) $E_A = E_C < E_B$

Sol. **C**

Higher separation, Lower electric field. Because Electric field inversly proportional the square of separation.

$E_A = E_c > E_B$

2. When the seperation between two charges is incresased, the electric potential energy of the charges

(A) increases (B) decresaes
(C) remains the same (D*) may increase or decrease

Sol. **D**

When the separation between two charges is increased, the electric potential Energy of charge may incease or decrease.

If Both charge are like charge then electric potential energy of charge decreases.

$$U = \frac{kq_1q_2}{r}$$

If Both charge are unlike charge then electric potential energy of charge increases.

$$U = \frac{-kq_1q_2}{r}$$

3. If a positive charge is shifted from a low-potential region to a high-potential region, the electric potential energy

(A*) increases
(B) decresaes
(C) remains the same
(D) may increase or decrease

Sol. **A**

Electric Potential Energy = qDv

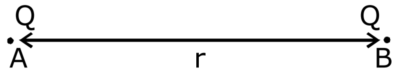
$= q(v_f - v_i)$

If positive charge is shifted from a Low potential region to a High-Potential region, then electric Potential Energy increases.

4. Two equal positive charges are kept at points A and B. The electric potential at the points between A and B (excluding these points) is studied while moving from A to B. The potential

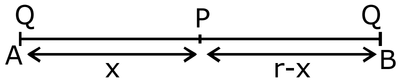
(A) continuously increases
(B) continuosly decreases
(C) increases then decreases
(D*) decreases than increases

Sol. **A**



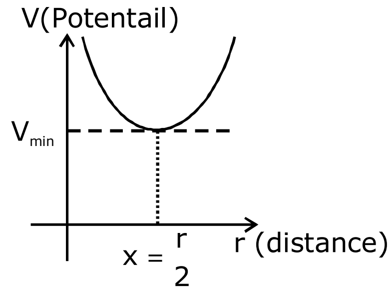
$V = \frac{KQ}{r}$

$V \rightarrow$ Electric Potential



$V_P = \frac{KQ}{x} + \frac{KQ}{r-x} = \frac{KQr}{x(r-x)}$

$\frac{dvp}{dx} = \frac{-KQr(r-2x)}{(r(r-x))^2} = 0$



r = 2x

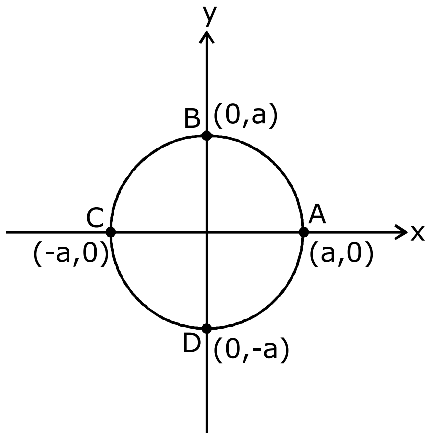
x = r/2

$v_{p_{min}} = \frac{KQ}{\frac{r}{2}} + \frac{KQ}{\frac{r}{2}} = \frac{4KQ}{r}$ $\quad$ at $\left(x = \frac{r}{2}\right)$

5. The electric field at the origin is along the positive X-axis. A small circle is drawn with the centre at the origin cutting theaxes at points A, B, C and D having coordinates (a,0), (0,a), (-a,0), (0,-a) respectively. Out of the points on the periphery of the circle, the potential is minimum at -

(A*) A (B) B (C) C (D) D

Sol. **A**



$E = E_0\hat{i}$ (Given)

(Potential at A) :-

$V_A = \left(E_0\hat{i} \Box a\hat{i}\right) = E_0 9$

(Potential at B) :-

$V_B = \left(E_0\hat{i} \Box a\hat{i}\right) = 0$

(Potential at C) :-

$V_C = \left(E_0\hat{i} \Box (-a)\hat{i}\right) = E_0 a$

(Potential at D) :-

$V_D = \left(E_0\hat{i} \Box (-a)\hat{j}\right) = 0$

6. If a body is charged by rubbing it, is weight -

(A) remains precisely constant

(B) increases slightly

(C) decreases slightly

(D*) may increase slightly or may decrease slightly

Sol. **D**

If a body is charged by rubbing it, its weight may inc4rease slightly or may decrease slightly.

