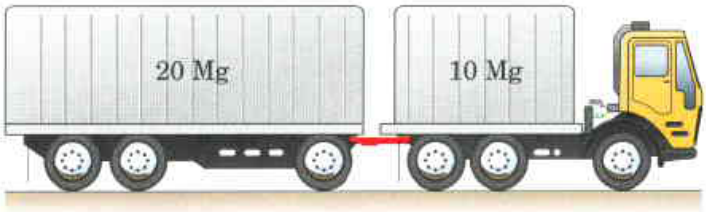
بسمه تعالی

نمونه سولات پایان ترم درس دینامیک ۹۵-۹٤ (نازک کار)

3/5 The 10-Mg truck hauls the 20-Mg trailer. If the unit starts from rest on a level road with a tractive force of 20 kN between the driving wheels of the truck and the road, compute the tension T in the horizontal drawbar and the acceleration a of the rig.

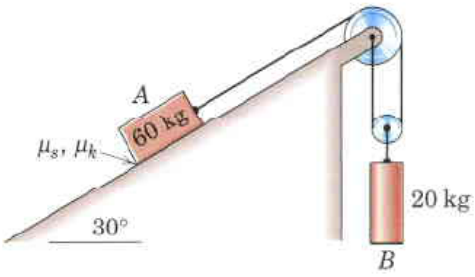
Ans. $T = 13.33$ kN, $a = 0.667$ m/s^2



Problem 3/5

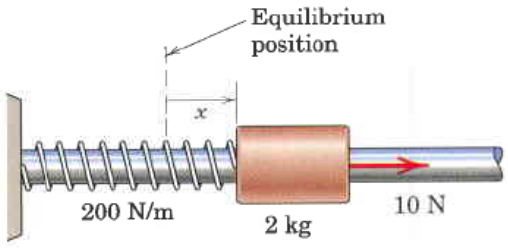
3/27 The system is released from rest with the cable taut. For the friction coefficients $\mu_s = 0.25$ and $\mu_k = 0.20$, calculate the acceleration of each body and the tension T in the cable. Neglect the small mass and friction of the pulleys.

Ans. $a_A = 1.450$ m/s^2 down incline
$a_B = 0.725$ m/s^2 up
$T = 105.4$ N



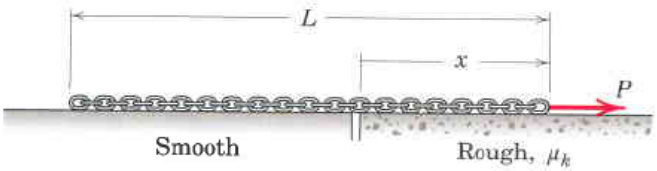
3/37 The spring of constant $k = 200$ N/m is attached to both the support and the 2-kg cylinder, which slides freely on the horizontal guide. If a constant 10-N force is applied to the cylinder at time $t = 0$ when the spring is undeformed and the system is at rest, determine the velocity of the cylinder when $x = 40$ mm. Also determine the maximum displacement of the cylinder.

Ans. $v = 0.490$ m/s, $x = 100$ mm



Problem 3/37

3/30 A heavy chain with a mass ρ per unit length is pulled along a horizontal surface consisting of a smooth section and a rough section by the constant force P. If the chain is initially at rest on the smooth surface with $x = 0$ and if the coefficient of kinetic friction between the chain and the rough surface is μ_k, determine the velocity v of the chain when $x = L$. Assume that the chain remains taut and thus moves as a unit throughout the motion. What is the minimum value of P that will permit the chain to remain taut? (*Hint:* The acceleration must not become negative.)



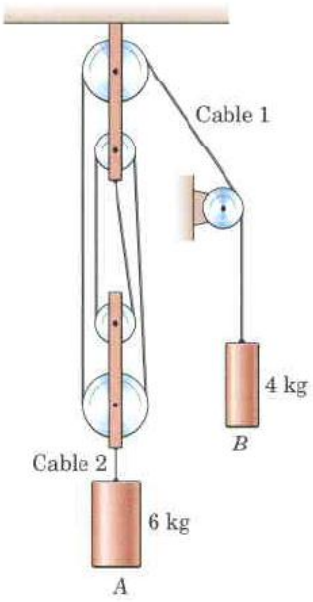
Problem 3/30

بسمه تعالی

نمونه سولات پایان ترم درس دینامیک ۹۵-۹۴ (نازک کار)

