# B.-Dinámica

$$1.-N=\frac{mg\cos\phi}{2}+\frac{3}{2}mv_0\dot{\phi}$$

$$2.-a)\ddot{\theta}-\frac{g}{l}\cos\theta=0;\ b)T=mg[3\operatorname{sen}\theta-1]$$

$$3.-\theta=\arccos\left(\frac{2}{3}\right)$$

$$4.-T(\theta)=m_2g(3\cos\theta-2)+m_2\frac{v_0^2}{L}$$

$$5.-N=\frac{m\left(g-\frac{H\rho_0v_0}{r}\right)}{\left(\frac{H}{R}\cos\theta+\operatorname{sen}\theta\right)}$$

$$6.-v=\sqrt{8ag};h_{max}=5a$$

$$7.-n=\frac{1}{2\pi}\frac{v_0\cos\alpha}{g}\sqrt{2gh+(v_0\operatorname{sen}\alpha)^2}$$

$8.-*$

$9.-*$

$$10.--\left(\frac{v_1a}{L-8\pi a}\right)\hat{\rho}+v_1L\hat{\theta}$$

$$11.-\dot{\phi}^2=\frac{g}{m_1L}(m_2-m_1\cos\vartheta);cond:\frac{m_2}{\cos\theta}\geq m_1\geq m_2\cos\theta$$

$$12.-\dot{\theta}=\sqrt{\frac{\mu g}{R}}$$

$$13.-\mu=\frac{g\cos\alpha-R\alpha}{Rw^2-g\operatorname{sen}\alpha}$$

$14.-*$

$$15.-t=\frac{r\operatorname{tg}\theta\ln 3}{2v_{max}\mu_d};N^\circ=\frac{\operatorname{tg}\theta\ln\left(4/3\right)}{2\mu}$$

$$16.-\mu_e=\frac{\Omega}{g}\left[4v_r^2+(R\Omega)^2\right]^{\frac{1}{2}}$$

$$17.-t=\frac{m}{k}\ln\left(1+\frac{2kv_0}{mg}\operatorname{sen}\theta\right)$$

18.−

$$a=\frac{g(m_1+m_2)\operatorname{sen}\theta-(\mu_1 m_1+\mu_2 m_2)\cos\theta}{m_1+m_2}$$

$$F=\frac{m_1 m_2 g\cos\theta}{m_1+m_2}(\mu_1+\mu_2)$$

$$19.-n=\frac{1}{2\pi}\sqrt{\frac{g}{R}}\int_0^x \operatorname{tg}\left(\operatorname{arctg}\left(\frac{v_0}{\sqrt{gR}}-\mu\sqrt{\frac{g}{R}}t\right)\right)dt$$

$$20.-a)T=\frac{mg\cos\alpha}{\operatorname{sen}\phi};b)\operatorname{tg}\phi=\mu$$

21.−

$a)ind:N\neq 0;$

$$b)F=\mu mR\dot{\theta}^2-\frac{mg}{\cos\theta}-\frac{mg}{4}evaluado*en*\operatorname{tg}\theta=\mu$$

22.−

$$a)w=\sqrt{\frac{\mu g}{r}+\frac{k}{m}\left(1-\frac{r_1}{r}\right)};$$

$b)N=mr_2w^2-k(r_2-r_1)-\mu mg$

$23.-F=\mu g(3m_2+m_1)$

24.−*

25.−

$$x=\frac{1}{2b}\ln\left(1+\frac{b}{g}v_0^2\right);si*v\to\infty*no*es*a\cot ada$$

$$t=\frac{1}{g}\sqrt{\frac{g}{b}}\left(\frac{\pi}{2}-\operatorname{arctg}\left(\sqrt{\frac{b}{g}}v_0\right)\right);a\cot ado$$

