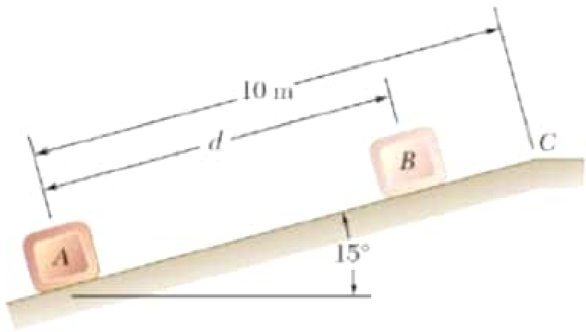


PROBLEM 13.9

A package is projected up a 15° incline at A with an initial velocity of 8 m/s. Knowing that the coefficient of kinetic friction between the package and the incline is 0.12, determine (*a*) the maximum distance d that the package will move up the incline, (*b*) the velocity of the package as it returns to its original position.

SOLUTION

(*a*) Up the plane from A to B:

$$T_A = \frac{1}{2}mv_A^2 = \frac{1}{2}\frac{W}{g}(8\text{ m/s})^2 = 32\frac{W}{g} \qquad T_B = 0$$

$$U_{A-B} = (-W\sin 15° - F)d \qquad F = \mu_k N = 0.12\,N$$

$$\nwarrow \Sigma F = 0 \quad N - W\cos 15° = 0 \quad N = W\cos 15°$$

$$U_{A-B} = -W(\sin 15° + 0.12\cos 15°)d = -Wd(0.3747)$$

$$T_A + U_{A-B} = T_B\text{:} \quad 32\frac{W}{g} - Wd(0.3743) = 0$$

$$d = \frac{32}{(9.81)(0.3747)} \qquad d = 8.70\text{ m} \blacktriangleleft$$

(*b*) Down the plane from B to A: (F reverses direction)

$$T_A = \frac{1}{2}\frac{W}{g}v_A^2 \qquad T_B = 0 \qquad d = 8.71\text{ m/s}$$

$$U_{B-A} = (W\sin 15° - F)d$$

$$= W(\sin 15° - 0.12\cos 15°)(8.70\text{ m/s})$$

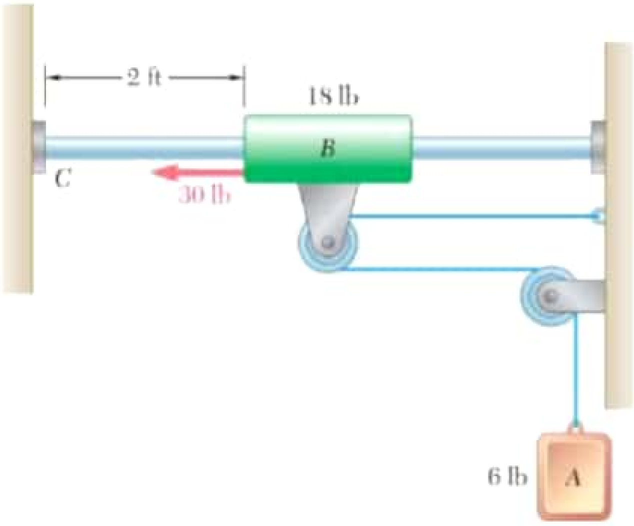
$$U_{B-A} = 1.245W$$

$$T_B + U_{B-A} = T_A \quad 0 + 1.245W = \frac{1}{2}\frac{W}{g}v_A^2$$

$$v_A^2 = (2)(9.81)(1.245)$$

$$= 24.43$$

$$v_A = 4.94\text{ m/s} \qquad \mathbf{v}_A = 4.94\text{ m/s} \measuredangle 15° \blacktriangleleft$$



PROBLEM 13.20

The system shown is at rest when a constant 30 lb force is applied to collar B. (a) If the force acts through the entire motion, determine the speed of collar B as it strikes the support at C. (b) After what distance d should the 30 lb force be removed if the collar is to reach support C with zero velocity?

