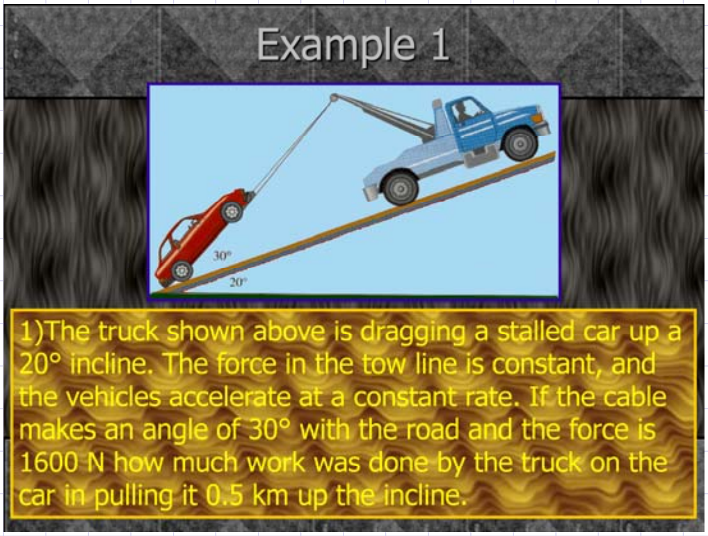
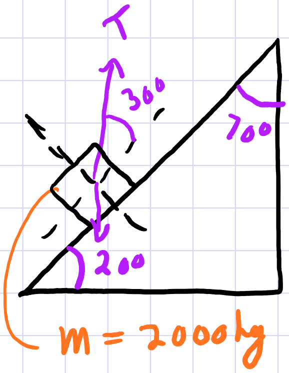
Example 1

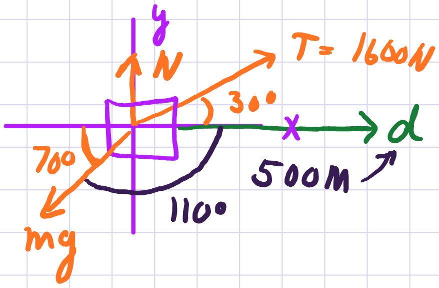
Monday, October 26, 2015 7:38 AM



Example 1

1)The truck shown above is dragging a stalled car up a 20° incline. The force in the tow line is constant, and the vehicles accelerate at a constant rate. If the cable makes an angle of 30° with the road and the force is 1600 N how much work was done by the truck on the car in pulling it 0.5 km up the incline.





