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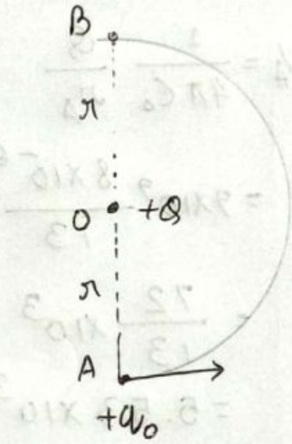
Electric Potential :: Paper - 01

(1) no Ans:-

$$R.H.S. = \frac{V}{m} = \frac{J}{Cm} = \frac{Nm}{Cm} = \frac{N}{C} = L.H.S.$$

(2) no Sol^n



$$V_A = \frac{1}{4\pi\epsilon_0}\frac{Q}{r}$$

$$V_B = \frac{1}{4\pi\epsilon_0}\frac{Q}{r}$$

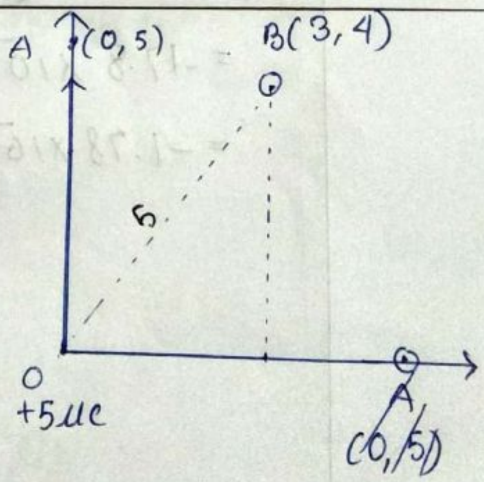
$$W_{A\to B} = +q_0(V_B - V_A)$$

$$= +q_0\left(\frac{1}{4\pi\epsilon_0}\frac{Q}{r} - \frac{1}{4\pi\epsilon_0}\frac{Q}{r}\right)$$

$$= +q_0 \cdot 0$$

$$= 0$$

(3) no Sol^n



$Q = +5\,\mu C$

$= 5\times10^{-6}\,C$

$q_e = -1.6\times10^{-9}\,C$

$$V_A = \frac{1}{4\pi\epsilon_0}\frac{5\times10^{-6}}{5} = 9\times10^{9}\times10^{-6} = 9\times10^{3}$$

