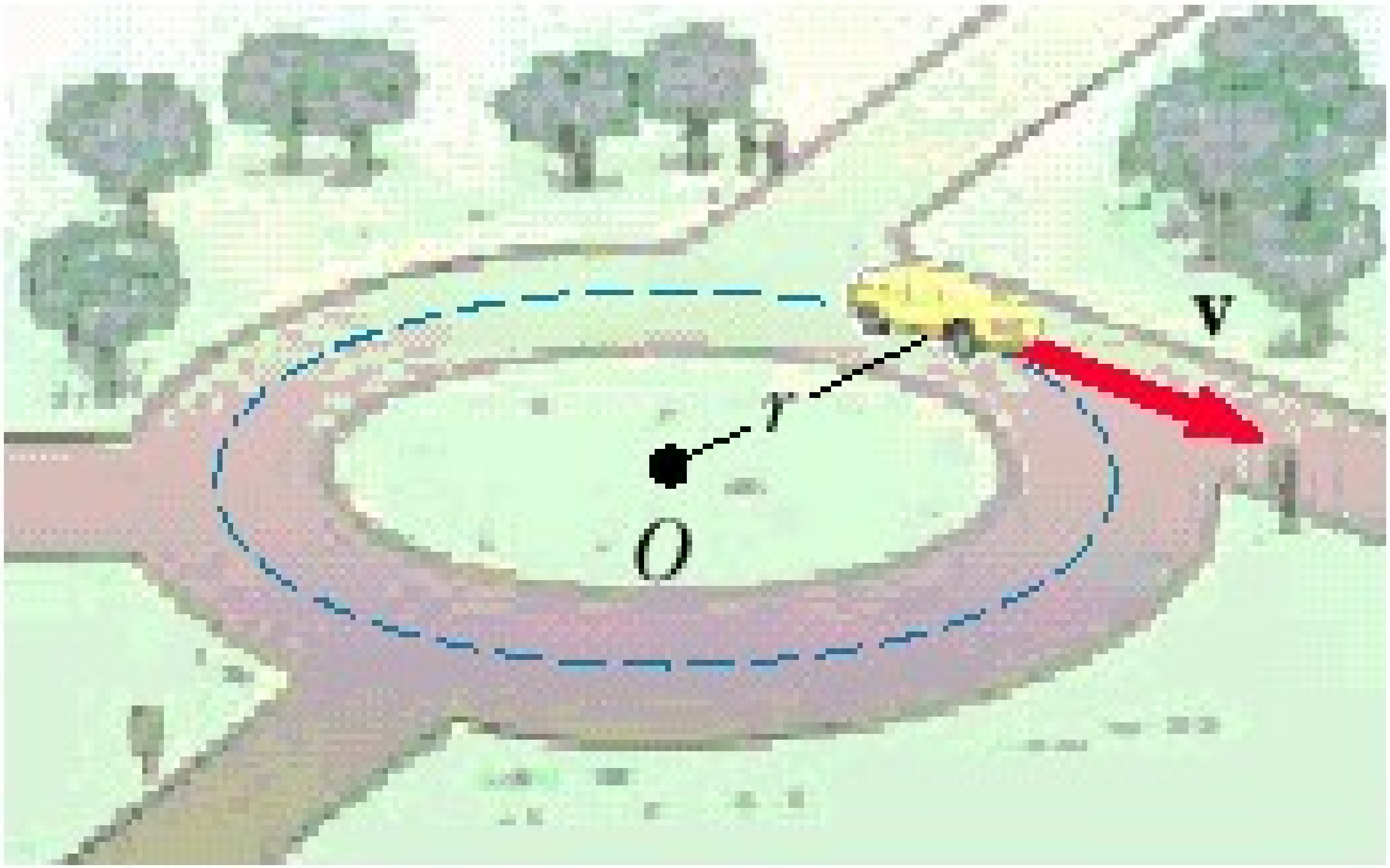
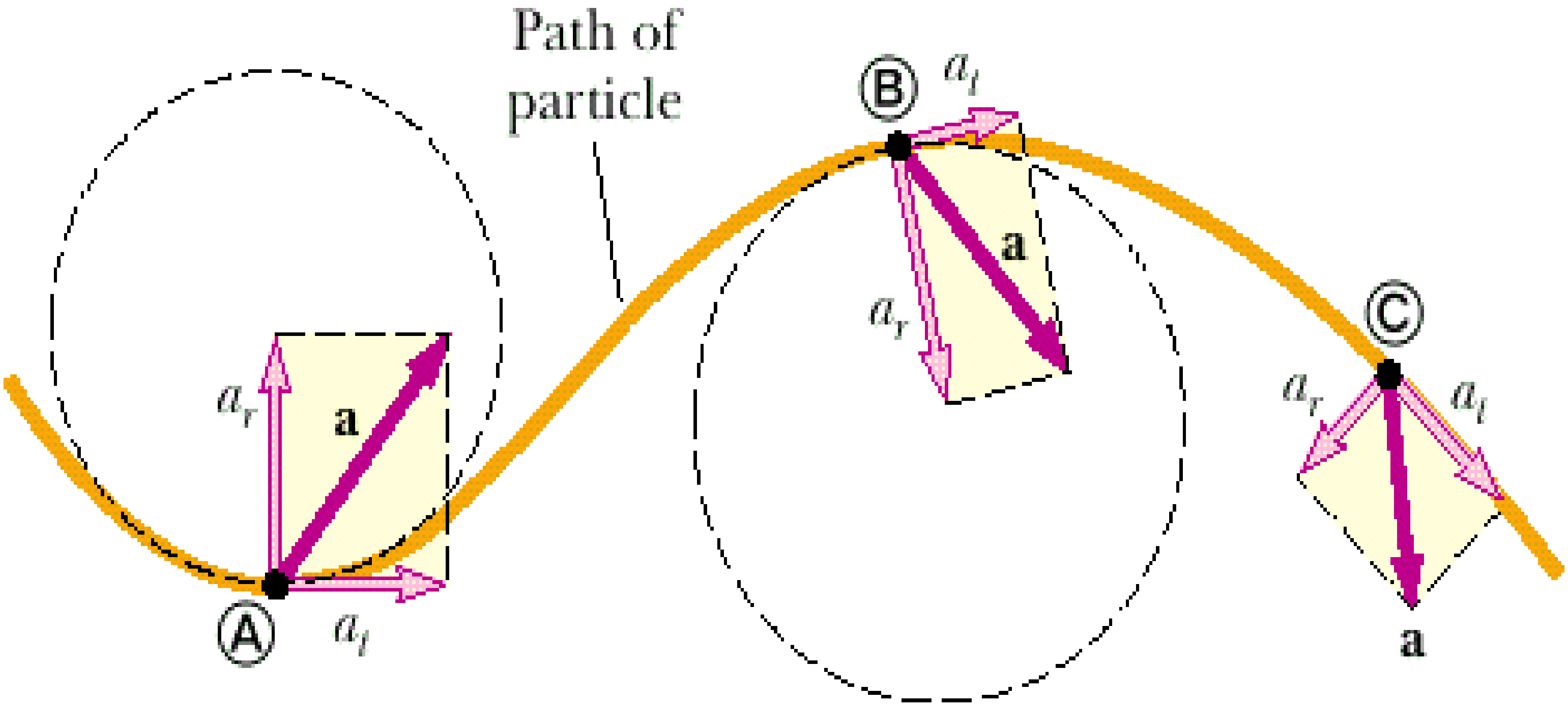
Movimiento Circular Uniforme

