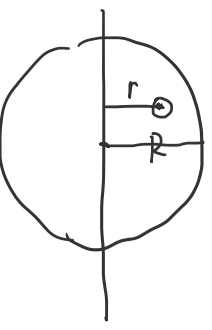



课后题

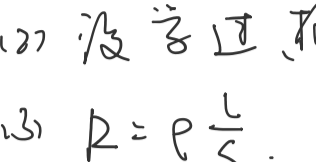
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1. 
$$\lambda = \frac{dq}{dl} = \frac{\rho \times 2\pi r ds}{T} \quad dq = \rho dV = \rho ds dl$$

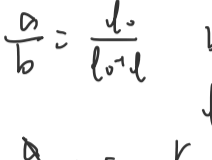
$$= \frac{Q}{4\pi R^2} \times 2\pi r = \frac{3Q}{4\pi R^2} r ds$$

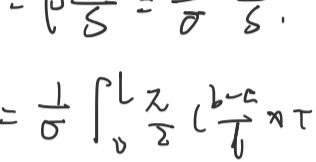
$$j = \frac{dI}{ds} = \frac{3Q}{4\pi R^2} \frac{wr}{R}$$

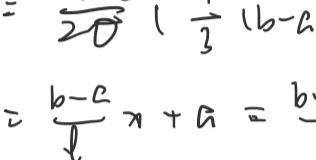
2.  $S = 1.0 \text{ mm}^2$
 $\lambda = 5 \times 10^{-4} \text{ A/m}$
 (1) $I = \frac{dq}{dt} = \frac{dn \times ze}{dt} = \frac{sp \, dl \, ze}{m_p \times v \, dt}$
 $mg \, \vec{z}$: $n = \frac{m}{m_p \times v} \sqrt{E} \vec{z}$: $n = \frac{slp}{m_p \times v}$
 $\frac{dl}{dt} = v = \frac{1.66 \times 10^{-27} \times 5 \times 10^8}{2 \times 10^{-16} \times 2 \times 10^8 \times 1.6 \times 10^{-19}} \times \frac{10^{-9}}{10^{-12}}$
 $= \frac{1.66 \times 5}{1.6 \times 3} \times 10^{-7} = 1.73 \times 10^{-7}$
 (2) $\vec{v} \times \vec{E} \parallel \vec{E} \perp \vec{E}$
 (3) $R = \rho \frac{L}{S}$
 $1\Omega = \frac{U}{I} = \frac{V_0}{I} = \frac{V_0}{q} = \frac{F \, dV}{q} = \frac{Q}{d}$
 $\frac{q \cdot \rho}{F \, d} = t = \frac{q \cdot \rho}{F}$
 (4) $\vec{E} = \frac{U}{d} = \frac{I \cdot R}{d} = \frac{I \cdot \rho L}{d \cdot S} = \frac{I \cdot \rho}{S} = j \cdot \rho$

3.  $R = \rho \frac{L}{S} = \frac{\rho L}{\pi R^2}$
 $= \frac{\rho L}{\pi \times (a + \frac{b-a}{L} x)^2}$
 $= \frac{\rho L}{\pi \times (a^2 + 2a(\frac{b-a}{L}x) + (\frac{b-a}{L}x)^2)}$
 $R = \int_0^L \frac{\rho dx}{\pi (a^2 + 2a(\frac{b-a}{L}x) + (\frac{b-a}{L}x)^2)}$
 $\frac{a}{L} = \frac{b}{L} \times \frac{L}{L} = \frac{b}{L}$
 $\frac{b}{L} = \frac{L}{L} \times \frac{b}{L} = \frac{b}{L}$
 $\frac{a}{L} = \frac{L}{L} \times \frac{a}{L} = \frac{a}{L}$
 $r = \frac{b-a}{L} \times (\frac{a}{L} x + a) = a + \frac{b-a}{L} x$
 $R = \rho \frac{L}{\pi} \int_0^L \frac{1}{(a + \frac{b-a}{L} x)^2} dx = \frac{\rho L}{\pi} \int_0^L \frac{1}{(a + \frac{b-a}{L} x)^2} dx$
 $= \frac{\rho L}{\pi} \times \frac{1}{\frac{b-a}{L}} \times \left(\frac{1}{a + \frac{b-a}{L} x} \right) \Big|_0^L = \frac{\rho L^2}{\pi(b-a)} \left(\frac{1}{a} - \frac{1}{b} \right)$
 $= \frac{\rho L^2}{\pi} \times \frac{1}{ab} = \frac{\rho L^2}{\pi ab}$

4.  $I_1 + I_2 = I_3$ $I_2 = I_4$
 $I_3 = I_2 + I_4$ $I_2 = I_4$
 $I_3 = I_2 + I_4 = 2I_2$
 $I_3 R_3 + I_2 R = 2I_2 R_3$
 $I_2 (R_3 + R) = 2I_2 R_3$
 $I_2 (R_3 + R) = 2I_2 R_3$
 $I_2 R = I_2 R_3$
 $R = R_3$

5.  $R = \frac{\int_a^b \vec{E} \cdot d\vec{l}}{\int_a^b \vec{j} \cdot d\vec{S}} = \frac{\int_a^b \vec{E} \cdot d\vec{l}}{\int_a^b \vec{j} \cdot d\vec{S}}$
 $\vec{j} = \sigma \vec{E}$
 $R = \frac{\int_a^b \vec{E} \cdot d\vec{l}}{\int_a^b \sigma \vec{E} \cdot d\vec{S}} = \frac{1}{\sigma} \int_a^b \frac{d\vec{l}}{r^2}$
 $= \frac{1}{\sigma} \int_a^b \frac{dr}{r^2} = \frac{1}{\sigma} \left(\frac{1}{a} - \frac{1}{b} \right)$

6.  $R_1 = \frac{R_2 R_3}{R_2 + R_3 + R_4}$
 $R_2 = \frac{R_1 R_3}{R_1 + R_2 + R_4}$
 $R_3 = \frac{R_1 R_2}{R_1 + R_2 + R_4}$
 $R_4 = \frac{R_1 R_2 R_3}{R_1 R_2 + R_1 R_3 + R_2 R_3}$

7.  $R_{12} = R_1 + R_2$
 $6\pi + 3b = 50 + b + (50 - \pi) - b$
 $6\pi + 3b = 3\pi + 50 - b\pi$
 $12\pi = 24\pi$ $\pi = 2\pi$
 $12\pi = 24\pi$ $\pi = 2\pi$
 $R_1 = R_2 + R_3$
 $R_2 = R_3 + R_4$
 $R_3 = R_4 + R_5$
 $R_4 = R_5 + R_6$
 $R_5 = R_6 + R_7$
 $R_6 = R_7 + R_8$
 $R_7 = R_8 + R_9$
 $R_8 = R_9 + R_{10}$
 $R_9 = R_{10} + R_{11}$
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