a) $W_T = F d \cos\theta$

$W_T = (1600N)(500M)\cos(30°)$

$W_T = 692,820\ J$

$W_T = 6.9 \times 10^5\ J$

b) $W_g = F d \cos\theta$

$W_g = mgd\cos\theta$

$W_g = (2000kg)(9.8\ m/s^2)(500m)\cos(110°)$

$W_g = -3.4 \times 10^{+6}\ J$

c) $W_N = F d \cos\theta$

$W_N = N d \cos(90°) = 0$

d) $W_{tot} = W_T + W_g + W_N = 6.9 \times 10^5 J - 3.4 \times 10^6 J + 0$

$W_{tot} = -2.7 \times 10^6\ J$

Example 2

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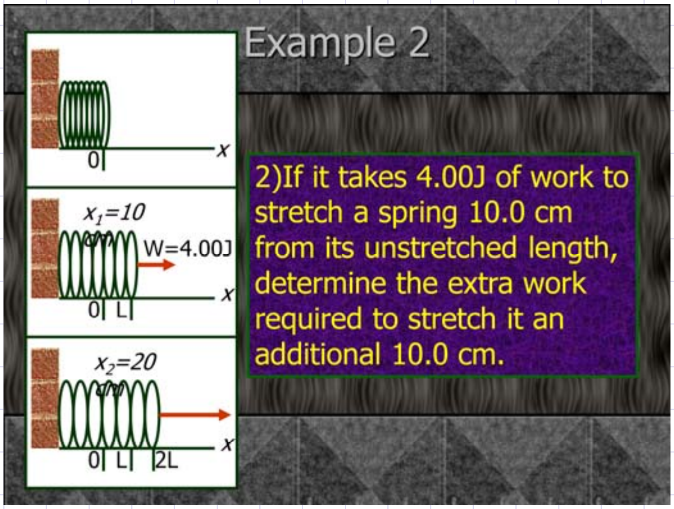
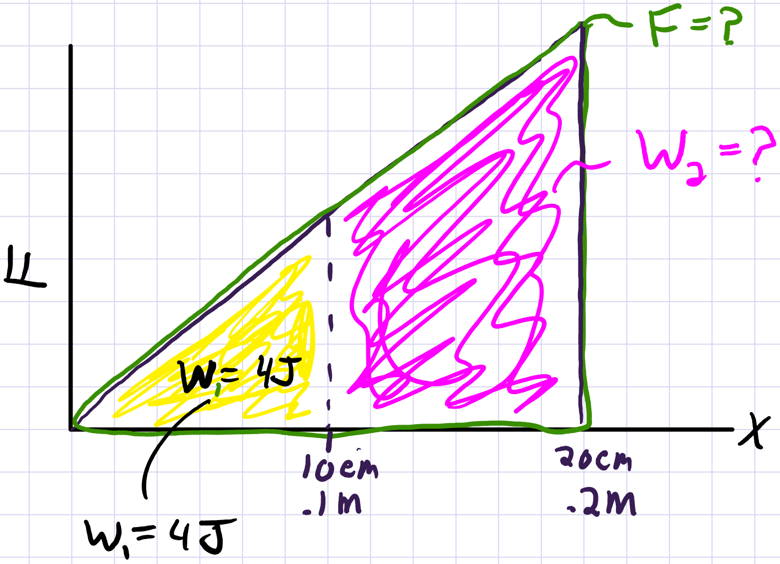
$F = -kX$ ↳ $\left(\frac{N}{m}\right)$



Example 2

2)If it takes 4.00J of work to stretch a spring 10.0 cm from its unstretched length, determine the extra work required to stretch it an additional 10.0 cm.

$\theta = 0 \quad \cos\theta = 1$



$$W_1 = \tfrac{1}{2}(\underset{\downarrow}{b})(\underset{\searrow}{h})$$

$$W_1 = \tfrac{1}{2}(X)(kX)$$

$$W_1 = \tfrac{1}{2}kX^2$$

$$k = \frac{2W_1}{X^2} = \frac{2(4J)}{(.1m)^2} = \rightarrow$$

$N \cdot m \rightarrow kg\,\frac{m}{s^2}$

$$k = 800\ N/m$$

$$W_{tot} = \tfrac{1}{2}kX^2$$

$$W_{tot} = \tfrac{1}{2}(800N/m)(.2m)^2$$

$$W_{tot} = 16J$$

$$W_2 = W_{tot} - W_1 = 16J - 4J$$

$$W_2 = 12J$$

Example 3

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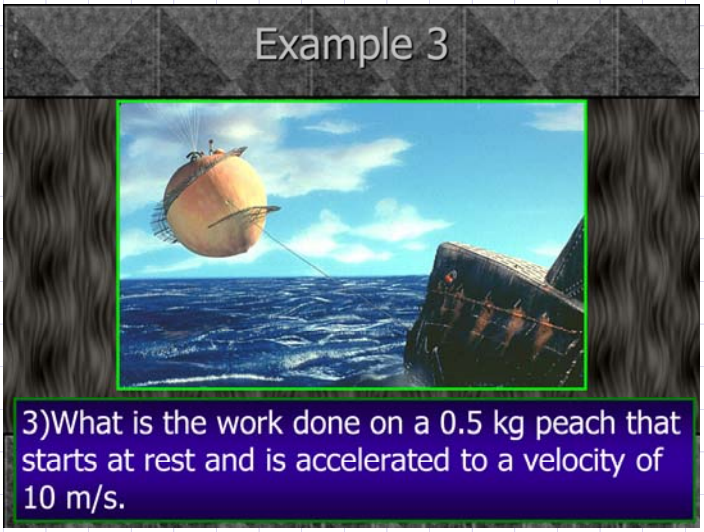
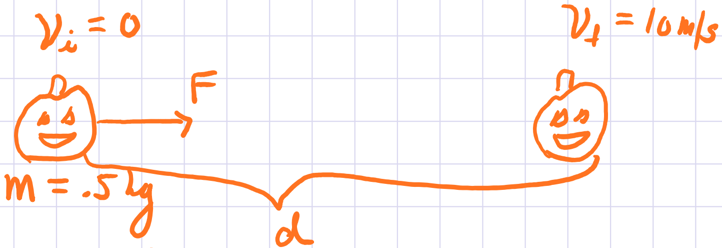


Example 3

3)What is the work done on a 0.5 kg peach that starts at rest and is accelerated to a velocity of 10 m/s.

