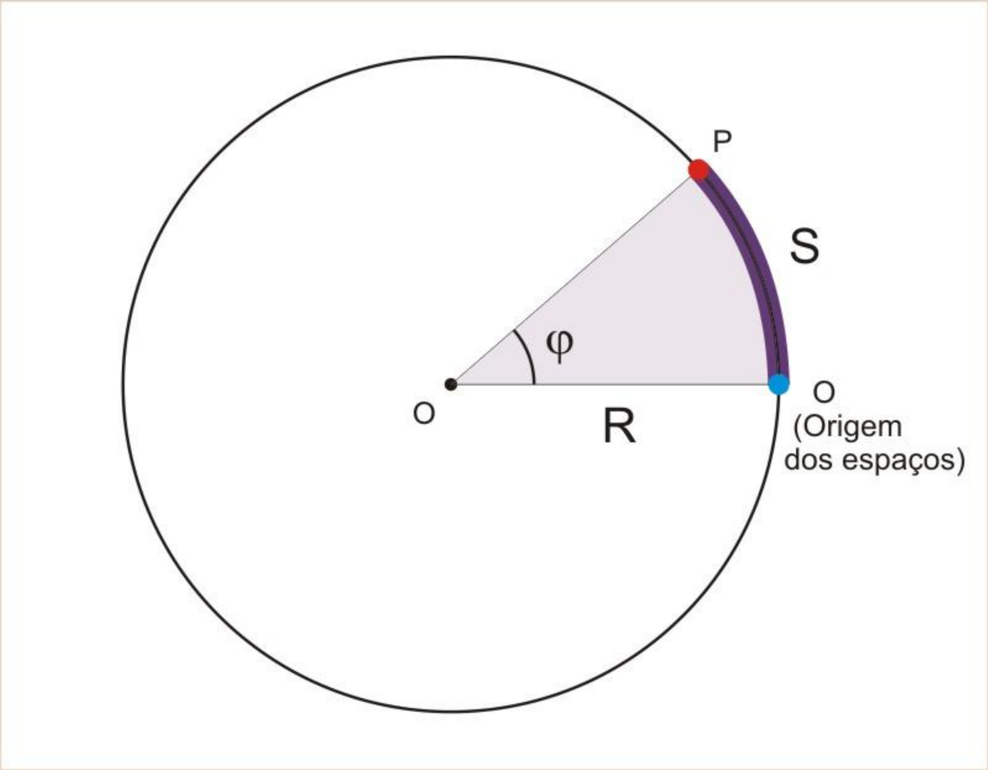
UNIVERSIDADE DO ESTADO DO RIO DE JANEIRO

