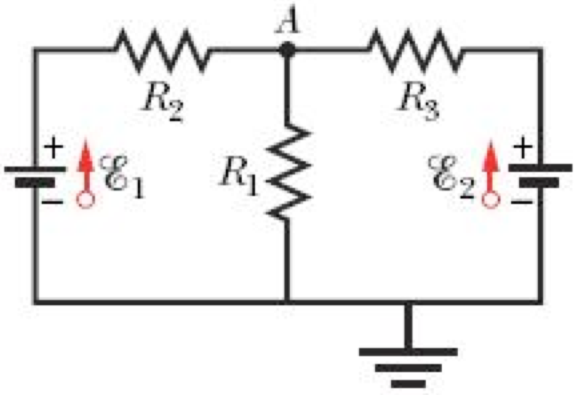
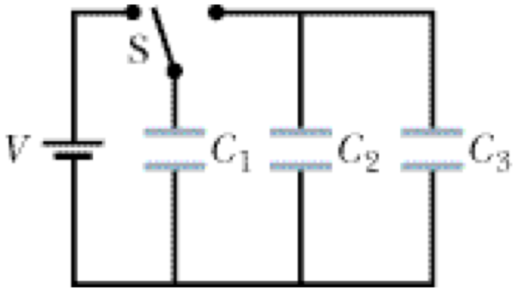
Reviews

In the figure ε_1 = 6 V, ε_2 = 12 V, R_1 = 90 Ω, R_2 = 210 Ω, and R_3 = 300 Ω. One point of the circuit is grounded (V = 0). What is the power output from either battery?



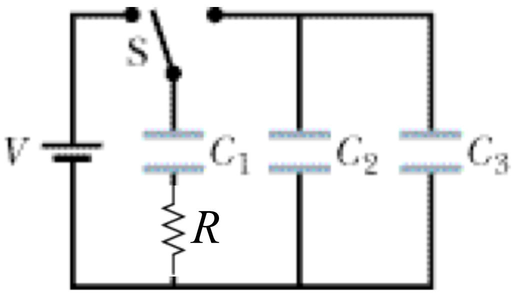
Reviews

In the figure V = 10 V, C_1 = 10 μF, and C_2 = C_3 = 5 μF. Switch S is first thrown to the left side until capacitor 1 is fully charged. Then the switch is thrown to the right. When equilibrium is reached, how much charge is on capacitor 2?



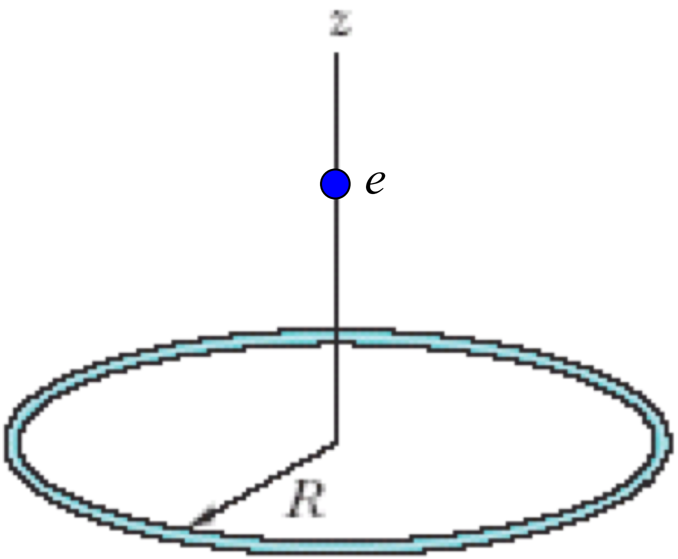
Reviews

In the figure $V = 10$ V, $C_1 = 10$ μF, and $C_2 = C_3 = 5$ μF. $R = 10\ \Omega$. Switch S is first thrown to the left side until capacitor 1 is fully charged. Then the switch is thrown to the right. When equilibrium is reached, how much charge is on capacitor 2?



Reviews

An electron e is constrained to the central perpendicular axis of a ring of charge of radius R =2.0 m and charge Q = 0.1 mC. Suppose the electron is released from rest a distance z_0 = 0.04 m from the ring center. It then oscillates through the ring center. Calculate its period under the condition that $z_0 << R$.