$$V_B = \frac{1}{4\pi\epsilon_0}\frac{5\times10^{-6}}{5} = 9\times10^{3}$$

$$W_{A\to B} = q_e(V_B - V_A) = q_e\cdot 0 = 0$$

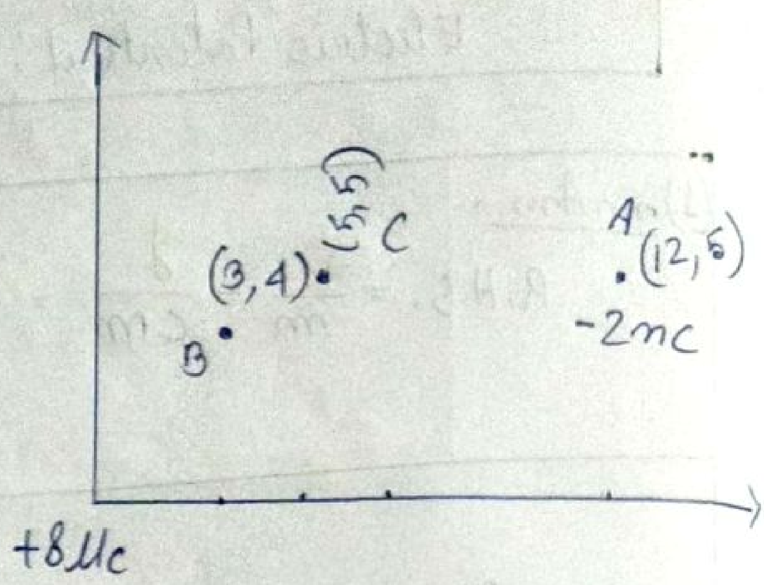
④ **mo Sol^n:—**

$Q = +8\mu C$

$= 8 \times 10^{-6}$

$q = -2nC$

$= -2 \times 10^{-9} C$



$W_{A \to C \to B} = W_{A \to B}$

$V_A = \frac{1}{4\pi\epsilon_0} \frac{Q}{r_A}$

$= 9 \times 10^{9} \frac{8 \times 10^{-6}}{13}$

$= \frac{72}{13} \times 10^{3}$

$= 5.53 \times 10^{3}$ Volt

$V_B = \frac{1}{4\pi\epsilon_0} \frac{Q}{r_B}$

$= 9 \times 10^{9} \frac{8 \times 10^{-6}}{5}$

$= \frac{72}{5} \times 10^{3}$

$= 14.4 \times 10^{3}$

13)72(5.5
65
70
65
50

5)72(14.4
5
22
20
20
2

$W_{A \to B} = q(V_B - V_A)$

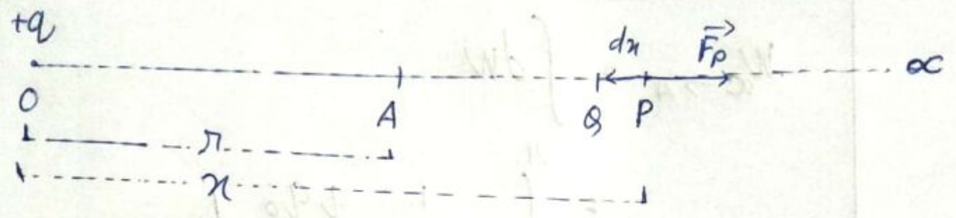
$= -2 \times 10^{-9} (14.4 \times 10^{3} - 5.5 \times 10^{3})$ J

$= -2 \times 10^{-9} \times 8.9 \times 10^{3}$

$= -17.8 \times 10^{-6}$

$= -1.78 \times 10^{-5}$ J

5 no Sol^n



Let a point charge $+q$ is placed at a point O, due to which electric potential at A

$$V_A = \frac{W_{\infty \to A}}{q_0} \quad \text{---- (I)}$$

$OA = r$

Let a point P, $OP = x$,

if $+q_0$ charge is placed at P,

force acting at P, $F_P = \frac{1}{4\pi\epsilon_0} \frac{q q_0}{x^2}$ ---- (II)

Let a point Q, $\vec{PQ} = \vec{dx}$

Now, work done in bring the charge from P to Q

$$dW_{P \to Q} = \vec{F_P} \cdot \vec{dx}$$

$$= F_P . dx \cos 180^\circ$$

$$= - F_P dx$$

$$= - \frac{1}{4\pi\epsilon_0} \frac{q q_0}{x^2} dx \quad \text{---- (III)}$$

Now, work done ~~from~~ in bring a charge from ∞ to A is

$$W_{\infty \to A} = \int dW$$

$$= \int_{\infty}^{r} -\frac{1}{4\pi\epsilon_0}\frac{q q_0}{r^2}\,dr$$

$$= -\frac{1}{4\pi\epsilon_0} q q_0 \int_{\infty}^{r} \frac{1}{r^2}\,dr$$

$$= -\frac{1}{4\pi\epsilon_0} q q_0 \left[-\frac{1}{r}\right]_{\infty}^{r}$$

$$= \frac{1}{4\pi\epsilon_0} q q_0 \left[\frac{1}{r} - \frac{1}{\infty}\right]$$

$$\Rightarrow W_{\infty \to A} = \frac{1}{4\pi\epsilon_0}\frac{q q_0}{r}$$

$$\Rightarrow \frac{W_{\infty \to A}}{q_0} = \frac{1}{4\pi\epsilon_0}\frac{q}{r}$$

$$\Rightarrow \boxed{V_A = \frac{1}{4\pi\epsilon_0}\frac{q}{r}}$$

(1M)