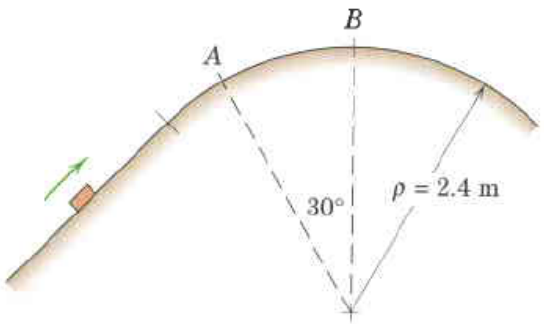
3/2 The 50-kg crate is stationary when the force P is applied. Determine the resulting acceleration of the crate if (*a*) $P = 0$, (*b*) $P = 150$ N, and (*c*) $P = 300$ N.

3/12 The block-and-tackle system is released from rest with all cables taut. Neglect the mass and friction of all pulleys and determine the acceleration of each cylinder and the tensions T_1 and T_2 in the two cables.

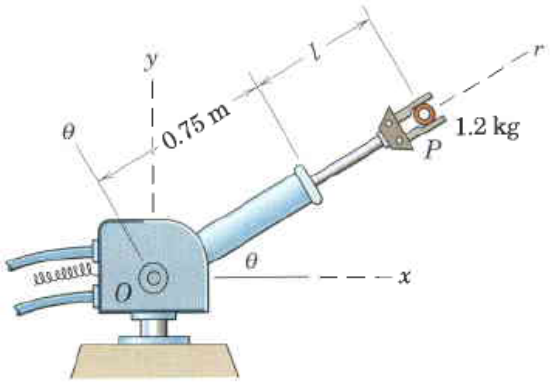


3/51 If the 2-kg block passes over the top B of the circular portion of the path with a speed of 3.5 m/s, calculate the magnitude N_B of the normal force exerted by the path on the block. Determine the maximum speed v which the block can have at A without losing contact with the path.

Ans. $N_B = 9.41$ N, $v = 4.52$ m/s



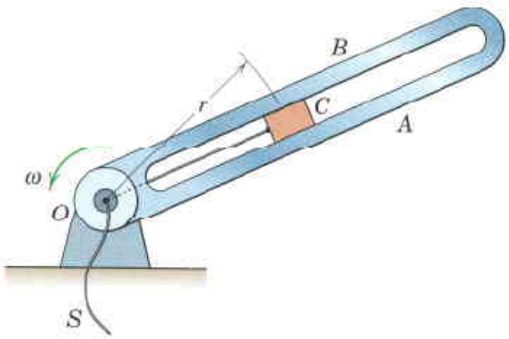
3/76 The robot arm is elevating and extending simultaneously. At a given instant, $\theta = 30°$, $\dot{\theta} = 40$ deg/s, $\ddot{\theta} = 120$ deg/s^2, $l = 0.5$ m, $\dot{l} = 0.4$ m/s, and $\ddot{l} = -0.3$ m/s^2. Compute the radial and transverse forces F_r and F_θ that the arm must exert on the gripped part P, which has a mass of 1.2 kg. Compare with the case of static equilibrium in the same position.



بسمه تعالی

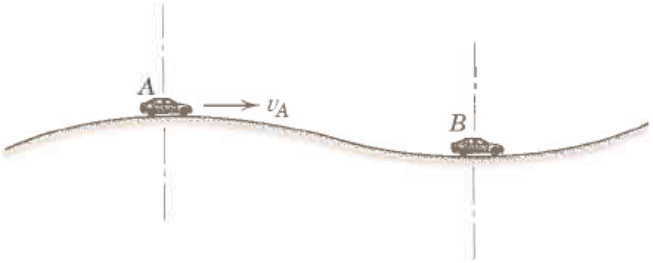
نمونه سولات پایان ترم درس دینامیک ۹۵-۹۴ (نازک کار)

3/86 The slotted arm revolves in the horizontal plane about the fixed vertical axis through point O. The 3-lb slider C is drawn toward O at the constant rate of 2 in./sec by pulling the cord S. At the instant for which $r = 9$ in., the arm has a counterclockwise angular velocity $\omega = 6$ rad/sec and is slowing down at the rate of 2 rad/sec^2. For this instant, determine the tension T in the cord and the magnitude N of the force exerted on the slider by the sides of the smooth radial slot. Indicate which side, A or B, of the slot contacts the slider.



