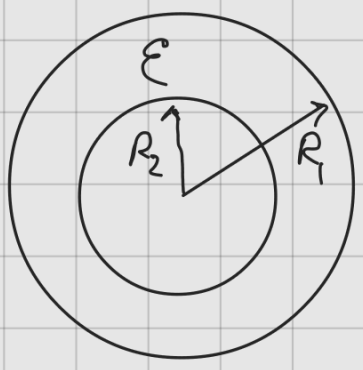
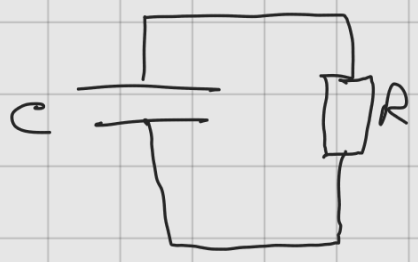
№9.7

Дано: $R_1, R_2, C, \mathcal{E}$

Найти: C, ρ

Решение:





1) Найдём R: $dR = \frac{\rho\, dr}{4\pi r^2} \Rightarrow R = \frac{\rho}{4\pi}\left(\frac{1}{R_2} - \frac{1}{R_1}\right)$

$= \frac{\rho(R_1 - R_2)}{4\pi R_1 R_2}$

2) $C = \frac{\mathcal{E} R_1 R_2}{R_1 - R_2} \Rightarrow \boxed{\mathcal{E} = \frac{C(R_1 - R_2)}{R_1 R_2}}$

3) $U + IR = 0$

$\frac{q}{C} + \dot{q}R = 0 \Rightarrow \frac{dq}{q} = -\frac{dt}{RC} \Rightarrow$

$\Rightarrow q = q_0 e^{-\frac{t}{RC}} \Rightarrow U = U_0 e^{-\frac{t}{RC}} \Rightarrow$

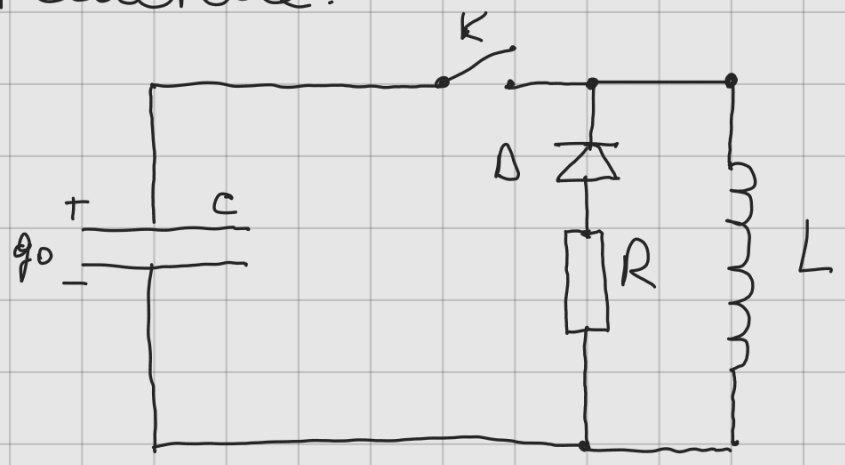
$\Rightarrow \frac{U_0}{U} = e^{\frac{t}{RC}} = 2 \Rightarrow \frac{t}{RC} = \ln 2$

$\frac{t}{C\rho(R_1 - R_2)} \cdot \frac{4\pi R_1 R_2}{} = \ln 2 \Rightarrow \boxed{\rho = \frac{4\pi t R_1 R_2}{C(R_1 - R_2)\ln 2}}$

№ 9.27

Дано:
C, q_0, L, R
Найти: q

Решение:



