

# MOVIMENTO OSCILATÓRIO

1) PÁG. 46

$$x = A \cdot \text{sen}(\omega t + \alpha)$$

$$v = A \cdot \omega \cdot \cos(\omega t + \alpha)$$

$$a = -A \cdot \omega^2 \text{sen}(\omega t + \alpha) \quad \text{e} \quad a = -\omega^2 x$$

2) PÁG. 46

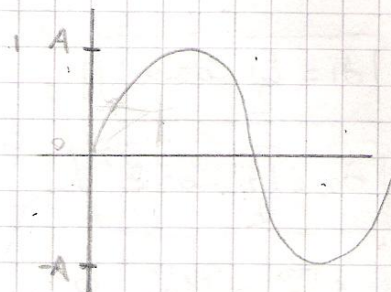
$$x = A \cdot \text{sen}(\omega t + \alpha) \quad t=0$$

a)  $0 = A \cdot \text{sen}(\alpha) \Rightarrow \text{sen} \alpha = 0 \Rightarrow \alpha = 0^\circ$

b)  $A = A \cdot \text{sen}(\alpha) \Rightarrow \text{sen} \alpha = 1 \Rightarrow \alpha = 90^\circ$

c)  $-A = A \cdot \text{sen}(\alpha) \Rightarrow \text{sen} \alpha = -1 \Rightarrow \alpha = -90^\circ$

d)  $\frac{1}{2}A = A \cdot \text{sen}(\alpha) \Rightarrow \text{sen} \alpha = 0,5 \Rightarrow \alpha = 30^\circ$



4) PÁG. 46

$$X = 10 \text{ cm} \quad (0,1 \text{ m}) \quad a = 1 \text{ m/s}^2 \quad T = ?$$

$$a = -\omega^2 x \Rightarrow \sqrt{\frac{a}{x}} = \omega \Rightarrow \boxed{\omega = 3,16 \frac{1}{s}}$$

$$T = \frac{2\pi}{\omega} \Rightarrow \boxed{T = 1,98 \frac{1}{s}}$$





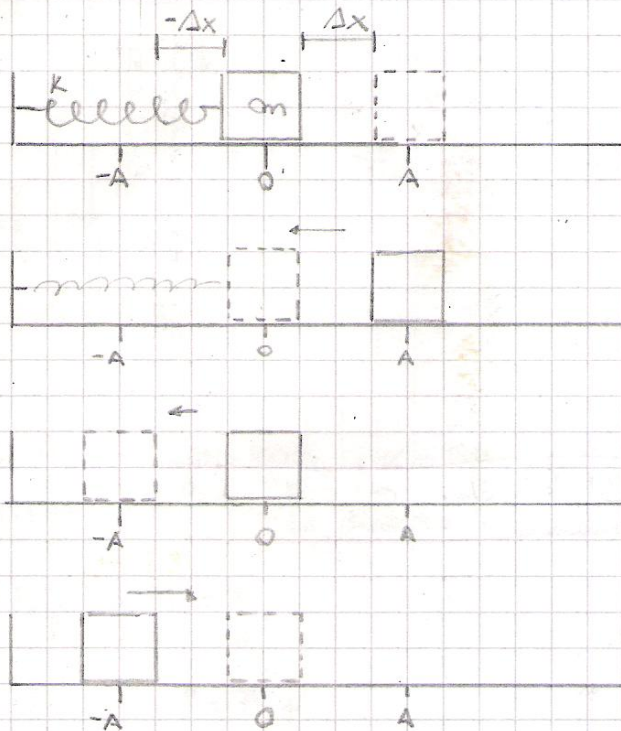
5) PÁG. 46

$$m = 3 \text{ kg}$$

$$k = 500 \text{ N/m}$$

$$\Delta x = 5 \text{ cm} (0,5 \text{ m})$$

$$x = A \cdot \text{Sen}(\omega t + \alpha)$$



FASE INICIAL

$$\omega = \sqrt{\frac{k}{m}}$$

$$\omega = 12,90 \frac{1}{s}$$

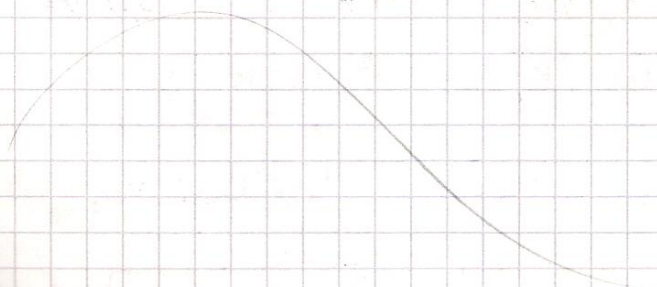
$$\circ \text{ FASE INICIAL} \rightarrow A = 0,5 \text{ m}; x = 0,5 \text{ m}; t = 0$$