3/55 The car passes over the top of a vertical curve at A with a speed of 60 km/h and then passes through the bottom of a dip at B. The radii of curvature of the road at A and B are both 100 m. Find the speed of the car at B if the normal force between the road and the tires at B is twice that at A. The mass center of the car is 1 meter from the road.

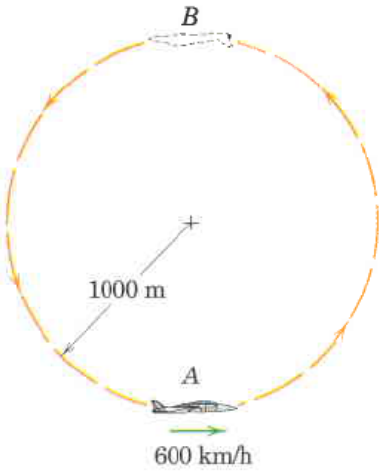
Ans. $v_B = 74.4$ km/h



Problem 3/55

3/67 A pilot flies an airplane at a constant speed of 600 km/h in the vertical circle of radius 1000 m. Calculate the force exerted by the seat on the 90-kg pilot at point A and at point B

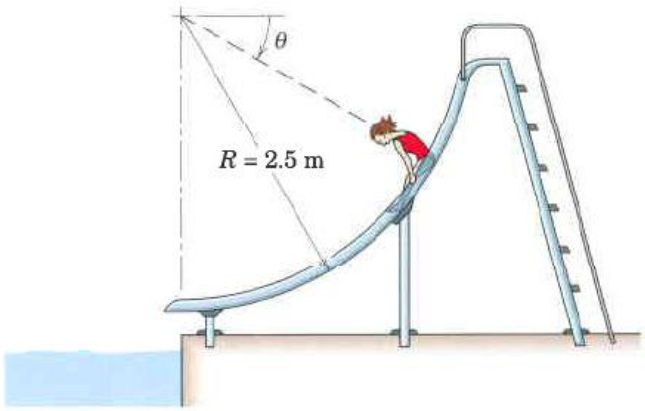
Ans. $N_A = 3380$ N, $N_B = 1617$ N



Problem 3/67

3/81 Beginning from rest when $\theta = 20°$, a 35-kg child slides with negligible friction down the sliding board which is in the shape of a 2.5-m circular arc. Determine the tangential acceleration and speed of the child, and the normal force exerted on her (a) when $\theta = 30°$ and (b) when $\theta = 90°$.

Ans. (a) $a_t = 8.50$ m/s^2, $v = 2.78$ m/s
$N = 280$ N
(b) $a_t = 0$, $v = 5.68$ m/s
$N = 795$ N

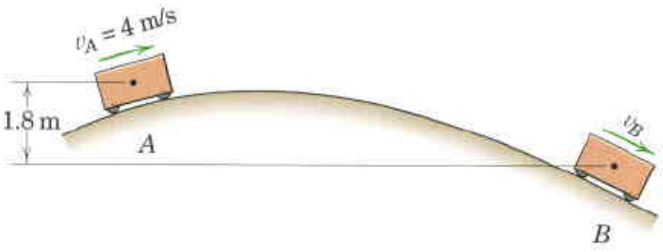


بسمه تعالی

نمونه سولات پایان ترم درس دینامیک ۹۵-۹۴ (نازک کار)

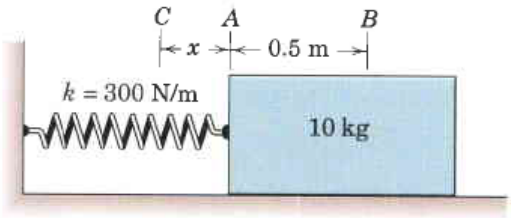
3/105 The small cart has a speed $v_A = 4$ m/s as it passes point A. It moves without appreciable friction and passes over the top hump of the track. Determine the cart speed as it passes point B. Is knowledge of the shape of the track necessary?

Ans. $v_B = 7.16$ m/s



3/145 The 10-kg block is released from rest on the horizontal surface at point B, where the spring has been stretched a distance of 0.5 m from its neutral position A. The coefficient of kinetic friction between the block and the plane is 0.30. Calculate (a) the velocity v of the block as it passes point A and (b) the maximum distance x to the left of A which the block goes.