Trayectoria circular con radio y rapidez constante

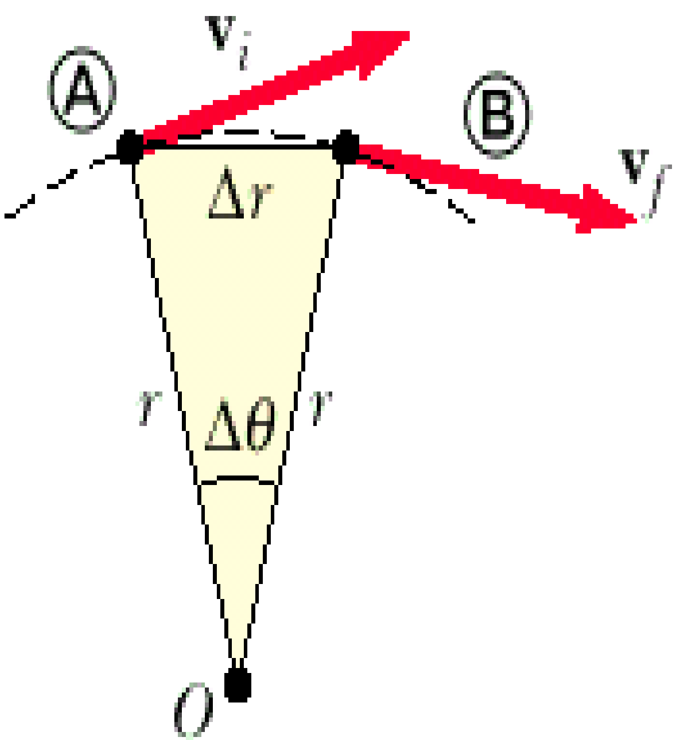


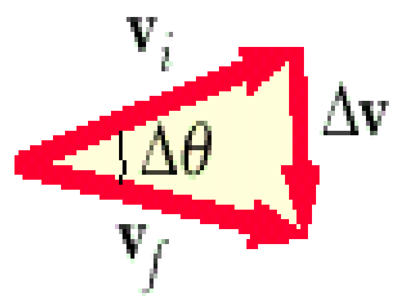
Movimiento Circular NO Uniforme



Movimiento Circular Uniforme

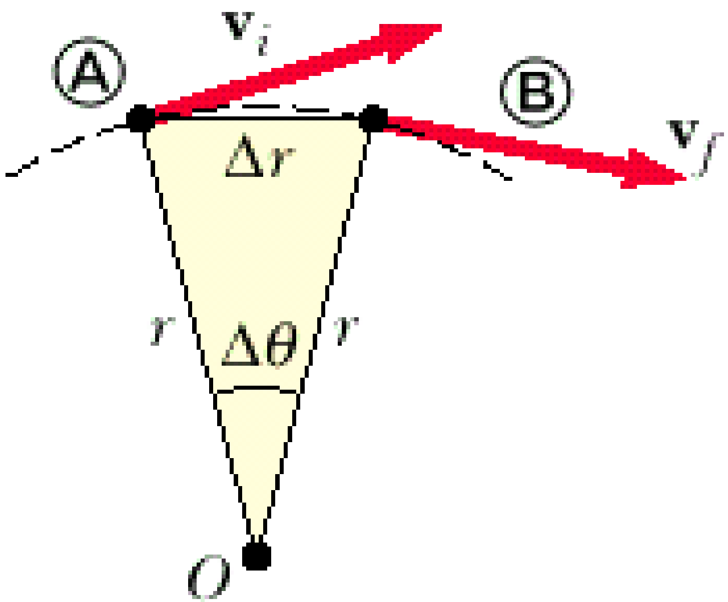
Movimiento con aceleración hacia el centro del círculo.





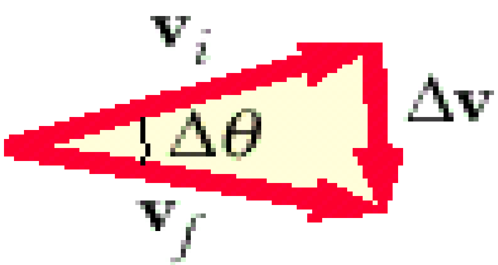
$$a_r = \frac{v^2}{r}$$

Movimiento Circular Uniforme



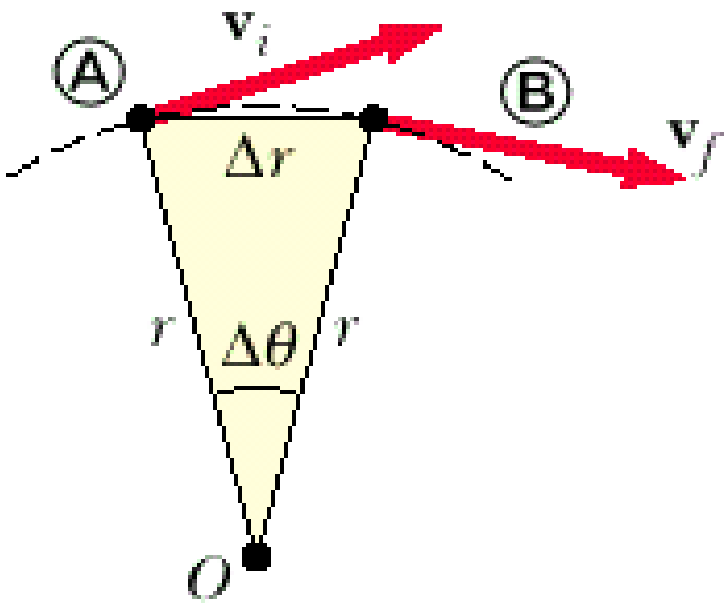
$$\overline{\mathbf{a}} = \frac{\mathbf{v}_f - \mathbf{v}_i}{t_f - t_i} = \frac{\Delta \mathbf{v}}{\Delta t}$$

$$\frac{\Delta v}{v} = \frac{\Delta r}{r}$$



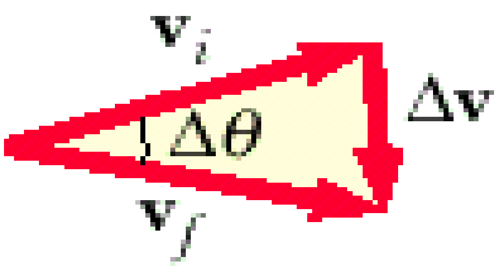
$$\overline{a} = \frac{v\,\Delta r}{r\,\Delta t}$$

Movimiento Circular Uniforme



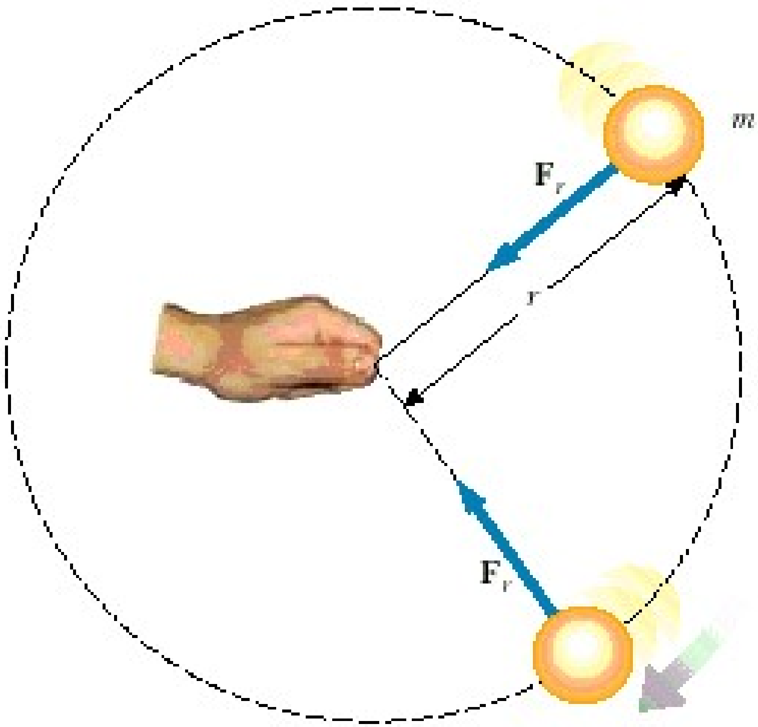
$$\frac{\Delta v}{v} = \frac{\Delta r}{r}$$

