$T = \frac{2\pi}{\omega}$

$T = 2\pi\sqrt{\frac{R}{g}}$

$T = 2\cdot 3{,}14\cdot\sqrt{\frac{2{,}5}{10}} = 3{,}14\,с$

(10) $\nu = 10\,Гц$

$\varphi_0 = \pi$

$x = A\cos(\omega t + \varphi_0)$

$\tau = ?$

$x(0) = A\cos\pi = -A$

$\upsilon(0) = \omega A\sin\pi = 0$

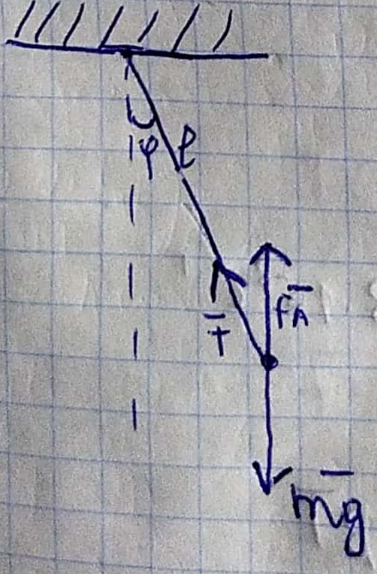
$\upsilon(\tau) = -\omega A$

$x(\tau) = 0$ $\Rightarrow \omega\tau = \frac{\pi}{2}$

$\boxed{\omega\tau = \frac{\pi}{2\omega} = \frac{\pi}{2\pi\nu} = \frac{1}{40}\,с}$

$\boxed{ДЗ-11}$

(0.)



$I\ddot{\varphi} = \bar{M}$

$I\ddot{\varphi} = -mgl\sin\varphi + F_A l\sin\varphi$

$\sin\varphi = \varphi$, потому что колебание малы

$I\ddot{\varphi} = F_A l\varphi - mgl\varphi$

$\eta = \frac{\rho_м}{\rho_ж}$, $I = ml^2 = \rho_м V l^2$

l, η

$\rho_м V l^2\ddot{\varphi} = (\rho_ж V g - \rho_м V g)\,l\varphi, \quad | : \rho_ж V l$

$\eta l \ddot{\varphi} = g\varphi - \eta g \varphi$

$\eta l \ddot{\varphi} - g(1-\eta)\varphi = 0$

$W_0^2 = \frac{g(1-\eta)}{\eta l} \Rightarrow T = 2\pi\sqrt{\eta l / g(1-\eta)}$

1. $T = 1c$ $\quad x = A_0 e^{-\delta t} \cos$

$\lambda = 0{,}3$ $\quad w = \frac{2\pi}{T} \quad \lambda = \delta T$

$\varphi = 0$

$t = 2T$ $\quad \delta = \frac{\lambda}{T} \quad x_1 = A_0 e^{-\delta 2T} \cos\frac{2\pi}{T} \cdot 2T = A_0 e^{2}$

$x_1 = 5cm = 0{,}05м$ $\quad x = A_0 e^{-\frac{\lambda}{T}} \cos\frac{2\pi}{T}$

$x(t) - ?$

$x(t) = 0{,}1 \cdot e^{-0{,}3t} \cos 2\pi t$

2. $\tau = 4мин$

$\frac{A(0)}{A(\tau)} = 2$ $\quad \beta T = \ln\left(\frac{A(0)}{A(T)}\right)$

$\beta = ?$ $\quad \beta = \frac{\ln\left(\frac{A(0)}{A(\tau)}\right)}{\tau} = 3 \cdot 10^{-3} c^{-1}$

3. $\lambda = 0{,}01$ $\quad \lambda = \ln\left(\frac{A(t)}{A(t+T)}\right) = \beta T$

