

CINEMÁTICA

$V_x = V_0 \cos \theta$
 $V_y = V_0 \sin \theta$ (depende del sist. ref.)

	1 DIMENSION		2 DIMENSIONES	
	media	instantánea	media	instantánea
Vel.	$V_m = \Delta x / \Delta t$	$v = dx/dt$	$\vec{V}_m = \Delta \vec{r} / \Delta t$	$\vec{v} = d\vec{r}/dt$
ac.	$a_m = \Delta v / \Delta t$	$a = dv/dt$	$\vec{a}_m = \Delta \vec{v} / \Delta t$	$\vec{a} = \vec{a}_n + \vec{a}_t$

(deriv. vectorial en función de t)
 $\vec{r} = (x, y)$

* Se suman todas las aceleraciones (sumíst. + grav....)

MRU $\left\{ \begin{aligned} [v = cte] [x = x_0 + vt] [a = 0] \end{aligned} \right.$
MRUA $\left\{ \begin{aligned} [v = v_0 + at] [x = x_0 + v_0t + \frac{1}{2}at^2] [a = \frac{dv}{dt}] \end{aligned} \right.$
MU $\left\{ \begin{aligned} [\omega = cte] [\theta = \theta_0 + \omega t] [a = 0] [\alpha = \frac{d\omega}{dt}] \end{aligned} \right.$
MUA $\left\{ \begin{aligned} [\omega = \omega_0 + at] [\theta = \theta_0 + \omega_0t + \frac{1}{2}at^2] [a_n = \frac{v^2}{r}] \end{aligned} \right.$

$[w = 2\pi f] [v = \omega R] [E_{str.}] L = 2\pi r, A = \pi r^2, v = \frac{4}{3}\pi r^3$

(4) Eq. TEMPERATURA: fórmula de la función. (hacer tantos si es necesario)
 $y = y(x)$ DEPENDE DE LA FORMA

DINÁMICA

$\left\{ \begin{aligned} [\Sigma \vec{F} = m\vec{a}] [F_r = NP] [N_e = \mu v] [N_e = \mu g] \end{aligned} \right.$
 $[F_{1 \rightarrow 2} = -F_{2 \rightarrow 1}]$ momento lineal: $[\vec{p} = m\vec{v}] [\vec{F} = \frac{d\vec{p}}{dt}] [\vec{L} = \vec{r} \times \vec{p}]$

ARRASTRE

$[F_r(\text{fluido}) = k\eta v] [k = 6\pi\eta R]$
 coef. viscosidad / coef. arrastre

Vel. límite: $(a=0, \theta=0)$

$V_{lim} = \frac{2g(P_{esf} - P_{fluido})R^2}{9\eta}$
 $V_{lim} = \frac{g(m_{esf} - m_{fluido})}{k\eta}$

EMPUJE: $F = mg - E \rightarrow F_T = F - F_r \Rightarrow ma = mg - E - F_r \rightarrow [E = m_A g = (\frac{4}{3}\pi R^3)g]$
 PARACAIDISTA: $[F_r = kv^2] \rightarrow F = ma = -mg + kv^2$

ENERGÍA

TRABAJO DE UNA F. (W=FEL) TRABAJO DE F. NO CONS

$dW = \vec{F} \cdot d\vec{s}$

$[dW = F ds \cos \theta] [W = \Delta(E_c + E_p)]$ para F. cons: $[W = \Delta E_c = -\Delta E_p] [P_{med} = \frac{W}{\Delta t}] [P = \vec{F} \cdot \vec{v}]$
 $[E_c = \frac{1}{2}mv^2]$ grav.: $[E_p = mgh]$ muelle: $[E_p = \frac{1}{2}kx^2]$ para F. cons: $[E_{m1} = E_{m2}]$

POTENCIAL MOLECULAR $[F = \frac{dE_p}{dr} \vec{u}_r] [E_p = -De + De(1 - e^{-\alpha(r-r_0)})^2] [E_p = -De(2(\frac{r}{r_0})^6 - (\frac{r}{r_0})^{12})]$

OSCILACIONES

(cuerda)

(aire)

$[v_p = \sqrt{\frac{F_T}{\mu}}] [N = \frac{m}{L}] [v_p = \sqrt{\frac{B}{\rho}}] [F = -kx = -bv]$ Ec. ondas $\left\{ \begin{aligned} [y = y(x \pm vt)] [\frac{d^2y}{dx^2} = \frac{\mu}{F_T} \frac{d^2y}{dt^2}] \end{aligned} \right.$
 tensión / densidad lineal


ONDAS ARMÓNICAS



$[y = A \sin(\omega t \pm kx + \phi_0)] [\frac{dy}{dt} = v_0 = -A\omega \cos(kx - \omega t \pm \phi)] [k = \frac{2\pi}{\lambda}] [\omega = 2\pi f] [v = \frac{1}{T}] [v_p = \lambda f]$