$$\overline{a} = \frac{v\,\Delta r}{r\,\Delta t}$$



$$a_r = \frac{v^2}{r}$$

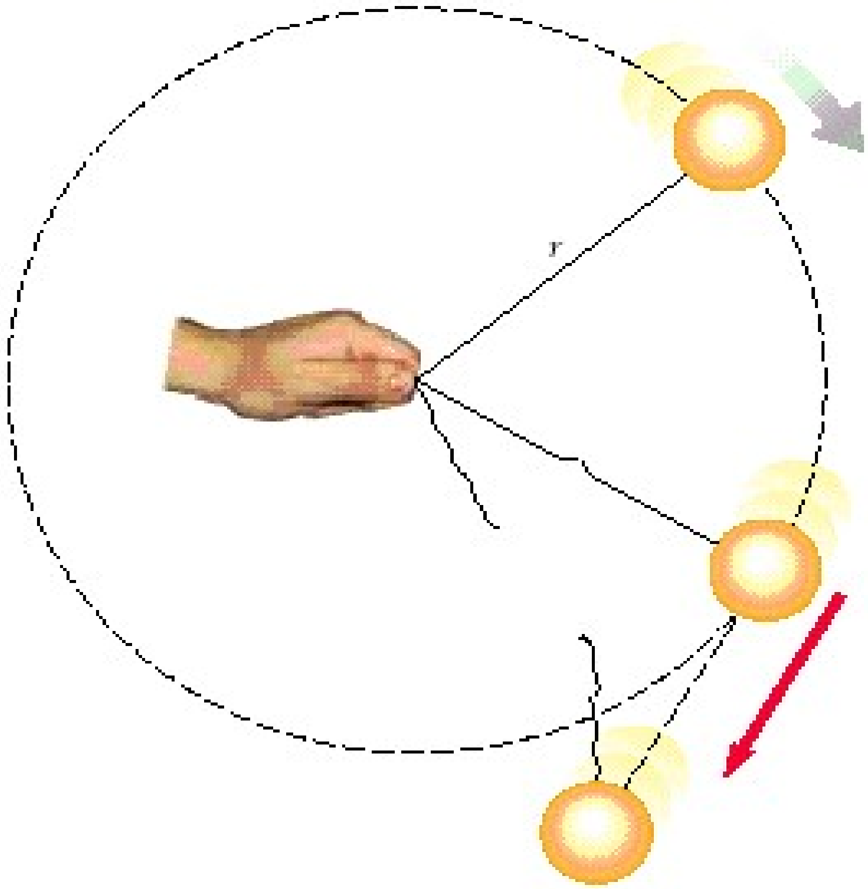
Dinámica del Movimiento Circular Uniforme



Si aplicamos la Ley de Newton al movimiento circular, obtenemos:

$$\sum F_r = ma_r = m\frac{v^2}{r}$$

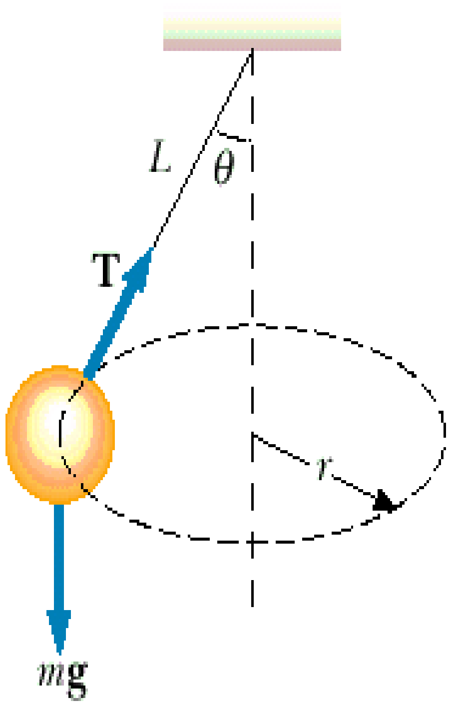
Dinámica del Movimiento Circular Uniforme

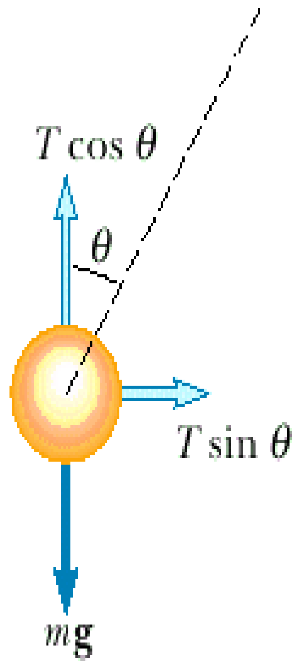


Cuando se corta la cuerda, ya no existe la fuerza para seguir la trayectoria circular.

$$\sum F_r = ma_r = m\frac{v^2}{r}$$

Dinámica del Movimiento Circular Uniforme





$$(1) \qquad T\cos\theta = mg$$

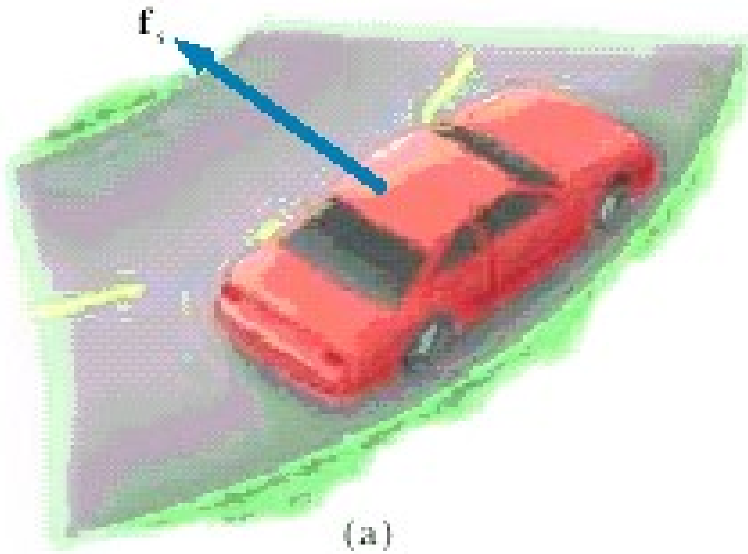
$$(2) \qquad \sum F_r = T\sin\theta = ma_r = \frac{mv^2}{r}$$

$$\tan\theta = \frac{v^2}{rg}$$

$$v = \sqrt{rg\tan\theta}$$

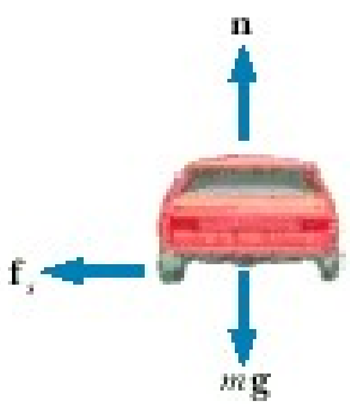
$$v = \sqrt{Lg\sin\theta\tan\theta}$$

Dinámica del Movimiento Circular Uniforme



(a)