$a = \frac{v_f - v_i}{t}$

$d = \Delta x = \left[\frac{v_f + v_i}{2}\right] t$



$v_i = 0$

$v_f = 10 m/s$

F

$m = .5kg$

d

$W = ?$

$W = Fd\,\cancel{\cos\theta} \nearrow 1$

$W = Fd$

$W = mad$

$W = m\left[\frac{v_f - v_i}{\cancel{t}}\right]\left[\frac{v_f + v_i}{2}\right]\cancel{t}$

$W = \frac{1}{2} m (v_f - v_i)(v_f + v_i)$

$W = \frac{1}{2} m (v_f^2 - v_i^2)$

$W = \boxed{\underbrace{\frac{1}{2} m v_f^2}_{KE}} - \cancel{\frac{1}{2} m v_i^2} \rightarrow 0$

$W = \frac{1}{2}(.5kg)(10 m/s)^2$

$\boxed{W = 25J}$

Example 4

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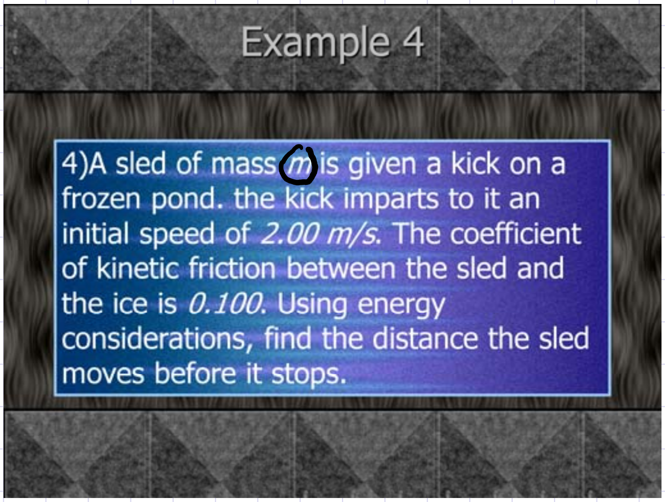
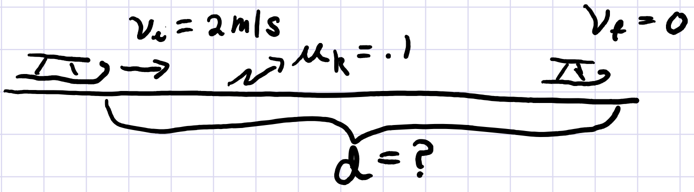


Example 4

4)A sled of mass *m* is given a kick on a frozen pond. the kick imparts to it an initial speed of *2.00 m/s*. The coefficient of kinetic friction between the sled and the ice is *0.100*. Using energy considerations, find the distance the sled moves before it stops.



$W = \Delta KE$

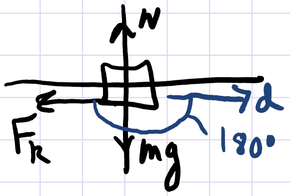
$F d \cancel{\cos\theta}^{\,-1} = \cancel{KE_f}^{\,0} - KE_i$

