

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

$[w = 2\pi f] [v = wR] [E_{\text{rot}}] L = 2\pi r, A = \pi r^2, v = \frac{4}{3}\pi r^3$

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

(deriv. parcial en función de T)  
 $P = (x, y)$

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

**MRU**  $\left\{ \begin{aligned} [v = cte] [x = x_0 + vt] [a = 0] \end{aligned} \right.$   
**MRUA**  $\left\{ \begin{aligned} [v = v_0 + at] [x = x_0 + v_0t + \frac{1}{2}at^2] [a = \frac{dv}{dt}] \end{aligned} \right.$   
**MCU**  $\left\{ \begin{aligned} [w = cte] [\theta = \theta_0 + w_0t] [a = 0] [\alpha = \frac{dw}{dt}] \end{aligned} \right.$   
**MCUA**  $\left\{ \begin{aligned} [w = w_0 + at] [\theta = \theta_0 + w_0t + \frac{1}{2}at^2] [a_n = \frac{v^2}{r}] \end{aligned} \right.$

$[v = wR] [a_t = wR]$

# DINÁMICA

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

## ARRASTRE

$[F_r(\text{fluido}) = khv] [k = E\pi R]$   
 coef. viscosidad  
 coef. arrastre

Vel. límite:  
 $(a=0, \theta=0)$

$\left\{ \begin{aligned} [V_{lim} = \frac{2g(P_{\text{pesf}} - P_{\text{fluido}})R^2}{9\eta}] [V_{lim} = \frac{g(m_{\text{pesf}} - m_{\text{fluido}})}{kh}] \end{aligned} \right.$

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:  $[W = \Delta E_c = -\Delta E_p] [P_{\text{med}} = \frac{W}{\Delta t}] [P = \vec{F} \cdot \vec{v}]$   
 $[E_c = \frac{1}{2}mv^2]$  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



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

$(T = \frac{2\pi}{\omega})$

## CINEMÁTICA MAS


  
 $(x \text{ m/s})$   $(x \text{ m/s})$ 
  
OBSERVACIÓN:  $\frac{d^2x}{dt^2} = (x(t))'' = -\omega^2 x$ 
  
 $\Rightarrow (x(t))'' + \omega^2 x = 0$

$$y = A \sin(\omega t \pm \phi_0 + \pi/2)$$

$$x(t) = A \cos(\omega t \pm \phi_0)$$

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

$$v(t) = -A\omega \sin(\omega t \pm \phi_0) \rightarrow \left(\frac{dv}{dt} = -A\omega^2 \cos(\omega t \pm \phi_0)\right)$$

## DINÁMICA MAS

### MUELLE



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

cte elástico

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

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

$$k = m\omega^2$$

$$E_m = E_c + E_p$$

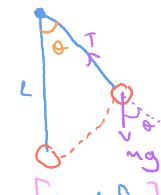
$$F = -kx$$

$$= -bv$$

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

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

### PÉNDULO



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

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

amortiguación

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

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

$$A = A_0 e^{-\gamma t}$$

$$\tau = \frac{m}{\lambda}$$

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

tiempo de extinción

## TRANSFERENCIA E.

## OSC. FORZADO

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

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

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

F transversal: Tensión

## 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  $= 0$

## 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.

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

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