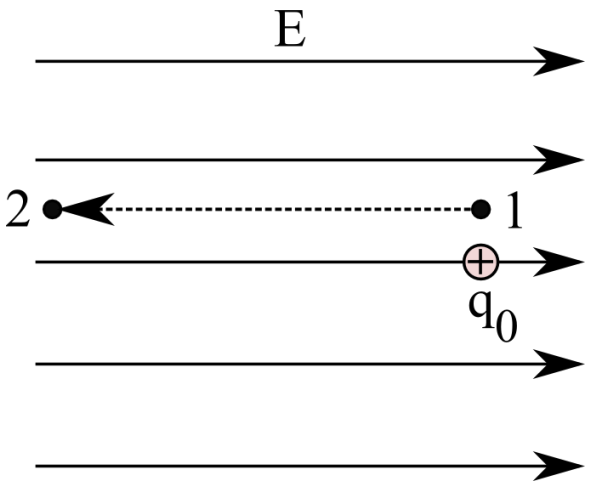
Answer on Question 60575, Physics, Electromagnetism

Question:

The potential energy of $3.0 \cdot 10^{-6}\ C$ charge changes from $0.02\ J$ to $0.08\ J$ when it is moved from point 1 to point 2. Calculate the change in the electric potential between these two points.

Solution:

Let's consider the positive test charge, q_0, that moves in the uniform electric field, E, from point 1 to point 2 as shown in picture below.



When the charge moves against the electric field from point 1 to point 2, work will have to be done on that charge by an external force. The work done on the charge changes its potential energy so that it increases. Therefore, the amount of work that is done is equal to the change in the potential energy. Because of the change in potential energy, there is a difference (or change) in electric potential between points 1 and 2. By the definition, the electric potential difference is the difference in electric potential between the final and the initial locations when work is done upon the charge to change its potential energy. Mathematically it can be written as follows:

$$\Delta V = V_2 - V_1 = \frac{W_{ext}(1 \to 2)}{q_0} = \frac{\Delta PE}{q_0} = \frac{PE_2 - PE_1}{q_0} = \frac{0.08\ J - 0.02\ J}{3.0 \cdot 10^{-6}\ C} = 20000\ V.$$

Answer:

$\Delta V = 20000\ V.$