

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.	$a_m = \Delta v / \Delta t$	$a = dv/dt$	$\vec{a}_m = \Delta \vec{v} / \Delta t$	$\vec{a} = \vec{a}_n + \vec{a}_t$

$\omega = 2\pi f$ $v = \omega R$ $E_{st.} = \frac{1}{2} L i^2$ $L = 2\pi r$ $A = \pi r^2$ $v = \frac{4}{3} \pi r^3$

(4) Ecuación de la función: (hacer tantas si es necesario)
 $y = y(x)$ DEPENDE DE LA FORMA

(de las ecuaciones de F)

MRU
 MRUA
 MCU
 MCUA

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

$[v = cte] [x = x_0 + vt] [a = 0]$
 $[v = v_0 + at] [x = x_0 + v_0 t + \frac{1}{2} at^2] [a = \frac{dv}{dt}]$
 $[w = cte] [\theta = \theta_0 + \omega t] [a = 0] [\alpha = \frac{d\omega}{dt}]$
 $[w = \omega_0 + at] [\theta = \theta_0 + \omega_0 t + \frac{1}{2} at^2] [a_n = \frac{v^2}{r}]$

$[v = \omega R] [a_t = \omega R]$

DINÁMICA

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

ARRASTRE

$[F_r (fluido) = k h v] [k = E \pi R]$

Vel. límite: $(a=0, \theta=0)$

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

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

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: $[W = \Delta E_c = -\Delta E_p] [P_{med} = \frac{W}{\Delta t}] [P = \vec{F} \cdot \vec{v}]$
 $[E_c = \frac{1}{2} m v^2]$ grav.: $[E_p = mgh]$ muelle: $[E_p = \frac{1}{2} k x^2]$ 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 $[y = y(x \pm vt)]$
 $\frac{d^2 y}{dx^2} = \frac{\mu}{F_T} \frac{d^2 y}{dt^2}$

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



 $(x \text{ mds})$

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



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

cte elástico

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

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

$$k = m\omega^2$$

$$E_m = E_c + E_p$$

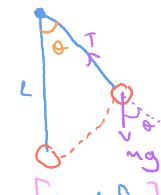
$$F = -kx$$

$$= -bv$$

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

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

PÉNDULO



$$s = L\theta$$

ARCO / ÁNGULO MÁX.

$$v = \frac{ds}{dt} = L \frac{d\theta}{dt} \quad \left[a = \frac{dv}{dt} = L \frac{d^2\theta}{dt^2} \right]$$

Si no tiene roz. (oscilaciones muy pequeñas) $\rightarrow \begin{cases} \sin\theta \approx \theta \\ v = \sqrt{g/L} \end{cases}$

OSC. AMORTIGUADO

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

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

cte amortiguación

$$\omega_1^2 = \omega_0^2 - \gamma^2 \quad [A = A_0 e^{-\gamma t}] \quad [\tau = \frac{m}{\lambda}]$$

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

tiempo de extinción

OSC. FORZADO

$$[\Sigma F = m\ddot{x} = -kx - \lambda v + F(t)]$$

En resonancia: $[A = \text{cte}]$

TRANSFERENCIA E.

F transversal: TENSIÓN

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

SISTEMAS DE PARTÍCULAS

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

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

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

CENTRO DE MASAS

$$\left[r_{cm} = \frac{\Sigma m_i r_i}{M_{TOTAL}} \right] \rightarrow [M r_{cm} = \Sigma m_i r_i]$$

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

CONS. MOMENTO LINEAL (SIEMPRE)

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

vel. sistema

MOMENTO LIN.

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

Colisión \rightarrow Elastica \rightarrow se conserva E_c
Inelastica \rightarrow no se conserva E_c

SIST.

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

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

antes de colisión tras colisión