$$0,5 \text{ m} = 0,5 \text{ m} \cdot \text{Sen}(\alpha) \Rightarrow 1 = \text{Sen} \alpha \Rightarrow \alpha = 90^\circ = \frac{\pi}{2}$$

QUEDARÍA ENTONCES...

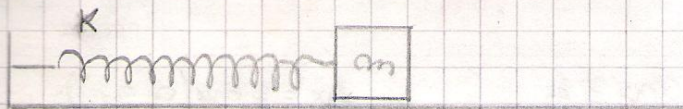
$$x = 0,5 \text{ m} \cdot \text{Sen}\left(12,90 \frac{1}{s} \cdot t + \frac{\pi}{2}\right)$$

$\alpha$  = ES COMO DECIR, DESDE DÓNDE PARTES EL SISTEMA. EN ESTE CASO DESDE  $\frac{\pi}{2}$  (QUE SERÍA LA AMPLITUD MÁXIMA)





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$$m = 100 \text{ kg}$$

$$K = ?$$

$$T = 1 \text{ s}$$

$$\omega = \sqrt{\frac{K}{m}} \Rightarrow \boxed{\omega^2 \cdot m = K} \quad (1)$$

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

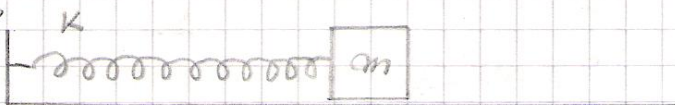
USANDO BCN (2) ...

$$\frac{2\pi}{1 \text{ s}} = \omega \Rightarrow \omega = 6,28 \frac{1}{\text{s}}$$

USANDO BCN (1) ...

$$K = (6,28)^2 \frac{1}{\text{s}^2} \cdot 100 \text{ kg} \Rightarrow \boxed{K = 3943 \text{ N/m} \approx 3,94 \times 10^3} \quad \checkmark$$

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$$K = 16 \text{ kgf/m} \quad (156 \text{ N/m}) \quad \text{kg m/s}^2$$

$$m = 10 \text{ kg}$$

$$F = ?$$

$$\omega = \sqrt{\frac{K}{m}} \Rightarrow \boxed{\omega = 3,94 \frac{1}{\text{s}^2}}$$

$$T = \frac{2\pi}{\omega} \Rightarrow T = 1,59 \text{ s}$$

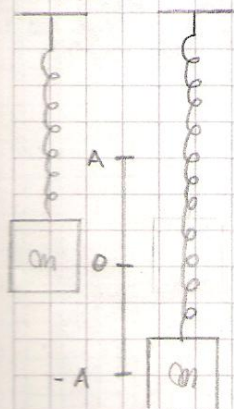
$$f = \frac{1}{T} \Rightarrow \boxed{f = 0,628 \text{ Hz}}$$

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$$F = 0,5 \text{ Hz}$$

$$m = 10,2 \text{ kg} \quad (100 \text{ N})$$

EQUILIBRIO



$$\omega = \sqrt{\frac{K}{m}} \Rightarrow \boxed{\omega^2 \cdot m = K} \quad (1)$$

$$K = (3,14)^2 \frac{1}{\text{s}^2} \cdot 10,2 \text{ kg}$$

$$\boxed{K = 100,56 \text{ N/m}} \quad \checkmark$$

$$f = \frac{1}{T} \Rightarrow T = \frac{1}{f} \Rightarrow \boxed{T = 2 \text{ s}}$$

$$T = \frac{2\pi}{\omega} \Rightarrow \omega = \frac{2\pi}{T} \Rightarrow \boxed{\omega = 3,14 \frac{1}{\text{s}}}$$