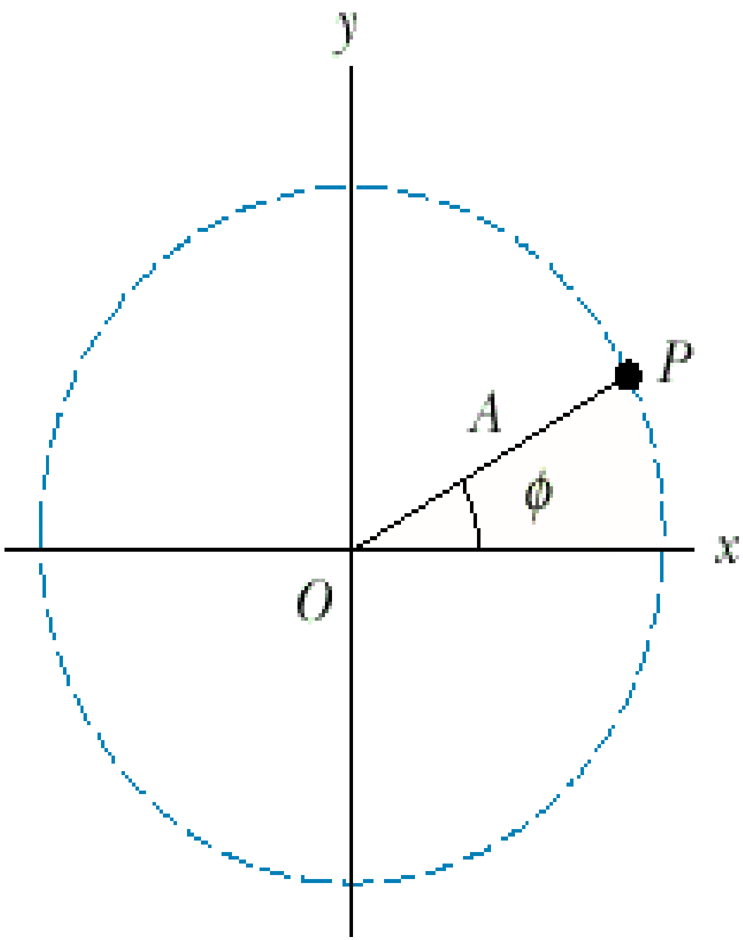
$$(1) \qquad f_s = m\frac{v^2}{r}$$

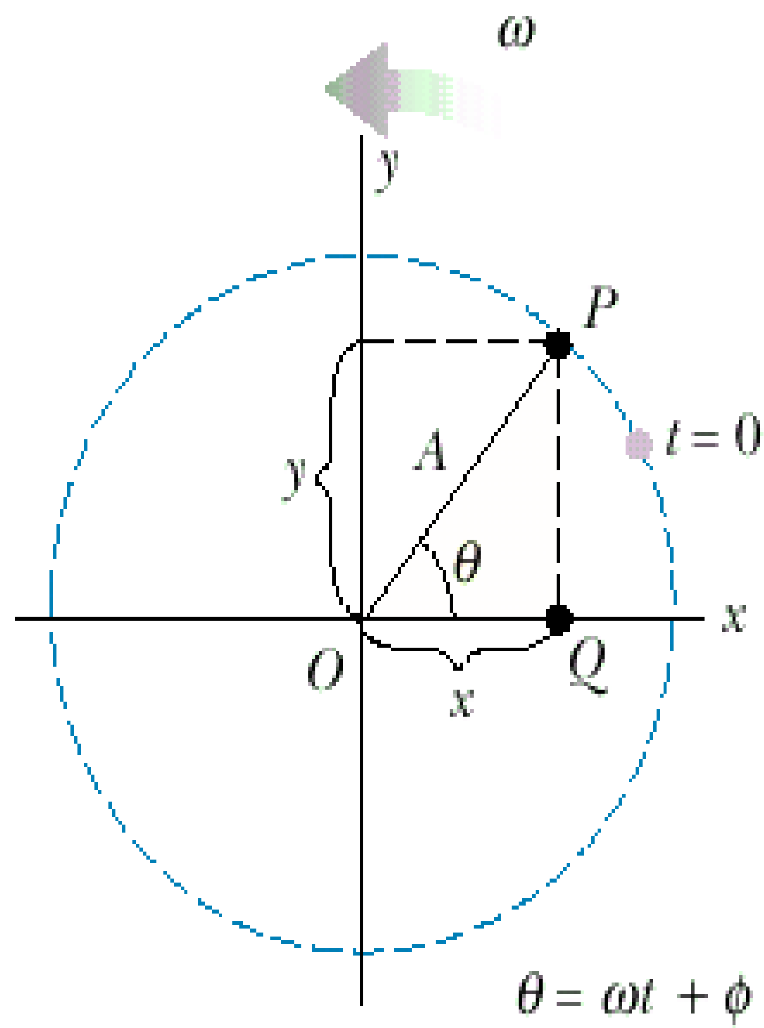


$$v_{\max} = \sqrt{\frac{f_{s,\max} r}{m}} = \sqrt{\frac{\mu_s m g r}{m}} = \sqrt{\mu_s g r}$$

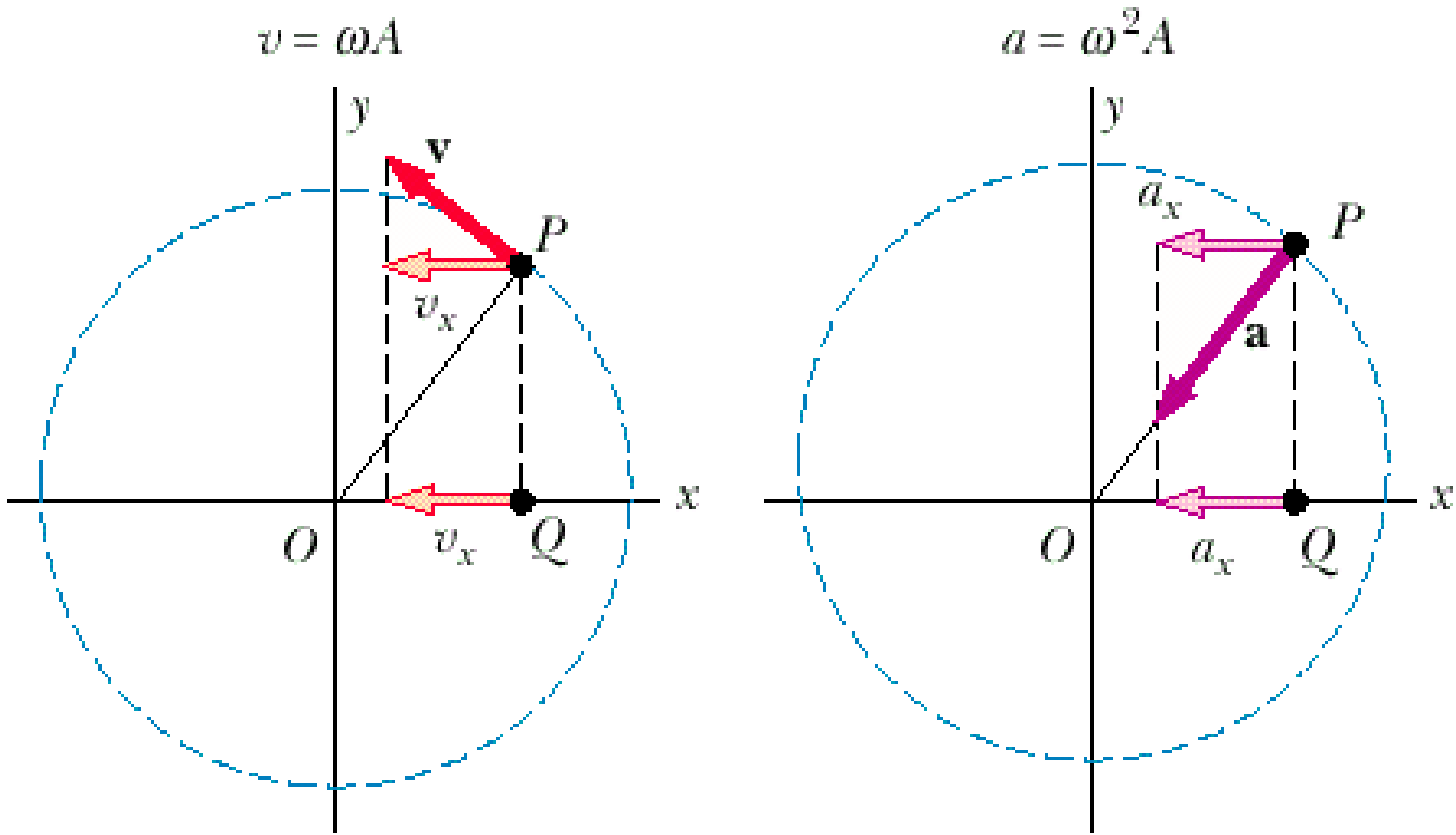
$$= \sqrt{(0.500)(9.80\ \mathrm{m/s^2})(35.0\ \mathrm{m})} = 13.1\ \mathrm{m/s}$$

