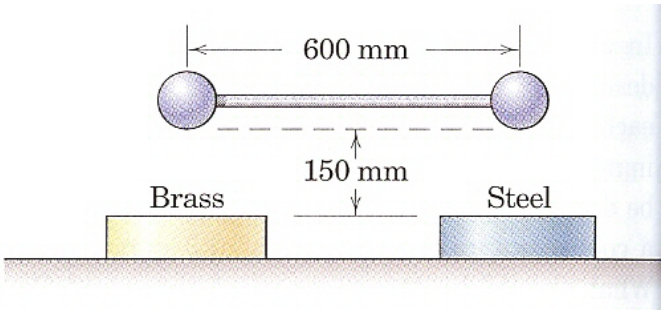
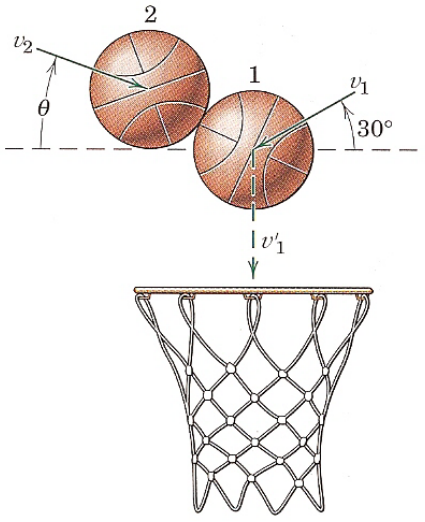
Dynamics (003) Homework #4 Due 15th.Oct .2008.

1. Two steel balls of the same diameter are connected by a rigid bar of negligible mass as shown and are dropped in the horizontal position from a height of 150 mm above the heavy steel and brass base plates. If the coefficient of restitution between the ball and the steel base is 0.6 and that between the other ball and the brass base is 0.4, determine the angular velocity ω of the bar immediately after impact. Assume that the two impacts are simultaneous.

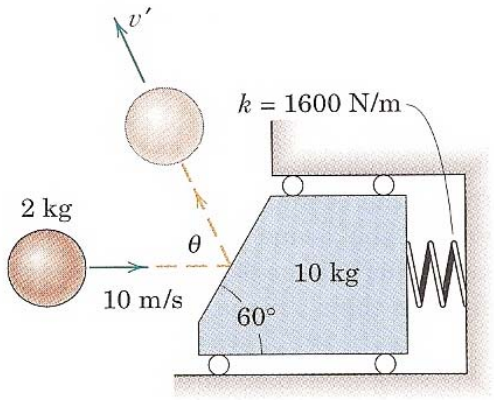


2. During a pregame warmup period, two basketballs collide above the hoop when in the positions shown. Just before impact, ball 1 has a velocity $\mathbf{v}_1$ which makes a 30° angle with the horizontal. If the velocity $\mathbf{v}_2$ of ball 2 just before impact has the same magnitude as $\mathbf{v}_1$, determine the two possible values of the angle θ, measured from the horizontal, which will cause ball 1 to go directly through the center of the basket. The coefficient of restitution is $e = 0.8$.

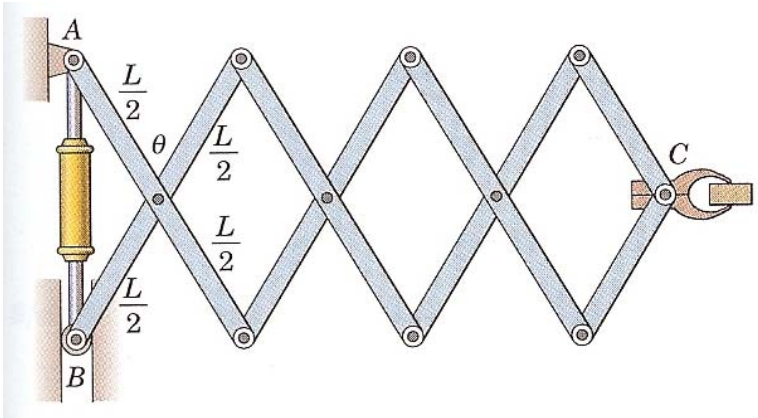


solve with (a) e=0.8 (b) e=0.9 (c) e=0.7

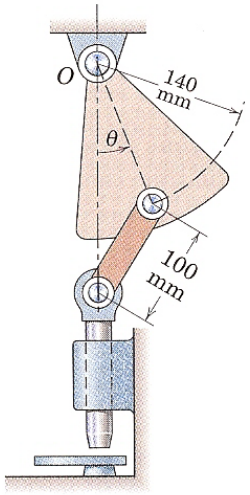
3. The 2-kg sphere is projected horizontally with a velocity of 10 m/s against the 10-kg carriage which is backed up by the spring with stiffness of 1600 N/m. The carriage is initially at rest with the spring uncompressed. If the coefficient of restitution is 0.6, calculate the rebound velocity v', the rebound angle θ, and the maximum travel δ of the carriage after impact.