SOLUTION

Let F be the cable tension and v_B be the velocity of collar B when it strikes the support. Consider the collar B. Its movement is horizontal so only horizontal forces acting on B do work. Let d be the distance through which the 30 lb applied force moves.

$$(T_1)_B + (U_{1\to 2})_B = (T_2)_B$$

$$0 + 30d - (2F)(2) = \frac{1}{2}\frac{18}{32.2}v_B^2$$

$$30d - 4F = 0.27950 v_B^2 \qquad (1)$$

Now consider the weight A. When the collar moves 2 ft to the left, the weight moves 4 ft up, since the cable length is constant. Also, $v_A = 2v_B$.

$$(T_1)_A + (U_{1\text{-}2})_A = (T_2)_B$$

$$0 + (F - W_A)(4) = \frac{1}{2}\frac{W_A}{g}v_A^2$$

$$4F - (6)(4) = \frac{1}{2}\frac{6}{32.2}(2v_B)^2$$

$$4F - 24 = 0.37267 v_B^2 \qquad (2)$$

Add Eqs. (1) and (2) to eliminate F.

$$30d - 24 = 0.65217 v_B^2 \qquad (3)$$

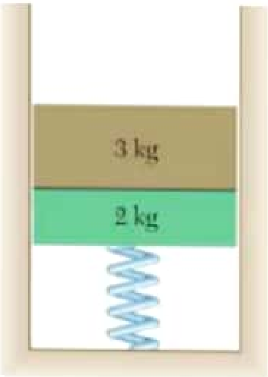
(a) Case a: $d = 2$ ft, $v_B = ?$

$$(30)(2) - (24) = 0.65217 v_B^2$$

$$v_B^2 = 55.2 \text{ ft}^2/\text{s}^2 \qquad v_B = 7.43 \text{ ft/s} \blacktriangleleft$$

(b) Case b: $d = ?$, $v_B = 0$.

$$30d - 24 = 0 \qquad d = 0.800 \text{ ft} \blacktriangleleft$$



PROBLEM 13.26

A 3-kg block rests on top of a 2-kg block supported by, but not attached to, a spring of constant 40 N/m. The upper block is suddenly removed. Determine (*a*) the maximum speed reached by the 2-kg block, (*b*) the maximum height reached by the 2-kg block.

SOLUTION

Call blocks A and B. $m_A = 2\text{ kg},\quad m_B = 3\text{ kg}$

(*a*) Position 1: Block B has just been removed.

Spring force: $F_S = -(m_A + m_B)g = -kx \uparrow$

Spring stretch: $x_1 = -\dfrac{(m_A + m_B)g}{k} = -\dfrac{(5\text{ kg})(9.81\text{ m/s}^2)}{40\text{ N/m}} = -1.22625\text{ m}$

Let position 2 be a later position while the spring still contacts block A.

Work of the force exerted by the spring: $(U_{1\to 2})_e = -\int_{x_1}^{x_2} kx\,dx$

$$= -\frac{1}{2}kx^2\Big|_{x_1}^{x_2} = \frac{1}{2}kx_1^2 - \frac{1}{2}kx_2^2$$

$$= \frac{1}{2}(40)(-1.22625)^2 - \frac{1}{2}(40)x_2^2 = 30.074 - 20x_2^2$$

Work of the gravitational force: $(U_{1\to 2})_g = -m_A g(x_2 - x_1)$

$$= -(2)(9.81)(x_2 + 1.22625) = -19.62x_2 - 24.059$$

Total work: $U_{1\to 2} = -20x_2^2 + 19.62x_2 + 6.015$

Kinetic energies: $T_1 = 0$

$$T_2 = \frac{1}{2}m_A v_2^2 = \frac{1}{2}(2)v_2^2 = v_2^2$$

Principle of work and energy: $T_1 + U_{1\to 2} = T_2$

$$0 + 20x_2^2 - 19.62x_2 + 6.015 = v_2^2$$

Speed squared: $v_2^2 = -20x_2^2 - 19.62x_2 + 6.015$ (1)

At maximum speed, $\dfrac{dv_2}{dx_2} = 0$

PROBLEM 13.26 (Continued)

Differentiating Eq. (1), and setting equal to zero,

$$2v_2 \frac{dv_2}{dx} = -40x_2 = -19.62 = 0$$

$$x_2 = -\frac{19.62}{40} = -0.4905 \text{ m}$$

Substituting into Eq. (1), $v_2^2 = -(20)(-0.4905)^2 - (19.62)(-0.4905) + 6.015 = 10.827 \text{ m}^2/\text{s}^2$

Maximum speed: $v^2 = 3.29$ m/s ◀

(*b*) Position 3: Block *A* reaches maximum height. Assume that the block has separated from the spring. Spring force is zero at separation.