$-Fd = -\frac{1}{2} m v_i^2$

$+\mu_k \cancel{m} g d = +\frac{1}{2} \cancel{m} v_i^2$

$d = \frac{1}{2}\frac{v_i^2}{\mu_k g} = \frac{(2\,m/s)^2}{2(.1)(9.8\,m/s^2)}$

$d = 2.04\,m$



$N - mg = 0$

$N = mg$

$F_k = \mu_k N$

$F_k = \mu_k mg$

Example 5

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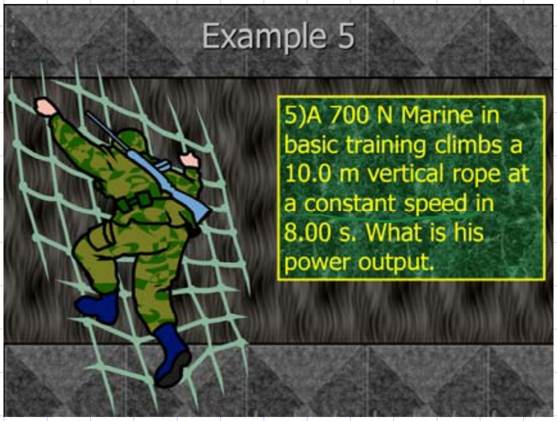
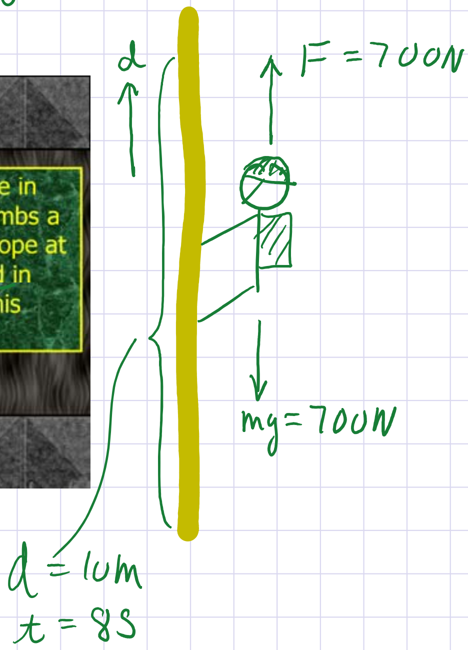


Example 5

5)A 700 N Marine in basic training climbs a 10.0 m vertical rope at a constant speed in 8.00 s. What is his power output.

$a = 0$



$$P = \frac{W}{t}$$

$$P = \frac{F\,d\cos\theta}{t} = F\,v\cos\theta$$

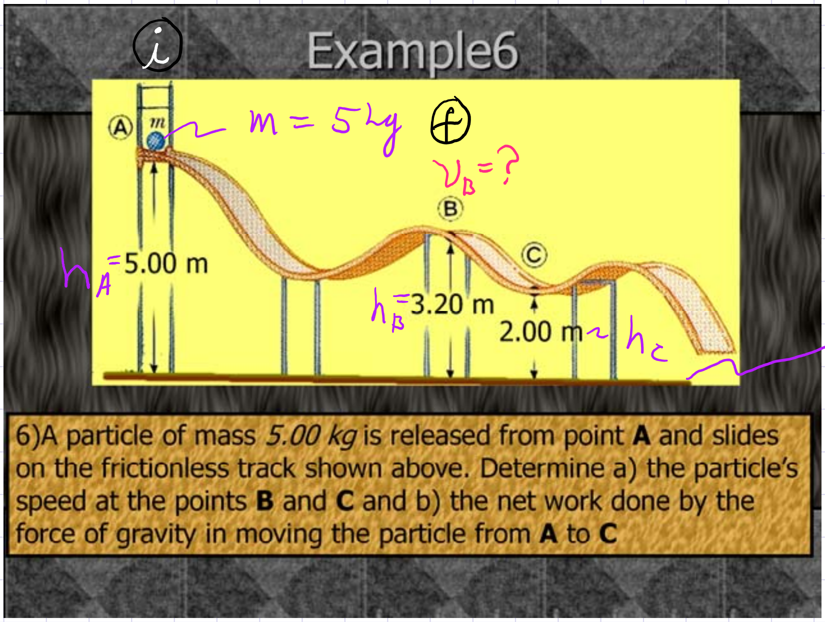
$$P = \frac{F \cdot d}{t}$$

$$P = \frac{(700N)(10m)}{8s}$$

$$P = 875\ W$$

Example 6

Monday, October 26, 2015 7:42 AM



Example6

6)A particle of mass *5.00 kg* is released from point **A** and slides on the frictionless track shown above. Determine a) the particle's speed at the points **B** and **C** and b) the net work done by the force of gravity in moving the particle from **A** to **C**