26.−

$ecuacion*de*movimiento*para*el*bloque*sobre*la*cuña:m\ddot{x}=-k[(x-X)-L_0]$

$ecuacion*para*la*cuña:ma_0=k[(x-X)-L_0]+F_0$

27.−*

28.−*

$$29.-v_2 = v_0\sqrt{\frac{m}{m + m_2}}\sqrt{1-\left(\frac{r_0}{r}\right)^2}\,\hat{r} + \frac{r_0}{r}v_0\hat{\theta}$$

$$30.-a)v = \sqrt{FR}$$

$$31.-a)\delta_{max} = \frac{2\mu_c mg}{k} \quad ;\mathrm{b)N} = \frac{\left(d-\frac{\mu_c mg}{k}\right)}{\left(\frac{2\mu_c mg}{k}\right)}$$

$$32.-\frac{\dot{\rho}^2}{2} = -\frac{ml^2v_0^2}{2}\left(\frac{l^2-\rho^2}{\rho^2 l^2}\right) + \frac{k}{2}\left(l^2-\rho^2\right)$$

$$33.\text{-}\ \mathrm{mg} + \frac{\mathrm{k}\pi\mathrm{d}}{\cos\theta\text{ - }2} \geq \frac{\mathrm{kR}\pi^2}{4(\cos\theta-2)}\text{;evaluando en }\theta = \pi/2\text{ se obtiene el resultado.}$$

$$34.\text{-}\ \mathrm{l} = \sqrt{\frac{\mathrm{w}_0^2 l^2}{3} + \frac{4}{3}\theta l}$$

35.-*

$$36.\text{-}\ \mu = \frac{\mathrm{gsen}\theta - R\alpha}{R\alpha^2 t^2 + g\cos\theta}\text{;se evalua en t = 0 y }\theta = 0\text{ obteniendose }\mu = \frac{\mathrm{R}\alpha}{\mathrm{g}}$$

$$37.-v = v_0 e^{-\mu\pi}\ ;\ \mathrm{t} = \frac{\mu}{\mathrm{v}_0}\left[e^{-\mu\pi}-1\right]$$

$$38.-es\ en\ \theta^* = \mathrm{arctg}\mu\left(1+\frac{2\mathrm{m}}{\mathrm{M}}\right);\ \mathrm{d}_{\mathrm{max}} = 2D\,\mathrm{sen}\,\theta^*$$

$$39.-a)v = \sqrt{2gh}\ ;\ \mathrm{b)N} = \mathrm{m}(4\mathrm{agh}+1)$$

40.-*

$$41.-a)K = \frac{1}{4}\frac{mv_0^2}{\left[\sqrt{l_0^2+D^2}-l_0\right]^2};\ \mathrm{b)}\ddot{x} = \frac{2\mathrm{k}}{\mathrm{m}}\left[\frac{l_0}{\sqrt{l_0^2+D^2}}-1\right]D$$

$$42.-w = \sqrt{\frac{g}{d}}\sqrt{\cos\alpha - \mu\,\mathrm{sen}\,\alpha}$$

$$43.-a)\dot{x}_m = \sqrt{2gL\,\mathrm{sen}\,\alpha\left(1-\frac{m}{M}\cos\alpha\right)}\ ;\ \mathrm{b)t} = \frac{1}{\sqrt{\mathrm{gsen}\alpha\left(1\text{ - }\frac{\mathrm{m}}{\mathrm{M}}\cos\alpha\right)}}$$

$$44.-v^{2}=\frac{4kp^{2}}{m}\left(1-\frac{\operatorname{sen}^{2}\theta}{(1-\operatorname{sen}\theta)^{2}}\right)-4gp\left(\frac{1}{1-\operatorname{sen}\theta}\right)$$

$$45.-b)\rho_{0}=\frac{g\operatorname{tg}\alpha}{v_{0}^{2}}$$

$$46.-\mu_{c}=\frac{2g}{\alpha t^{*}}\text{ con t}^{*}=\sqrt{\frac{6L}{5g}}$$

47.-*

$$48.-0=\ddot{r}-r\dot{\phi}^{2}\operatorname{sen}^{2}\alpha\,;0=-\mathrm{r}\dot{\phi}^{2}\operatorname{sen}\alpha\cos\alpha\,;0=2\dot{\mathrm{r}}\dot{\phi}\operatorname{sen}\alpha+\mathrm{r}\ddot{\phi}\operatorname{sen}\alpha$$

$$\mathrm{r}\dot{\phi}^{2}=r_{0}v_{0}\equiv cte$$

$$49.-v_{0}=\mu g\sqrt{\frac{2m_{1}}{k}\left(\frac{m_{1}}{m_{2}}-1\right)}$$

$$50.-t=\frac{\mu_{c}g}{k}$$

$$51.-x=\frac{1}{k}\frac{v_{0}^{2-n}}{2-n};\textit{para}\text{ demostrar basta evaluar en los n indicados}$$