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

CINEMÁTICA MAS



 $(x \text{ mAx})$

OBSERVACIÓN: $\frac{d^2x}{dt^2} = (x(t))'' = -\omega^2 x$

 $\Rightarrow (x(t))'' + \omega^2 x = 0$

$$y = A \sin(\omega t \pm \varphi_0 + \pi/2)$$

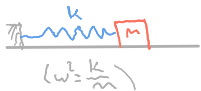
$$x(t) = A \cos(\omega t \pm \varphi_0)$$

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

$$v(t) = -A\omega \sin(\omega t \pm \varphi_0) \rightarrow \left(\frac{dv}{dt} = -A\omega^2 \cos(\omega t \pm \varphi_0)\right)$$

DINÁMICA MAS

MUELLE



$$F = m a = m(-\omega^2 x)$$

cte elástico

$$E_p = \frac{1}{2} k x^2$$

$$E_c = \frac{1}{2} m v^2$$

$$k = m \omega^2$$

$$E_m = E_c + E_p$$

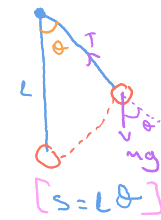
$$F = -kx$$

$$= -bv$$

$$E_m = \frac{1}{2} k A^2$$

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

PÉNDULO



ARCO / ÁNGULO MÁX.

$$v = \frac{ds}{dt} = L \frac{d\theta}{dt} \quad \alpha = \frac{dv}{dt} = L \frac{d^2\theta}{dt^2}$$

Si no tiene roz. (oscilaciones muy pequeñas) \rightarrow

$$\begin{cases} \sin \theta \approx \theta \\ v = \sqrt{g/L} \end{cases}$$

OSC. AMORTIGUADO

$$\left(\lambda > b\right) \quad \left[\frac{d^2x}{dt^2} + 2\gamma \frac{dx}{dt} + \omega_0^2 x = 0\right] \quad [x(t) = A e^{-\gamma t} \cos(\omega_1 t + \varphi)]$$

amortiguación

$$\gamma = \frac{\lambda}{2m}$$

$$\omega_1^2 = \omega_0^2 - \gamma^2$$

$$A = A_0 e^{-\gamma t} \quad \tau = \frac{m}{\lambda}$$

tiempo de extinción

- $\gamma < \omega_0$ subamortiguado
- $\gamma = \omega_0$ crítico
- $\gamma > \omega_0$ sobreamortiguado

TRANSFERENCIA E.

OSC. FORZADO

$$[\Sigma F = m a = -kx - \lambda v + F(t)]$$

En resonancia: $[A = cte]$

Variación E con el tiempo \rightarrow POTENCIA: $[P = \frac{1}{2} N v \omega^2 A^2] \quad [\Delta E = \frac{1}{2} N \omega^2 A^2 \Delta x]$

F transversal: Tensión

SISTEMAS DE PARTÍCULAS

$$[\vec{F}_{1 \rightarrow 2} = \frac{m_1 m_2}{m_1 + m_2} \cdot \frac{d\vec{v}_{1 \rightarrow 2}}{dt}]$$

$$[r_{1 \rightarrow 2} = r_1 - r_2]$$

$$(d(\vec{v}_1 - \vec{v}_2))$$

CENTRO DE MASAS

$$[r_{cm} = \frac{\sum m_i r_i}{M_{TOTAL}}] \rightarrow [M \cdot r_{cm} = \sum m_i r_i]$$

SIST. \rightarrow No AISLADO: acel. del centro de masas $= 0$

CONS. MOMENTO LINEAL (siempre)

$$[\vec{v}_{cm} = \frac{\sum m_i \vec{v}_i}{M_T}] = \frac{\vec{P}}{M_T}$$

vel. sistema

$$[\frac{d\vec{P}}{dt} = F]$$

COLISIONES

ELÁSTICAS $[p = cte] [E_c = cte]$

$$E_{c0} = E_{c0} + Q \Rightarrow (\frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2 = \frac{1}{2} m_1 v_1'^2 + \frac{1}{2} m_2 v_2'^2 + Q)$$

INELÁSTICAS $[p = cte] [E_c \neq cte]$

$$L_0 = p_0 \Rightarrow (m_1 \vec{v}_1 + m_2 \vec{v}_2 = m_1 \vec{v}_1' + m_2 \vec{v}_2')$$

$$[m_1 \vec{v}_1 + m_2 \vec{v}_2 = m_1 \vec{v}_1' + m_2 \vec{v}_2']$$

SIST.

$$[\frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2 = \frac{1}{2} m_1 v_1'^2 + \frac{1}{2} m_2 v_2'^2 + Q]$$

antes de colisión tras colisión