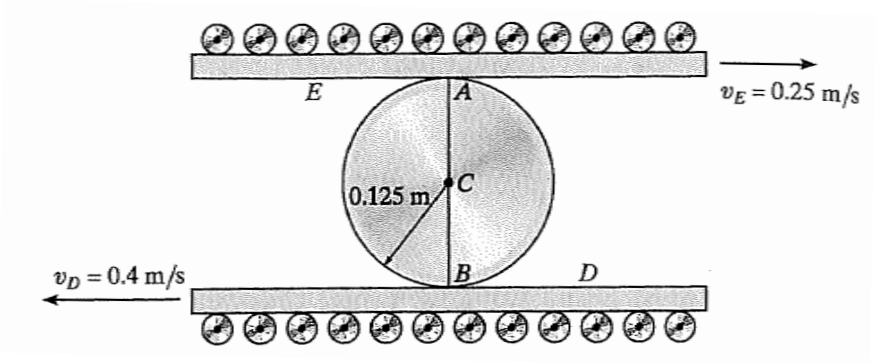
Dynamics Doctoral Qualifying Exam

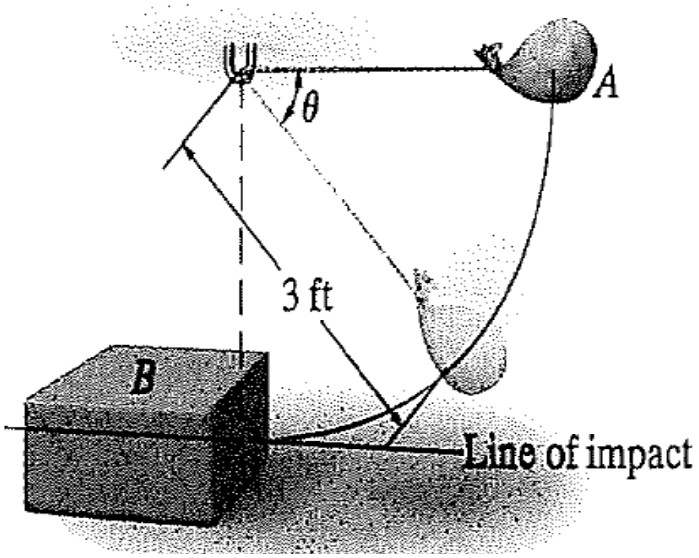
Time allowed: 2 hours

- Closed book and closed notes; one sheet (8.50 x 11.00 in, 2-sided) of formulas is allowed
- There are 4 problems worth a total of 100 points
- You MUST show and explain work to get credit
- Proceed in a linear fashion down the page – underlining your final answer
- Calculator allowed
- Laptops, cell phones, and similar electronic devices are not allowed
- Caution – usually the costliest mistake on a dynamics exam is not identifying the correct method (conservation of energy. F=ma, etc.) to solve the problem

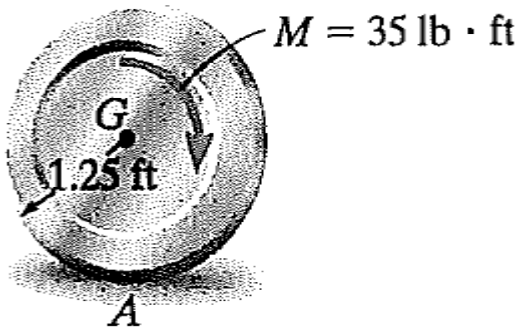
1. (25) The cylinder shown rolls without slipping between the two moving plates *E* and *D*. Determine the angluar velocity, ω and the velocity of its center, v_c.



2. (25) The bag *A* weighing 6lb is released from rest at the position θ =*0°* as shown in the figure. After falling to θ=*90°*, it strikes an 18lb box, *B*. If the coefficent of restitution between the bag and box is *e*=0.5 determine the velocities of the bag and box just after impact.



3. (25) The *50lb* wheel shown has a radius of gyration, k_G=*0.70 ft*. If a 3*5 lb-ft* couple is applied to the wheel , determine the the acceleration of its mass center, a_G. The coefficents of static and dynamic friction between the wheel and the plane at *A* are μ_s=0.3 and μ_k=0.25 respectively.



4. (25) The *10kg* rod *AB* shown in the figure is constrained so that its ends move in the horizontal and vertical slots. The spring has a stifness of *k=800N/m* and is unstretched when θ=*0°*. Determine the angular velocity of AB, ω, when θ=*0°* . if the rod is released from rest when θ=*30°*. Neglect the mass of the slider blocks. (For a uniform bar of length L and mass, m - I_G=(1/12)mL^2)