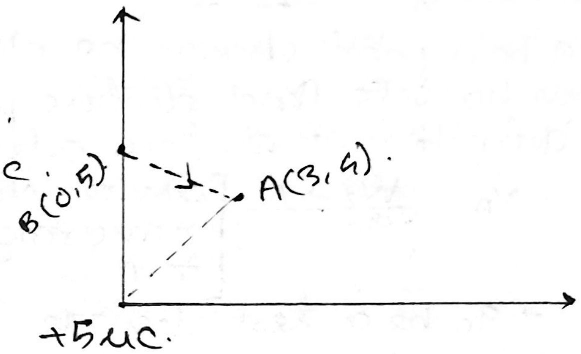
Electric Potential : Paper – 01

Solution: 3

Given, $q = +5\mu C$
$= +5\times10^{-6} C$.
charge on electron.
$q_0 = 1.6\times10^{-19} C$.



$V_A = \frac{9\times10^9 \times 5\times10^{-6}}{5}$

$= 9\times10^3 V$.

Again.

$V_B = \frac{9\times10^9\times5\times10^{-6}}{5}$

$= 9\times10^3 V$.

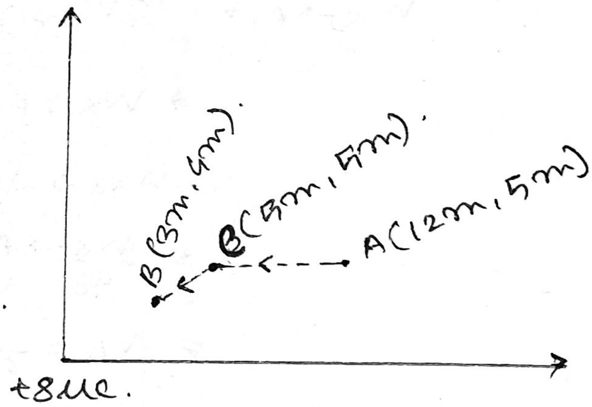
$\therefore W_{B\to A} = q_0(V_A - V_B)$.

$= 1.6\times10^{-19}(9\times10^3 - 9\times10^3)$.

$= 0$.

Solution 4

Given, $q = +8\mu C$
$= 8\times10^{-6} C$.
$q_0 = -2nC$.
$= -2\times10^{-9} C$.



Now.

$W_{A\to C\to B} = W_{A\to B} = q_0[V_B - V_A]$.

Here, $V_A = \frac{9\times10^9\times8\times10^{-6}}{13}$

$= 5.53\times10^3 V$.

and $V_B = \frac{9\times10^9\times8\times10^{-6}}{5}$

$= 14.4\times10^3 V$.

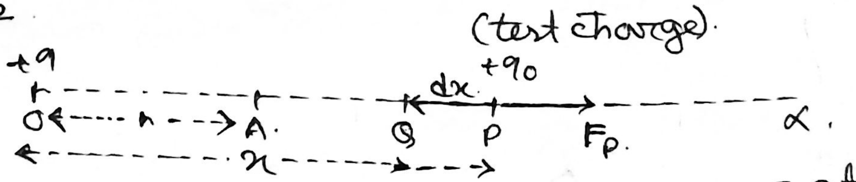
$\therefore W_{A\to B} = q_0[V_B - V_A]$.

$= (-2\times10^{-9})[14.4 - 5.5]\times10^3$.

$= (-2\times10^{-9})(8.9\times10^3)$.

$= -17.8\times10^{-6} J$.

Ans:- 5



Let +q be a point charge be placed at O. due to which we have to find electric potential at A, OA = r.

By definition of electric potential

$$V_A = \frac{W_{\infty \to A}}{q_0}$$ [where $W_{\infty \to A}$ is the workdone in moving the +q0 charge from ∞ to A]

Let +q0 be a test charge be placed at P.

Let OP = x.

Repulsive force between +q at O and +q0 at P.

$$\vec{F}_P = \frac{1}{4\pi\epsilon_0}\frac{qq_0}{x^2}$$ (towards right)

Let $\vec{PQ} = \vec{dx}$.

The small workdone in bringing the body from P to Q.

$$dW_{P\to Q} = \vec{F}_P \cdot \vec{PQ} = F_P dx \cos 180°$$ [∵ $\vec{F}$ and $\vec{PQ}$ are in opp direction]

$$= -\frac{1}{4\pi\epsilon_0}\frac{qq_0}{x^2}dx \rightarrow (1)$$

$$\therefore W_{\infty\to A} = \int dW_{P\to Q} = \int_{\infty}^{r} -\frac{1}{4\pi\epsilon_0}\frac{qq_0}{x^2}dx$$

$$\Rightarrow W_{\infty\to A} = -\frac{1}{4\pi\epsilon_0}qq_0\int_{\infty}^{r}\frac{dx}{x^2}$$

$$\Rightarrow W_{\infty\to A} = -\frac{1}{4\pi\epsilon_0}qq_0\left[-\frac{1}{x}\right]_{\infty}^{r}$$

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

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