Ans. (a) $v = 2.13$ m/s, (b) $x = 0.304$ m



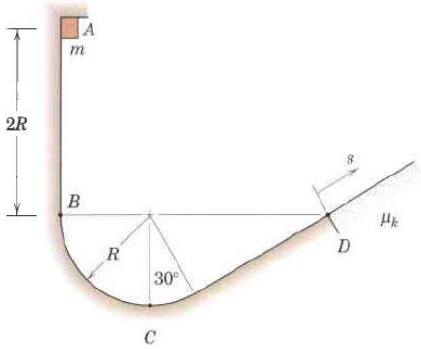
$\mu_k = 0.30$

3/129 The small slider of mass m is released from rest while in position A and then slides along the vertical-plane track. The track is smooth from A to D and rough (coefficient of kinetic friction μ_k) from point D on. Determine (a) the normal force N_B exerted by the track on the slider just after it passes point B, (b) the normal force N_C exerted by the track on the slider as it passes the bottom point C, and (c) the distance s traveled along the incline past point D before the slider stops.

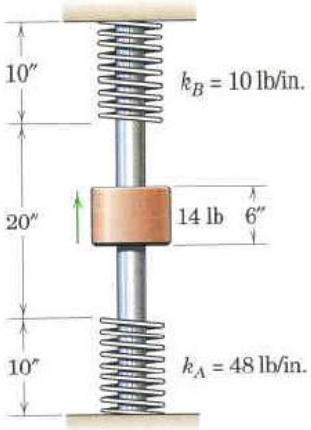
Ans. (a) $N_B = 4mg$

(b) $N_C = 7mg$

(c) $s = \dfrac{4R}{1 + \mu_k\sqrt{3}}$



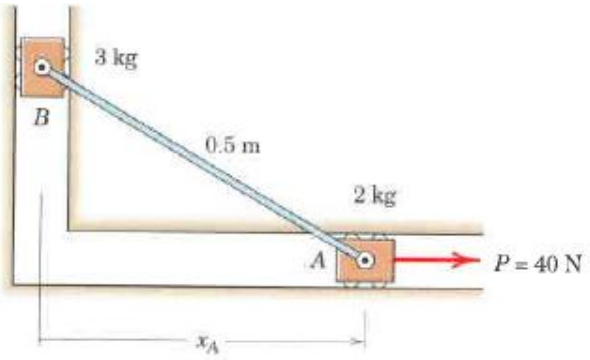
3/162 The springs are undeformed in the position shown. If the 14-lb collar is released from rest in the position where the lower spring is compressed 5 in., determine the maximum compression x_B of the upper spring.



بسمه تعالی

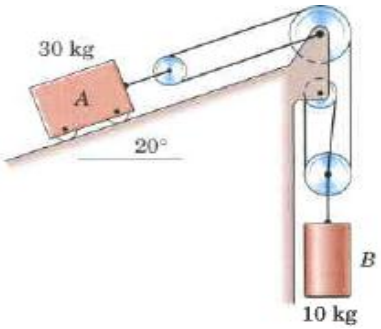
نمونه سولات پایان ترم درس دینامیک ۹۵-۹۴ (نازک کار)

3/44 The sliders A and B are connected by a light rigid bar of length $l = 0.5$ m and move with negligible friction in the horizontal slots shown. For the position where $x_A = 0.4$ m, the velocity of A is $v_A = 0.9$ m/s to the right. Determine the acceleration of each slider and the force in the bar at this instant.

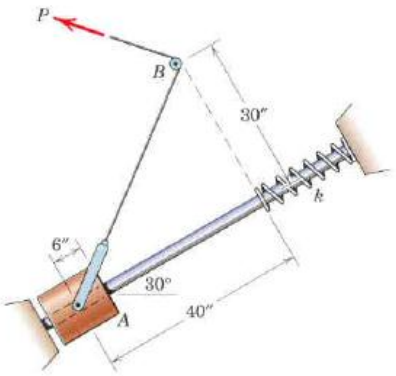


3/25 Neglect all friction and the mass of the pulleys and determine the accelerations of bodies A and B upon release from rest.