Work of the force exerted by the spring:

$$(U_{1\to 3})_e = -\int_{x_1}^{0} kx dx = \frac{1}{2}kx_1^2 = \frac{1}{2}(40)(1.22625)^2 = 30.074 \text{ J}$$

Work of the gravitational force:

$$(U_{1\to 3})_g = -m_A gh = -(2)(9.81)h = -19.62\ h$$

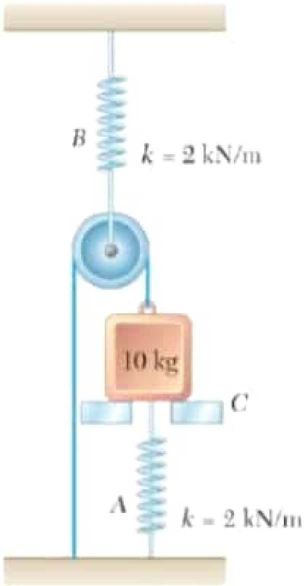
Total work: $U_{1\to 3} = 30.074 - 19.62\ h$

At maximum height, $v_3 = 0, \quad T_3 = 0$

Principle of work and energy: $T_1 + U_{1\to 3} = T_3$

$$0 + 30.074 - 19.62\ h = 0$$

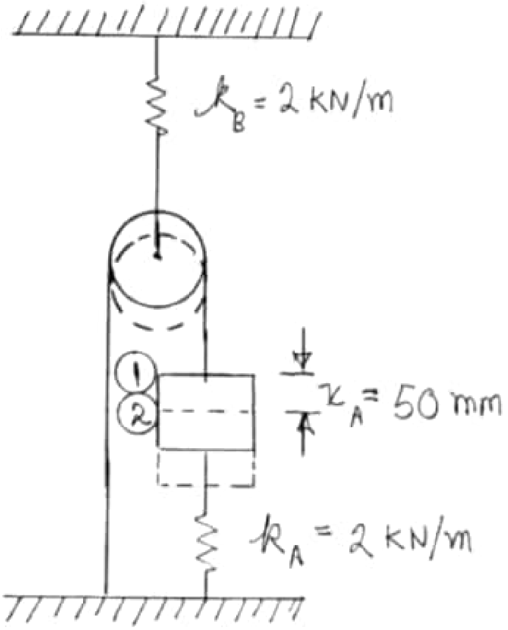
Maximum height: $h = 1.533$ m ◀



PROBLEM 13.30

A 10-kg block is attached to spring *A* and connected to spring *B* by a cord and pulley. The block is held in the position shown with both springs unstretched when the support is removed and the block is released with no initial velocity. Knowing that the constant of each spring is 2 kN/m, determine (*a*) the velocity of the block after it has moved down 50 mm, (*b*) the maximum velocity achieved by the block.

SOLUTION



(*a*) W = weight of the block $= 10\ (9.81) = 98.1$ N

$$x_B = \frac{1}{2}x_A$$

$$U_{1-2} = W(x_A) - \frac{1}{2}k_A(x_A)^2 - \frac{1}{2}k_B(x_B)^2$$

(Gravity) (Spring *A*) (Spring *B*)

$$U_{1-2} = (98.1\text{ N})(0.05\text{ m}) - \frac{1}{2}(2000\text{ N/m})(0.05\text{ m})^2$$

$$-\frac{1}{2}(2000\text{ N/m})(0.025\text{ m})^2$$

$$U_{1-2} = \frac{1}{2}(m)v^2 = \frac{1}{2}(10\text{ kg})v^2$$

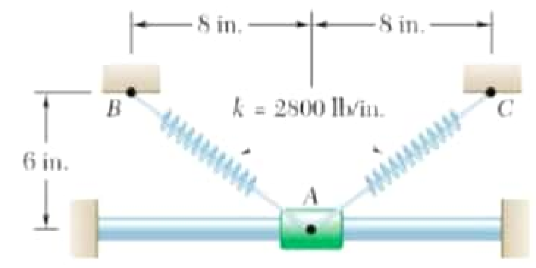
$$4.905 - 2.5 - 0.625 = \frac{1}{2}(10)v^2$$

$v = 0.597$ m/s ◀

(*b*) Let x = distance moved down by the 10 kg block

$$U_{1-2} = W(x) - \frac{1}{2}k_A(x)^2 - \frac{1}{2}k_B\left(\frac{x}{2}\right)^2 = \frac{1}{2}(m)v^2$$

