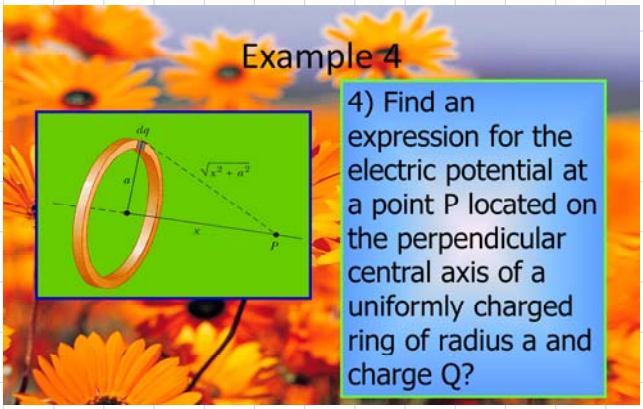
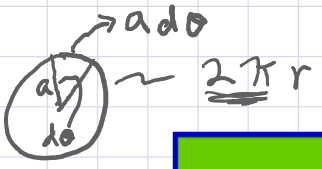
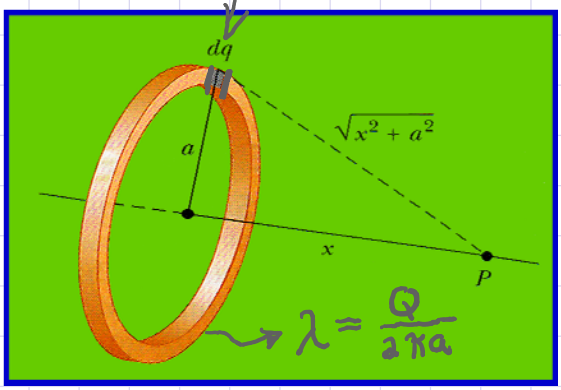
Example 4

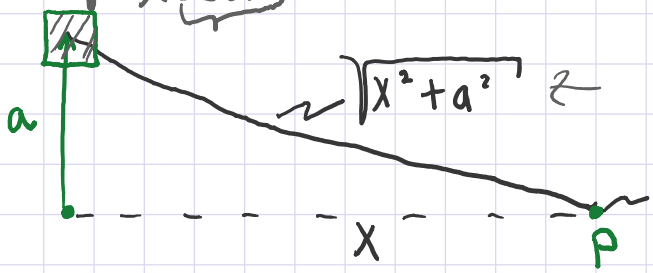
Monday, February 16, 2015 7:37 AM







$dq = \lambda a\, d\theta$



$$dV = k\frac{dq}{r}$$

$$dV = k\frac{a\lambda\, d\theta}{r}$$

$$V = \int_0^{2\pi} k\frac{a\lambda}{r}\, d\theta$$

$$V = k\frac{a\lambda}{r}\left[\theta\right]_0^{2\pi}$$

$$V = k\frac{a\lambda}{r}(2\pi)$$

$$V = k\frac{a\frac{Q}{2\pi a}}{r}(2\pi)$$

$$\boxed{V = k\frac{Q}{\sqrt{x^2+a^2}}}$$

Example 5

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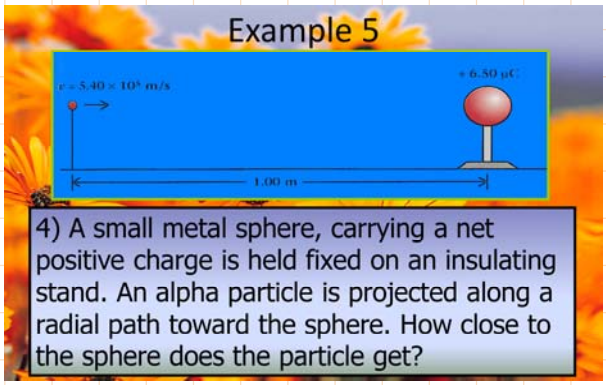


2 P
2 N
α

$v_i = 5.4 \times 10^5 \text{ m/s}$

r_f

$q = 2(1.6 \times 10^{-19} \text{ C})$
$= 3.2 \times 10^{-19} \text{ C}$

$Q = 6.5 \times 10^{-6} \text{ C}$

$m = 4(1.67 \times 10^{-27} \text{ kg})$
$= 6.68 \times 10^{-27} \text{ kg}$

$r_i = 1 \text{ m}$

$\Delta KE + \Delta PE = W_f$ ($W_f \to 0$)

$KE_f - KE_i + PE_f - PE_i = 0$ ($KE_f \to 0$)

$-KE_i + qV_f - qV_i = 0$

$-\frac{1}{2}mv_i^2 + q\left[k\frac{Q}{r_f} - k\frac{Q}{r_i}\right] = 0$

$-\frac{1}{2}mv_i^2 + qkQ\left[\frac{1}{r_f} - \frac{1}{r_i}\right] = 0$

$\frac{1}{r_f} - \frac{1}{r_i} = \frac{mv_i^2}{2qkQ}$

$\frac{1}{r_f} = \frac{1}{r_i} + \frac{mv_i^2}{2qkQ}$

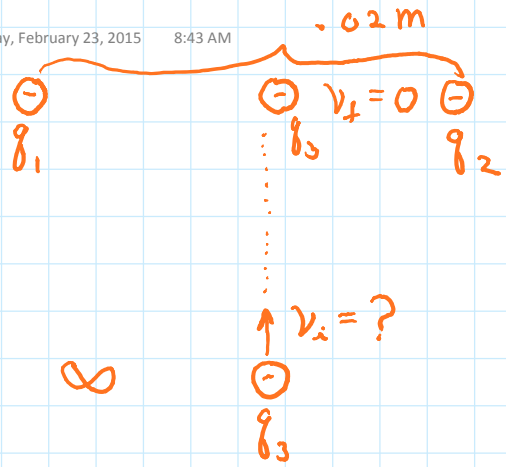
$\frac{1}{r_f} = \frac{1}{1\text{m}} + \frac{(6.68 \times 10^{-27}\text{kg})(5.4 \times 10^5 \text{m/s})^2}{2(3.2 \times 10^{-19}\text{C})(9 \times 10^9 \text{N}\frac{\text{m}^2}{\text{C}^2})(6.5 \times 10^{-6}\text{C})}$

$\frac{1}{r_f} = 1.052/\text{m}$

$r_f = .95 \text{ m}$

$.05 \text{ m} = 5 \text{ cm}$

Monday, February 23, 2015 8:43 AM



$q_1 = q_2 = q_3 = -1.6 \times 10^{-19}\,C$

$m_e = 9.11 \times 10^{-31}\,kg$

$\Delta KE + \Delta PE = 0$

$KE_f - KE_i + PE_f - PE_i = 0$ ($KE_f \to 0$, $PE_i \to 0$)

$-KE_i + q_3(V_{1,f} + V_{2,f}) = 0$

$-\frac{1}{2} m v_i^2 + q_3\left(k\frac{q_1}{r_1} + k\frac{q_2}{r_2}\right) = 0$

$-\frac{1}{2} m v_i^2 + q_3\left(2k\frac{q_1}{r_1}\right) = 0$

$$v_i = \sqrt{\frac{4kq_1q_3}{m r_1}}$$

$$v_i = \sqrt{\frac{4\left(9\times10^9\, N\frac{m^2}{C^2}\right)(1.6\times10^{-19}\,C)^2}{(9.11\times10^{-31}\,kg)(.01\,m)}}$$

$v_i = 3.18 \times 10^2\ m/s$