Reminders 07-29-09:

7th Webassign due Wed. 11:59PM

· Exam 3 Chapters 6-8 Thursday

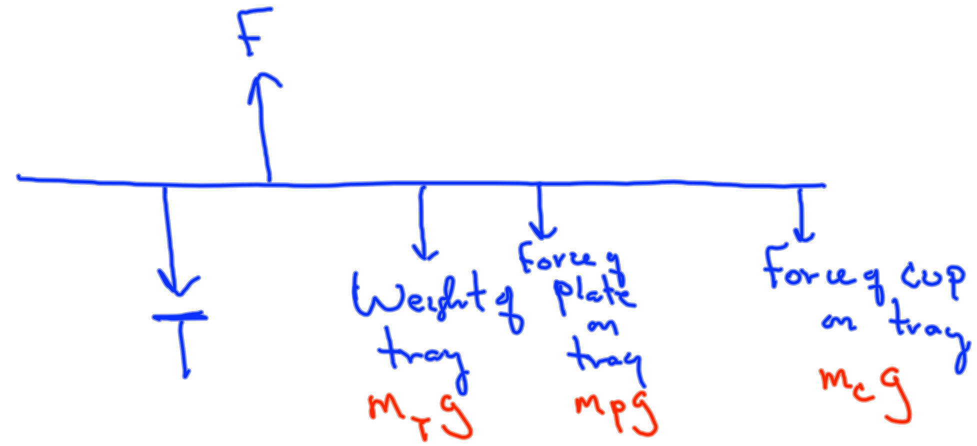
· Go over Problem 2 and 5 Exam 2 Fall 2001, Problem 1 Exam 4 Fall 2001, Problem 1,4, and 5, Exam 3 Spring 2000. I don't have examples from chapters 6 and 7 on these exams. Just go over the homework and class problems from chapters 6,7, and 8.

· Standard assessment p.169 answers D, B, B, C, B, B, D, it goes past ring. Standard assessment p.195 answers C,D,A,C,D #6 800,000km

Standard assessment p.227 answers C, A, C, A, B, C

Objectives:

- Rotational Dynamics
- Moment of Inertia
- Impulse and Momentum



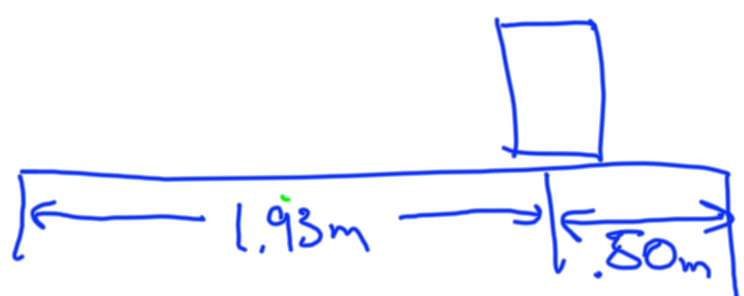
$$\Sigma F_y = F - T - m_T g - m_p g - m_c g = 0$$