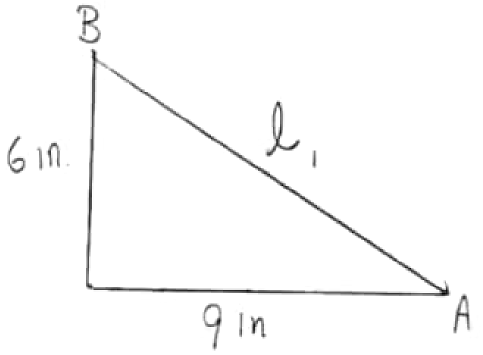
$$\frac{d}{dx}\left[\frac{1}{2}(m)v^2\right] = 0 = W - k_A(x) - \frac{k_B}{8}(2x)$$



PROBLEM 13.58

A 4-lb collar can slide without friction along a horizontal rod and is in equilibrium at A when it is pushed 1 in. to the right and released from rest. The springs are undeformed when the collar is at A and the constant of each spring is 2800 lb/in. Determine the maximum velocity of the collar.

SOLUTION

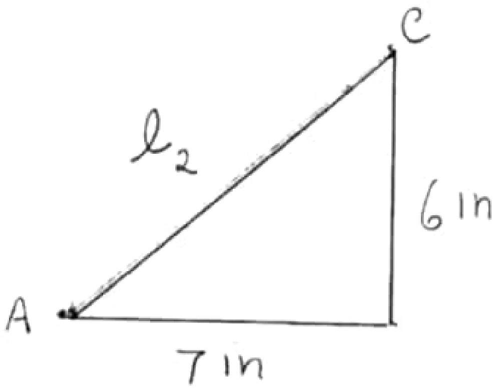


$$\ell_1 = \sqrt{6^2 + 9^2} = 10.817 \text{ in.}$$

$$\ell_0 = \sqrt{(6)^2 + (8)^2} = 10 \text{ in.} = 0.8333 \text{ ft}$$

$$\text{Stretch} = 10.817 - 10 = 0.817 \text{ in.}$$

$$S_1 = 0.06805 \text{ ft}$$



$$\ell_2 = \sqrt{(7)^2 + (6)^2} = 9.215 \text{ in.}$$

$$\text{Stretch} = 9.2195 - 10 = -0.7805 \text{ in.}$$

$$S_2 = 0.06504 \text{ ft}$$

$$T_1 = 0, \quad V_2 = 0$$

$$T_2 = \frac{1}{2} m v_2^2$$

$$= \frac{1}{2}\left(\frac{4}{32.2}\right) v_2^2$$

$$V_1 = \frac{1}{2}(33{,}600 \text{ lb/ft})\left(S_1^2 + S_2^2\right)$$

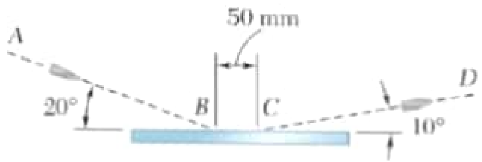
$$V_1 = (16{,}800)(0.008861) = 148.86 \text{ ft} \cdot \text{lb}$$

$$\cancel{T_1} + V_1 = T_2 + \cancel{V_2}$$

$$148.86 = \frac{1}{2}\left(\frac{4}{32.2}\right) v_2^2$$

$$v_2^2 = 2396.7$$

$v_2 = 49.0$ ft/s ◀



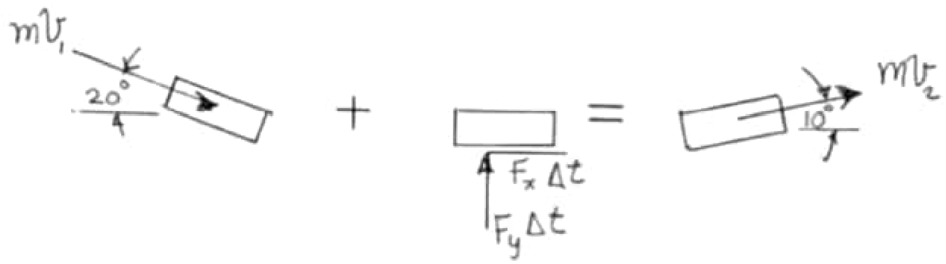
PROBLEM 13.144

A 28-g steel-jacketed bullet is fired with a velocity of 650 m/s toward a steel plate and ricochets along path *CD* with a velocity 500 m/s. Knowing that the bullet leaves a 50-mm scratch on the surface of the plate and assuming that it has an average speed of 600 m/s while in contact with the plate, determine the magnitude and direction of the impulsive force exerted by the plate on the bullet.