Movimiento Circular Uniforme y Movimiento Armónico Simple MAS

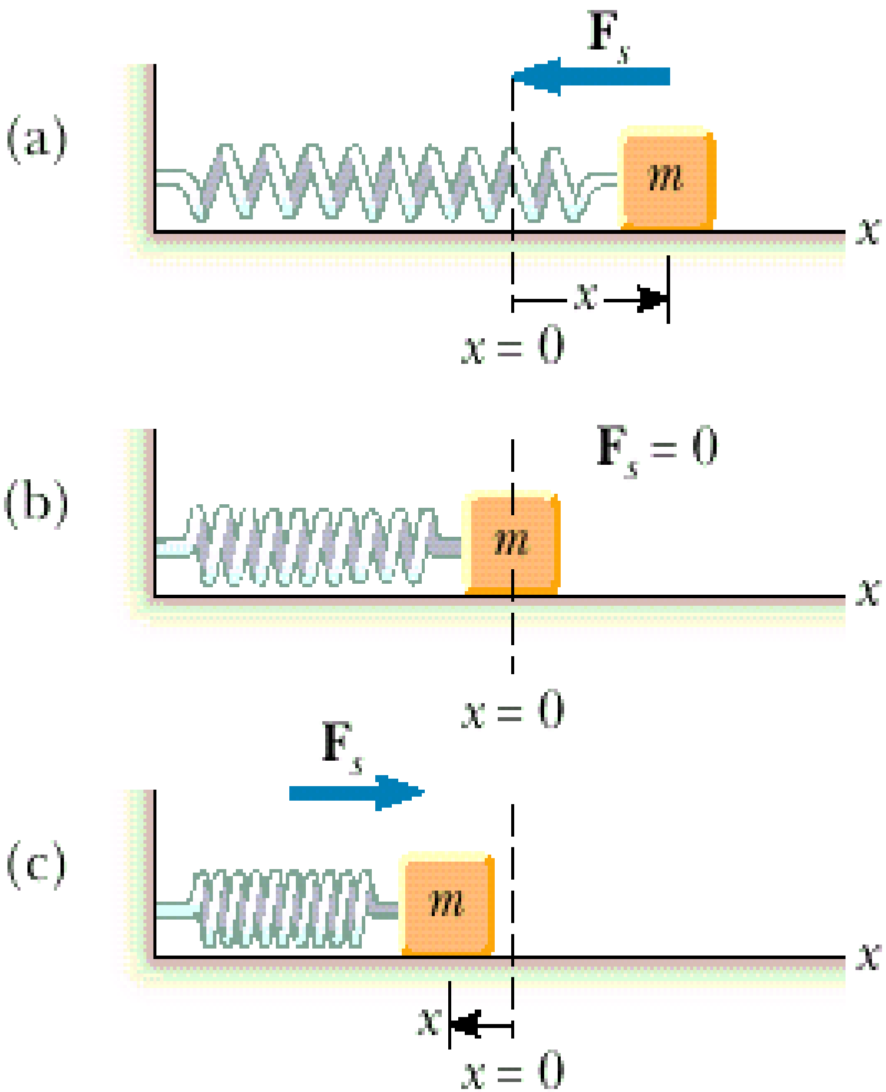




Movimiento Circular Uniforme y Movimiento Armónico Simple MAS



Movimiento Armónico Simple MAS

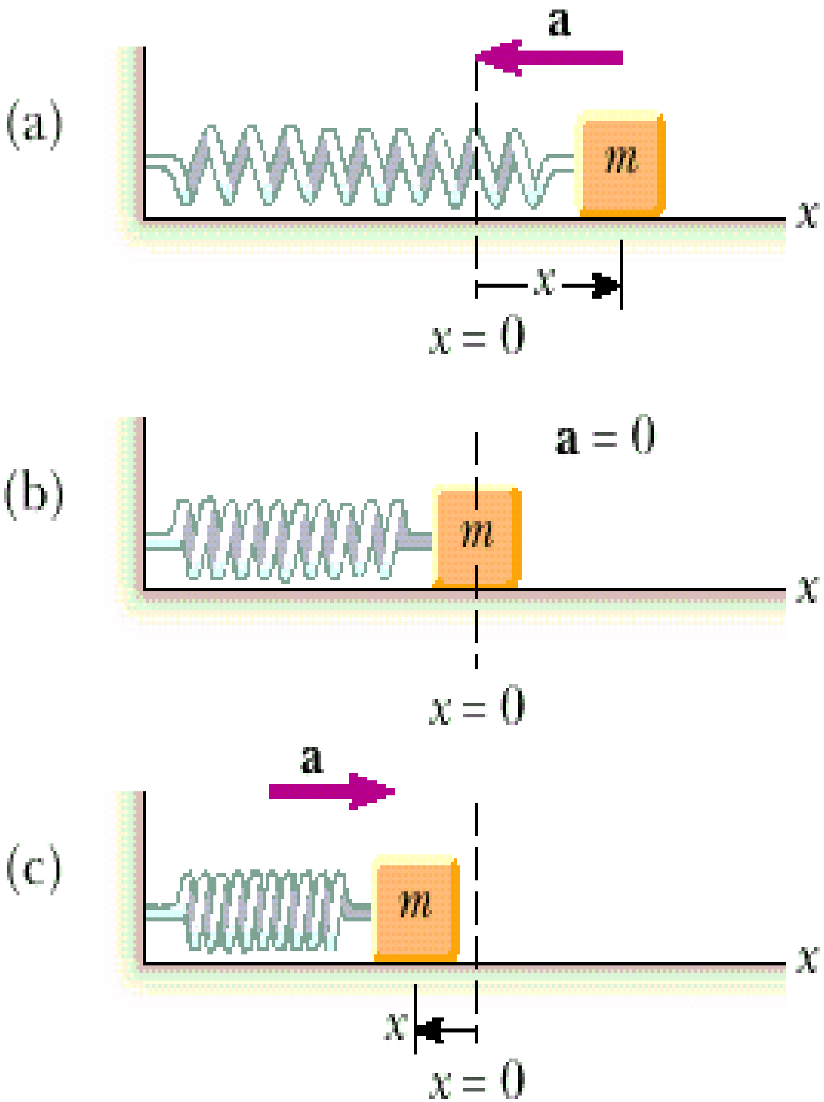


$$F_s = -kx$$

$$F_s = -kx = ma$$

$$a = -\frac{k}{m}x$$

Movimiento Armónico Simple MAS

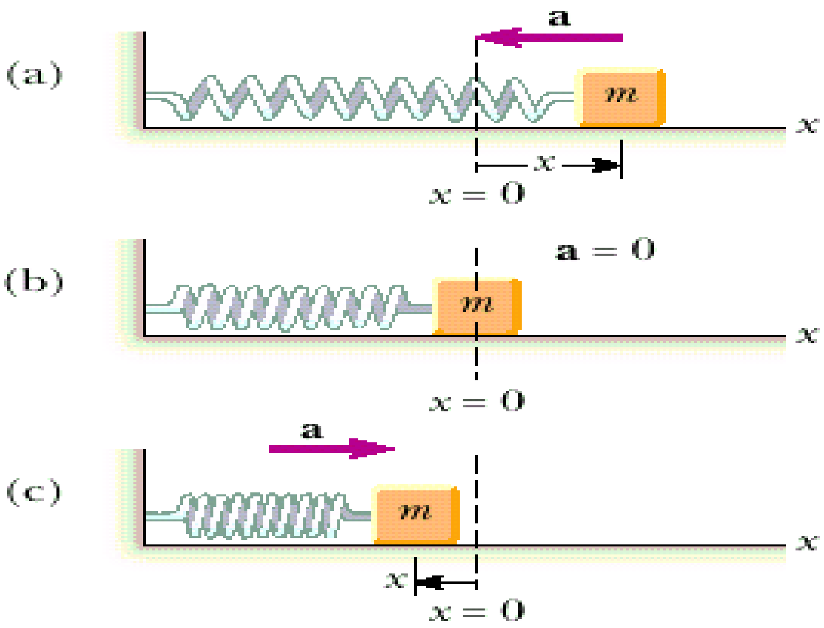


$$\frac{d^2x}{dt^2} = -\frac{k}{m}x$$

$$\frac{d^2x}{dt^2} = -\omega^2 x$$

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

Movimiento Armónico Simple MAS



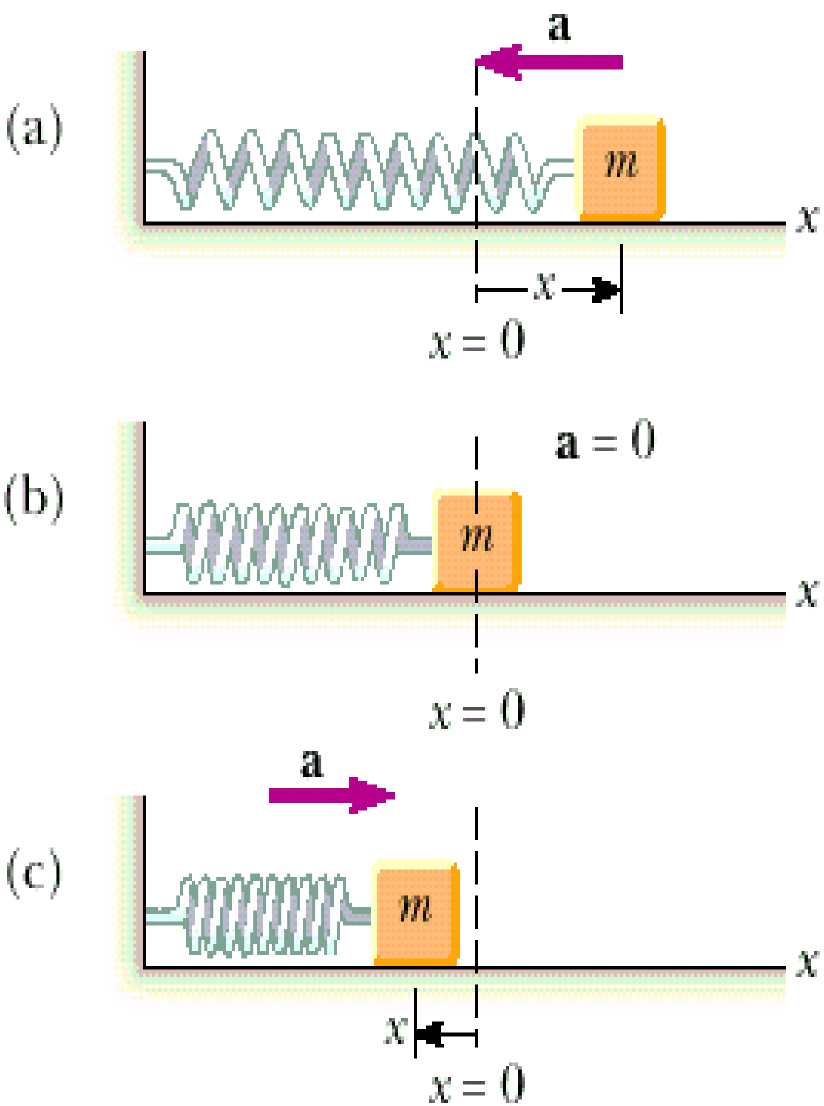
$$\frac{d^2x}{dt^2} = -\omega^2 x$$

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

$$\frac{dx}{dt} = A\frac{d}{dt}\cos(\omega t + \phi) = -\omega A\sin(\omega t + \phi)$$

$$\frac{d^2x}{dt^2} = -\omega A\frac{d}{dt}\sin(\omega t + \phi) = -\omega^2 A\cos(\omega t + \phi)$$