OSCILAÇÕES

DFAT

FÍSICA TEÓRICA E EXPERIMENTAL II

Movimento circular

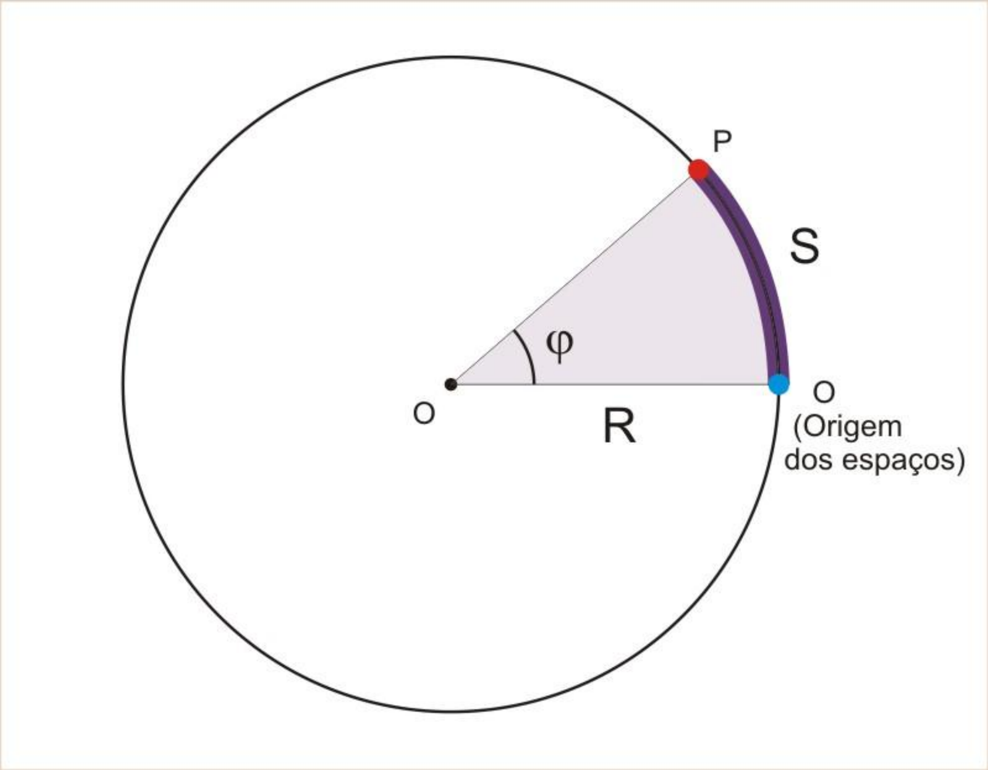


$$\frac{S}{\Delta t} \longrightarrow \frac{\varphi}{\Delta t}$$

$$V = \frac{S}{\Delta t} \longrightarrow \boxed{\omega = \frac{\varphi}{\Delta t}}$$

