Answer on Question#40102, Physics, Electrodynamics

TWO EQUAL POSITIVE CHARGES ARE KEPT AT POINTS A AND B. THE ELECTRIC POTENTIAL AT THE POINTS BETWEEN A AND B IS STUDIED WHILE MOVING FROM A TO B. THE POTENTIAL-

1. CONTINUOUSLY INCREASES

2. CONTINUOUSLY DECREASES

3. INCREASES THEN DECREASES

4. DECREASES THEN INCREASES

Solution

Let's consider point x between the charges. The distance between the first charge (A) and point X is x. The distance between the second charge (B) and point X is $r - x$.

The electric potential at any point is the algebraic sum of the potential at that point due to each individual charge. Therefore, the potential at the point x between the charges is

$$V = \frac{kq}{x} + \frac{kq}{r-x}.$$

Let's find derivative of $V(x)$:

$$\frac{dV}{dx} = \frac{d}{dx}\left(\frac{kq}{x} + \frac{kq}{r-x}\right) = kq\left(-\frac{1}{x^2} + \frac{1}{(r-x)^2}\right) = kq\frac{x^2-(r-x)^2}{x^2(r-x)^2}.$$

This function is negative when $x < \frac{r}{2}$ - the potential decreases to middle of distance, the function is positive when $x > \frac{r}{2}$ - the potential increases to point B.

Answer: 4. DECREASES THEN INCREASES.