a) $\Delta KE + \Delta PE = 0$

$KE_f - \cancel{KE_i}^{0} + PE_f - PE_i = 0$

$\frac{1}{2}\cancel{m}v_B^2 + \cancel{m}gh_B - \cancel{m}gh_A = 0$

$\frac{1}{2}v_B^2 + gh_B - gh_A = 0$

PE = 0

$v_B^2 = 2(gh_A - gh_B)$

$v_B = \sqrt{2g(h_A - h_B)}$

$v_B = \sqrt{2(9.8 m/s^2)(5m - 3.2m)}$

$v_B = 5.94 m/s$

$v_C = \sqrt{2g(h_A - h_C)}$

$v_C = \sqrt{2(9.8 m/s^2)(5m - 2m)}$

$v_C = 7.67 m/s$

B) $W_g = \Delta KE$

$W_g = -\Delta PE$

$W_g = PE_f - PE_i$

$W_g = mgh_c - mgh_A$

$W_g = mg(h_c - h_A)$

$W_g = (5kg)(9.8 m/s^2)[2m - 5m]$

$W_g = -147J$

$\boxed{W_g = 147J}$

Example 7

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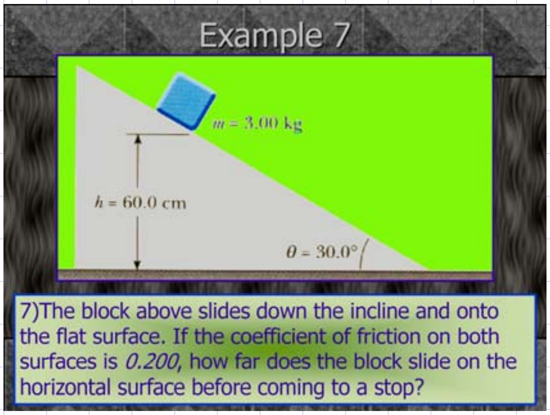
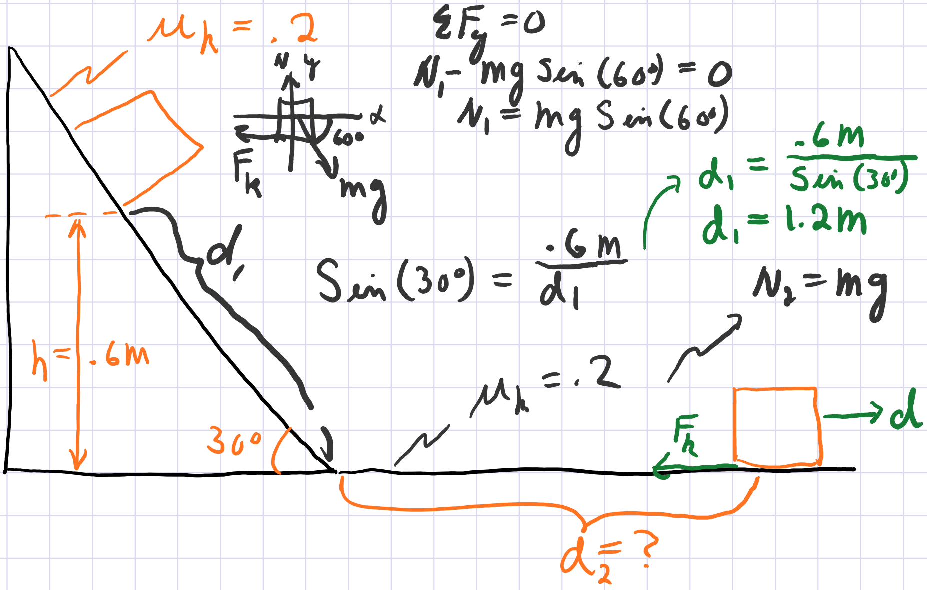


Example 7

7)The block above slides down the incline and onto the flat surface. If the coefficient of friction on both surfaces is *0.200*, how far does the block slide on the horizontal surface before coming to a stop?



$\Sigma F_y = 0$

$N_1 - mg\sin(60°) = 0$

$N_1 = mg\sin(60°)$

$\sin(30°) = \frac{.6m}{d_1}$

$d_1 = \frac{.6m}{\sin(30°)}$

$d_1 = 1.2m$

$N_2 = mg$

$$\Delta KE + \Delta PE = W_f$$

$$\cancel{KE_f}^{0} - \cancel{KE_i}^{0} + \cancel{PE_f}^{0} - PE_i = W_f$$

$$-mgh = W_{f_1} + W_{f_2}$$

$$-mgh = F_{k_1} d_1 \cos\theta + F_{k_2} d_2 \cos\theta$$

$$-mgh = \mu_k N_1 d_1 \cancel{\cos\theta}^{-1} + \mu_k N_2 d_2 \cancel{\cos\theta}^{-1}$$

