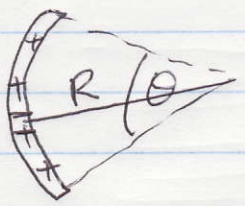
Physics 210 - Solutions to Multiple Choice - Week 5

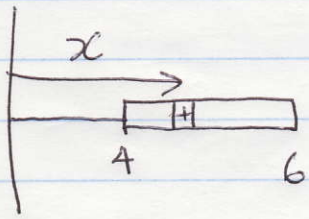
1.



$$V = \int \frac{K\,dq}{R} = \frac{K}{R}\int dq = \frac{K}{R}Q = \frac{K}{R}\lambda R\theta$$

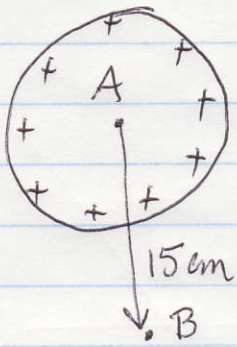
$$V = K\lambda\theta = 9\times10^{9} \times 3.5\,nC/m \times \pi/3 = 33V$$

2.



$$V = K\int \frac{dq}{x} = K\lambda\int \frac{dx}{x} = K\frac{4nC}{2m}\cdot\int_{4}^{6}\frac{dx}{x}$$

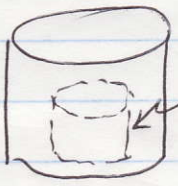
3.



$$V_{surface} = \frac{KQ}{R} = \frac{KQ}{.05} \qquad V_{center} = V_{surface}$$

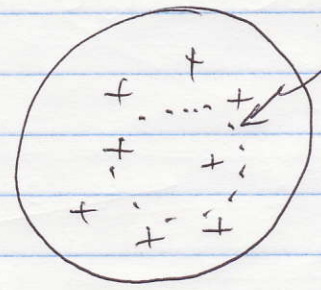
$$\Delta V = V_B - V_A = \frac{KQ}{.15} - \frac{KQ}{.05} = -30V$$

4.



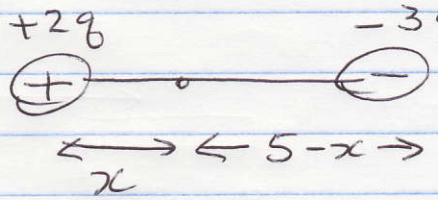
$$E = \frac{Q_{in}}{A\varepsilon_0} = \frac{\rho V_{in}}{A\varepsilon_0} = \rho\cdot\frac{\pi r^2 L}{2\pi r L\varepsilon_0} = \frac{\rho r}{2\varepsilon_0}$$

$$\Delta V = -\int E\cdot dr = -\int_{.02}^{.04}\frac{\rho r}{2\varepsilon_0} = -\frac{\rho}{2\varepsilon_0}\frac{1}{2}r^2\Big|_{.02}^{.04} = -1.7V$$

5. 

$$E = \frac{\rho V_{in}}{A\varepsilon_0} = \frac{\rho \frac{4}{3}\pi r^3}{4\pi r^2 \varepsilon_0} = \frac{\rho r}{3\varepsilon_0}$$

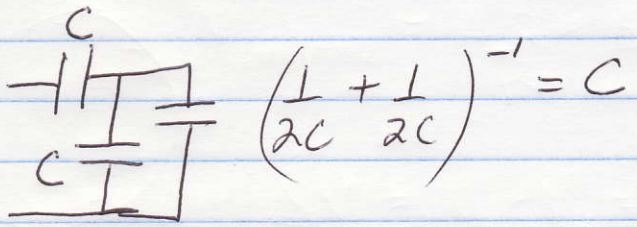
$$\Delta V = -\int E \cdot dr = -\int_0^{.04} \frac{\rho r}{3\varepsilon_0} = -\frac{\rho}{3\varepsilon_0}\frac{1}{2} r^2 \Big|_0^{.04} = 3V$$

9. 

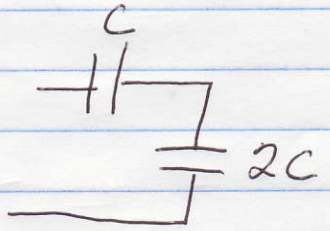
$$\frac{K(2q)}{x} = \frac{K(3q)}{5-x}$$

$$10 - 2x = 3x$$

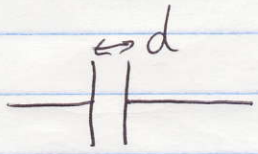
$$x = 2$$

10. 

$$\left(\frac{1}{2C} + \frac{1}{2C}\right)^{-1} = C \Rightarrow$$



$$\Rightarrow \left(\frac{1}{C} + \frac{1}{2C}\right)^{-1} = \frac{2}{3}C = \frac{2}{3}(45\mu F) = 30\mu F$$

11. 

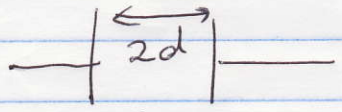
Before

$C_0 = \frac{\varepsilon_0 A}{d}$

Q_0, V_0

$Q_0 = C_0 V_0$

$\Rightarrow$ disconnect from battery, charge stays the same



After

$C = \frac{\varepsilon_0 A}{2d} = \frac{C_0}{2}$

$Q = Q_0$

$V = \frac{Q_0}{C} = \frac{Q_0}{C_0} 2 = 2V_0$