Ans. $a_A = 1.024$ m/s^2 down the incline
$a_B = 0.682$ m/s^2 up

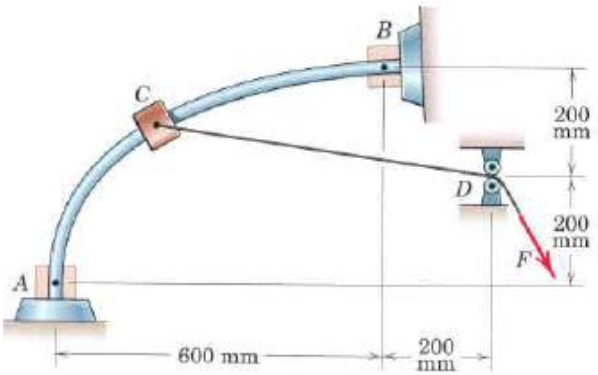


3/110 The 30-lb collar A is released from rest in the position shown and slides with negligible friction up the fixed rod inclined 30° from the horizontal under the action of a constant force $P = 50$ lb applied to the cable. Calculate the required stiffness k of the spring so that its maximum deflection equals 6 in. The position of the small pulley at B is fixed.



3/143 The 0.60-kg collar slides on the curved rod in the vertical plane with negligible friction under the action of a constant force F in the cord guided by the small pulleys at D. If the collar is released from rest at A, determine the force F which will result in the collar striking the stop at B with a velocity of 4 m/s.

Ans. $F = 13.21$ N

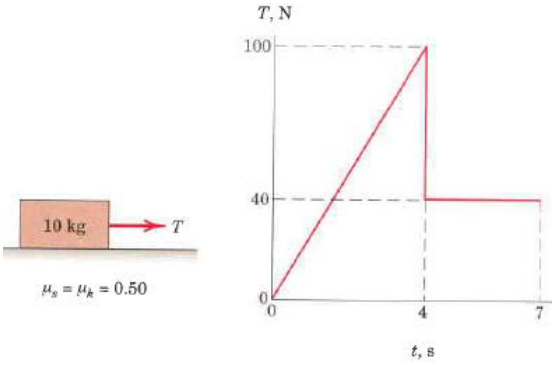


بسمه تعالی

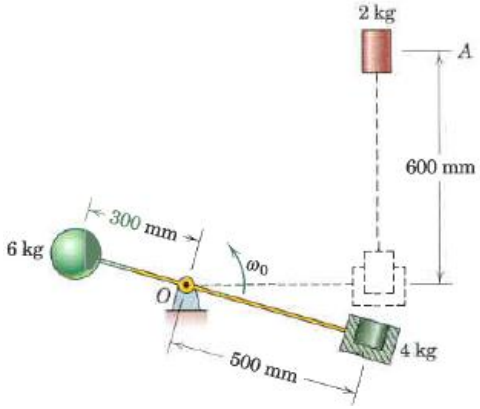
نمونه سولات پایان ترم درس دینامیک ۹۵-۹۴ (نازک کار)

3/217 The 10-kg block is resting on the horizontal surface when the force T is applied to it for 7 seconds. The variation of T with time is shown. Calculate the maximum velocity reached by the block and the total time Δt during which the block is in motion. The coefficients of static and kinetic friction are both 0.50.

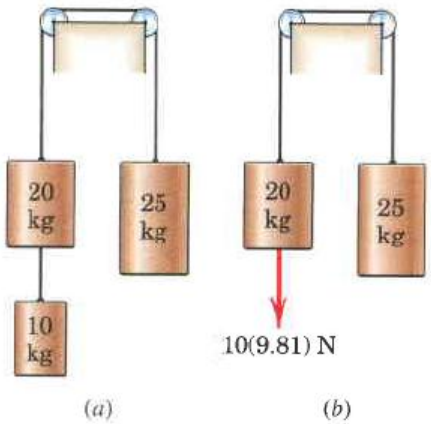
Ans. $v_{max} = 5.19$ m/s, $\Delta t = 5.54$ s



3/236 The 6-kg sphere and 4-kg block (shown in section) are secured to the arm of negligible mass which rotates in the vertical plane about a horizontal axis at O. The 2-kg plug is released from rest at A and falls into the recess in the block when the arm has reached the horizontal position. An instant before engagement, the arm has an angular velocity $\omega_0 = 2$ rad/s. Determine the angular velocity ω of the arm immediately after the plug has wedged itself in the block.