$$S = \varphi . R$$

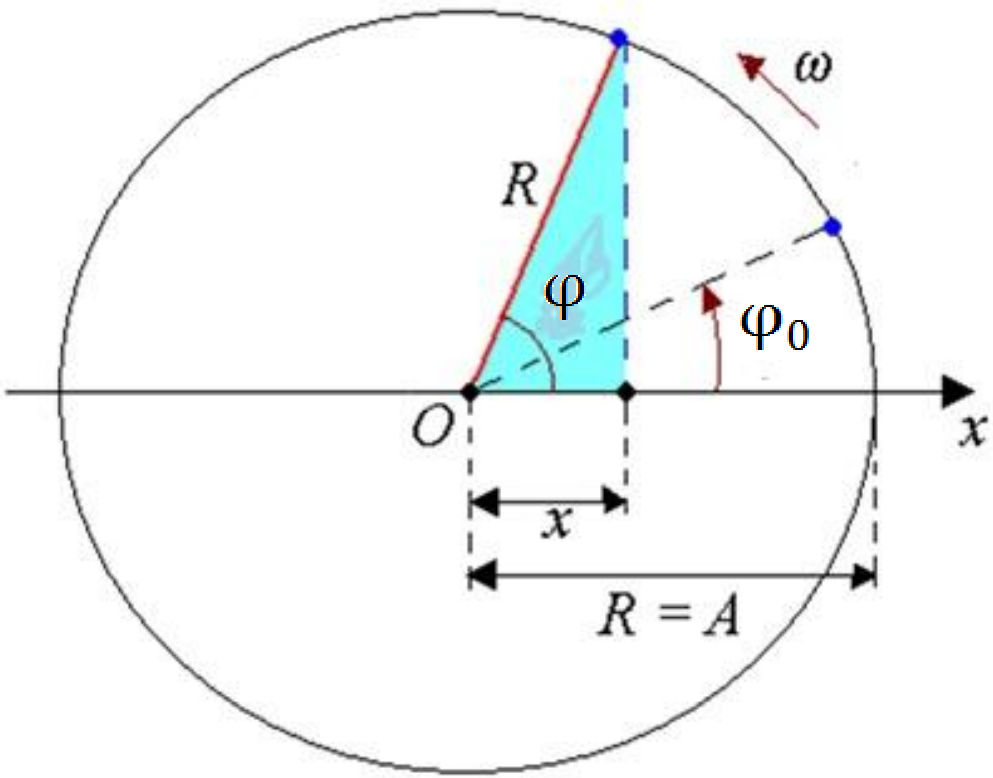
Movimento circular



$$f = \frac{n^{\underline{o}}\ \text{voltas}}{\Delta t}$$

$$f = \frac{1}{T}$$

Função horária do posição - MHS



$$\varphi = \varphi_0 + \omega t$$

$$x = R\cos\varphi$$

$$\varphi = \varphi_0 + \omega t$$

$$x = A\cos\varphi$$

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

Outras funções

$$V = \frac{dx}{dt}$$

$$v(t) = \frac{d(A\cos(\omega t + \varphi_0))}{dt}$$

$$v(t) = -\omega A sen(\omega t + \varphi_0)$$

$$a = \frac{dV}{dt}$$

$$a(t) = \frac{d(-\omega A\, sen(\omega t + \varphi_0))}{dt}$$

$$a(t) = -\omega^2 A\cos(\omega t + \varphi_0)$$

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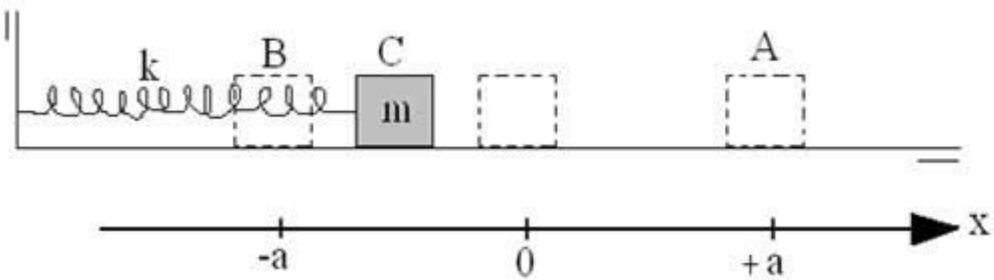
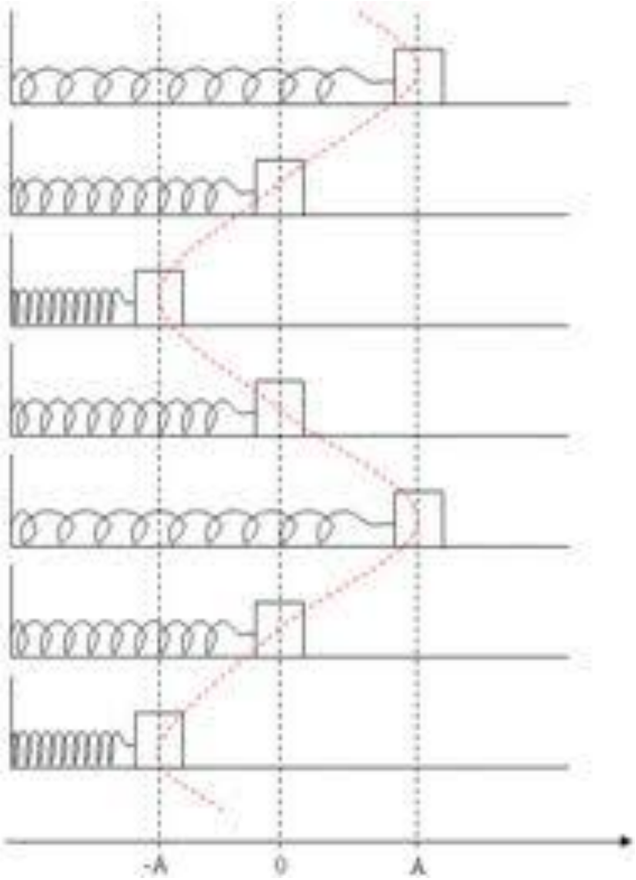
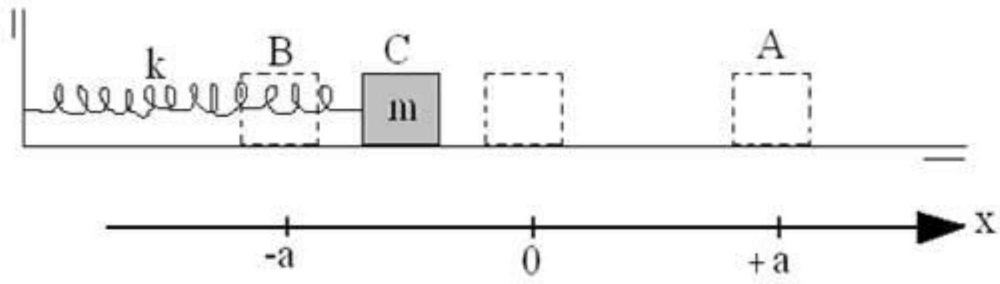
Osciladores lineares