52.-*

$$53.\text{-}\mathrm{a})\mathrm{h}=\frac{\mathrm{mv}_{0}}{\mathrm{c}}+\left(\frac{m}{c}\right)^{2}g\ln\left(\frac{mg}{mg+cv_{0}}\right);\mathrm{b})\mathrm{t}=\frac{\mathrm{m}}{\mathrm{c}}\ln\left(\frac{mg+cv_{0}}{mg}\right)$$

54.-*

$$55.-a)v=-v_{0}\hat{\rho}+\rho w_{0}\hat{\theta}\,;\mathrm{a}=-\rho\mathrm{w}_{0}^{2}\hat{\rho}+2v_{0}w_{0}\hat{\theta}$$

$$\mathrm{b})\rho=\frac{\left((\lambda\rho_{0})^{2}+\rho^{2}\right)^{\frac{3}{2}}}{2(\lambda\rho_{0})^{2}+\rho^{2}}$$

$$\mathrm{c})\mathrm{T}=\rho\mathrm{w}_{0}^{2}\quad\mathrm{N}=-2\mathrm{v}_{0}w_{0}$$

$56.- \mu = \dfrac{2\,\mathrm{tg}\,\alpha}{2}$

$57.- \mathrm{a)}\mathrm{v}_0 = \sqrt{\dfrac{\mu g}{\rho_0}}$

$\mathrm{b)}\mathrm{T}(\rho_0) = \dfrac{1}{2}\left(\mu m g + \rho_0 v_0^2\right)$

$58.- a)T = 3mg\,\mathrm{sen}\,\theta$

$\mathrm{b)}\mu = \dfrac{\mathrm{sen}\,\theta\cos\theta}{1+\mathrm{sen}^2\,\theta}$

$59.- a)t = \dfrac{\pi}{2}\sqrt{\dfrac{m_1+m_2}{k}}$

$\mathrm{b)w} = \dfrac{\mathrm{kd}^2 m_2}{2(m_1+m_2)}$

$60.- a)v = \dfrac{g}{w_0\,\mathrm{tg}\,\alpha}$

$\mathrm{b)r} = \dfrac{\mathrm{g}\cos\alpha}{\mathrm{w}_0\,\mathrm{sen}\,\alpha} \pm \dfrac{\sqrt{(g\cos\theta)^2 - (w_0 v_0\,\mathrm{sen}\,\alpha)^2}}{(w_0\,\mathrm{sen}\,\alpha)^2}$

61.– las respuestas se derivan de la solucion de la siguiente ecuacion diferencial :

$\mathrm{m}\ddot{\rho} + \mathrm{c}\dot{\rho} + \left(\mathrm{k} - \mathrm{mw}^2\right)\rho = kl_0$

$62.- h = l + \dfrac{1}{2}\dfrac{d^2-\delta^2}{\delta}$

$63.- \dot{\theta} = \sqrt{\dfrac{g}{R}\,\mathrm{tg}\,\alpha}\ ; t = \dfrac{L}{\mu g}\left(v_0 - \sqrt{\dfrac{g}{R}\,\mathrm{tg}\,\alpha}\right)$

$64.- N = \dfrac{m\,\mathrm{sen}\,\alpha}{\cos(\beta-\alpha)}\left(g - \dot{\theta}^2 L\cos\alpha\right)$ con $\dot{\theta}$ constante

65.-*

66.-*

67.-*

68.-*

69.-*

70.-*

$$71.-\Delta = \frac{3mg}{k} - d$$

$$72.-*$$

$$73.-a)\alpha z_{max} = \frac{m_0}{m}\left(1 - e^{-\alpha z_{max}}\right); \mathrm{b)} z_{max} = \frac{\ln k}{\alpha}; \mathrm{c)T} = \frac{2\pi}{\sqrt{\alpha \mathrm{g}}}$$

$$74.-a)s = \frac{\rho_0}{a}\sqrt{1+a^2}\ ; \mathrm{b)}\dot{\theta} = \frac{\mathrm{v_b}}{\rho_0\sqrt{1+a^2} + a v_0 t}; \mathrm{c)F} = \frac{\mathrm{m v_0^2}}{2\rho_0\sqrt{1+a^2}}$$

$$75.-a)m\ddot{z}_m = N\cos\alpha - mg\ ; m\ddot{x}_m = -N\operatorname{sen}\alpha\ ; \mathrm{M}\ddot{\mathrm{x}}_{\mathrm{M}} = N\operatorname{sen}\alpha$$