NOTA



$$W_{FC} = -\Delta E_p$$

$$W_{FC} = \Delta E_c$$

$\downarrow$   
WFC

$$x = A \sin(\omega t + \alpha)$$

HOJA Nº

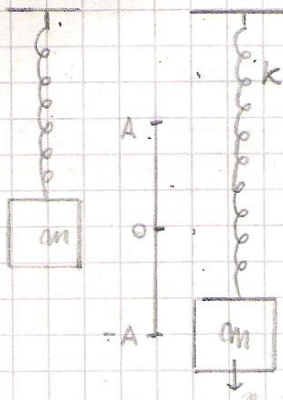
FECHA

(10) PÁG. 46

$$K = 1000 \text{ N/m}$$

$$m = 10 \text{ kg}$$

EQUILIBRIO



$$\omega = \sqrt{\frac{K}{m}} \Rightarrow \omega = 10 \frac{1}{s}$$

$$T = \frac{2\pi}{\omega} \Rightarrow T = 0,628 \text{ s}$$

(11) PÁG. 46

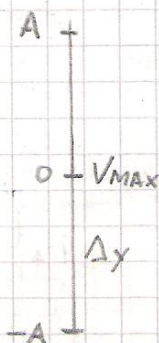
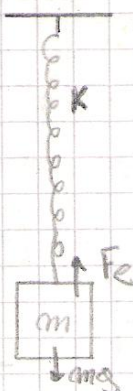
$$m = 100 \text{ kg}, K = 9800 \text{ N/m}$$

$$\omega = \sqrt{\frac{K}{m}} \Rightarrow \omega = 9,89 \frac{1}{s}$$

EQUILIBRIO

LO SUJETO DESJUNDOLO  
CABEL

$$T = \frac{2\pi}{\omega} \Rightarrow T = 0,635 \text{ s}$$



$$\Delta x_T = 2\Delta y (0,2 \text{ m})$$

$$x = A \sin(\omega t + \alpha)$$

$$0 = 0,1 \sin \alpha$$

$$\sin \alpha = 0 \Rightarrow \alpha = 0^\circ$$

Posición  
Inicial

EN POSICIÓN DE EQUILIBRIO ( $F = k \Delta y$ )

$$F_e - m g = 0 \Rightarrow F_e = m g \Rightarrow m g = k \Delta y \Rightarrow \frac{m g}{k} = \Delta y = A$$

$$\Delta y = 0,1 \text{ m}$$

$$W_{FC} = -\Delta E_{pe} \Rightarrow -(E_{pef} - E_{pei})$$

$$W_{FC} = -\frac{1}{2} K (\Delta x_T)^2 + \frac{1}{2} K (\Delta x_i)^2 \Rightarrow W_{FC} = -4900 \text{ N/m} \cdot 0,04 \text{ m}^2$$

$$W_{FC} = -196 \text{ J}$$

$$v_{\max} = A \omega \cos(\omega t + \alpha) \Rightarrow v_{\max} = 0,1 \text{ m} \cdot 9,89 \frac{1}{s} \Rightarrow v_{\max} = 0,98 \text{ m/s}$$

ESTO ES COMO PORQUE ESTAMOS EN LA  
POSICIÓN INICIAL DONDE  $t=0, \alpha=0$  Y  $v=v_{\max}$ .

NOTA



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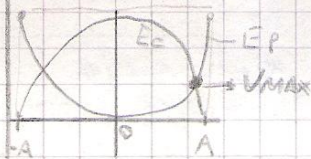
$$m = 0,05 \text{ kg (50g)}$$

$$A = 30 \text{ cm (0,3m)}$$

$$f = 50 \text{ Hz}$$

$$E_m = ?$$

$$\text{EN EQUILIBRIO } E_c = E_m$$



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

$$E_m = E_c + E_p$$

$$E_m = \frac{1}{2} m v^2 \Rightarrow v = \frac{\sqrt{2 E_m}}{m} = 94,23 \text{ s}$$

$$f = \frac{1}{T} \Rightarrow T = \frac{1}{f} \Rightarrow T = 0,02 \text{ s}$$

$$T = \frac{2\pi}{\omega} \Rightarrow \omega = \frac{2\pi}{T} \Rightarrow \omega = 314,15 \frac{1}{s}$$

$$E_m = \frac{1}{2} m \omega^2 A^2 \Rightarrow E_m = 0,025 \text{ kg} \cdot 8882,12 \frac{1}{s^2} \cdot \text{m}^2$$