1) $q = q_0 \cos \omega t \Rightarrow I = -\omega q_0 \sin \omega t$

$$\frac{dI}{dt} = -\omega^2 q_0 \cos \omega t = 0$$

$$t = \frac{\pi}{2\omega} \Rightarrow$$

$$\Rightarrow I = -\omega q_0$$

2) $IR + L\dot{I} = 0$

$$\frac{dI}{I} = -\frac{R}{L} dt \Rightarrow I = I_0 e^{-\frac{Rt}{L}}$$

$$q = \int_0^{+\infty} I\,dt = \int_0^{+\infty} \omega q_0 e^{-\frac{Rt}{L}} dt = \omega q_0 \cdot \frac{L}{R} =$$

$$= q_0 \frac{1}{\sqrt{LC}} \cdot \frac{L}{R} = \frac{q_0}{R}\sqrt{\frac{L}{C}}$$

$u - L\dot{I} = 0$
$\frac{q}{C} = L\ddot{q} \rightarrow \ddot{q} - \frac{q}{LC} = 0$
$\lambda^2 - \frac{1}{LC} = 0 \rightarrow \lambda^2 = \frac{1}{LC} \rightarrow \lambda =$

№ 9.33

Дано:

$\alpha, \frac{L}{L_0} = \frac{1}{2}$

$\frac{C}{C_0} = 2$

$\frac{R}{R_0} = 1$

$\frac{N}{N_0} - ?$

Решение:

$$Q = \frac{\pi}{\lambda} = \pi N_e = \frac{1}{R}\sqrt{\frac{L}{C}} \Rightarrow$$

$$\Rightarrow N_e = \frac{1}{\pi R}\sqrt{\frac{L}{C}} \Rightarrow \frac{N}{N_0} = \frac{1}{2}$$

№9.36

Дано:

$C = 10^{-7}$ Ф

$u = 10^3$ В

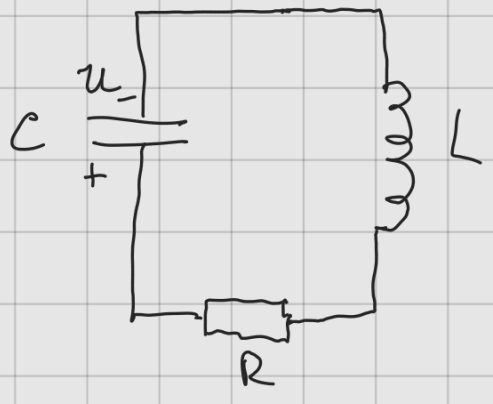
$L = 0{,}1$ Гн

R_{cr}

Найти: t, I

1) $R_{cr} = 2\sqrt{\frac{L}{C}}$

2)



1) $\frac{q}{C} + IR + L\dot{I} = 0$

$\ddot{q} + 2\beta\dot{q} + \omega_0^2 q = 0$

$q = q_0 e^{-\beta t} \rightarrow \underline{I} = -\beta b + t e^{-\beta t}$ (const)

$\frac{dI}{dt} = e^{-\beta t}(-b\beta + b\beta^2 t) = e^{-\beta t} b\beta(\beta t - 1) = 0$

$\begin{cases} q = (a + bt)e^{-\beta t} \\ a = q_0,\ b = a\beta \text{ (Нач. условия)} \end{cases}$ где q'

$t = \frac{1}{\beta} = 2\sqrt{\frac{L}{C}} = 10^{-4}$ (с)

$$L = \frac{1}{\beta} = \frac{2L}{R} = \sqrt{CL} = 10^{-6}\ (C)$$

2) $$|I| = \left|-a\beta^2\sqrt{CL}\,\frac{1}{e}\right| = CU\,\frac{R^2}{4L^2}\cdot\sqrt{CL}\,\frac{1}{e} =$$

$$= \cancel{C}U\,\frac{\cancel{4}\cancel{L}}{\cancel{C}}\cdot\frac{1}{\cancel{4}L^{\cancel{2}}}\sqrt{CL}\,\frac{1}{e} = \frac{U}{e}\sqrt{\frac{C}{L}} =$$

$$= \frac{10^3}{e}\cdot\sqrt{10^6} = \frac{1}{e} \approx 0{,}37\ (A)$$