Osciladores lineares



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

$$\boxed{x(t) = A}$$

$$v(t) = -\omega A \operatorname{sen}(\omega t + \varphi_0)$$

$$\boxed{v(t) = \mp \omega A}$$

$$a(t) = -\omega^2 A\cos(\omega t + \varphi_0)$$

$$\boxed{a(t) = -\omega^2 A}$$

Lei de força

$$F = ma \quad \therefore \quad F = -kx$$

$$ma = -kx$$

$$m(-\omega^2 A) = -kA$$

$$\omega^2 = \frac{k}{m}$$

$$\boxed{\omega = \sqrt{\frac{k}{m}}}$$

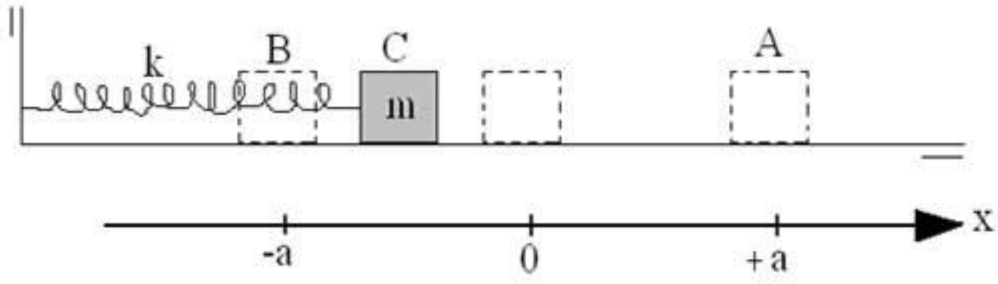
$$\omega = \frac{2\pi}{T} \longrightarrow \frac{2\pi}{T} = \sqrt{\frac{k}{m}}$$

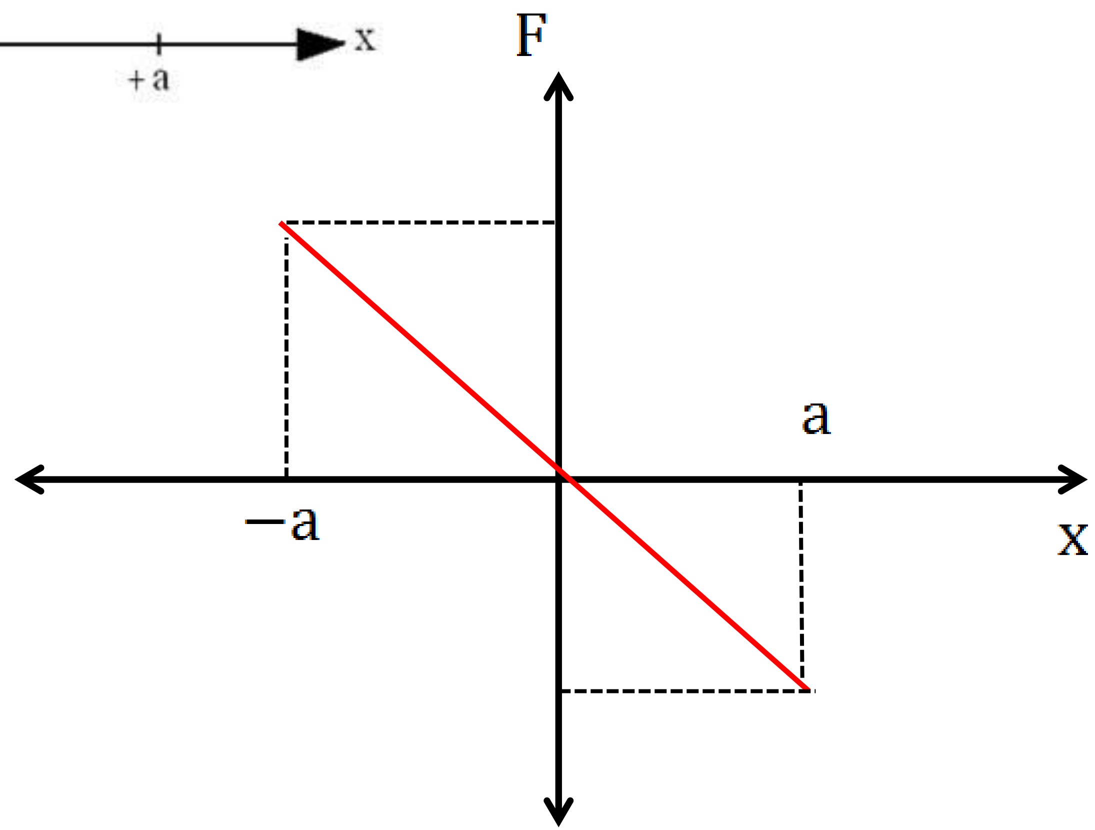
$$\frac{2\pi^2}{T^2} = \frac{k}{m} \longrightarrow \frac{T^2}{(2\pi)^2} = \frac{m}{k}$$