SOLUTION

Given: $m = 0.028$ kg, $v_1 = 650$ m/s, $v_2 = 500$ m/s

Impulse-momentum diagram of the bullet:



Impulse momentum in the x-dir $\longrightarrow$

$$mv_1\cos 20° - F_x\Delta t = mv_2\cos 10°$$

So,

$$F_x\Delta t = mv_1\cos 20° - mv_2\cos 10°$$

$$= 0.028\,(650)\cos 20° - 0.028\,(500)\cos 10° = 3.3151\ \text{N}\cdot\text{s}$$

y-dir $\uparrow$

$$-mv_1\sin 20° + F_y\Delta t = mv_2\sin 10°$$

So,

$$F_y\Delta t = mv_2\sin 10° + mv_1\sin 20°$$

$$= 0.028\,(500)\sin 10° + 0.028\,(650)\sin 20° = 8.6558\ \text{N}\cdot\text{s}$$

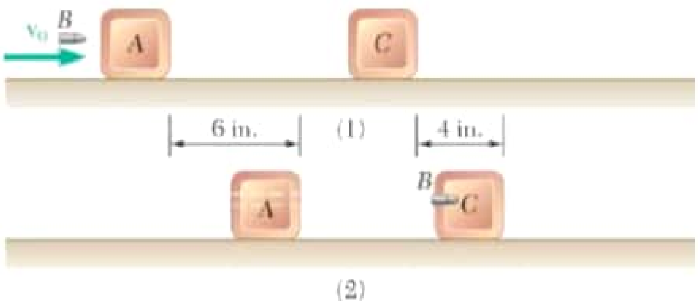
We need Δt. The average velocity is 600 m/s

$$\Delta x = v_{\text{ave}}\,\Delta t;\ \Delta t = \frac{\Delta x}{v_{\text{ave}}} = \frac{0.05\ \text{m}}{600\ \text{m/s}} = 83.33\times 10^{-6}\ \text{s}$$

So

$$\left.\begin{aligned} F_x &= \frac{3.3151}{83.33\times 10^{-6}} = 39.78\ \text{kN} \\ F_y &= \frac{8.6558}{83.33\times 10^{-6}} = 103.87\ \text{kN} \end{aligned}\right\}$$

$\bar{F} = 111.2$ kN $\measuredangle$ 69.0° ◀



PROBLEM 13.149

Bullet B weighs 0.5 oz and blocks A and C both weigh 3 lb. The coefficient of friction between the blocks and the plane is $\mu_k = 0.25$. Initially the bullet is moving at v_0 and blocks A and C are at rest (Figure 1). After the bullet passes through A it becomes embedded in block C and all three objects come to stop in the positions shown (Figure 2). Determine the initial speed of the bullet v_0.

SOLUTION

Masses:

Bullet: $$m_B = \frac{0.5}{(16)(32.2)} = 970.5 \times 10^{-6}\,\text{lb}\cdot\text{s}^2/\text{ft}$$

Blocks A and C: $$m_A = m_C = \frac{3}{32.2} = 93.168 \times 10^{-3}\,\text{lb}\cdot\text{s}^2/\text{ft}$$

Block C + bullet: $$m_C + m_B = 94.138 \times 10^{-3}\,\text{lb}\cdot\text{s}^2/\text{ft}$$

Normal forces for sliding blocks from $N - mg = 0$

Block A: $$N_A = m_A g = 3.00 \text{ lb.}$$

Block C + bullet: $$N_C = (m_C + m_B)g = 3.03125 \text{ lb.}$$

Let v_0 be the initial speed of the bullet;

v_1 be the speed of the bullet after it passes through block A;

v_A be the speed of block A immediately after the bullet passes through it;

v_C be the speed block C immediately after the bullet becomes embedded in it.

Four separate processes and their governing equations are described below.

1. The bullet hits block A and passes through it. Use the principle of conservation of momentum.

$$(v_A)_0 = 0$$

$$m_B v_0 + m_A (v_A)_0 = m_B v_1 + m_A v_A$$

$$v_0 = v_1 + \frac{m_A v_A}{m_B} \qquad (1)$$

2. The bullet hits block C and becomes embedded in it. Use the principle of conservation of momentum.

$$(v_C)_0 = 0$$

$$m_B v_1 + m_C (v_C)_0 = (m_B + m_C) v_C$$

$$v_1 = \frac{(m_B + m_C) v_C}{m_B} \qquad (2)$$

PROBLEM 13.149 (Continued)