$T = 56\,N$

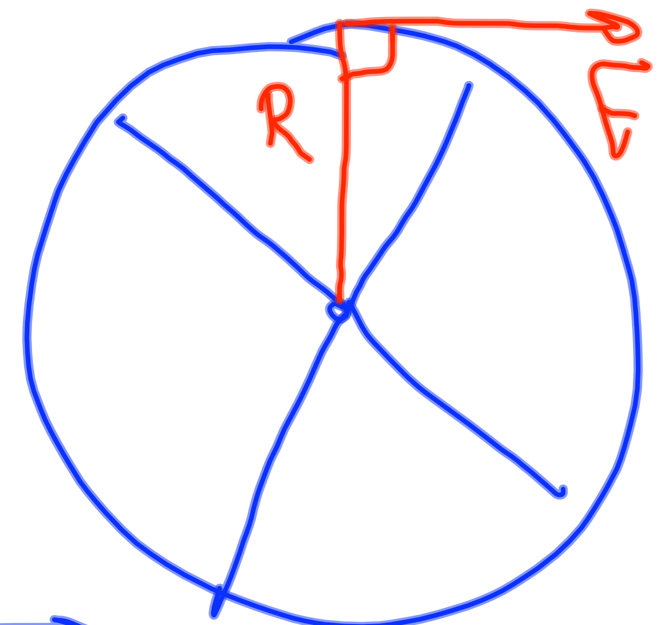
$F = 70\,N$

Compare to #7a #8 Webassign

#8



#6



$r = .38\,m$

$\alpha = 2.53\,rad/s^2$

$F = 0.10\,N$

$$\sum \vec{F} = m\vec{a}$$

$$\sum \vec{\tau} = I\alpha$$

$$\sum \vec{\tau} = FR = I\alpha$$

$$I = \frac{FR}{\alpha} = \frac{(.10\,N)(.38\,m)}{2.53/s^2}$$

$$= .015\,Kg\,m^2$$

#9 Gwin $v_i =$

$v_f = 0$

$d = .241 m$

$R = .120 m$

$m = .60 kg$

$\Delta x = 13 m$

$I = 5.8 \times 10^{-3} kg\text{-}m^2$

want α

$$v_f^2 - v_i^2 = 2 a \Delta x$$

$$a = \frac{v_f^2 - v_i^2}{2 \Delta x} = \frac{-v_i^2}{2 \Delta x}$$

$$a = R\alpha$$

$$\alpha = \frac{a}{R} = \left(\frac{-v_i^2}{2 \Delta x}\right) \frac{1}{R}$$

b) $\tau = I\alpha$

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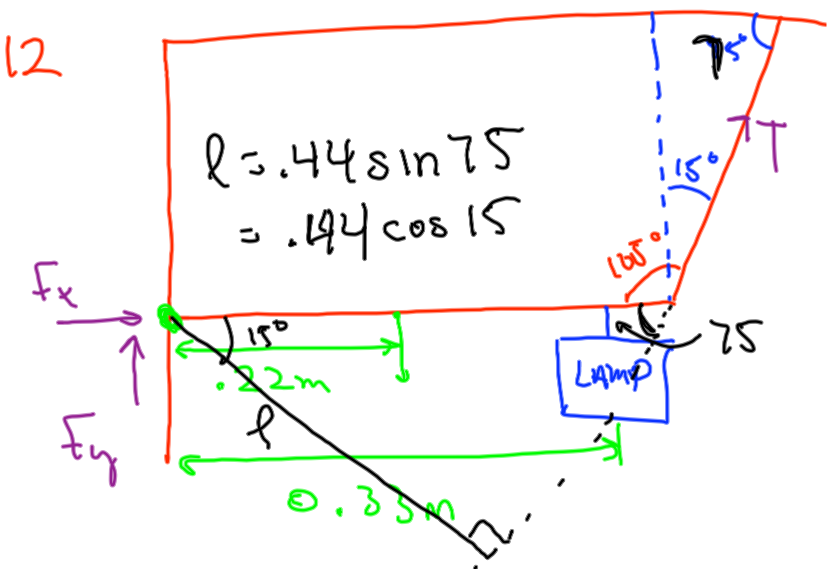


Torque due to pole

$\tau_g = W_g(.22)$

$= (27N)(.22m) = 5.94 mN$

$\tau_{Lamp} = W_L(.33m)$

$= (64N)(.33m) = 21.1 Nm$

$\Sigma \tau : \tau_{rope} - 5.94 Nm - 21.1 Nm = 0$

$\tau_{rope} = 27.06 Nm$

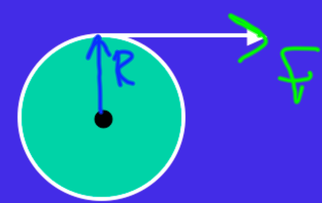
$= T_{rope} \, l = 27.06 Nm$

$$T_{rope} = \frac{27.06 Nm}{.44 \sin 75}$$

$\doteq 63.7N$

Rotational Dynamics-Ex

A uniform disk of radius 0.140 m and mass 6.00 kg is pivoted so that it rotates freely about its axis. A string on the pulley is pulled with a force of 25.0N. What is τ and α? What is ω after 5.00s? What if the disk is replaced by a hoop?



