Física General I

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Tarea #3

Los ejercicios están ordenados 1 por pagina

EXAMEN 1

P1) $f = 4\ rev/min = 0,067\ Hz$

a) $\omega = 2\pi f$

$\omega = 0,067 \cdot 2\pi = 0,42\ rad/s$

$\alpha = \frac{\omega_f - \omega_i}{t}$

$\alpha = 0,2\ rad/s^2$

$a_T = \alpha \cdot R$

$a_T = 0,21 \cdot 0,03m$

$a_T = 6,31 \times 10^{-3}\ m/s^2$ a

b) $a_c = \frac{v_t^2}{R} = 5,3 \times 10^{-3}\ m/s^2$ b

c) $\theta = \left(\frac{\omega_0 + \omega_f}{2}\right) t$

$\theta = 0,42\ rad$

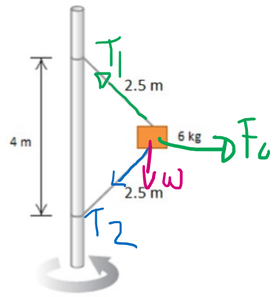
$\Rightarrow 0,42\ rad \cdot \frac{1\ vuelta}{2\pi\ rad}$

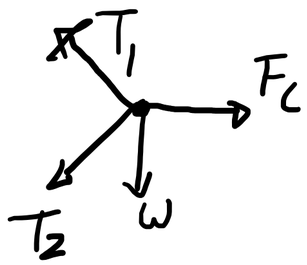
$\Rightarrow 0,067\ vueltas$ c

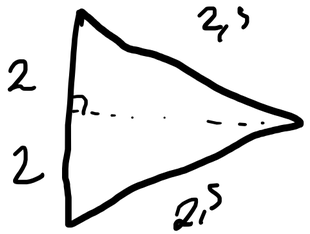
d) $a_{tot} = \sqrt{a_c^2 + a_T^2}$

$a_{tot} = 8,24 \times 10^{-3}\ m/s^2$ d

P2)







$\cos\theta = \frac{1,5}{2,5}$

$\text{sen}\,\theta = \frac{2}{2,5}$

a) $\Sigma F_y = 0$

$0 = T_{1y} - T_{2y} - W$

$mg = T_1 \text{sen}\theta - T_2 \text{sen}\theta$

$1 \cdot 9,8 = 100\left(\frac{2}{2,5}\right) - T_2\left(\frac{2}{2,5}\right)$

$\boxed{T_2 = 26,5\ N}$ a

b)

$100\cos\theta + 26,5\cos\theta = 6\frac{v_t^2}{1,5}$

$\frac{\left[100\left(\frac{1,5}{2,5}\right) + 26\left(\frac{1,5}{2,5}\right)\right]1,5}{6} = v_T$

$v_T = 4,37\ m/s$

$\boxed{\frac{v_T}{R} = 2,90\ rad/s \cdot \omega}$ b

c)

$T_y - W = 0$

$T\,\text{sen}\theta = mg$

$T = \frac{mg}{\text{sen}\theta} = 73,5\ N$

$\Sigma F_x = ma_c$

$T_x - ma_c = 0$

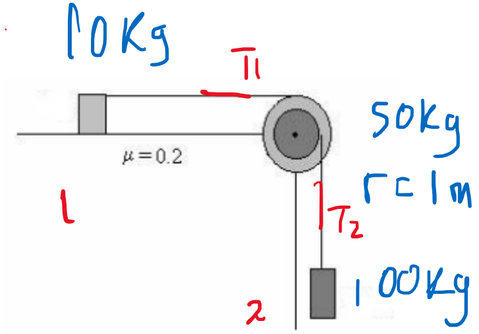
$T\cos\theta = \frac{mv_t^2}{R}$

$v_t = \sqrt{\frac{T\cos\theta \cdot R}{m}}$

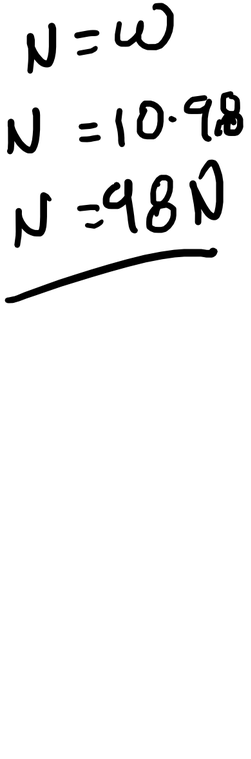
$v_t = 3,32\ m/s$

$\boxed{\omega = \frac{v_t}{R} = 2,21\ rad/s}$ c

P3)



