Voltage and Potential Energy

Friday, May 4, 2018 2:21 PM

A charged object produces a voltage around it

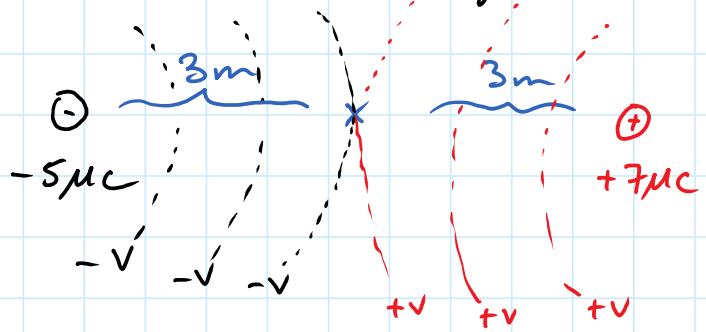
potential difference / electric potential

$\Delta V = V_b - V_a$

$$V = \frac{kQ}{r}$$

produces the voltage
- scalar
- units Volts (V)

Calculate the voltage at location x



$V = \frac{kQ}{r} = \frac{(9\times10^9)(-5\mu C)}{3}$

$= -15\times10^3\ V$

$= -15000\ V$

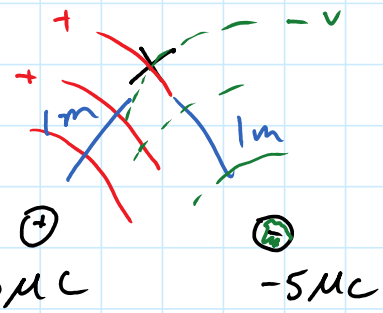
$V = \frac{(9\times10^9)(7\mu C)}{3}$

$= 21\times10^3\ V$

$= 21000\ V$

at x $V = 6000\ V$

Ex



$V = \frac{kQ}{r} = \frac{(9\times10^9)(3\mu C)}{1}$

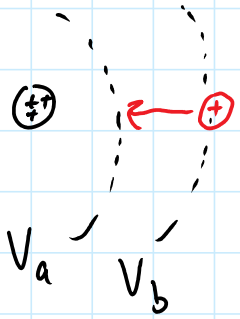
$= 27000\ V$

$V = \frac{(9\times10^9)(-5\mu C)}{1}$

$= -45000\ V$

$V = -18000\ V$

Electric Potential Energy



Work is required to move a 2nd charge from b to a.

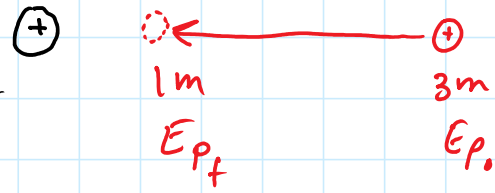
$\Delta E_p = \Delta V \cdot Q$ ← moving charge.

$$\Delta V = \frac{\Delta E_p}{Q}$$

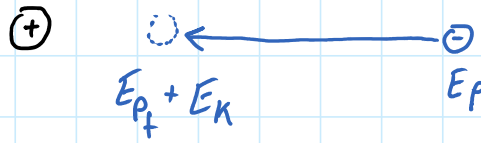
$$E_p = \left(\frac{KQ}{r}\right) Q$$

$$E_p = \frac{KQ_1Q_2}{r}$$

Ex



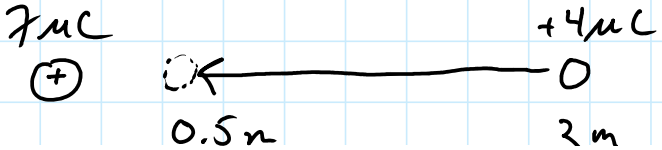
$\Delta E = E_{p_f} - E_{p_o}$



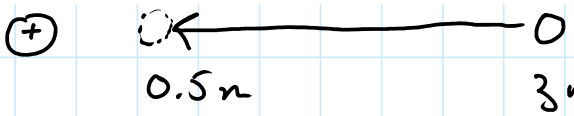
$E_b = E_a$

$E_{p_o} = E_{p_f} + E_K$

How much energy is required to move a 4μc charge from 3.0 m to 0.5 m from a 7μC charge.



$\Delta E = E_{p_f} - E_{p_o}$



$\Delta E = E_{p_f} - E_{p_0}$

$E_{p_f} = \frac{K Q_1 Q_2}{r}$

$= \frac{(9\times10^9)(7\mu C)(4\mu C)}{.5}$

$= .504\ J$

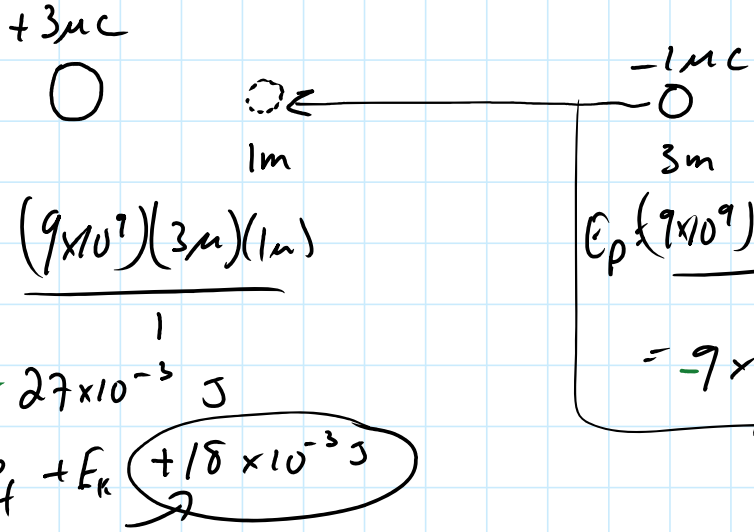
$E_{p_0} = \frac{(9\times10^9)(4\mu C)(7\mu C)}{3}$

84×10^{-3}

$= .084\ J$

$.504 - .084$

$= .420\ J$



Find the E_K for the $-1\mu C$ charge.

$\frac{(9\times10^9)(3\mu)(1m)}{1}$

$-27\times10^{-3}\ J$

$E_{p_f} + E_K \quad +18\times10^{-3}\ J$

$E_p = \frac{(9\times10^9)(3\mu)(1m)}{3}$

$= -9\times10^{-3}\ J$

E_{p_0}