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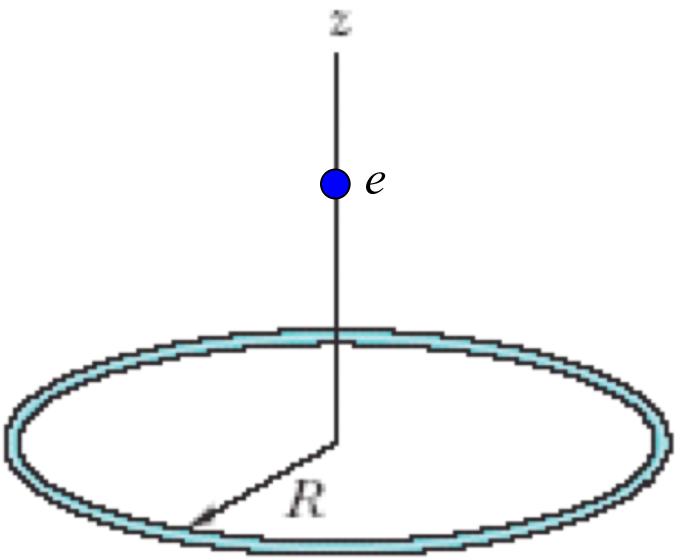


$$E_z = \oint_{fullcircle} k_e \frac{z\,dq}{\left(R^2+z^2\right)^{\frac{3}{2}}} = \frac{k_e z}{\left(R^2+z^2\right)^{\frac{3}{2}}} \oint_{fullcircle} dq$$

$$= \frac{k_e z Q}{\left(R^2+z^2\right)^{\frac{3}{2}}} \cong \frac{k_e Q}{R^3} z, \quad \text{when } z_0 << R$$

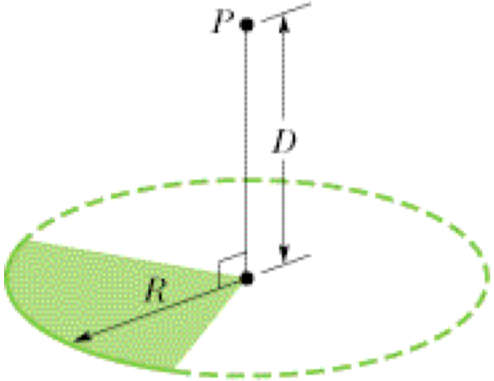
$$F_e = -eE_z = -\frac{k_e e Q}{R^3} z \equiv -kz$$

$$\omega_0 = \sqrt{\frac{k}{m_e}} = \sqrt{\frac{k_e e Q}{m_e R^3}}$$

$$T = \frac{2\pi}{\omega_0} = 2\pi R \sqrt{\frac{m_e R}{k_e e Q}}$$

Reviews

A plastic disk of radius R = 80 cm is charged on one side with a uniform surface charge density 8.0 fC/m^2, and then three quadrants of the disk are removed. The remaining quadrant is shown in the figure. With V = 0 at infinity, what is the potential in volts due to the remaining quadrant at point P, which is on the central axis of the original disk at distance D = 0.8 cm from the original center?



