PHYSICS

CONCEPT OF ELECTRIC POTENTIAL & POTENTIAL ENERGY

$W = \Delta U$

$= U_f - U_i$

$= \frac{KQq}{r} - \frac{KQq}{\infty}$

$= q\left(\frac{KQ}{r} - \frac{KQ}{\infty}\right)$

$W = q(V_f - V_i)$

$W_{ext} = q\Delta V = \Delta U$

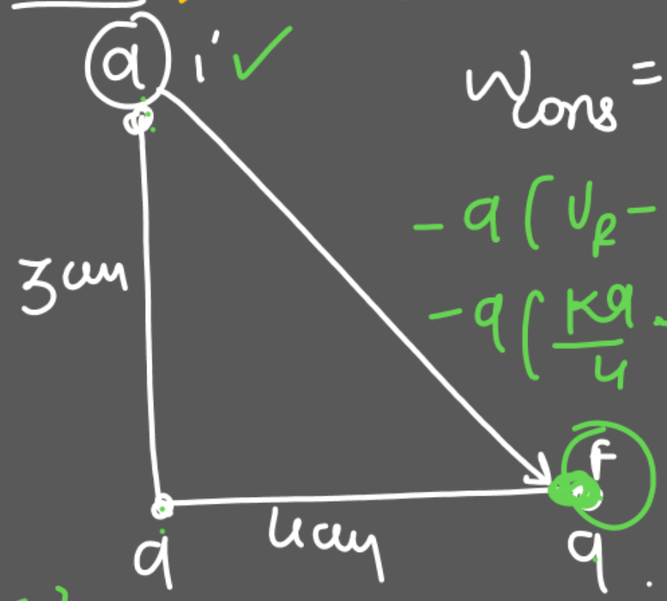
$W_{cons} = -q\Delta V = -\Delta U$

➤ DAILY LIVE SUPER DOCTOR SERIES

PHYSICS

CONCEPT OF ELECTRIC POTENTIAL & POTENTIAL ENERGY

Ques: [Neetanian comedy]



$W_{cons} = ?$

$-q(V_f - V_i)$

$-q\left(\frac{Kq}{4} - \frac{Kq}{3} - \frac{Kq}{5}\right)$

$Kq^2\left(\frac{-1}{12} - \frac{1}{5}\right) = Kq^2\left(\frac{1}{4} - \frac{1}{3} - \frac{1}{5}\right)$

$= \frac{+17Kq^2}{60}$

$W_{ext} = q\Delta V = \Delta U$

$\therefore W_{cons} = -q\Delta V = -\Delta U$

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CONCEPT OF ELECTRIC POTENTIAL & POTENTIAL ENERGY

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Q

NEET 2017

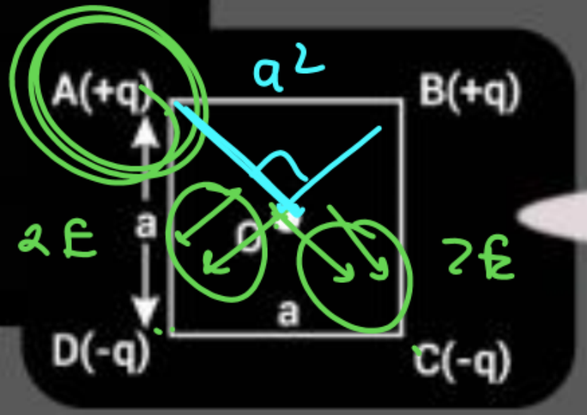
Four charges +q, +q, –q and –q are placed respectively at the corners A, B, C & D of a square of side a. The potential and field at the centre O of the square are respectively

(a) zero, $4q/a^2$

(b) zero, $\frac{4\sqrt{2}q}{a^2}$

(c) $4\sqrt{2}q/a$; $4q/a^2$

(d) $4\sqrt{2}q$; $4\sqrt{2}q/a^2$



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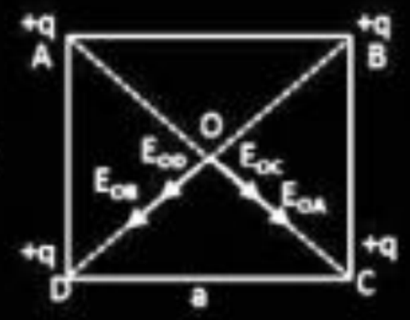
Ans. (b)

Sol.