7. An electric dipole is placed in a uniform electric field. The net electric force on the dipole -

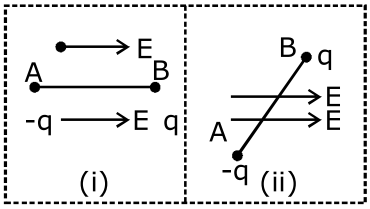
(A*) is always zero

(B) depends on the orientation of the dipole

(C) can never be zero

(D) dependw on the strength of the dipole

Sol. **A**



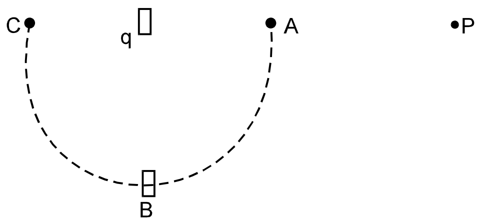
Net Electric force = $F_A + F_B$

$= -qE + qE$

$= 0$

In a uniform Electric field the net Electric force on the dipole is always zero.

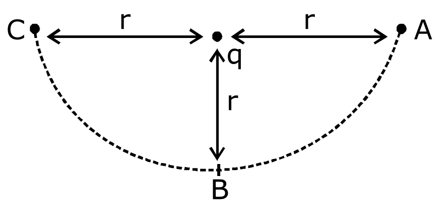
8. Consider the situtaion fig. The work done in taking a point charge from P to A is W_A, from P to B is W_B and from P to C is W_C



(A) $W_A < W_B < W_C$ (B) $W_A > W_B > W_C$

(C*) $W_A = W_B = W_C$ (D) none of these

Sol. **C**



Electric Potential at A 'due to q' Þ $V_A = \frac{Kq}{r}$

Electric Potetial at B 'due to q' Þ $V_B = \frac{Kq}{r}$

& Electric potential at c 'due to q' Þ $V_C = \frac{Kq}{r}$

work done = -Du = -qDV $\{\text{Let at 'P'}, V_P = 0\}$

Here $V_A = V_B = V_C$

The work done is taking a point charge from P to A, B & C is same.

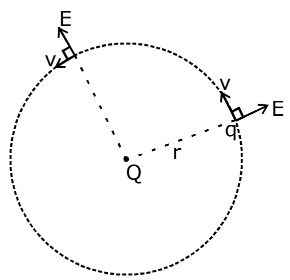
so $w_A = w_B = w_c$

9. A point charge q is rotated along a circle in the electric field generated by another point charge Q. The work done by the electric field on the roatating charge in one complete revolution is

(A*) zero (B) positive (C) negative

(D) zero if the charge Q is at the centre and nonzero otherwise

Sol. **A**



In a circle Electric field due to t 'Q' is always perpendicular to the displacement oif the charge 'q'.

Workdone = $\vec{F}.\vec{d}$

$= \left(q\vec{E}\right).\vec{d} = q\left(\vec{E}.\vec{d}\right) = 0$

$\therefore \vec{E} \perp \vec{d}$

Workdoen by the Electric field on the rotating charge in one complete revolution is zero.

OBJECTIVE – II

1. Mark out the correct options.
(A*) The total charge of the universe is constant.
(B) The total positive charge of the universe is constant.
(C) The total negative charge of the universe is constant
(D) The total number of charged particles in the universe is constant

Sol. A
The total charge (Positive + negative) oif the universe is constant.

2. A point charge is brought in an electric field. The electric field at a nearby point **HCV II _Ch-29_Obj.2_2**

(A) will increase if the charge is positive (B) will decrease if the charge is negative
(C*) may increase if the charge is positive (D*) may decrease if the charge is negative

Sol. CD
The electric field at a near by point may increase if the charge is positive or may decreases if the charge is negative.