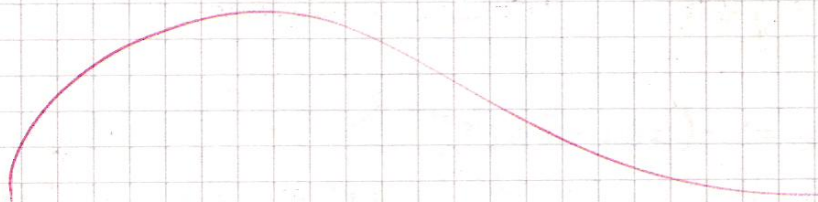
$$E_m = 222 \text{ J}$$

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$$m = 300 \text{ g (0,3 kg)} \quad k = 4,8 \text{ N/cm} \quad T = ?$$

$$\omega = \sqrt{\frac{k}{m}} \Rightarrow \omega = 4 \frac{1}{s}$$

$$T = \frac{2\pi}{\omega} \Rightarrow T = 1,57 \text{ s}$$





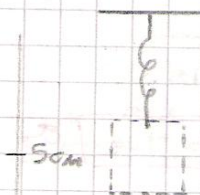
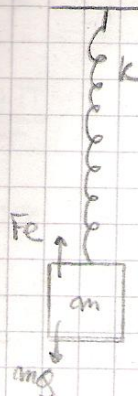
$$x = A \sin(\omega t + \alpha)$$

$$0 = \sin \alpha \Rightarrow \alpha = 0$$

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$$m = 0,3 \text{ kg} \quad k = 4,8 \text{ N/cm}$$

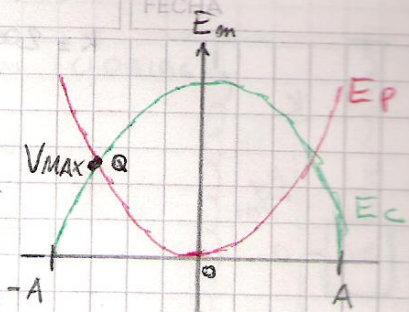
EQUILIBRIO



0 - VMAX

CONSTANTE

$$E_m = 0$$



EN EL PUNTO Q (EQUILIBRIO)  
V ES VMAX Y  $E_c = E_p$

$$\frac{1}{2} m v^2 = \frac{1}{2} k x^2$$

$$v = \sqrt{\frac{k x^2}{m}}$$

$$v = 0,2 \text{ m/s}$$

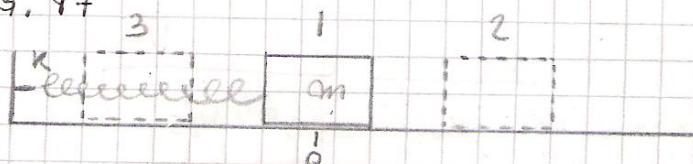
TAMBIÉN SE PUEDE HACER CON  
LA FORMULA  $v = A \omega \cos(\omega t + \alpha)$

$v = A \omega$  PERO NO SE PUEDE

PARA CUALQUIER CASO.

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REPOSO



a)  $\vec{v} = +$  ;  $\vec{a} = -$

b)  $\vec{v} = +$  ;  $\vec{a} = -$

c)  $v = 0$  ;  $a = 0$

d)  $\vec{v} = +$  ;  $\vec{a} = +$

e)  $v = 0$  ;  $a = 0$

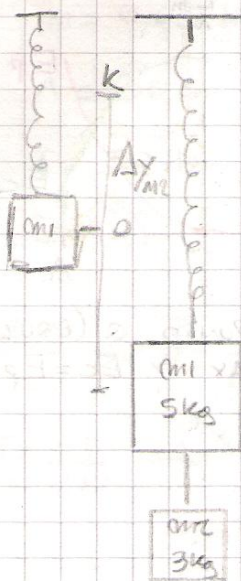
PREGUNTAR AL  
PROF.