$\frac{A_0}{A_n} = 3$

$N = ?$ $\quad A(\tau) = A_0 \cdot e^{-\beta\tau}, \ \tau = NT$

$$A(NT) = A(0)\, e^{-\beta NT} = A(0)\, e^{-\lambda N}$$

$$\frac{A_0}{A_N} = \frac{A(0)}{A(NT)} = e^{\lambda N}$$

$$\ln\left(\frac{A_0}{A_N}\right) = \lambda N$$

$$N = \frac{\ln\left(\frac{A_0}{A_N}\right)}{\lambda} \approx 110$$

4. $T_0 = 1c$

$\lambda = 0{,}628$

$T - ?$

$$w = \sqrt{w_0^2 - \delta^2}$$

$$w = \frac{2\pi}{T} \qquad w_0 = \frac{2\pi}{T_0}$$

$$w = \sqrt{w_0^2 - \delta^2} \Rightarrow \frac{4\pi^2}{T^2} = \frac{4\pi^2}{T_0^2} - \delta^2$$

$$\lambda = \delta T \Rightarrow \delta = \frac{\lambda}{T}$$

$$\frac{4\pi^2}{T^2} = \frac{4\pi^2}{T_0^2} - \left(\frac{\lambda}{T}\right)^2 \Rightarrow \frac{4\pi^2}{T^2} + \frac{\lambda^2}{T^2} = \frac{4\pi^2}{T_0^2} \Rightarrow$$

$$\frac{1}{T^2}\left(4\pi^2 + \lambda^2\right) = \frac{4\pi^2}{T_0^2} \Rightarrow T^2 = \frac{T_0^2}{4\pi^2}\left(4\pi^2 + \lambda^2\right) \Rightarrow$$

$$T = \frac{T_0}{2\pi}\sqrt{4\pi^2 + \lambda^2}$$

$$T = \frac{T_0}{2\pi}\sqrt{(4\pi^2 + \lambda^2} = \frac{1}{2\cdot 3{,}14}\sqrt{4\cdot 3{,}14^2 + 0{,}628^2} =$$

$$= 1{,}005\, c$$

Сканировано с CamScanner

(5) $l = 1$ м

$t = 5$ мин

$\frac{A(0)}{A(\tau)} = 2$

$\lambda - ?$

$$w_0 = \sqrt{\frac{g}{l}}$$

$$A(\tau) = A(0) e^{-\beta \tau}$$

$$T = \frac{2\pi}{\sqrt{w_0^2 - \beta^2}}$$

$$\beta = \frac{\ln\left(\frac{A(0)}{A(\tau)}\right)}{\tau}$$

$$\lambda = \beta T = \frac{\ln\left(\frac{A(0)}{A(\tau)}\right)}{\tau} \frac{2\pi}{\sqrt{\frac{g}{l} - \beta^2}} = 4,6 \cdot 10^{-3}$$

(6) $\beta_2 =$

$\lambda_1 = 1,5$

$\lambda_2 = ?$

$k = ?$

$$\lambda_1 = \beta_1 T_1$$

$$\lambda_2 = \beta_2 T_2 = n \beta_1 T_2$$

$$T = \frac{2\pi}{w} \qquad w = \sqrt{w_0^2 - \beta^2}$$

$$\lambda_1 = \beta_1 \frac{2\pi}{\sqrt{w_0^2 - \beta^2}} = 2\pi \sqrt{\frac{\beta_1^2}{w_0^2} - 1}$$

$$\lambda^2 (w_0^2 - \beta_1^2) = 4\pi^2 \beta_1^2 \to \beta_1 = \frac{\lambda_1 w_0}{\sqrt{4\pi^2 + \lambda_1^2}}$$