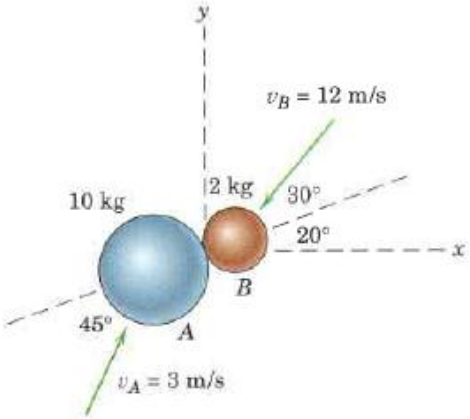
3/126 Each of the two systems is released from rest. Calculate the velocity v of each 25-kg cylinder after the 20-kg cylinder has dropped 2 m. The 10-kg cylinder of case (a) is replaced by a 10(9.81)-N force in case (b).



3/271 Sphere A collides with sphere B as shown in the figure. If the coefficient of restitution is $e = 0.5$, determine the x- and y-components of the velocity of each sphere immediately after impact. Motion is confined to the x-y plane.

Ans. $(v_A')_x = -1.672$ m/s, $(v_A')_y = 1.649$ m/s

$(v_B')_x = 6.99$ m/s, $(v_B')_y = -3.84$ m/s

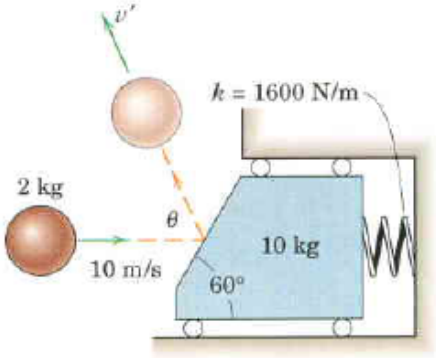


بسمه تعالی

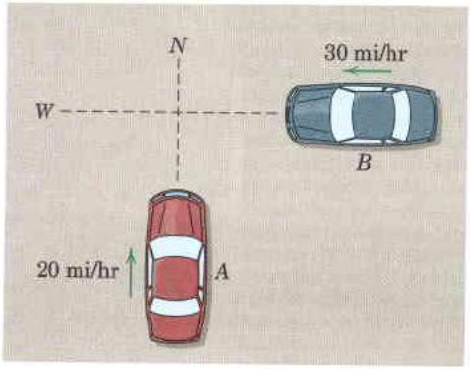
نمونه سولات پایان ترم درس دینامیک ۹۵-۹۴ (نازک کار)

▶3/278 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.

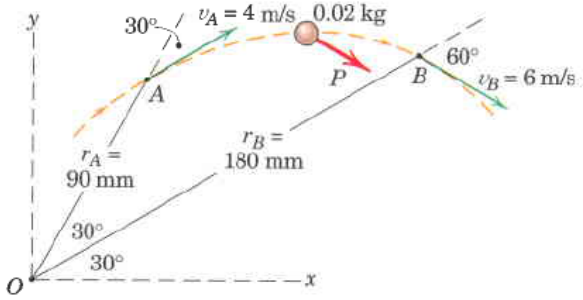
Ans. $v' = 6.04$ m/s, $\theta = 85.9°$, $\delta = 165.0$ mm



3/208 Car B weighing 3200 lb and traveling west at 30 mi/hr collides with car A weighing 3400 lb and traveling north at 20 mi/hr as shown. If the two cars become entangled and move together as a unit after the crash, compute the magnitude v of their common velocity immediately after the impact and the angle θ made by the velocity vector with the north direction.



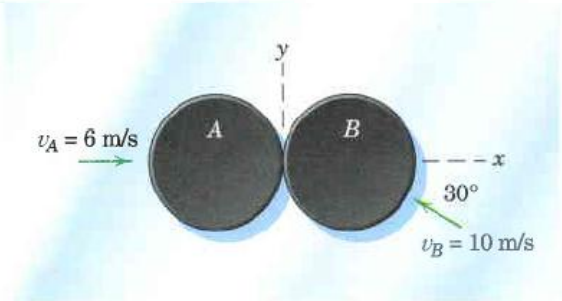
3/242 The 0.02-kg particle moves along the dashed trajectory shown and has indicated velocities at positions A and B. Calculate the time average of the moment about O of the resultant force P acting on the particle during the 0.5 second required for it to go from A to B.



3/269 Two identical hockey pucks moving with initial velocities v_A and v_B collide as shown. If the coefficient of restitution is $e = 0.75$, determine the velocity (magnitude and direction θ with respect to the positive x-axis) of each puck just after impact. Also calculate the percentage loss n of system kinetic energy.