Movimiento Armónico Simple MAS



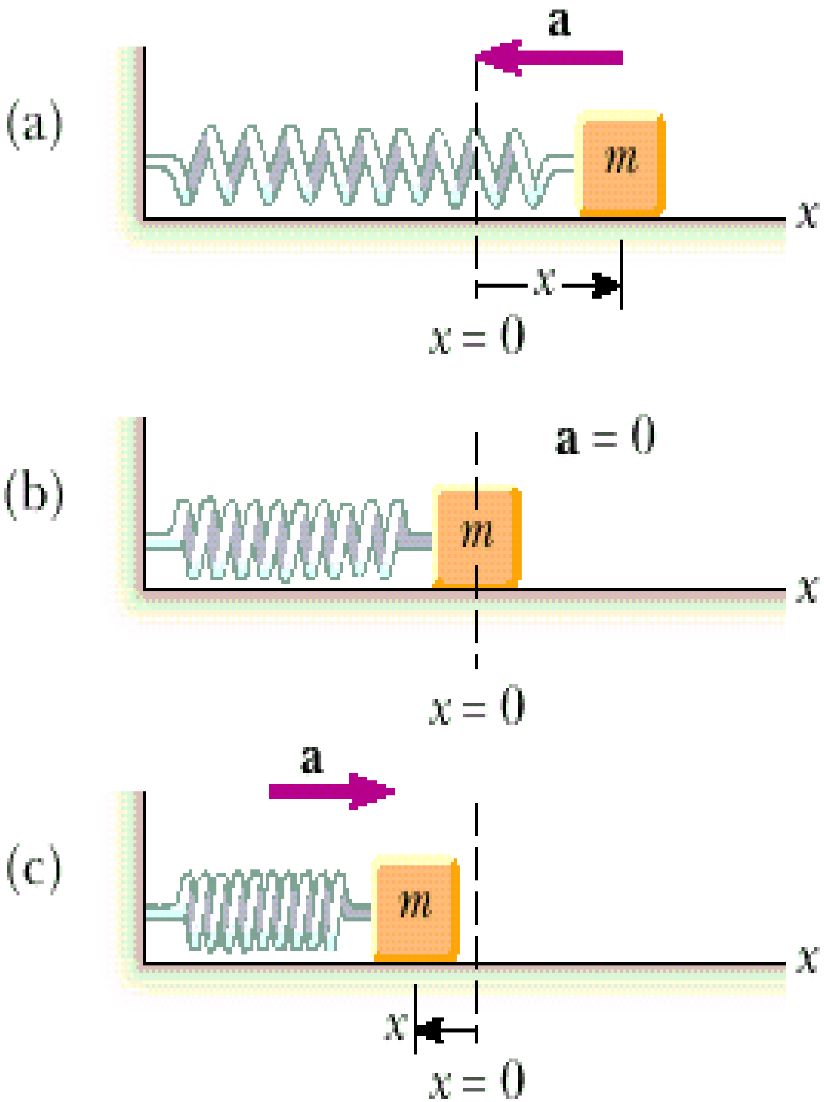
$$\frac{d^2x}{dt^2} = -\omega^2 x$$

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

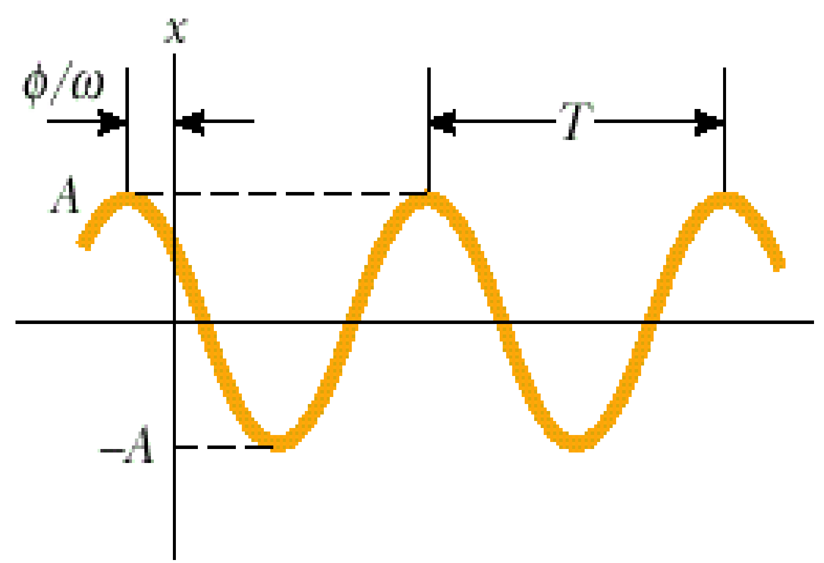
$$T = \frac{2\pi}{\omega} = 2\pi\sqrt{\frac{m}{k}}$$