$$T^2 = \frac{m}{k}(2\pi)^2$$

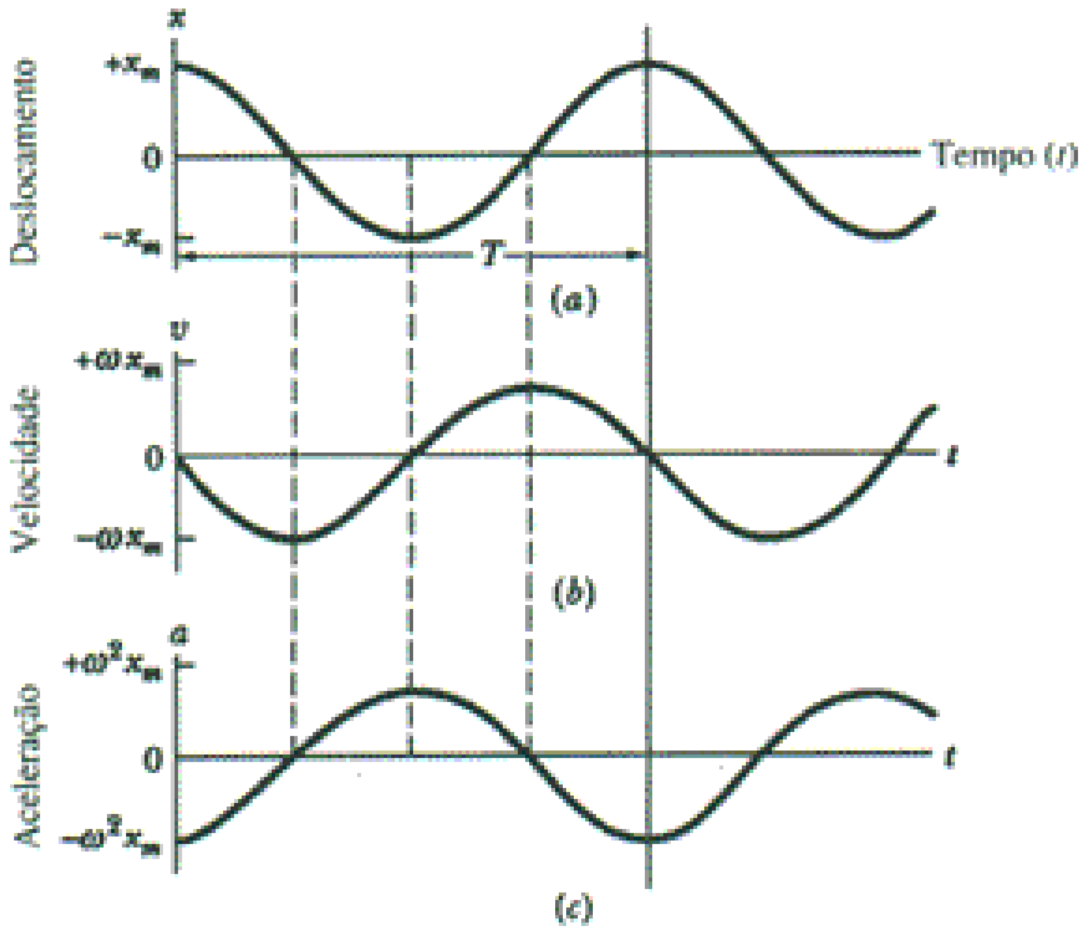
$$\boxed{T = 2\pi\sqrt{\frac{m}{k}}}$$

Gráficos





Gráficos

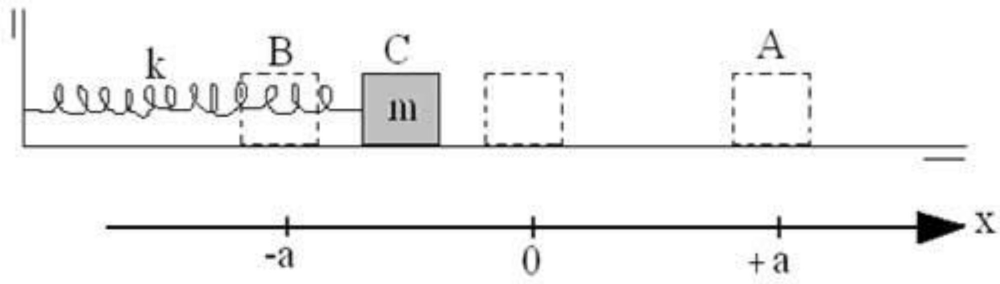


$$x(t) = A$$

$$v(t) = \mp\omega A$$

$$a(t) = -\omega^2 A$$

Osciladores lineares



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

$$\boxed{x(t) = A}$$

$$v(t) = -\omega A sen(\omega t + \varphi_0)$$

$$\boxed{v(t) = \mp\omega A}$$

$$a(t) = -\omega^2 A\cos(\omega t + \varphi_0)$$

$$\boxed{a(t) = -\omega^2 A}$$

Energia mecânica

$$E_M = E_p + E_c$$

$$E_M = \text{constante}$$

$$\text{cte} = E_p + E_c$$

$$E_p = \frac{kx^2}{2}$$

