

Answer on Question #40423, Physics, Electromagnetism

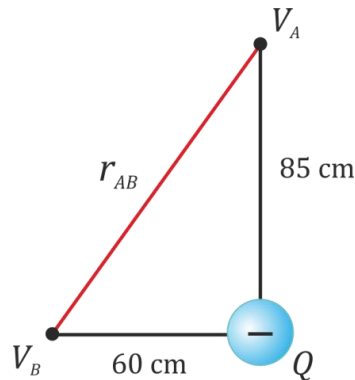
Two points A and B are 85cm north and 60cm west of a point charge of $-45 \cdot 10^{-3} \text{C}$ respectively. Calculate the potential difference between A and B.

Solution:

The electric potential at any point in space produced by a point charge Q is given by the expression below.

$$V = \frac{kQ}{r} = \frac{Q}{4\pi\epsilon_0 r}$$

where Coulomb's constant $k = 8.988 \cdot 10^9 \text{ Nm}^2\text{C}^{-2}$, r is a distance from a point charge.



When the charge creating the field is positive, the voltage is positive; when the central charge is negative, the voltage is negative.

At the point A

$$V_A = \frac{8.988 \cdot 10^9 \cdot (-45) \cdot 10^{-3}}{0.85} = -475.8 \cdot 10^6 \text{ V}$$

At the point B

$$V_B = \frac{8.988 \cdot 10^9 \cdot (-45) \cdot 10^{-3}}{0.60} = -674.1 \cdot 10^6 \text{ V}$$

The potential difference between A and B

$$V_{AB} = V_B - V_A = (-674.1 + 475.8) \cdot 10^6 \text{ V} = -198.3 \cdot 10^6 \text{ V}$$

Answer. $-198.3 \cdot 10^6 \text{ V} = -198.3 \text{ MV}$ (megavolt).