$$V_O = V_A + V_B + V_C + V_D = \frac{k.q}{OA} + \frac{k.q}{OB} - \frac{k.q}{OC} - \frac{k.q}{OD}$$

$$OA = OB = OC = OD = \frac{a}{\sqrt{2}}$$

$$V_O = 0$$

$$\left|\vec{E}_A\right| = \left|\vec{E}_B\right| = \left|\vec{E}_C\right| = \left|\vec{E}_D\right| = \frac{k.q}{\left(\frac{a}{\sqrt{2}}\right)^2} = k.\frac{2q}{a^2}$$

$\vec{E}_A$ and $\vec{E}_C$ are along C.

$$\vec{E}_{AC} = 2.\left|\vec{E}_A\right| = \frac{k.4q}{a^2}$$

$\vec{E}_B$ and $\vec{E}_D$ are along D.

$$\left|\vec{E}_{BD}\right| = 2.\left|\vec{E}_B\right| = \frac{k.4q}{a^2}$$

$$\left|\vec{E}_{net}\right| = \sqrt{E_{AC}^2 + E_{BD}^2} = \sqrt{\left(k.\frac{4q}{a^2}\right)^2 + \left(k.\frac{4q}{a^2}\right)^2} = k.\frac{4\sqrt{2}q}{a^2}$$

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Previous Year Question Practice

Q

NEET 2013

Two charges of 4 μC each are placed at the corners A and B of an equilateral triangle of side length 0.2 m in air. The electric potential at C is $\left(\frac{1}{4\pi\varepsilon_0} = 9\times10^9 \frac{N-m^2}{C^2}\right)$

(a) 9×10^4 V
(b) 18×10^4 V
(c) 36×10^4 V
(d) 72×10^4 V

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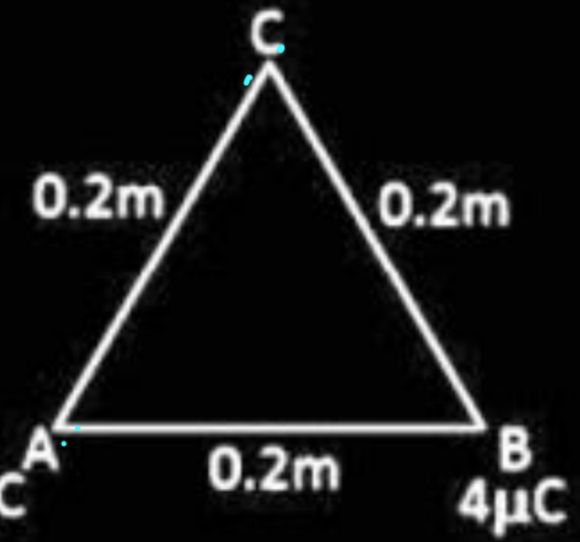
Ans. (c)

Sol.



$$V_C = V_{CA} + V_{CB}$$

$$= k.\frac{4\times10^{-6}}{2\times10^{-1}} + k.\frac{4\times10^{-6}}{2\times10^{-1}}$$

$$= 2\times9\times10^{9}\times2\times10^{-5} = 36\times10^{4}\ V$$

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Previous Year Question Practice

Q

NEET 2015

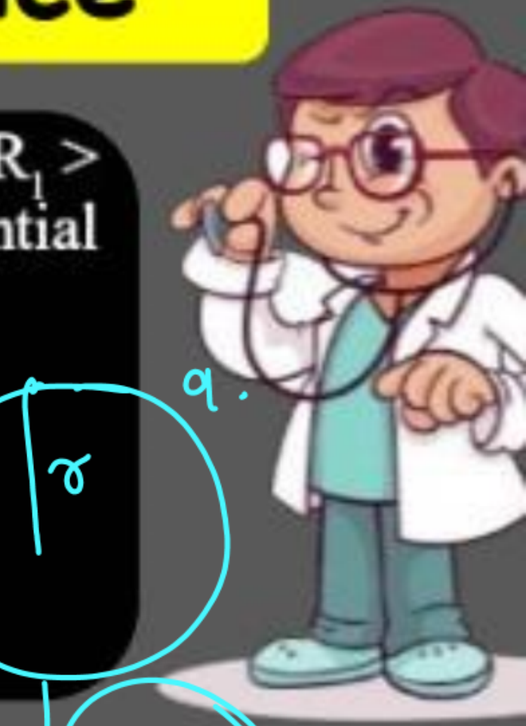
Two concentric, thin metallic spheres of radii R_1 and R_2 ($R_1 > R_2$) bear charges Q_1 and Q_2 respectively. Then the potential at radius r between R_1 and R_2 will be $\left(K = \frac{1}{4\pi\epsilon_0}\right)$