$$+\cancel{mg}h = +\mu_k \cancel{mg} \sin(60°) d_1 + \mu_k \cancel{mg} d_2$$

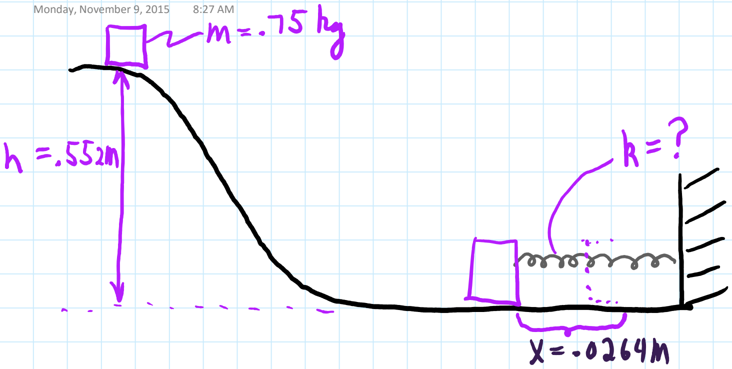
$$d_2 = \frac{h - \mu_k \sin(60°) d_1}{\mu_k}$$

$$d_2 = \frac{.6m - (.2)\sin(60°)(1.2m)}{.2}$$

$$d_2 = 1.96m$$

Extra 1

Monday, November 9, 2015 8:27 AM



$$F = kX$$

$$\Delta KE + \Delta PE = 0$$

$$\Delta KE + \Delta PE_s + \Delta PE_g = 0$$

$$\cancelto{0}{KE_f} - \cancelto{0}{KE_i} + PE_{sf} - \cancelto{0}{PE_{si}} + \cancelto{0}{PE_{gf}} - PE_{gi} = 0$$

$$PE_{sf} - PE_{gi} = 0$$

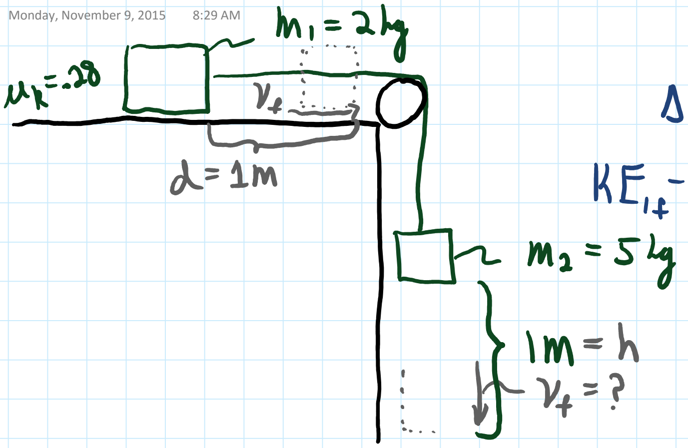
$$\tfrac{1}{2}kX^2 - mgh = 0$$

$$k = \frac{2mgh}{X^2} = \frac{2\,\overbrace{(.75\,kg)(9.8\,m/s^2)}^{N}\,\overset{m}{(.552\,m)}}{(.0264\,m)^2}$$

$$k = 11,642\ N/m$$

Extra 2

Monday, November 9, 2015 8:29 AM



$$\Delta KE + \Delta PE = W_f$$

$$\Delta KE_1 + \Delta KE_2 + \cancelto{0}{\Delta PE_1} + \Delta PE_2 = W_f$$

$$KE_{1f} - \cancelto{0}{KE_{1i}} + KE_{2f} - \cancelto{0}{KE_{2i}} + \cancelto{0}{PE_{2f}} - PE_{2i} = W_f$$

$$KE_{1f} + KE_{2f} - PE_{2i} = F_k d \cancelto{-1}{\cos\theta}$$

$$\frac{1}{2} m_1 v_f^2 + \frac{1}{2} m_2 v_f^2 - m_2 g h = \mu_k N d$$

$$\frac{1}{2} v_f^2 (m_1 + m_2) - m_2 g h = -\mu_k m_1 g d$$

$$\frac{1}{2} v_f^2 (m_1 + m_2) = m_2 g h - \mu_k m_1 g d$$

$$v_f = \sqrt{\frac{2g(m_2 h - \mu_k m_1 d)}{(m_1 + m_2)}}$$

$$v_f = \sqrt{\frac{2(9.8 m/s^2)[5kg(1m) - (.28)(2kg)(1m)]}{7kg}}$$

$$\boxed{v_f = 3.53 m/s}$$