

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

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

(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**  $\left\{ \begin{aligned} [v = v_0 + at] [x = x_0 + v_0 t + \frac{1}{2} at^2] [a = \frac{dv}{dt}] \end{aligned} \right.$   
**MCU**  $\left\{ \begin{aligned} [\omega = cte] [\theta = \theta_0 + \omega t] [a = 0] [\alpha = \frac{d\omega}{dt}] \end{aligned} \right.$   
**MCUA**  $\left\{ \begin{aligned} [\omega = \omega_0 + at] [\theta = \theta_0 + \omega_0 t + \frac{1}{2} at^2] [a_n = \frac{v^2}{r}] \end{aligned} \right.$

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

# 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

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

Vel. límite:  
 $(a=0, \theta=0)$

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

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  $\left\{ \begin{aligned} [y = y(x \pm vt)] [ \frac{d^2 y}{dx^2} = \frac{\mu}{F_T} \frac{d^2 y}{dt^2} ] \end{aligned} \right.$   
 tensión  $\leftarrow$  densidad lineal  $\leftarrow$  ( $\frac{1}{v^2}$ )


## ONDAS ARMÓNICAS



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

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

## CINEMÁTICA MAS


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

$$x(t) = A \cos(\omega t \pm \varphi_0 + \pi/2)$$

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

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

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

## DINÁMICA MAS

### MUELLE



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

cte elástico

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

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

$$k = m\omega^2$$

$$E_m = E_c + E_p$$

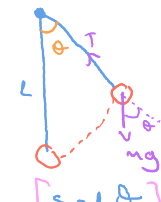
$$F = -kx$$

$$= -bv$$

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

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

### PÉNDULO



ARCO / ÁNGULO MÁX.

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

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

$$\sin \theta \approx \theta$$

$$v = \sqrt{g/L}$$

## OSC. AMORTIGUADO

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

amortiguación

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

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

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

tiempo de extinción

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

## TRANSFERENCIA E.

## OSC. FORZADO

$$\Sigma F = m\alpha = -kx - \lambda v + F(t)$$

En resonancia:  $A = cte$

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

## 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

$$r_{cm} = \frac{\Sigma m_i r_i}{M_{TOTAL}} \rightarrow M r_{cm} = \Sigma m_i r_i$$

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

## CONS. MOMENTO LINEAL (siempre)

$$\vec{v}_{cm} = \frac{\Sigma m_i \vec{v}_i}{M_T} = \frac{\vec{P}}{M_T}$$

$$P = \Sigma m \vec{v}$$

vel. sistema

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

## COLISIONES

ELÁSTICAS  $[p = cte] [E_c = cte]$

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

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

$$p_{c0} = p_{cfin} \Rightarrow (m_1 \vec{v}_1 + m_2 \vec{v}_2 = m_1 \vec{v}_1' + m_2 \vec{v}_2')$$

$\hookrightarrow$  Perfectamente inelásticas: Los cuerpos se juntan  $(m_1 v_1 + m_2 v_2 = (m_1 + m_2) v)$