3. Block A slides on the plane. Use principle of work and energy.

$$T_1 + U_{1\to 2} = T_2$$

$$\frac{1}{2}m_A v_A^2 - \mu_k N_A d_A = 0 \quad \text{or} \quad v_A = \sqrt{\frac{2\mu_k N_A d_A}{m_A}} \tag{3}$$

4. Block C with embedded bullet slides on the plane. Use principle of work and energy.

$$d_C = 4 \text{ in.} = 0.33333 \text{ ft}$$

$$T_1 + U_{1\to 2} = T_2$$

$$\frac{1}{2}(m_C + m_B)v_C^2 - \mu_k N_C d_C = 0 \quad \text{or} \quad v_C = \sqrt{\frac{2\mu_k N_C d_C}{m_C + m_B}} \tag{4}$$

Applying the numerical data:

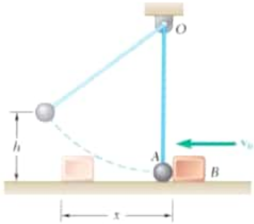
From Eq. (4), $$v_C = \sqrt{\frac{(2)(0.25)(3.03125)(0.33333)}{94.138\times 10^{-3}}} = 2.3166 \text{ ft/s}$$

From Eq. (3), $$v_A = \sqrt{\frac{(2)(0.25)(3.00)(0.5)}{93.168\times 10^{-3}}} = 2.8372 \text{ ft/s}$$

From Eq. (2), $$v_1 = \frac{(94.138\times 10^{-3})(2.3166)}{970.5\times 10^{-6}} = 224.71 \text{ ft/s}$$

From Eq. (1), $$v_0 = 224.71 + \frac{(93.138\times 10^{-3})(2.8372)}{970.5\times 10^{-6}}$$

$v_0 = 497$ ft/s ◀

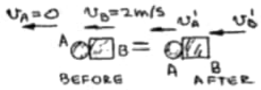


PROBLEM 13.175

A 1-kg block B is moving with a velocity $\mathbf{v}_0$ of magnitude $v_0 = 2$ m/s as it hits the 0.5-kg sphere A, which is at rest and hanging from a cord attached at O. Knowing that $\mu_k = 0.6$ between the block and the horizontal surface and $e = 0.8$ between the block and the sphere, determine after impact (a) the maximum height h reached by the sphere, (b) the distance x traveled by the block.

SOLUTION

Velocities just after impact



Total momentum in the horizontal direction is conserved:

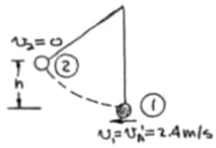
$$m_A v_A + m_B v_B = m_A v_A' + m_B v_B'$$
$$0 + (1\text{ kg})(2\text{ m/s}) = (0.5\text{ kg})(v_A') + (1\text{ kg})(v_B')$$
$$4 = v_A' + 2v_B' \qquad (1)$$

Relative velocities:

$$(v_A - v_B)e = (v_B' - v_A')$$
$$(0-2)(0.8) = v_B' - v_A'$$
$$-1.6 = v_B' - v_A' \qquad (2)$$

Solving Eqs. (1) and (2) simultaneously:

$$v_B' = 0.8\text{ m/s}$$
$$v_A' = 2.4\text{ m/s}$$



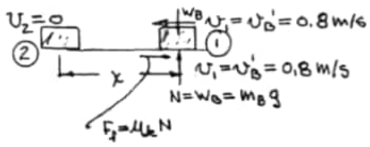
(a) Conservation of energy:

$$T_1 = \frac{1}{2}m_A v_1^2 \quad V_1 = 0$$
$$T_1 = \frac{1}{2}m_A(2.4\text{ m/s})^2 = 2.88\,m_A$$
$$T_2 = 0$$
$$V_2 = m_A gh$$
$$T_1 + V_1 = T_2 + V_2 \qquad 2.88\cancel{m}_A + 0 = 0 + \cancel{m}_A(9.81)h$$

$h = 0.294$ m ◀

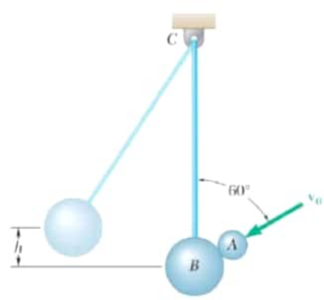
PROBLEM 13.175 (Continued)