Ans. $v_A' = 6.83$ m/s at $\theta_A = 180°$

$v_B' = 6.51$ m/s at $\theta_B = 50.2°$, $n = 34.6\%$

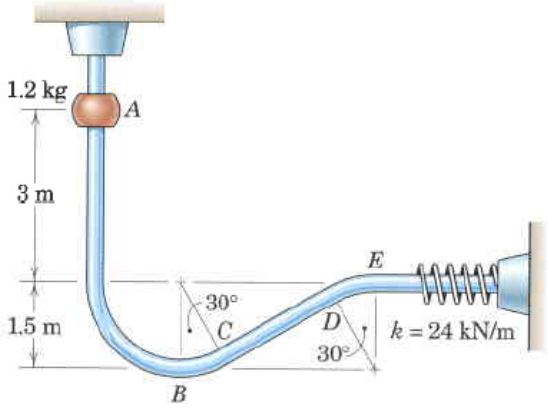


بسمه تعالی

نمونه سولات پایان ترم درس دینامیک ۹۵-۹۴ (نازک کار)

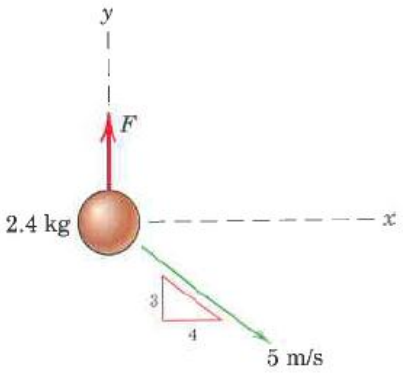
3/149 The 1.2-kg slider is released from rest in position A and slides without friction along the vertical-plane guide shown. Determine (a) the speed v_B of the slider as it passes position B and (b) the maximum deflection δ of the spring.

Ans. (a) $v_B = 9.40$ m/s, (b) $\delta = 54.2$ mm



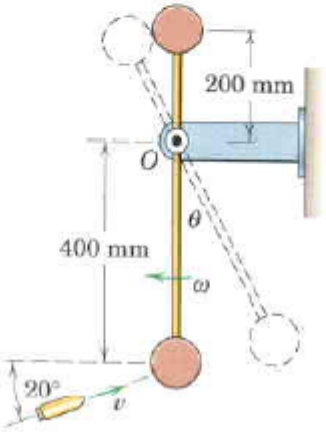
3/205 The 2.4-kg particle moves in the horizontal x-y plane and has the velocity shown at time $t = 0$. If the force $F = 2 + 3t^2/4$ newtons, where t is time in seconds, is applied to the particle in the y-direction beginning at time $t = 0$, determine the velocity v of the particle 4 seconds after F is applied and specify the corresponding angle θ measured counterclockwise from the x-axis to the direction of the velocity.

Ans. $v = 8.06$ m/s, $\theta = 60.3°$



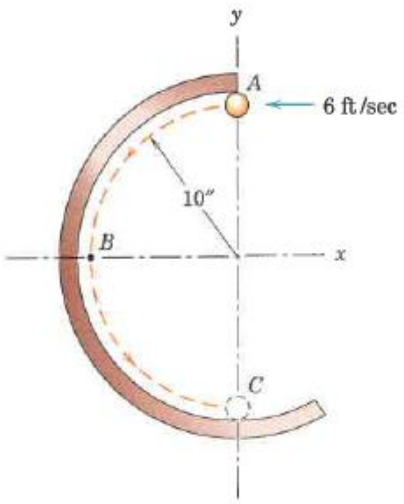
Problem 3/205

3/248 A pendulum consists of two 3.2-kg concentrated masses positioned as shown on a light but rigid bar. The pendulum is swinging through the vertical position with a clockwise angular velocity $\omega = 6$ rad/s when a 50-g bullet traveling with velocity $v = 300$ m/s in the direction shown strikes the lower mass and becomes embedded in it. Calculate the angular velocity ω' which the pendulum has immediately after impact and find the maximum angular deflection θ of the pendulum.



3/235 A small 4-oz particle is projected with a horizontal velocity of 6 ft/sec into the top A of the smooth circular guide fixed in the vertical plane. Calculate the time rate of change $\dot{\mathbf{H}}_B$ of angular momentum about point B when the particle passes the bottom of the guide at C.

Ans. $\dot{\mathbf{H}}_B = 1.113\mathbf{k}$ lb-ft



Problem 3/235