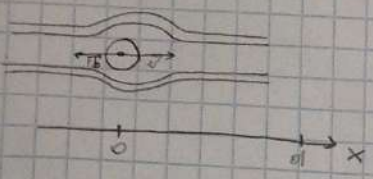
Questionario di fisica n° 3b — Michele Di Luca

Esercizio n° 1



$m = 200\,g = 0{,}2\,kg$
$b = 2$
$dl = 8\,m$

Eq forze $\vec{F_b} = m\vec{a}(t)$

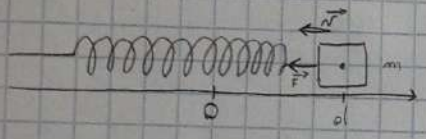
x) $-bv(t) = ma(t)$

$x(t) = v_0\tau\,(1 - e^{-\frac{t}{\tau}})$

$\tau = \frac{m}{b} = \frac{0{,}2}{2} = 0{,}1\,s$

$d = v_0\tau \longrightarrow v_0 = \frac{dl}{\tau} = \frac{8}{0{,}1} = 80\,m/s$

Esercizio n° 3



$m = 2\,kg$
$k = 10\,N/m$
$dl = +10\,cm = +0{,}1\,m$
$v_0 = 2\,m/s$

Eq. forze $\vec{F} = m\vec{a}$

x) $-kx = ma$

$x''(t) + \frac{k}{m}x(t) = 0 \longrightarrow x''(t) = -\frac{k}{m}x(t)$

$x(t) = A\,sen(\omega t + \varphi)$

$a(t) = x''(t) = -A\,sen\,\omega^2(\omega t + \varphi)$

$\left[-\omega^2 + \frac{k}{m}\right] A\,sen(\omega t + \varphi) = 0$

$\omega = \sqrt{\frac{k}{m}} = 2{,}23\,\frac{rad}{s} \qquad T = \frac{2\pi}{\omega} = 2{,}81\,s$

Condizioni iniziali

$x(0) = x_0 = 10\,cm = 0{,}1\,m$
$v(0) = v_0 = 2\,m/s$

$x(0) = x_0 = A\,sen\,\varphi$
$v(0) = v_0 = A\omega\cos\varphi \longrightarrow A = \sqrt{x_0^2 + \frac{v_0^2}{\omega_0^2}}$

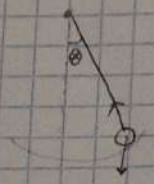
$x = \sqrt{x_0^2 + \frac{v_0^2}{\omega_0^2}}\,sen\,\varphi \qquad x_{MAX} = \sqrt{\frac{x_0^2 + v_0^2}{\omega_0^2}} = 0{,}9\,m$

$v = \omega\sqrt{x_0^2 + \frac{v_0^2}{\omega_0^2}}\cos\varphi \qquad v_{MAX} = \omega\sqrt{\frac{x_0^2 + v_0^2}{\omega_0^2}} = 2\,m/s$

$a = -\omega^2\sqrt{x_0^2 + \frac{v_0^2}{\omega_0^2}}\,sen\,\varphi \qquad a_{MAX} = \omega^2\sqrt{\frac{x_0^2 + v_0^2}{\omega_0^2}} = 4{,}47\,m/s^2$

Физика № 4

$m = 200г = 0,2кг$
$l = 1,2\ м$
$\theta = 5°$
$20\ \frac{см}{мин}$



$T = \frac{60}{20} = 3\ сек.$

$T = 2\pi\sqrt{\frac{l}{g}} \Rightarrow g = \frac{4\pi^2 l}{T^2}$

$g = \frac{4\pi^2 \cdot 1,2}{3^2} = 5,26\ \frac{м}{с^2}$

$\theta(t) = A \sin\varphi$
$\omega(t) = A\omega \cos\varphi$

$\omega = \sqrt{\frac{g}{l}} = 2,09\ \frac{рад}{с}$

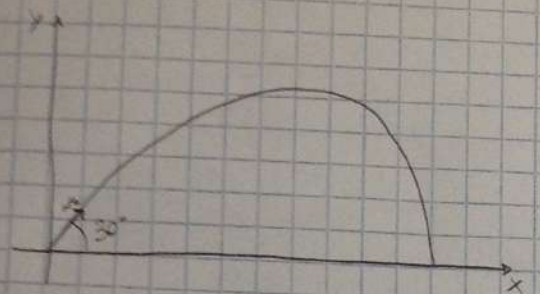
$\theta(t) = \theta_0 \sin\varphi$
$\omega(t) = \theta_0\omega \cos\varphi$

$5° = 0,0872\ рад$

$\omega_{max}\ L * \theta_0\omega = L * 0,0872 \cdot 2,09 = 0,182\ \frac{рад}{с}$

$V = \omega x = 0,182 \cdot 1,2 = 0,219\ \frac{м}{с}$

Esercizio n°2



$m = 200\,g = 0{,}2\,kg$
$v_0 = 200\,\frac{m}{s}$
$\alpha = 30°$
$b = 0{,}02$

$$\vec{P} + \vec{F_R} = m\vec{a}$$

x) $-b v_x = m a_x \rightarrow a_x = v_x' = -\frac{b}{m} v_{0x}$

y) $-mg - b v_{0y} = m a_y \rightarrow a_y = v_y' = -\frac{b}{m} v_{0y} - g$

$v_x = v_x e^{-\frac{t}{\tau}}$

$v_y = v_y e^{-\frac{t}{\tau}} - g\tau(1 - e^{-\frac{t}{\tau}})$

$x = \int v_x dt = v_x \tau (1 - e^{-\frac{t}{\tau}})$

$y = \int v_y dt = v_y \tau (1 - e^{-\frac{t}{\tau}}) + g\tau^2 (1 - e^{-\frac{t}{\tau}})$

$x = v_x \tau (1 - e^{-\frac{t}{\tau}}) \rightarrow 1 - e^{-\frac{t}{\tau}} = \frac{x}{v_x \tau}$; $e^{-\frac{t}{\tau}} = 1 - \frac{x}{v_x \tau}$;

$\log e^{-\frac{t}{\tau}} = \log\left(1 - \frac{x}{v_x \tau}\right)$; $-\frac{t}{\tau} = \log\left(1 - \frac{x}{v_x \tau}\right)$;

$t = -\tau \log\left(1 - \frac{x}{v_x \tau}\right)$

$y(x) = v_y \tau \cdot \frac{x}{v_x \tau} + g\tau^2 \cdot \frac{x}{v_x \tau} + \tau^2 g \log\left(1 - \frac{x}{v_x \tau}\right)$

$y(x) = \frac{v_y}{v_x} x + \frac{g\tau}{v_x} x + \tau^2 g \log\left(1 - \frac{x}{v_x \tau}\right)$