(b) Work and energy:



$$T_1 = \frac{1}{2}m_B v_1^2 = \frac{1}{2}m_B(0.8\text{ m/s})^2 = 0.32m_B \qquad T_2 = 0$$
$$U_{1\text{-}2} = -F_f x = -\mu_k Nx = -\mu_k m_B gx = -(0.6)(m_B)(9.81)x$$
$$U_{1\text{-}2} = -5.886m_B x$$
$$T_1 + U_{1\text{-}2} = T_2: \quad 0.32m_B - 5.886m_B x = 0$$

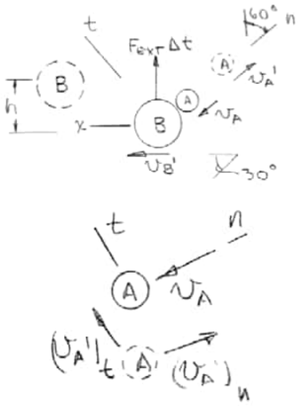
$x = 0.0544$ m $\qquad$ $x = 54.4$ mm ◀



PROBLEM 13.183

A 340-g ball B is hanging from an inextensible cord attached to a support C. A 170-g ball A strikes B with a velocity $\mathbf{v}_0$ of magnitude 1.5 m/s at an angle of 60° with the vertical. Assuming perfectly elastic impact ($e = 1$) and no friction, determine the height h reached by ball B.

SOLUTION



Ball A alone

Momentum in t-direction conserved

$$m_A(v_A)_t = m_A(v_A')_t$$

$$(v_A)_t = 0 = (v_A')_t$$

Thus $$(v_A')_n = v_A' \measuredangle 60^\circ$$

Total momentum in the x-direction is conserved.

$$m_A v_A \sin 60^\circ + m_B(v_B)_x = m_A(-v_A')\sin 60 + m_B v_B'$$

$$v_A = v_0 = 1.5 \text{ m/s} \qquad (v_B)_x = 0$$

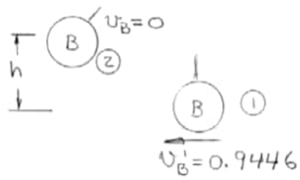
$$0.17(1.5)(\sin 60^\circ) + 0 = -(0.17)(v_A')(\sin 60^\circ) + (0.34)v_B'$$

$$0.2208 = -0.1472 v_A' + 0.34 v_B' \tag{1}$$

Relative velocity in the n-direction

$$\left[-v_A - (v_B)_n\right]e = -v_B'\cos 30^\circ - v_A';$$

$$(-1.5 - 0)(1) = -0.866 v_B' - v_A' \tag{2}$$



Solving Equations (1) *and* (2) simultaneously

$$v_B' = 0.9446 \text{ m/s},\ v_A' = 0.6820 \text{ m/s}$$

Conservation of energy ball B

$$T_1 = \frac{1}{2}m_B(v_B')^2$$

$$T_1 = \frac{1}{2}\frac{W_B}{g}(3.0232)^2 \qquad T_2 = 0$$

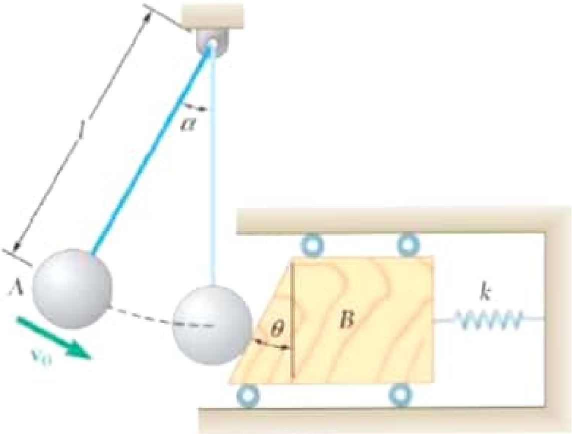
PROBLEM 13.183 (Continued)

$$V_1 = 0 \qquad V_2 = W_B h$$

$$T_1 + V_1 = T_2 + V_2;\ \frac{1}{2}\frac{\cancel{W_B}}{g}(0.9446)^2 = 0 + \cancel{W_B}h;$$

$$h = \frac{(0.9446)^2}{(2)(9.81)} = 0.0455 \text{ m}$$

$h = 45.5$ mm ◀



PROBLEM 13.189

When the rope is at an angle of $\alpha = 30^\circ$ the 1-kg sphere A has a speed $v_0 = 0.6$ m/s. The coefficient of restitution between A and the 2-kg wedge B is 0.8 and the length of rope $l = 0.9$ m The spring constant has a value of 1500 N/m and $\theta = 20°$. Determine, (*a*) the velocities of A and B immediately after the impact (*b*) the maximum deflection of the spring assuming A does not strike B again before this point.