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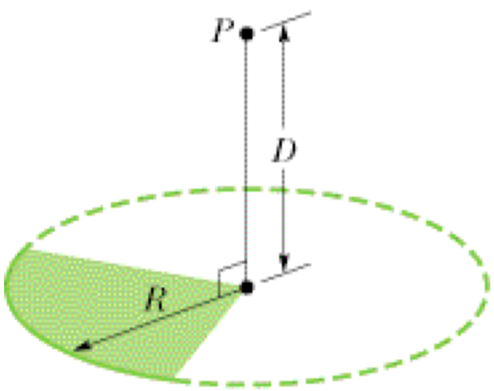
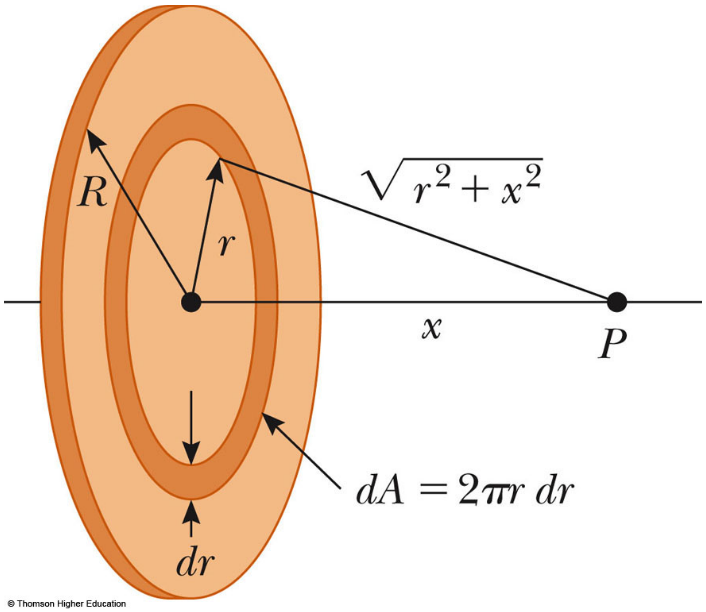


For full disk $V = \frac{\sigma}{2\varepsilon_0}\left[\sqrt{\left(R^2 + D^2\right)} - D\right]$

For 1/4 disk $V = \frac{\sigma}{8\varepsilon_0}\left[\sqrt{\left(R^2 + D^2\right)} - D\right]$

Reviews

A disk has a radius R and surface charge density of σ. What is the electric field at a point P along the perpendicular central axis of the disk? What the answer will be when $R >> x$?



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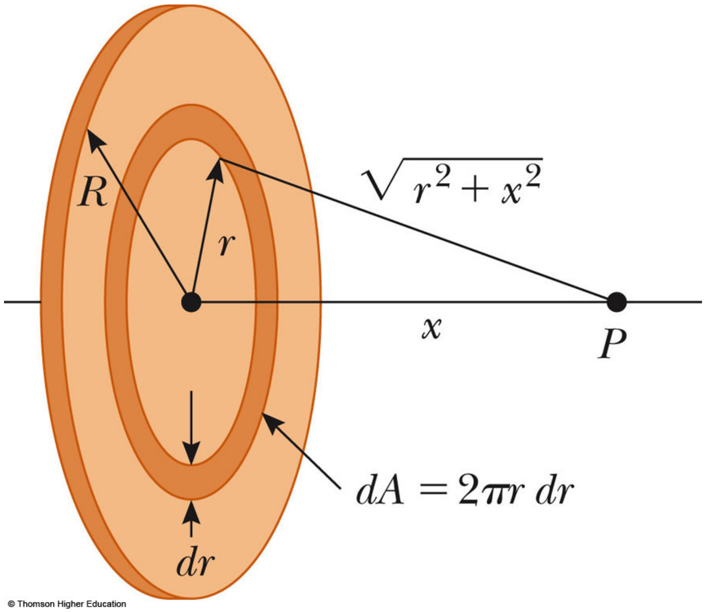

$$dV = k_e \frac{dq}{\sqrt{r^2+x^2}} = \frac{1}{4\pi\varepsilon_0}\frac{\sigma(2\pi r)dr}{\sqrt{r^2+x^2}} = \frac{\sigma}{4\varepsilon_0}\frac{d\left(r^2+x^2\right)}{\sqrt{r^2+x^2}}$$

$$V = \int_0^R \frac{\sigma}{4\varepsilon_0}\frac{d\left(r^2+x^2\right)}{\sqrt{r^2+x^2}} = \frac{\sigma}{4\varepsilon_0}\left.\frac{\left(r^2+x^2\right)^{-\frac{1}{2}+1}}{-\frac{1}{2}+1}\right|_0^R = \frac{\sigma}{2\varepsilon_0}\left[\sqrt{\left(R^2+x^2\right)} - x\right]$$

$$E_x = -\frac{dV}{dx} = \frac{\sigma}{2\varepsilon_0}\left(1 - \frac{x}{\sqrt{R^2+x^2}}\right)$$

$$E_x \rightarrow \frac{\sigma}{2\varepsilon_0}$$

Compare with Gauss Law type 3