(a) $K(Q_1 + Q_2)/r$

(b) $K(Q_1/r + Q_2/R_2)$

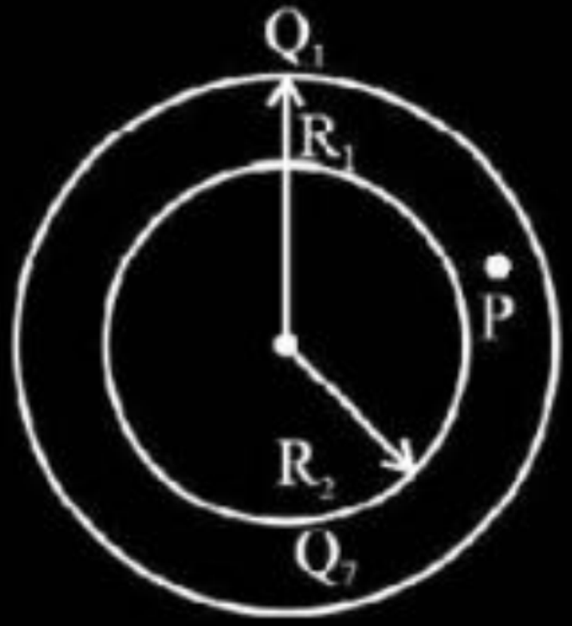
(c) $K(Q_2/r + Q_1/R_1)$

(d) $K(Q_1/R_1 + Q_2/R_2)$



Ans. (c)

Sol.



Potential at point P = Potential due to charger Q_2 on inner sphere + Potential due to change Q_1.

On Outer surface $= k.\frac{Q_2}{r} + k.\frac{Q_1}{R_1}$

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Q

NEET 2014

A hollow hemisphere of radius R is charged uniformly with surface density of charge σ. What will be the potential at centre ?

(a) $\frac{\sigma R}{2\epsilon_0}$ (b) $\frac{\sigma}{4\epsilon_0}$

(c) $\frac{\sigma}{2\epsilon_0}$ (d) $\frac{4\sigma R}{3\epsilon_0}$

$= \frac{KQ}{R}$

$= \frac{K\sigma A}{R}$

$= \frac{\frac{1}{4\pi\epsilon_0}\sigma 2\pi R^2}{R}$

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Ans. (a)

Sol.

Potential at Centre $V = k\frac{Q}{R}$ $\qquad V = \frac{1}{4\pi \epsilon_0}.\frac{2\pi R^2 \sigma}{R}$

$$V = \frac{\sigma R}{2 \epsilon_0}$$

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Previous Year Question Practice

Q

NEET 2019

A thin spherical conducting shell of radius R has a charge q. Another charge is placed at the centre of the shell. The electrostatic potential at a point P at a distance R/2 from the centre of the shell is

(a) $\frac{2Q}{4\pi\varepsilon_0 R}$

(b) $\frac{2Q}{4\pi\varepsilon_0 R} - \frac{q}{4\pi\varepsilon_0 R}$

(c) $\frac{2Q}{4\pi\varepsilon_0 R} + \frac{q}{4\pi\varepsilon_0 R}$

(d) $\frac{(q+Q)q}{4\pi\varepsilon_0 R}$

Ans. (c)

Sol. Potential at any internal point diue to q

of charged shell $= \frac{q}{4\pi\varepsilon_0 R}$

Potential at P due to at centre $= \frac{1}{4\pi\varepsilon_0}\frac{2Q}{R}$

$\therefore$ Total potential point

$$= \frac{q}{4\pi\varepsilon_0 R} + \frac{2Q}{4\pi\varepsilon_0 R} = \frac{1}{4\pi\varepsilon_0 R}(q + 2Q)$$

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Previous Year Question Practice

Q

NEET 2012

In uniform electric field

(a) All points are at same potential

(b) no two points can have same potential

(c) pair of points separated by same distance must have same difference of potential

(d) none of these

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Ans. (d)

Sol Considering below figure,

Electric field (E)

(a) b and c are not at same potential, because potential decrease in direction of E

(b) Not correct a and b have same potential.

(c) If distance between a and b is equal to that between b&c clearly potential diff. between them are not same

Hence ,(d).

SACHIN SIR PHYSICS

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