1)



$\Sigma F_y = 0$ $\quad \Sigma F_x = ma$

$N = w$ $\quad T_1 - F_r = ma$

$N = 10 \cdot 9,8$ $\quad T_1 - \mu N = ma$

$N = 98\,N$ $\quad T_1 = 10a + 0,2 \cdot 98$

$T_1 = 10a + 19,6$

2)

$w_2 - T_2 = ma$

$T_2 = mg + ma$

$T_2 = 980 + 100a$

$\Sigma \tau = I\alpha$

$\Sigma \tau = \frac{mr^2}{2} \cdot \frac{a}{r}$

$T_1 + T_2 = \frac{mra}{2}$

$\tau_1 + \tau_2 = 25a$

$\tau_1 = (10a + 19,6) \cdot 1 \cdot \operatorname{sen} 90$

$\tau_1 = 10a + 19,6$

$\tau_2 = (980 + 100a) \cdot 1 \operatorname{sen} 90$

$-\tau_2 = -980 + 100a$

$10a + 19,6 - 980 - 100a = 25a$

$115a = 960,4$

$a = 8,35\ m/s^2$

$\omega = \frac{a}{r} = 8,35\ rad/s$ a

b) $a = 8,35 m/s^2$ b

$T_1 = 10a + 19,6$

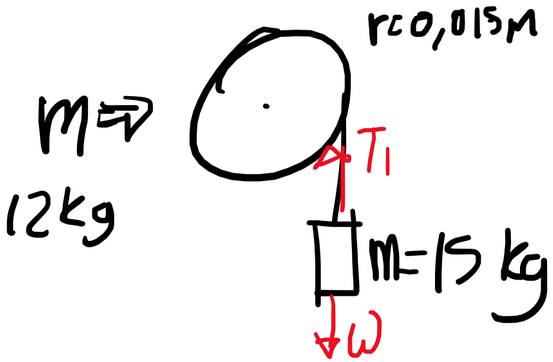
$T_1 = 103,11\,N$

$T_2 = 980 + 100a$

$T_2 = 1815\,N$

c

P4/



$Ma = T_1 - W$

$T_1 = ma + W$

$T_1 = 15a + 147$

$\Sigma \tau = I\alpha$

$\Sigma t = \frac{mr}{2}a$

$\tau_1 = -0{,}015(15a + 147)\sin 90$

$\tau_1 = -0{,}225a - 2{,}205$

$\frac{12 \cdot a \cdot 0{,}015}{2} = -0{,}225a - 2{,}205$

$a = 7\ M/S$

$T_1 = 15a + 147$

$T_1 = 42\ N$ a

$d = Vt + \frac{1}{2}at^2$

$t = 1{,}69\ s$ d

$d = \frac{(V_0 - V_f)}{2}t$

$V_f = 11{,}83\ M/S$ c

$K = \frac{1}{2}MV^2 + \frac{1}{2}I\omega^2$

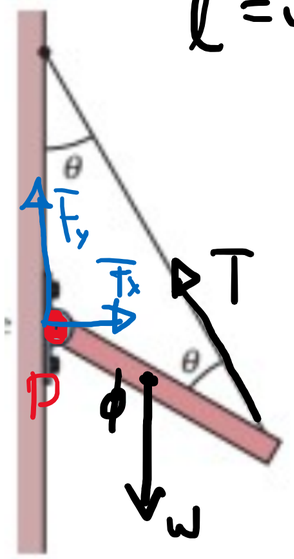
$V = \omega r$

$11{,}83 = 0{,}15\omega$

$\omega = 78{,}87$

$I = \frac{mr^2}{2} = 0{,}135$

$\Delta K = 1259{,}5\ J$ b



$\ell = 3m$

$\phi = 120°$

$\theta = 30°$

Torque en P.