$$E_p = \frac{k(A\cos(\omega t + \varphi_0))^2}{2}$$

$$\boxed{E_p = \frac{1}{2}kA^2\cos^2(\omega t + \varphi_0)}$$

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Energia mecânica

$$E_c = \frac{mV^2}{2}$$

$$E_c = \frac{m(-\omega A sen(\omega t + \varphi_0))^2}{2}$$

$$E_c = \frac{1}{2} m\omega^2 A^2 sen^2(\omega t + \varphi_0)$$

$$k = m\omega^2$$

$$\boxed{E_c = \frac{1}{2} kA^2 sen^2(\omega t + \varphi_0)}$$

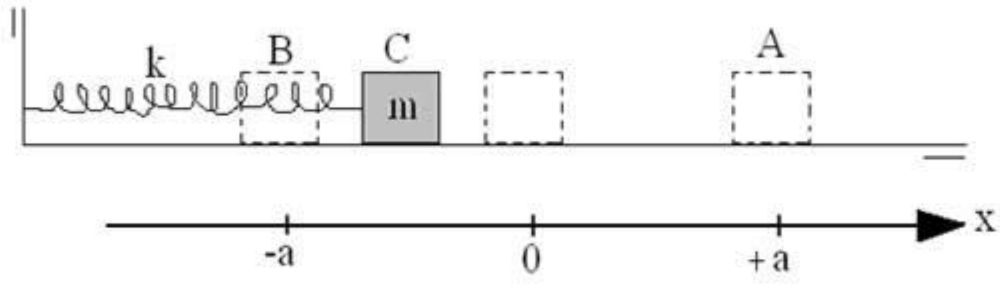
$$E_M = E_p + E_c$$

Energia mecânica

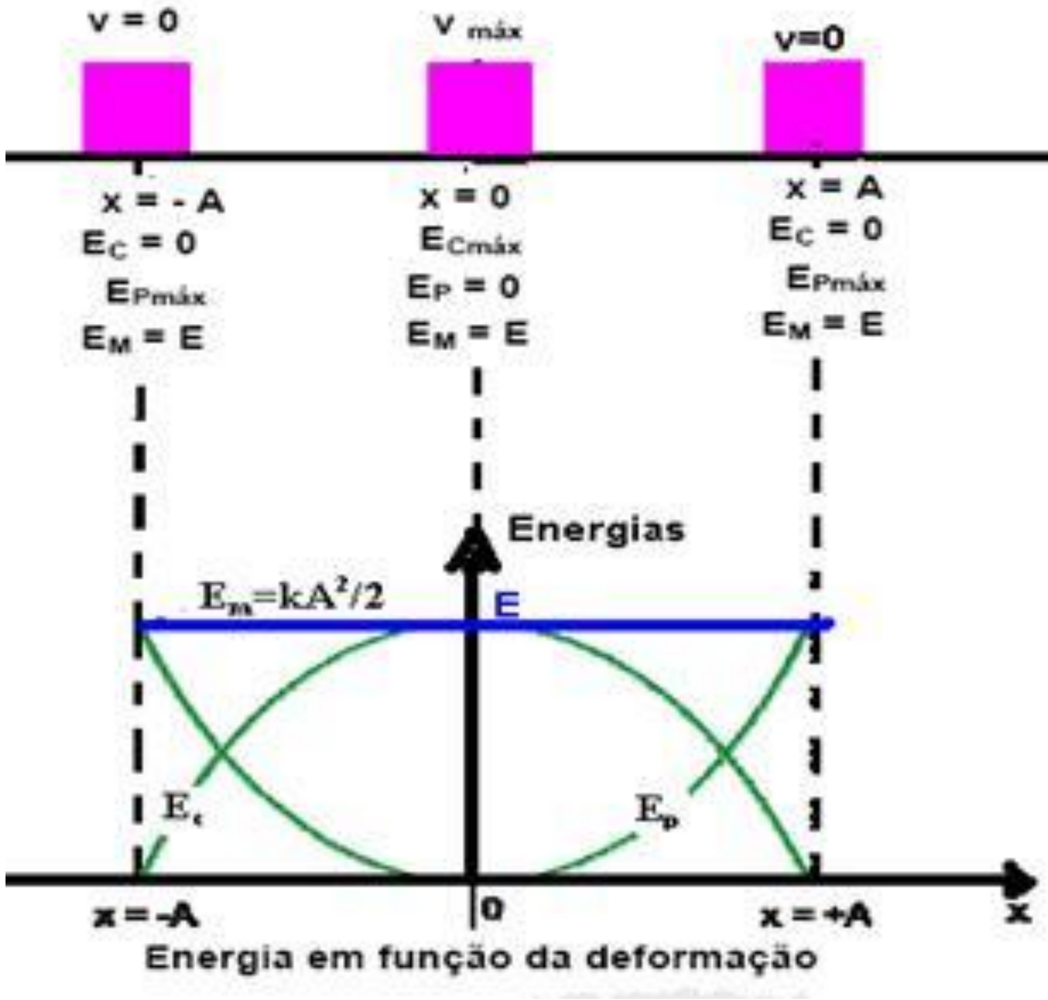
$$\frac{1}{2}kA^2\cos^2(\omega t + \varphi_0) + \frac{1}{2}kA^2\text{sen}^2(\omega t + \varphi_0) = E_M$$

