

Name _____ Section _____

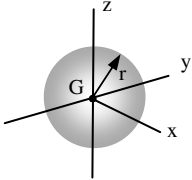
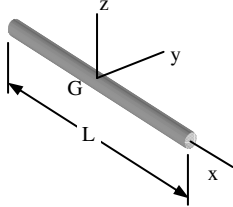
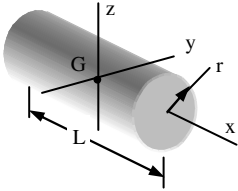
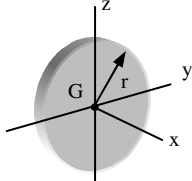
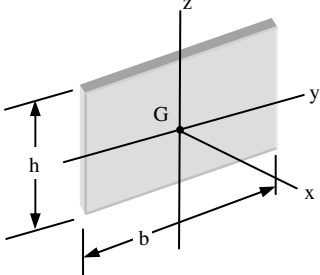
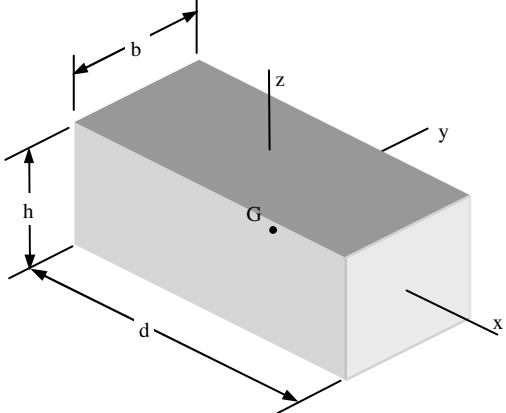
ES204
Examination III
February 9, 2007

Problem	Score
1	/30
2	/35
3	/35
Total	/100

Show all work for credit
AND
Turn in your signed help sheet

NOTE:
Set up all the equations first and save the solutions to the end.

Mass moment of Inertia of some Common Shapes

<p>Solid Sphere</p> $I_x = I_y = I_z = \frac{2}{5} mr^2$	
<p>Slender Rod</p> $I_y = I_z = \frac{1}{12} mL^2$	
<p>Solid Circular Cylinder</p> $I_x = \frac{1}{2} mr^2$ $I_y = I_z = \frac{1}{12} m(L^2 + 3r^2)$	
<p>Thin Disk</p> $I_x = \frac{1}{2} mr^2$ $I_y = I_z = \frac{1}{4} mr^2$	
<p>Thin Rectangular Plate</p> $I_x = \frac{1}{12} m(b^2 + h^2)$ $I_y = \frac{1}{12} mh^2$ $I_z = \frac{1}{12} mb^2$	
<p>Brick</p> $I_x = \frac{1}{12} m(b^2 + h^2)$ $I_y = \frac{1}{12} m(h^2 + d^2)$ $I_z = \frac{1}{12} m(b^2 + d^2)$	

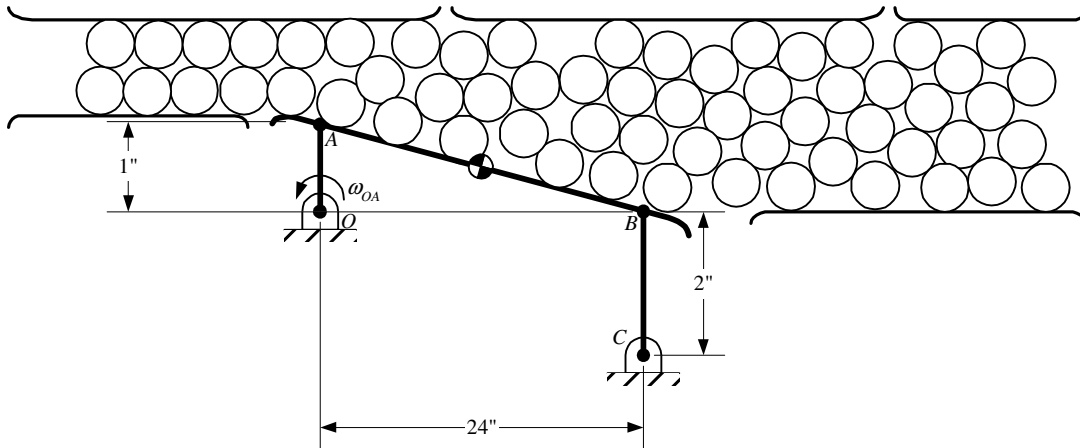
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ES204 Examination III

Problem 1

30 pts
Feb. 9, 2007

A pharmaceutical company manufacturing an over-the-counter medicine needs to merge three up-stream processing lines. Mechanism $OABC$ is designed to “jostle” and assist the medicine vials as they progress through the “neck-down” area. A motor, running at a constant angular velocity (ω_{OA}) of 6 rad/s ccw, is attached at O to produce the desired assistance.

For the position shown, determine the angular accelerations for members AB (coupler) and BC (rocker).



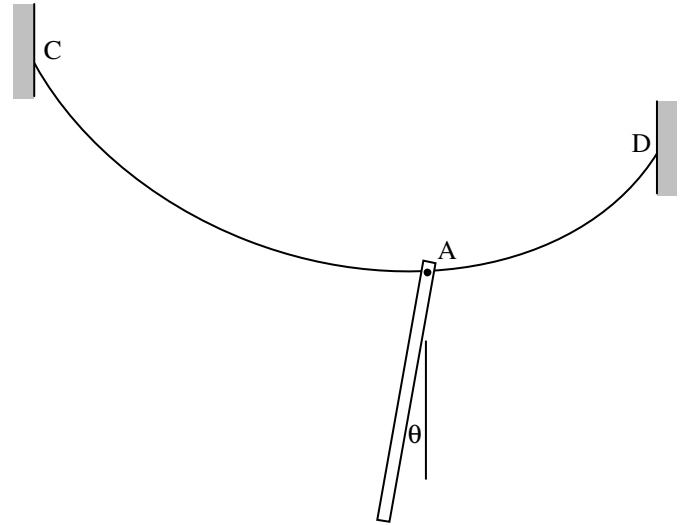
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ES204 Examination III

Problem 2

35 pts
Feb. 9, 2007

A slender uniform bar of mass m and length L is being moved from point C to point D by sliding it down a frictionless track. At the position shown the following is known: the speed of point A is v_A , the angular velocity of the bar is ω , the angle with respect to the vertical is θ and the radius of curvature of the cable at this instant is R . At the instant considered the bar is at the lowest point on the curve.

Determine the equations necessary to find the reaction between the bar and the track at this instant. **Do not solve the equations.** Your answer should consist of a list of unknowns and clearly numbered equations.



A disk of mass, m , mass moment of inertia, I_G is sitting on a conveyor belt when the belt is suddenly turned on such a way that the belt experiences a known constant acceleration, a . The smooth vertical bar is simply to hold the barrel if the belt is not moving.

- Assuming the disk rolls without slipping up the incline determine the equations necessary to find the angular acceleration of the disk and the friction force between the conveyor and the disk.
- How would you check your assumption that the disk rolls without slipping?