$$f = \frac{1}{T} = \frac{1}{2\pi}\sqrt{\frac{k}{m}}$$

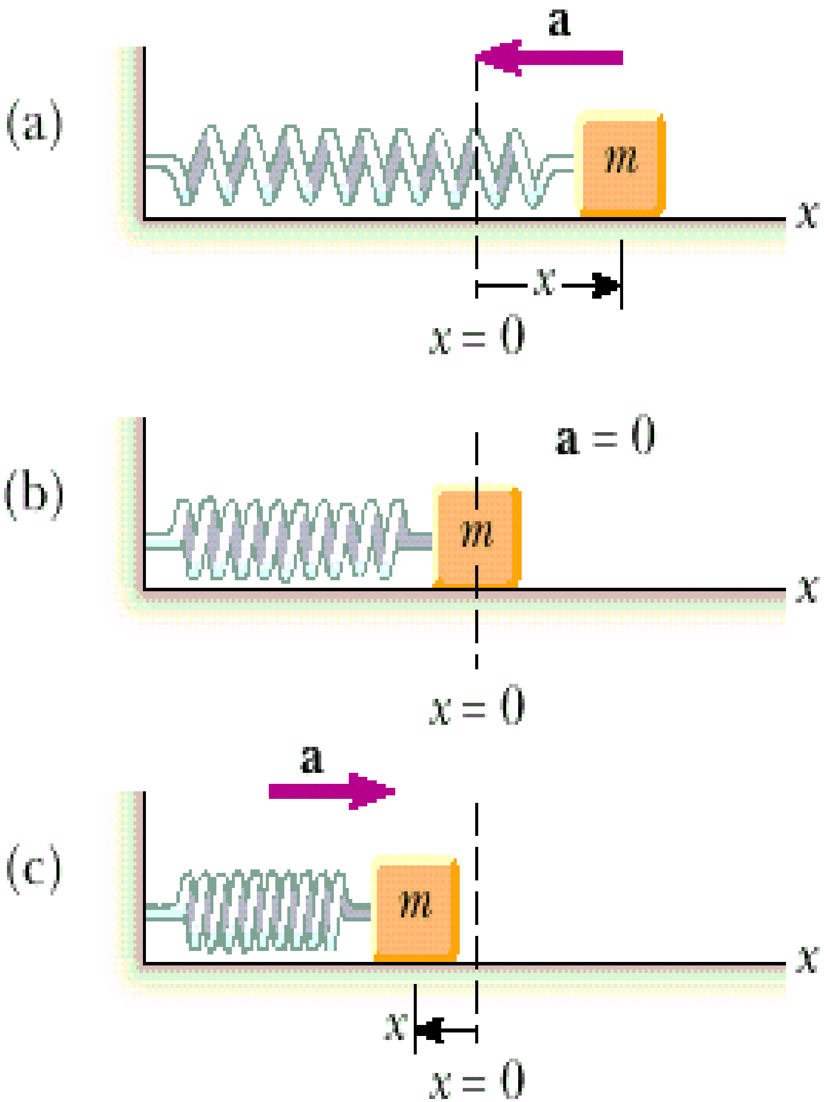
Movimiento Armónico Simple MAS



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



Movimiento Armónico Simple MAS

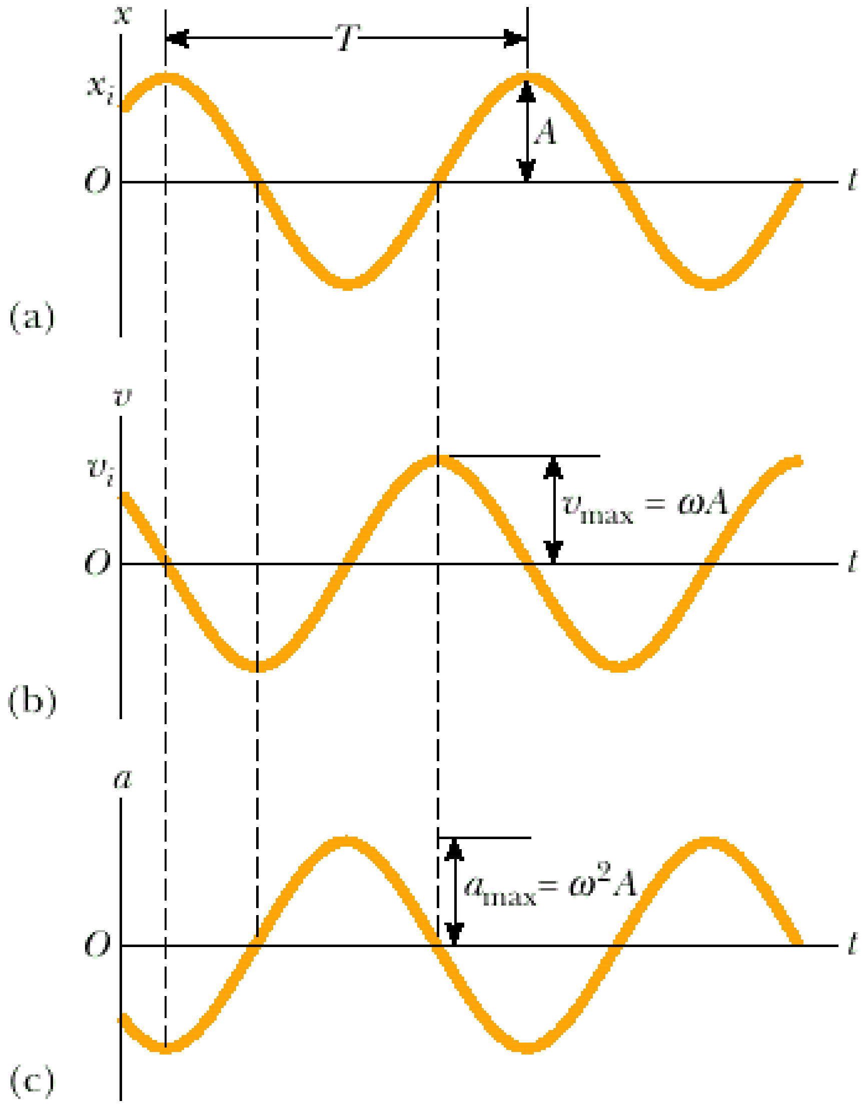


$$x = A\cos(\omega t + \phi)$$

$$v = \frac{dx}{dt} = -\omega A \sin(\omega t + \phi)$$

$$a = \frac{dv}{dt} = -\omega^2 A \cos(\omega t + \phi)$$

Movimiento Armónico Simple MAS



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

$$v = \frac{dx}{dt} = -\omega A\sin(\omega t + \phi)$$

$$a = \frac{dv}{dt} = -\omega^2 A\cos(\omega t + \phi)$$

Energía en el Oscilador Armónico Simple MAS