$$m_1 = 5 \text{ kg}$$

$$m_2 = 3 \text{ kg}$$

$$k = 200 \text{ N/m}$$



$$\omega = \sqrt{\frac{k}{m_1}} \Rightarrow \omega = 6,32 \frac{1}{s}$$

$$T = \frac{2\pi}{\omega} \Rightarrow T = 0,99 \text{ s}$$

$$f = \frac{1}{T} \Rightarrow f = 1 \text{ s}^{-1} \text{ o } 1 \text{ Hz}$$

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

$$F_e - m_2 g = 0 \Rightarrow F_e = m_2 g \Rightarrow m_2 g = k x$$

$$\Rightarrow x = \frac{m_2 g}{k} \Rightarrow \Delta x_{m_2} = 0,15 \text{ m}$$

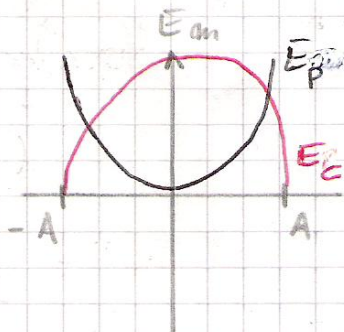
• EN EQUILIBRIO  $E_p = E_c$

$$\frac{1}{2} k x^2 = \frac{1}{2} m v^2$$

$$\sqrt{\frac{k x^2}{m}} = v_{\text{max}} \Rightarrow v_{\text{max}} = \sqrt{\frac{k (\Delta x_{m_2})^2}{m_1}} = 0,94 \text{ m/s}$$

• CUANDO LA AMPLITUD ES MÁXIMA,  $E_m = E_p$

$$E_m = E_p = \frac{1}{2} k x^2 \Rightarrow E_m = 2,25 \text{ J}$$





SOLICITA

$$\text{Sen}(2,09 \cdot 2 + 90) = \frac{x}{A}$$

$$x = A \cdot \text{Sen}(\omega t + \alpha)$$

HOJA N°

FECHA

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$$F = \frac{1}{3} \text{ s}^{-1} \quad \Delta t = 2 \text{ s} \quad x = 5,196 \text{ cm} \quad (0,05196 \text{ m})$$

$$F = \frac{1}{T} \Rightarrow T = \frac{1}{F} \Rightarrow T = 3 \text{ s} \quad A = ? \quad V_{(t)} = ?$$

$$\omega = \frac{2\pi}{T} \Rightarrow \omega = 2,09 \text{ s}^{-1}$$

$$\text{USANDO } x = A \text{ Sen}(\omega t + \alpha) \Rightarrow A = \frac{x}{\text{Sen}(\omega t + \alpha)}$$

$$A = \frac{5,196 \text{ cm}}{\text{sen}(2,09 \cdot 2 \text{ s})} \Rightarrow A = \frac{5,196 \text{ cm}}{\text{Sen}(239^\circ)} \Rightarrow A = \frac{5,196}{-0,85} \Rightarrow A = -6 \text{ cm}$$

$$V_y = A \omega \cos(\omega t + \alpha) \Rightarrow V_y = 6 \text{ cm} \cdot 2,09 \text{ s}^{-1} \cdot \cos(2,09 \cdot 2 \text{ s} + 0)$$

$$V_y = 12,54 \text{ cm/s} \cdot \cos(239,49) \Rightarrow V_y = 12,54 \text{ cm/s} \cdot (-0,5) \Rightarrow V_y = -6,27 \text{ cm/s}$$

$$0 - 0,062 \text{ m/s}$$

✓



$$0,153 \text{ m}$$

$$X = A \sin(\omega t + \alpha)$$

18)  $m = 3 \text{ kg}$   $\Delta y = 15,3 \text{ cm}$   $\Delta y_2 = 10 \text{ cm}$