$$\lambda_2 = \frac{n \lambda_1 2\pi}{\sqrt{4\pi^2 + \lambda_1(1 - n^2)}}$$

$$4\pi^2 + \lambda_1^2 (1 - n^2) = 0$$

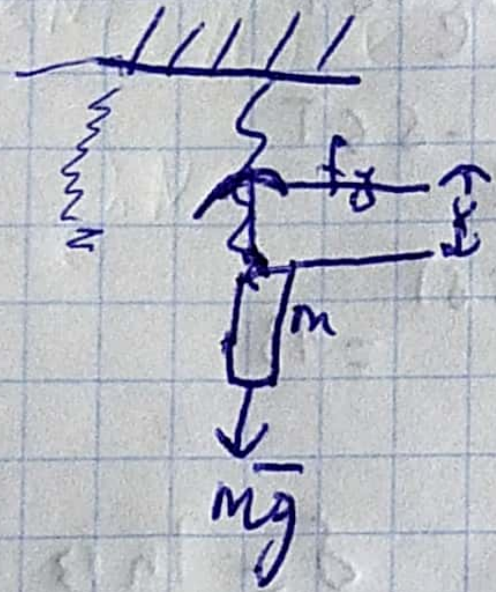
$$n = k = \sqrt{\frac{\lambda_1^2 + 4\pi^2}{\lambda_1}}$$

$$w_{рез} = \sqrt{w_0^2 - 2\beta^2_{кв}} \to Q = \frac{A_{рез}}{A^0}$$

7. $x = 9{,}8$ см

$\lambda = 3{,}1$

$T = ?$



$$\vec{F}_{упр} + m\vec{g} = 0$$

$$kx = mg$$

$$\frac{m}{k} = \frac{x}{g}$$

$$\omega_0 = \sqrt{\frac{k}{m}} = \sqrt{\frac{g}{x}}$$

$$T = \frac{2\pi}{\sqrt{\omega_0^2 - \beta^2}}; \quad \beta = \frac{\lambda}{T} \Rightarrow T^2\left(\omega_0^2 - \frac{\lambda^2}{T^2}\right) = 4\pi^2$$

$$T = \sqrt{\frac{4\pi^2 + \lambda^2}{\omega_0^2}} \approx 0{,}065 \approx 0{,}07\ с$$

8. $T = 0{,}2\,c$ $\qquad A_1 = A_0 e^{-\delta T}$

$\frac{A_1}{A_6} = 13 \qquad A_6 = A_0 e^{-\delta 6T}$

$\frac{A_1}{A_6} = e^{5\delta T} = 13$

$\nu_{рез} - ?$

$5\delta T = \ln 13 \qquad \delta = \frac{\ln 13}{5T} \qquad \omega_{рез} = \sqrt{\omega_0^2 - 2\delta^2}$

$\omega = \sqrt{\omega_0^2 - \delta^2} \qquad \omega = \frac{2\pi}{T} \qquad \omega_0^2 = \left(\frac{2\pi}{T}\right)^2 + \delta^2$

$$\omega_{рез} = \sqrt{\left(\frac{2\pi}{T}\right)^2 + \delta^2 - 2\delta^2} = \sqrt{\left(\frac{2\pi}{T}\right)^2 - \delta^2} =$$

$$= \sqrt{\left(\frac{2\pi}{T}\right)^2 - \left(\frac{\ln 13}{5T}\right)^2}$$

$$\nu_{рез} = \frac{1}{2\pi}\sqrt{\left(\frac{2\pi}{T}\right)^2 - \left(\frac{\ln 13}{5T}\right)^2} = \cancel{\frac{1}{2\pi}}$$

$$= \frac{1}{2\pi T}\sqrt{4\pi^2 - \frac{\ln^2 13}{25}} \approx 5\ Гц$$

9. $N = 50$

$A_0 / A_N = 2$

$Q - ?$

$Q = \frac{\pi}{\Theta} \qquad \Theta = \delta T$

$A_N = A_0 e^{-\delta t} = A_0 e^{-\delta NT} = A_0 e^{-\Theta N}$

$\frac{A_0}{A_N} = e^{\Theta N} = 2 \qquad \Theta N = \ln 2$

$\Theta = \frac{\ln 2}{N}, \quad Q = \frac{\pi N}{\ln 2} \qquad Q = 227.$