$\tau_w = r w \operatorname{sen}\phi$

$\tau_w = \frac{\ell}{2} \cdot 222 \cdot \operatorname{sen} 120°$

$\tau_w = -288,39\ Nm$

$\tau_T = r T \operatorname{sen}(30)$

$\tau_T = \ell \cdot T \operatorname{sen}(30)$

$+ \quad \tau_T = +1,5T\ Nm$

$\Sigma \tau = 0$ equil.

$1,5T - 288,39 = 0$

$T = 192,26\ N$ c

en P

$\Sigma F_x = 0$

$F_x - T_x = 0$

$F_x = T_x$

$F_x = T \cos 30$

$F_x = 166,5\ N$

$\Sigma F_y = 0$

$F_y - W = 0$ b

$F_y = W$

$F_y = 222\ N$

EXAMEN 2

EJERCICIO 1 (20 puntos)

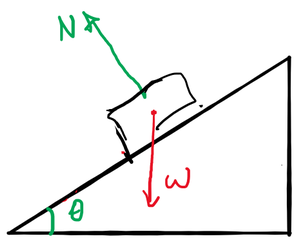
En un camino horizontal, una curva de 100 m de radio tiene el peralte adecuado para una rapidez de 20 m/s (Para esta velocidad no hay fricción con la pista en sentido radial). Si un automóvil toma dicha curva a 50 m/s.

a) Dibuje los diagramas de fuerza cuando el objeto viaja a 20m/s y cuando el objeto viaja a 40m/s respectivamente. (6 puntos)

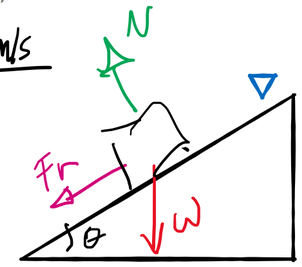
b) Calcule el ángulo de la pista de peralte (4 puntos)

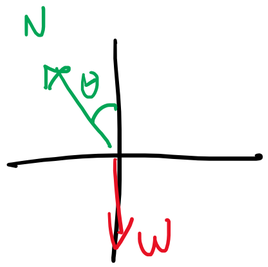
c) Calcule la velocidad angular que tiene en la curva a 50m/s. (5 puntos)

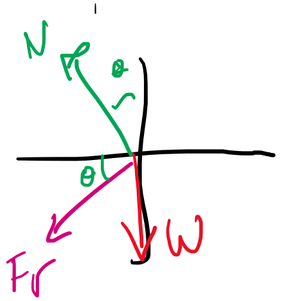
d) ¿Qué coeficiente mínimo de fricción estática debe haber entre los neumáticos y la carretera para no derrapar? (5 puntos)



a 20m/s







a

$r = 100m$

$V_p = 20m/s$

$V = 50m/s$

a 50m/s

$\Sigma F_y = 0$

$N\cos\theta - W = 0$

$N = \frac{mg}{\cos\theta}$

$\Sigma F_x = ma_c$

$N\operatorname{sen}\theta = m\frac{V^2}{R}$

$\frac{mg}{\cos\theta}\operatorname{sen}\theta = m\frac{V^2}{R}$

$mg\tan\theta = m\frac{V^2}{R}$

$\tan\theta = \frac{V^2}{gR}$

$\theta = \tan^{-1}\left(\frac{V^2}{gR}\right) = 22,2°$ b

$\omega = \frac{V_T}{R}$

$\omega = \frac{50m/s}{100m} = 0,5\ rad/s$ c

Para que no derrape

$F_r = F_c$

$\mu N = m\frac{V^2}{R}$

$\mu \cdot mg = m\frac{V^2}{R}$

$\mu = \frac{V^2}{Rg}$

$\mu = \frac{(50)^2}{100 \cdot 9.8} = 2,5$ d

P2) $\omega_f = \frac{3\,rev}{min} \cdot \frac{1\,min}{60\,s} \cdot \frac{2\pi\,rad}{1\,rev}$

$r = 0{,}03\,m$ $\omega_f = 0{,}314\,rad/s$

$\alpha = 15\,rad/s^2$

$\omega_f = 3\,rev/min$

a) $\omega_f = \omega_0 - \alpha t$

$\frac{\omega_f}{\alpha} = t = \frac{0{,}314\,rad/s}{15\,rad/s^2} = 0{,}028$

$a_T = \alpha r$

$a_T = 15\,rad/s^2 \cdot 0{,}03\,m$

$a_T = 0{,}45\,m/s^2$ a

b)