SOLUTION

Masses: $m_A = 1$ kg

$m_B = 2$ kg

<u>Analysis of sphere *A* as it swings down</u>:

Initial state: $\alpha = 30°, \quad h_0 = l(1-\cos\alpha) = (0.9)(1-\cos 30°) = 0.12058$ m

$$V_0 = m_A g h_0 = (1)(9.81)(0.12058) = 1.1829 \text{ N}\cdot\text{m}$$

$$T_0 = \frac{1}{2}mv_0^2 = \frac{1}{2}(1)(0.6)^2 = 0.180 \text{ N}\cdot\text{m}$$

Just before impact: $\alpha = 0, \quad h_1 = 0, \quad V_1 = 0$

$$T_1 = \frac{1}{2}m_A v_A^2 = \frac{1}{2}(1)v_A^2 = 0.5v_A^2$$

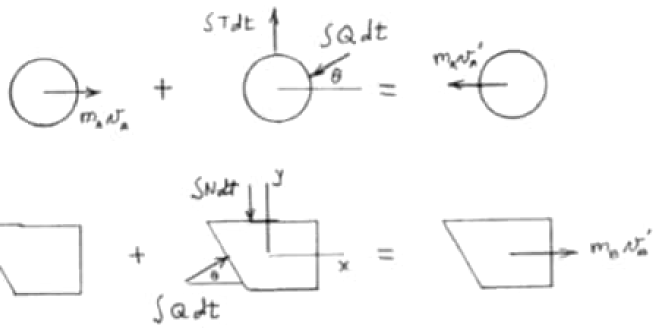
Conservation of energy: $T_0 + V_0 = T_1 + V_1$

$$0.180 + 1.1829 = 0.5v_A^2 + 0$$

$$v_A^2 = 2.7257 \text{ m}^2/\text{s}^2$$

$$\mathbf{v}_A = 1.6510 \text{ m/s} \longrightarrow$$

Analysis of the impact: Use conservation of momentum together with the coefficient of restitution. $e = 0.8$.



Note that the ball rebounds horizontally and that an impulse $\int T dt$ is applied by the rope. Also, an impulse $\int N dt$ is applied to B through its supports.

<u>Both *A* and *B*</u>:

Momentum in *x*-direction:

$$m_A(v_A)_x + 0 = m_A(v'_A)_x + m_B(v'_B)_x$$

$$(1)(1.6510) = (1)(v'_A)_x + (2)(v'_B)_x \tag{1}$$

Coefficient of restitution: $(v_A)_n = (v_A)_x \cos\theta$

$$(v_B)_n = 0, \quad (v'_A)_n = (v'_A)_x \cos\theta, \quad (v'_B)_x \cos 30°$$

$$(v'_B)_n - (v'_A)_n = e[(v_A)_n - (v_B)_n]$$

$$(v'_B)_x \cos\theta - (v'_A)_x \cos\theta = e[(v_A)_x \cos\theta]$$

Dividing by $\cos\theta$ and applying $e = 0.8$ gives

$$(v'_B)_x - (v'_A)_x = (0.8)(1.6510) \tag{2}$$

Solving Eqs. (1) and (2) simultaneously,

$$(v'_A)_x = -0.33020 \text{ m/s}$$

$$(v'_B)_x = 0.99059 \text{ m/s}$$

$\mathbf{v}'_A = 0.330 \text{ m/s} \longleftarrow$ ◀

(*a*) *Velocities immediately after impact.* $\mathbf{v}'_B = 0.991 \text{ m/s} \longrightarrow$ ◀

(*b*) Maximum deflection of wedge *B*.

Use conservation of energy: $T_{B1} + V_{B1} = T_{B2} + V_{B2}$

$$T_{B1} = \frac{1}{2} m_B v_B^2$$

$$V_{B1} = 0$$

$$T_{B2} = 0$$

$$V_{B2} = \frac{1}{2} k(\Delta x)^2$$

The maximum deflection will occur when the block comes to rest (ie, no kinetic energy)

$$\frac{1}{2} m_B v_B^2 = \frac{1}{2} k(\Delta x)^2$$

$$(\Delta x)^2 = \frac{m_B v_B^2}{k} = \frac{(2)(0.99059 \text{ m/s})^2}{1500 \text{ N/m})}$$

$(\Delta x) = 0.0362$ m $\qquad \Delta x = 36.2$ mm ◀