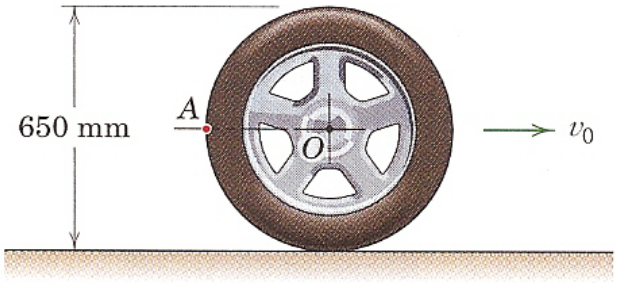
4. The linear actuator is designed for rapid horizontal velocity v of jaw C for a slow change in the distance between A and B. If the hydraulic cylinder decreases this distance at the rate u, determine the horizontal velocity of jaw C in terms of the angle θ.



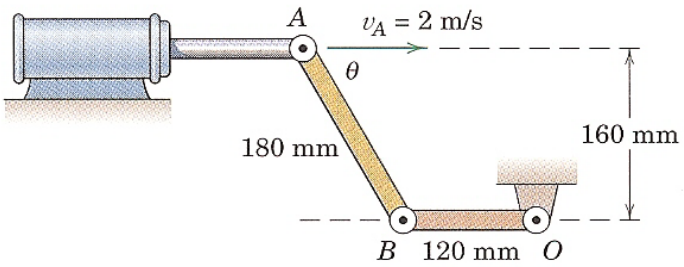
5. The punch is operated by a simple harmonic oscillation of the pivoted sector given by $\theta = \theta_0 \sin 2\pi t$ where the amplitude is $\theta_0 = \pi/12$ rad (15°) and the time for one complete oscillation is 1 second. Determine the acceleration of the punch when (*a*) $\theta = 0$ and (*b*) $\theta = \pi/12$.



6. The magnitude of the absolute velocity of point *A* on the automobile tire is 12 m/s when *A* is in the position shown. What are the corresponding velocity v_O of the car and the angular velocity ω of the wheel? (The wheel rolls without slipping.)



7. Horizontal motion of the piston rod of the hydraulic cylinder controls the rotation of link OB about O. For the instant represented, $v_A = 2$ m/s and OB is horizontal. Determine the angular velocity ω of OB for this instant.



Computer problem

13.C6 A 1-kg collar is attached to a spring and slides without friction along a circular rod which lies in a vertical plane. The spring has a constant $k = 0.60$ kN/m and is undeformed when the collar is at point B. Knowing that the collar is released from rest at point C, (a) determine and plot the speed of the collar as a function of θ for values of θ from 90° to θ_m, where θ_m is the maximum value of θ, (b) determine the maximum speed of the collar and the corresponding value of θ.

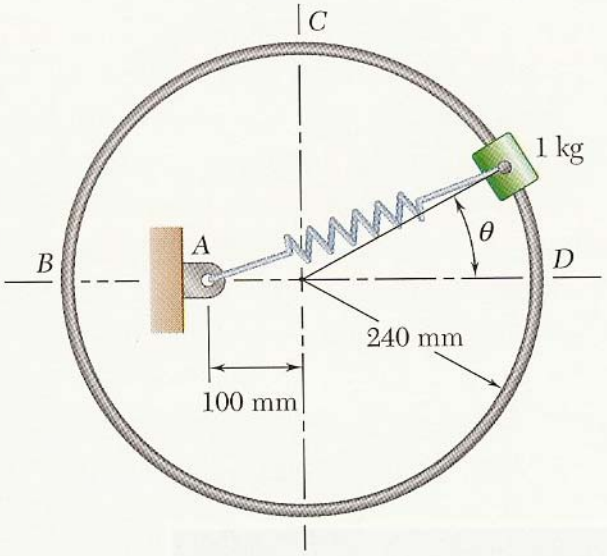


Fig. P13.C6