$V_t = \omega r$

$V_t = 0{,}314 \cdot 0{,}03$

$V_t = 9{,}42 \times 10^{-3}\,m/s$

$a_r = \frac{V_t^2}{r} = \frac{(9{,}42 \times 10^{-3})^2}{0{,}03}$

$a_r = 2{,}96 \times 10^{-3}\,m/s^2$ b

c) $\theta = \frac{\omega_f^2 - \omega_0}{2\alpha} = \frac{0{,}314^2 - 0}{2 \cdot 15}$

$\theta = 3{,}286 \times 10^{-3}\,rad$

$s = r \cdot \theta = 0{,}03 \cdot 3{,}286 \times 10^{-3}$

$s = 9{,}86 \times 10^{-5}\,m$ c

d)

$a_{Tot} = \sqrt{a_T + a_c}$

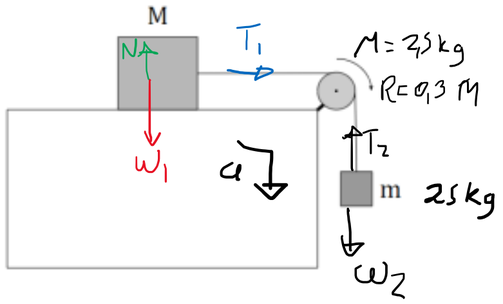
$a_c = a_r = 2{,}96 \times 10^{-3}\,m/s^2$

$a_T = 0{,}45 \cdot m/s^2$

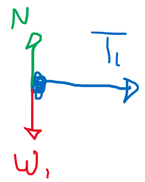
$a_{Tot} = \sqrt{0{,}45^2 + (2{,}96 \times 10^{-3})^2}$

$a_{Tot} = 0{,}45\,m/s^2$ d

$M = 15\,kg$



Para M



$T_1 = ma$

$T_1 = 15a$

Para m

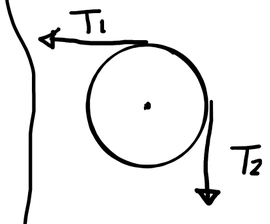
$w_2 - T_2 = ma$

$T_2 = mg - ma$

$T_2 = 245 - 25a$

Torques en la polea

$I = \frac{MR^2}{2}$



$+\tau_1 = (0,3) \cdot T_1 \, Sen\, 90$

$+\tau_1 = 4,5a$

$-\tau_2 = -(0,3) \cdot T_2 \cdot Sen\, 90$

$-\tau_2 = -73,5 + 7,5a$

$\sum \tau = I\alpha$

$\sum \tau = \frac{mr^2}{2} \cdot \left(\frac{a}{r}\right)$

$\sum \tau = \frac{2,5 \cdot (0,3)}{2} a$

$\tau_1 + T_2 = \frac{3}{8} a$

$4,5a - 73,5 + 7,5a = \frac{3}{8} a$

$11,625a = 735$

$a = 6,32\,m/s^2$ a

b)