$$\frac{1}{2}kA^2(\text{sen}^2(\omega t + \varphi_0) + \cos^2(\omega t + \varphi_0) = E_M$$

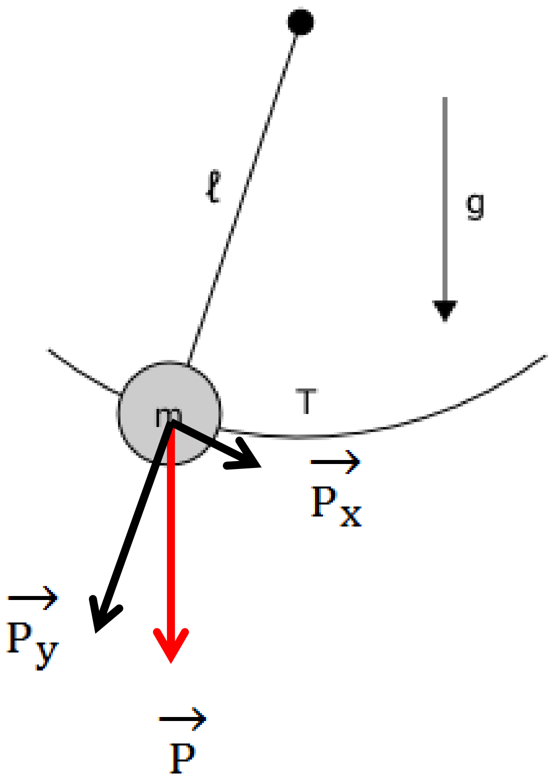
$$E_M = \frac{1}{2}kA^2$$

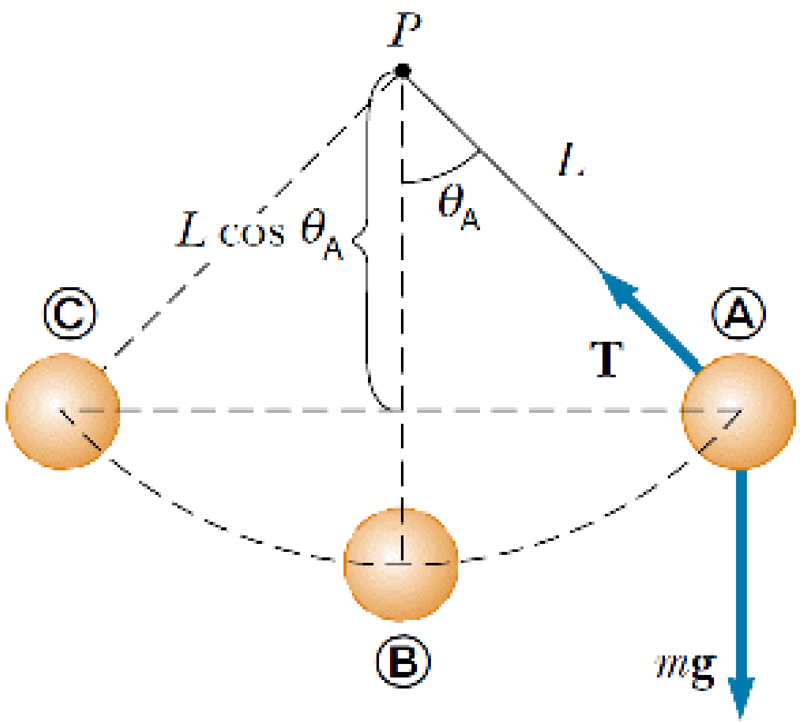


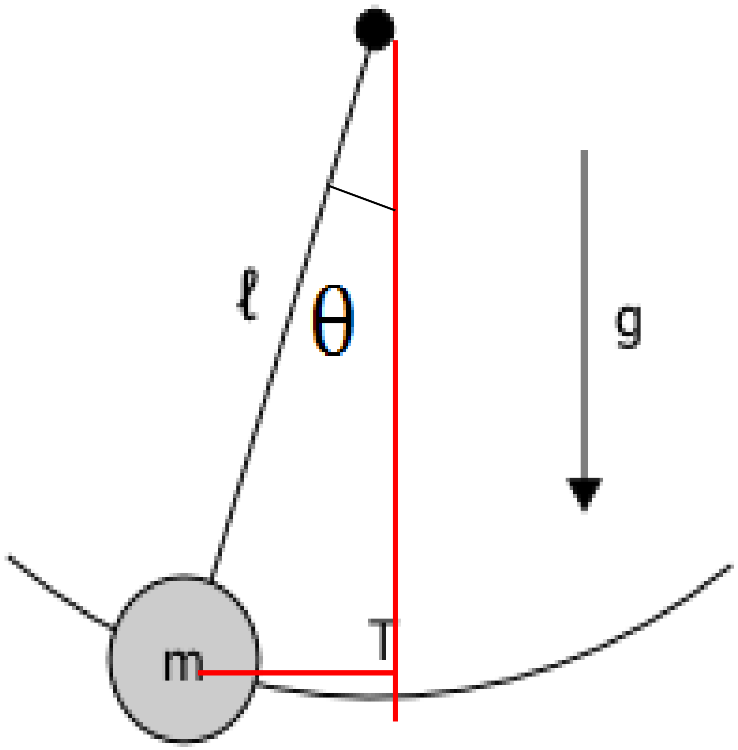
Energia mecânica



Pêndulo simples



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Pêndulo simples

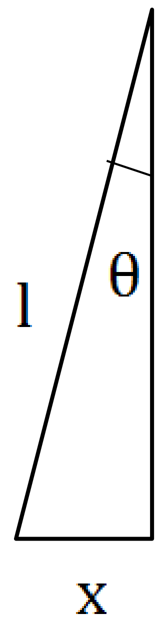
$$F = -P.\operatorname{sen}\theta$$

$$F = -m.g.\operatorname{sen}\theta$$

$$F = -m.g.\frac{x}{l}$$

$$\boxed{F = -k.x}$$

$$-k.\cancel{x} = -m.g.\frac{\cancel{x}}{l}$$



$$k = \frac{m.g}{l}$$

$$\boxed{T = 2\pi\sqrt{\frac{m}{k}}}$$

$$T = 2\pi\sqrt{\frac{m}{\frac{m.g}{l}}}$$

$$\boxed{T = 2\pi\sqrt{\frac{l}{g}}}$$

Exercício 1

Em um barbeador elétrico, a lâmina se move para frente e para trás ao longo de uma distância de 2mm em movimento harmônico simples, com frequência de 120hz. Encontre: a) a amplitude; b) a velocidade máxima da lâmina e c) o módulo da aceleração máxima da lâmina.

Exercício 1

a) $\boxed{A = \frac{2}{2} = 1\text{mm}}$

b) $v = \omega A \qquad \omega = \frac{\varphi}{\Delta t}$

$$v = \frac{2\pi}{T} A$$

$$v = 2.\pi.f.A$$

$$v = 2.3{,}14.120.1.10^{-3}$$

$$\boxed{v = 0{,}754\text{m/s}}$$

c) $a = \omega^2 A \qquad a = (2\pi f)^2 A$

$$a = (2.3{,}14.120)^2 1.10^{-3}$$

$$\boxed{a = 568\text{m/s}^2}$$

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