$$\mathrm{b)N} = \mathrm{mg}\frac{\cos\alpha}{1+\frac{\mathrm{m}}{\mathrm{M}}\operatorname{sen}^2\alpha} = N_0 cte$$

$$\mathrm{c)t}^* = \left(\frac{2H}{g - \frac{N_0\cos\alpha}{m}}\right)^{\frac{1}{2}}$$

$$76.-*$$

$$77.-*$$

$$78.-v_0 = w_0 L$$

$$79.-*$$

$$80.-*$$

$$81.-a)x_{max} = \frac{2mg(1-\mu_c)}{k}; \mathrm{b)v_{max}} = g(1-\mu_c)\left(\frac{m}{2k}\right)^{\frac{1}{2}}$$

$$\mathrm{c)}\left|2\mu_{\mathrm{c}} - 1\right| = \mu_e \text{ con } \mu_{\mathrm{c}} \le \mu_e$$

$$82.-a)m\left(\ddot{\rho}_1 - \rho_1 w_0^2\right) = -k\left(\rho_1 - \rho_2 - L_0\right)$$

$$m\left(\ddot{\rho}_2 - \rho_2 w_0^2\right) = -k\left(\rho_1 - \rho_2 - L_0\right)$$

$$\mathrm{b)}d = L_0 + \frac{kL_0}{m}t^2$$

$$\mathrm{c)d\ oscila\ alrededor\ de\ d_0} = \frac{L_0}{1 - \frac{m w_0^2}{2k}} \text{ con } \mathrm{w} = \left(\frac{2\mathrm{k}}{\mathrm{m}} - w_0^2\right)^{\frac{1}{2}}$$

$$83.- a) s = \frac{R}{\mu}\ln\left(1+\frac{v_0}{v^*}\right) \text{con } v^* = \frac{kR}{\mu m}$$

$b)$si k = 0 la particula nunca se detiene

$$84.\text{- a)} m_1\ddot{x}_1 = G\frac{m_1 m_2}{(x_2-x_1)^2}; m_2\ddot{x}_2 = -G\frac{m_1 m_2}{(x_2-x_1)^2}$$

$$\text{b)x} = \frac{\text{m}_2 a}{m_1+m_2} - R\frac{(m_2-m_1)}{m_1+m_2}$$

$$\text{c) v}_1 = \left[\frac{2Gm_2^2}{m_1+m_2}\left[\frac{1}{2R}-\frac{1}{a}\right]\right]^{\frac{1}{2}}; v_2 = \left[\frac{2Gm_1^2}{m_1+m_2}\left[\frac{1}{2R}-\frac{1}{a}\right]\right]^{\frac{1}{2}}$$

$$85.- a) T = \frac{\sqrt{2}m_2F_0}{m_1+m_2}; b) t_1 = \left(\frac{3\pi R m_1}{F_0}\right)^{\frac{1}{2}}$$

$$86.- a) t^* = \frac{m}{c}\ln\left(1+\frac{c}{a}v_0\right); b)\frac{a}{c} \le v_0 \text{ velocidad crece asintoticamenteal valor } \frac{\text{mg}}{\text{c}}(\mu\cos\alpha - \text{sen}\,\alpha)$$

$$\text{c)}\frac{\text{a}}{\text{c}} \ge v_0 \text{ v disminuye asintoticamente}$$

$$\text{d)v}_0 = \frac{a}{c}$$

$$87.- a)\delta_{max} = \frac{2mg}{k}(1-\mu_c)$$

$$b) v_{max} = \sqrt{\frac{m}{2g}g(1-\mu_c)}$$

$$\text{c)}\mu_{\text{e}} = 1-2\mu_c$$

$$88.- a) M = \frac{mv_0^2}{\rho_0 g}; b)(m+M+\Delta m)\ddot{\rho} = \frac{m\rho_0^2 v_0^2}{\rho^3} - (M+\Delta m)g; c)\Delta m = 2M$$

$$89.- a) t = \frac{L^2}{2v_0 R}; b) s = v_0 t$$

$$90.- a) v_0 = \sqrt{\frac{m}{M}\frac{g}{R}}$$

$$\text{b)N} = \frac{1}{2\pi}v_1\int_0^{\frac{\rho_0}{2v_1}}\sqrt{1+(v_0 t)^2}\,dt; c) F_0 = \frac{M\rho_0 v_0^2}{2} - mg$$

91.- *