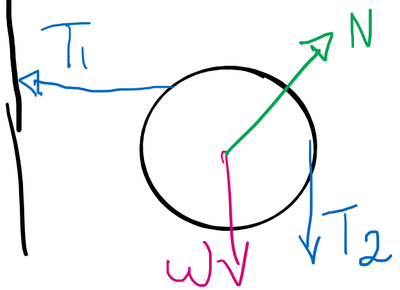
$T_1 = 15a = 15 \cdot 6,32$

$T_1 = 94,8\,N$

$T_2 = 245 - 25 \cdot 6,32$ b

$T_2 = 86,93\,N$

c) fen la polea



$\sum F_x = 0$

$T_1 - N_x = 0$

$T_1 = N_x$

$94,8 = N_x$

$\sum F_y = 0$

$N_y - T_2 - w = 0$

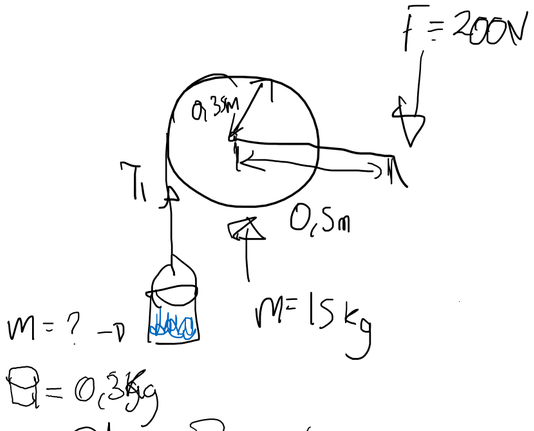
$N_y = T_2 + w$

$N_y = 86,93 + 2,5 \cdot 9,8$

$N_y = 111,43\,N$

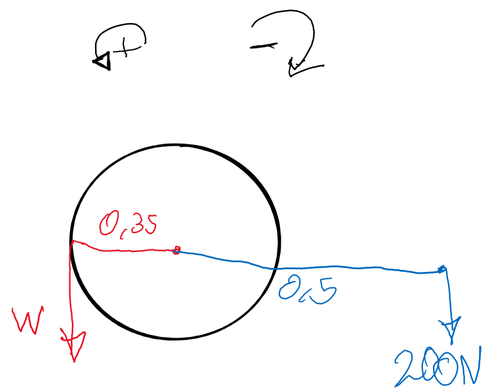
$N = \sqrt{N_x^2 + N_y^2}$

$N = 146,30\,N$ c



$V = 0,3kg$

$a = 2 m/s$



$\sum \tau = I\alpha \qquad \alpha = \frac{a}{r}$

$\tau_W = r W \operatorname{sen} 90$

$\tau_W = +0,35\,W \; Nm$

$\tau_F = r F \operatorname{sen} 90$

$\tau_F = 0,5 \cdot 200$

$\tau_F = -100 Nm$

$\tau_{neto} = \sum \tau_i$

$\tau_{neto} = \tau_W + \tau_F$

$\tau_{neto} = 0,35 \cdot (300,7) - 100$

$\tau_{neto} = 5,2485 \; Nm$ b

$0,35W - 100 = I \cdot \frac{a}{r}$

$0,35W - 100 = \frac{mr^2}{2} \cdot \frac{2}{r}$

$0,35W - 100 = 15 \cdot 0,35$

$W = \frac{15 \cdot 0,35 + 100}{0,35}$

$\Rightarrow W = 300,7 N$

$m = W/g = 300,7 / 9,8$

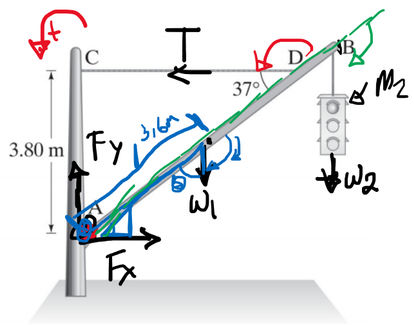
$m = 30,68 kg$

$m_{agua} = m - 0,3kg$

$m_{agua} = 30,38 kg$ a

$m_1 = 12kg$ $m_2 = 21,5kg$ $l = 7,2m$

$\{ \sum F = 0$ $\{ \sum \tau = 0$ $\tau = rF\sin\theta$



$\sum F_{Ax} = 0$

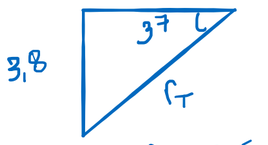
$Fx - T = 0$

$Fx = T$

$\sum t_{Ay} = 0$

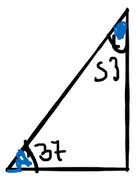
$Fy - w_1 - w_2 = 0$

$Fy = w_1 + w_2$



$\sin 37 = \frac{3,8}{r_T}$

$r_T = 6,314m$



$\tau_1 = 3,6m(12kg \cdot 9,8m/s^2) \cdot \sin 53$

$\tau_1 = 338,11\ Nm$

$\tau_2 = 7,2m \cdot (21,5kg \cdot 9,8m/s^2) \cdot \sin 53°$

$\tau_2 = 1211,52\ Nm$

$\tau_T = (6,314m) \cdot T \cdot \sin 37$

$\tau_T = 3,8T$

$\sum \tau = 0$

$\tau_T - \tau_1 - \tau_2 = 0$

$3,8T - 338,11 - 1211,52 = 0$

$3,8T = 1549,63 \rightarrow$ **$T = 407,79\ N$ (a)** Rta/

$F_x = T$

$F_x = 407,79\ N$

$F_y = 210,7 + 117,6$ Rta/

$F_y = 328,3\ N$