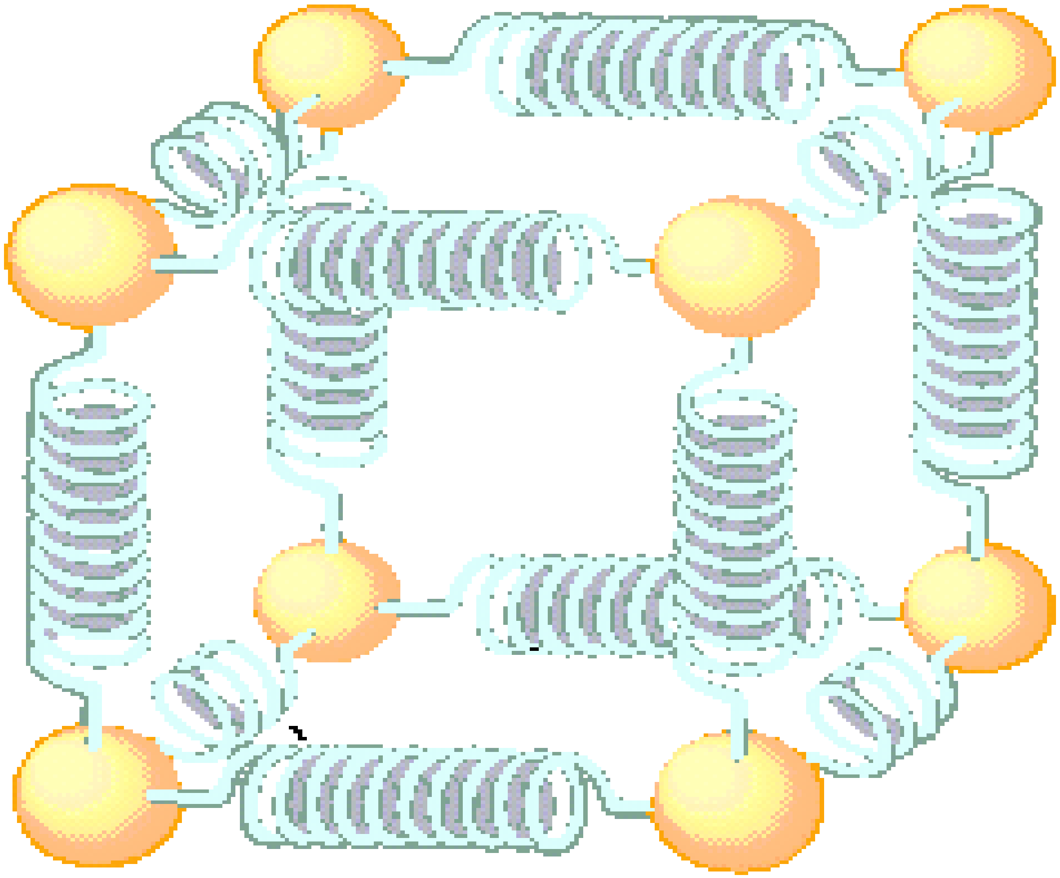
$$K = \frac{1}{2}\, mv^2 = \frac{1}{2}\, m\omega^2 A^2 \sin^2(\omega t + \phi)$$

$$U = \frac{1}{2}\, kx^2 = \frac{1}{2}\, kA^2 \cos^2(\omega t + \phi)$$

$$E = K + U = \frac{1}{2}\, kA^2 [\sin^2(\omega t + \phi) + \cos^2(\omega t + \phi)]$$

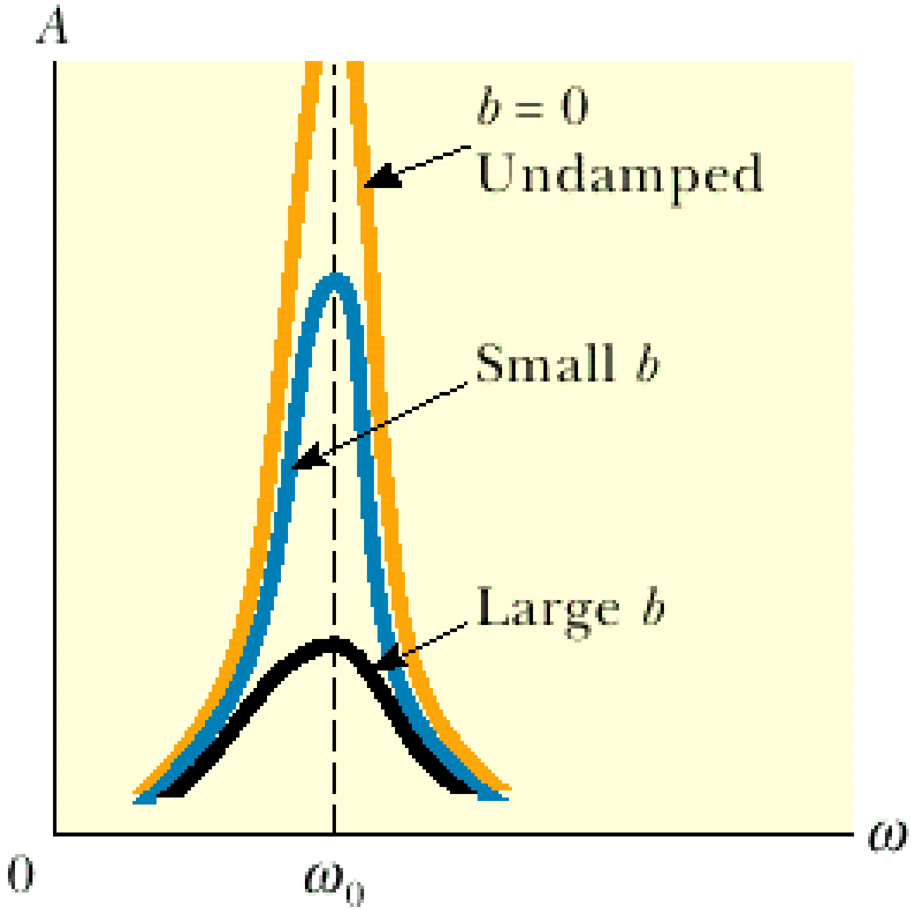
$$E = \frac{1}{2}\, kA^2$$

Modelo de átomos en una molécula



Oscilador Forzado Amortiguado

$$F_{ext} \cos \omega t - kx - b\frac{dx}{dt} = m\frac{d^2x}{dt^2}$$



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

$$A = \frac{F_{ext}/m}{\sqrt{(\omega^2 - \omega_0{}^2)^2 + \left(\frac{b\omega}{m}\right)^2}}$$