Answer on Question #40693, Physics, Electromagnetism

An electric charge $q = 10^{-3} \, \mu C$ is placed at the origin (0, 0) of X-Y coordinate system. Two points A and B are situated at $(\sqrt{2}, \sqrt{2})$, and $(2, 0)$ respectively. The potential difference between the points A and B will be :- (1)9 volt (2)Zero (3)2 volt (4)3.5 volt

Solution

The electric potential $V(r)$ generated by a point charge q is

$$V(r) = \frac{q}{4\pi\epsilon_0 r},$$

where ϵ_0 called the vacuum permittivity.

The distance between the points A and the origin is

$$r_A = \sqrt{\left(\sqrt{2} - 0\right)^2 + \left(\sqrt{2} - 0\right)^2} = 2.$$

The distance between the points B and the origin is

$$r_B = \sqrt{(2-0)^2 + (0-0)^2} = 2.$$

As the points A and B are at the same distance from the charge q, they are at same potential:

$$V_A = \frac{q}{4\pi\epsilon_0 r_A} = \frac{q}{4\pi\epsilon_0 r_B} = V_B.$$

Hence potential difference between the points A and B is zero.

Answer: (2) Zero.