$$1 \text{ RAD} = 2\pi = 360^\circ$$

$$1 \text{ RAD} = 2\pi$$

$$2,5 \text{ rad}$$

$$T = ?$$

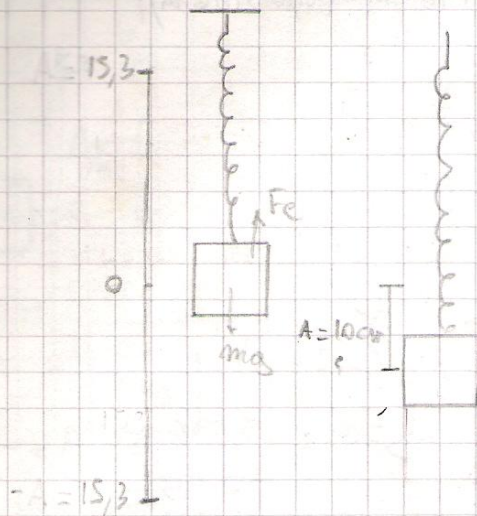
$$X(1,35) = ?$$

$$V(1,35) = ?$$

$$a(1,35) = ?$$

$$\omega = \sqrt{\frac{k}{m}} \Rightarrow \omega = 8 \frac{1}{5}$$

$$T = \frac{2\pi}{\omega} \Rightarrow T = 0,78 \text{ s}$$



EN EQUILIBRIO...

$$F_e - mg = 0 \Rightarrow F_e = mg \Rightarrow mg = k \cdot \Delta y \Rightarrow \frac{mg}{\Delta y} = k$$

$$\Rightarrow k = 192,15 \text{ N/m}$$

$$X = A \sin(\omega t + \alpha) \text{ PARA } t = 0 \text{ s} \Rightarrow \alpha = 0$$

$$X = 10 \text{ cm} \sin(8 \frac{1}{5} \cdot 1,35)$$

$$X = 10 \text{ cm} \sin(595,82)$$

$$180 - 2\pi$$

$$X = -8,27 \text{ cm}$$

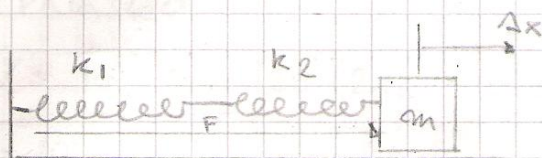
$$V_y = A \cdot \omega \cdot \cos(\omega t + \alpha) \Rightarrow V_y = 0,1 \text{ m} \cdot 8 \frac{1}{5} \cos(8 \frac{1}{5} \cdot 1,35)$$

$$V_y = 0,8 \text{ m/s} \cos(595,82) \Rightarrow V_y = 0,8 \text{ m/s} \cdot (-0,56) \Rightarrow V_y = -0,44 \text{ m/s}$$

$$a = -A\omega^2 \Rightarrow a = -6,4 \text{ m/s}^2$$



19) PAG. 47



EN ESTE SITUACION, LA FUERZA ES UNA SOLA, ENTONCES...

$$F = k_1 X_1 \Rightarrow X_1 = \frac{F}{k_1}$$

$$F = k_2 X_2 \quad + \quad X_2 = \frac{F}{k_2}$$

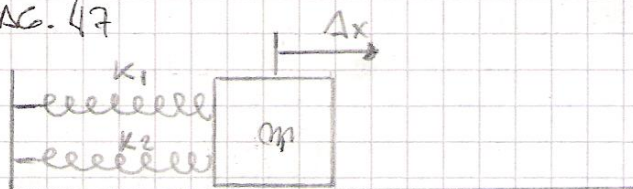
$$X_1 + X_2 = X = F \cdot \left( \frac{1}{k_1} + \frac{1}{k_2} \right)$$

$$F = \frac{X}{\frac{1}{k_1} + \frac{1}{k_2}} \Rightarrow F = \frac{X}{\frac{k_1 + k_2}{k_1 \cdot k_2}}$$

$$\Rightarrow F = X \left( \frac{k_1 \cdot k_2}{k_1 + k_2} \right)$$

NOTA C.

20) PAG. 47



$$F_1 = k_1 \Delta x$$

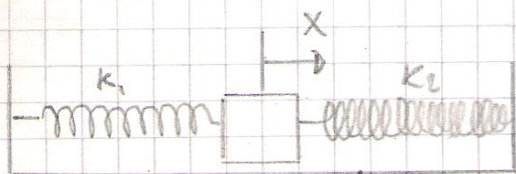
$$F_2 = k_2 \Delta x$$

$$F_1 + F_2 = F = k_1 X + k_2 X \Rightarrow F = X (k_1 + k_2)$$

NOTA B.



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$$F_1 = k_1 X$$

$$F = F_1 + F_2$$

$$F_2 = k_2 X_2$$

$$X = X_1 = X_2$$

$$F_1 + F_2 = F = k_1 X + k_2 X$$

$$F = X(k_1 + k_2)$$

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