Answer: 3.5Nm; 59.5rad/s²; 298 rad/s; 29.8 rad/s²

$$\tau = FR = (25.0\,N)(.140\,m) = 3.50\,N\,m$$

$$\tau = I\alpha$$

$$\alpha = \frac{\tau}{I} = \frac{\tau}{\frac{1}{2}MR^2} = \frac{3.50\,N\,m}{\frac{1}{2}(6.00\,kg)(.140\,m)^2}$$

$$\alpha = 59.5\,rad/s^2$$

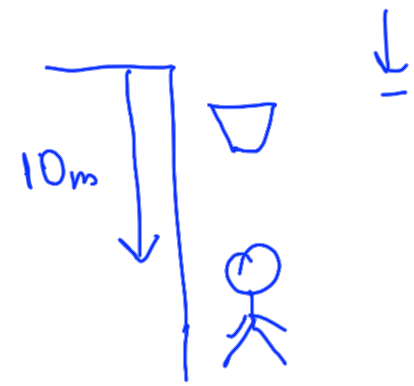
$$\omega_f = \omega_i + \alpha t$$

$$\omega_i = 0$$

$$\omega_f = \alpha t = (59.5\,rad/s^2)(5.00\,s) = 298\,rad/s$$

- A mischievous child drops a 1 kg flower pot on the head of a person 10 m below. What is the momentum of the pot upon impact?

$\vec{p} = m\vec{v}$



$V_i = 0$

$a = -9.80\, m/s^2$

$\Delta y = -10\, m$

$V_f^2 - V_i^2 = 2a\Delta y$

$V_f^2 = 2a\Delta y$

$V_f = \sqrt{2a\Delta y}$

$= \sqrt{2(-9.80\, \frac{m}{s^2})(-10\, m)}$

$= \pm 14\, m/s$

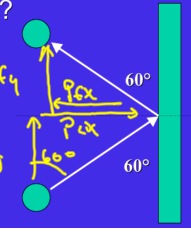
So $V_f = -14\, m/s$ cause down is neg.

$\vec{p} = (1.0\, kg)(-14\, m/s)$

$= \boxed{-14\, kg\, m/s}$

Example

A 3 kg steel ball strikes a wall with a speed of 10 m/s at an angle of 60° with the surface. It bounces off with the same speed and angle. If the ball is in contact with the wall for 0.2 s, what is the change in momentum of the ball? What is the impulse delivered by the wall? What is the average force exerted on the ball by the wall?



$P_{iy} = mv\cos 60$

$P_{fy} = mv\cos 60$

$\Delta P_y = 0$

$P_{ix} = mv\sin 60$

$P_{fx} = -mv\sin 60$

$\Delta P_x = -2mv\sin 60$

Here $\vec{p}$ is in 2D

must consider Δp_x and Δp_y dir

$\Delta P_y = 0$

$\Delta P_x = -2mv\sin 60$

$= -2(3\,kg)(10\,m/s)\sin 60$

$= -52\,kg\,m/s$

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magnitude of Δp is

$\Delta p = \sqrt{\Delta p_x^2 + \Delta p_y^2}$

$= 52\,kg\,m/s$

direction $\theta = \tan^{-1}\frac{\Delta p_y}{\Delta p_x}$

$\theta = 180°$

$F\Delta t = \Delta\vec{p} = -52\,kg\,m/s$ in x-dir

$F = \frac{\Delta\vec{p}}{\Delta t} = \frac{-52\,kg\,m/s}{0.2\,s} = -260\,N$

Force of wall on ball

Force of ball on wall is $+260\,N$ by Newton's 3rd Law