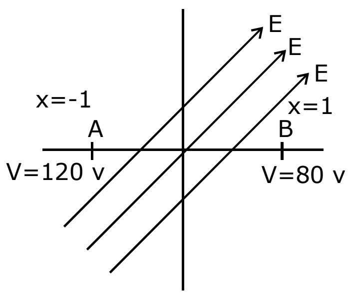
3. The electric field and the electric potential at a point are E and V respectively
(A) If E = 0, V must be zero (B) If V = 0, E must be zero
(C) If E ¹ 0, V cannot be zero (D) If V ¹ 0, E cannot be zero

Ans. None of these
We not commenton Electric field as well as Electric potential Because Here not given the informatio about the existance of charge in surrounding area.

4. The electric potential decreases uniformly from 120 V to 80 V as one moves on the X-axis from x = – 1 cm to x = + 1 cm. The electric field at the origin
(A) must be equal to 20V/cm (B*) may be equal to 20V/cm
(C*) may be greater than 20V/cm (D) may be less than 20V/cm

Sol. BC

$$\Delta V = -E \cdot dr$$
$$(v_f - v_i) = -E \cdot dr = E_x (B - A)$$
$$(80 - 120) = -E_x \cdot (2)$$
$$E_x = \frac{40}{2} = 20 \text{ v / cm}$$

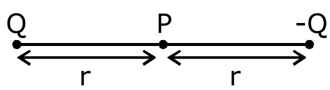


If electric field lines lies in ‘x’ direction than it may be equal to 20 v/cm.
If Electric field lines liesin ‘x-y’ direction than it may be greater than 20 v/cm.

5. Which of the following quantites do not depend on the choice of zero potential or zero potential energy
(A) potential at a point
(B*) potential difference between two points
(C) potential energy of a two - charge system
(D*) change in potential energy of a two-charge system

Sol. CD

$$V_p = \frac{KQ}{r} - \frac{KQ}{r} = 0$$



6. An electric dipole is placed in an electric field generated by a point charge

(A) The net electric force on the dipole must be zero

(B) The net electric force on the dipole may be zero

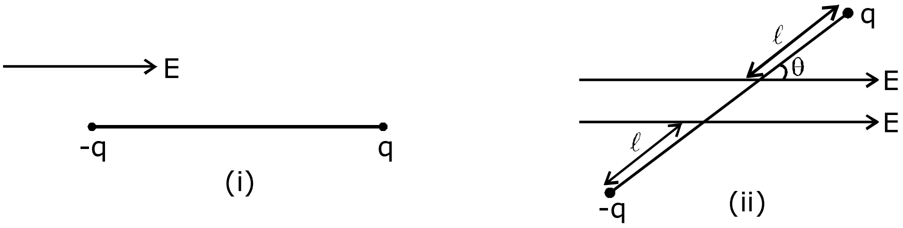
(C) The torque on the dipole due to the field must be zero

(D*) The torque on the dipole due to the field may be zero

Sol. D

In the uniform Electric field the net electric force on the dipole is alwas zero.

In uniform Electric field the torque on the dipole due to field may be zero.



T = 0

Here t Þ Torque

T = 2 qEl sin q ⊗ $\neq 0$

7. A proton and an electron are placed in a unifrorm electric field.

(A) The electric forces acting on them will be equal

(B*) The magnitudes of the forces will be equal

(C) Their acelerations will be equal

(D) The magnitudes of the accelerations will be equal.

Sol. **B**

Proton contain positive charge = 1.6×10^{-19} = e

electron contain negative charge = -1.6×10^{-19} = -e

force inoniforma electric field is = qE

$\therefore$ The Magniludes of Electric force is equal But direction of electric force is opposite to each other.

mass of proton = 1.67×10^{-27} Kg.

mass of electron = 9.1×10^{-31} Kg.

So that Magnitudes of their acceleration will be unequal.

8. The electric field in a region is directed outward and is propertional to the distance r form the origin. Taking the electric potential at the origin to be zero

(A) it is uniform in the region

(B) it is proportional to r

(C*) it is proportional to r^2

(D) it increases as one goes away from the origin

Sol. **C**

DV = -E.dr Given (E $\propto$ r)

(V - 0) = -E.dr Þ E $\propto r^2$