X3.16b 2050

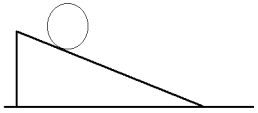
PHYS-2050(16) (Kaldon-13132) **Name** _____
WMU-Spring 2006
Exam 3B - 100,000 points + 20,000 ☆ points **Book Title** _____
04/05/2006•Rev.6

State Any Assumptions You Need To Make – Show All Work – Circle Any Final Answers
Use Your Time Wisely – Work on What You Can – Be Sure to Write Down Equations
Feel Free to Ask Any Questions ☐☆2a ☐☆2b ☐☆2c ☐☆2e

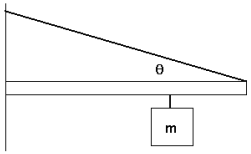
The Downside of Physics (50,000 points)

1.) A solid ball of mass 0.838 kg and radius 0.135 m is moving at a linear speed of $v = 5.00$ *m/s*. (a) Find the angular momentum L of the ball, if the ball is rolling without slipping.

(b) The rolling ball from (a) starts out at rest on an inclined plane at a height h above the ground. At the bottom, the ball is rolling without slipping and moving with a linear speed of 5.00 m/s. Find h.



(c) A metal pole 4.00 meters long and a weight 98.1 N is kept from falling by a taut steel cable at an angle $\theta = 24°$. A mass of 12.0 kg is suspended 1.33 meters from the end. Draw the Free Body Diagram and the Free Rotation Diagram of the metal pole. There is an unknown force F_1 from the wall on the base of the metal pole at left – set your axis of rotation there.

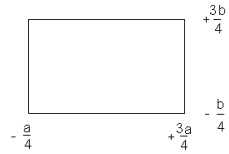


Find (d) the tension T_1 in the steel cable.

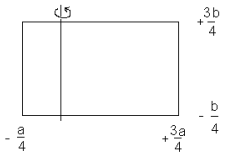
(e) The steel cable ($Y_{steel} = 20.0 \times 10^{10}$ N/m²) is stretched by 0.0100 mm. If the cable has a square cross-section of sides d, find d. *If you did not get an answer to (d), use $T_1 = 135$ N.*

"When You're A Star Problem, You're A Star Problem All The Way…!" **(50,000 points)**

2.) ☆(a) A rectangular plate of mass m = 5.00 kg has sides $a = 1.00$ *m* and $b = 0.480$ *m*. Find the center of mass coordinate y_{cm} by integrating $y_{cm} = \frac{1}{M}\int y\,dm$.



☆(b) For the above rectangular plate, find the moment of inertia I about the y-axis as shown, by integrating $I = \int r^2 dm$.



☆(c) A solid disk of mass 71.3 kg and radius 1.21 m has a motion that follows the following equation. Find the angular acceleration, α, at time t = 1.00 sec.

$$\theta(t) = 4.00\,rad - (4.00\ rad/s)\,t + (4.00\ rad/s^2)\,t^2 - (4.00\ rad/s^3)\,t^3$$

(d) The planet Venus is sometimes described as Earth's mean twin, because while it is about the same size as Earth, its atmosphere is poisonous and it is far too hot. If the mass of Venus is 4.88×10^{24} *kg* and its radius is 6.06×10^{6} *m*, find the acceleration due to gravity, g_{Venus} . $G = 6.67 \times 10^{-11}\ N \cdot m^2/kg^2$

☆(e) A torque $\vec{\tau}$ to tighten a bolt consists of a force being applied at a distance from the axis of rotation. As the bolt gets tighter, it gets harder and harder to turn the bolt, so the torque as a function of angle is given by $\tau = C\,\theta^3$, where C is some constant with appropriate units. If the total work done by applying this torque through *six* complete revolutions is 1500. J, then find C.