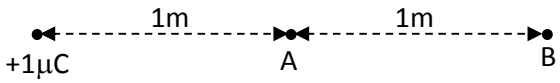
Name: _____

PHY 232 Summer 2016 Class Work

Class 10. Electric Potential and Potential Energy

Consider a point charge of +1μC. Given ε_0=8.8542×10^{-12} C^{2}m^{-2}N^{-1} and e= 1.6022×10^{-19} C.



(a) What is the potential at point A?

$$V_A = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r} = \frac{1}{4\pi\varepsilon_0}\frac{1\times10^{-6}}{2} = \underline{\underline{4494\ V}}$$

(b) What is the potential at point B?

Note that for the same Q, V ∝ 1/r .

$$\therefore V_B = \frac{V_A}{2} = \frac{4494}{2} = \underline{\underline{2247\ V}}$$

(c) If a proton of mass 1.6726×10^{-27}kg is released from rest at point A, what will be its speed at point B?

$$\Delta U = e(V_B - V_A) = 1.6022\times10^{-19}\times(2247-4494) = -3.6001\times10^{-16}\ J$$

$$\text{Conservation of energy: } \Delta K + \Delta U = 0$$

$$\Rightarrow \left(\frac{1}{2}m_p v^2 - 0\right) + (-3.6001\times10^{-16}) = 0$$

$$\Rightarrow \frac{1}{2}\times1.6726\times10^{-27}\,v^2 = 3.6001\times10^{-16}$$

$$\Rightarrow v^2 = 4.3047\times10^{11}$$

$$\Rightarrow v = \underline{\underline{6.561\times10^5\ m/s}}$$