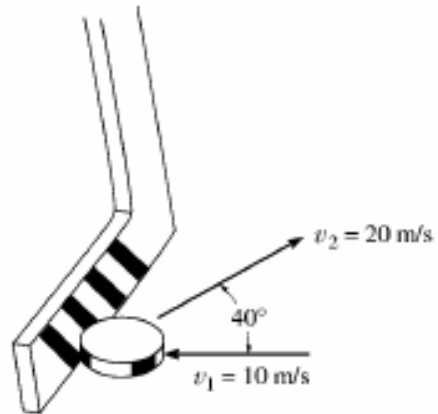
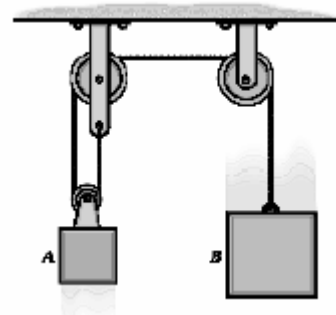


CE 222 ENGINEERING MECHANICS II (SPRING 2014 – 2015)
Home Exercise III – Kinetics of particles (Impulse & Momentum, Impact)
<http://www2.ce.metu.edu.tr/~ce222>

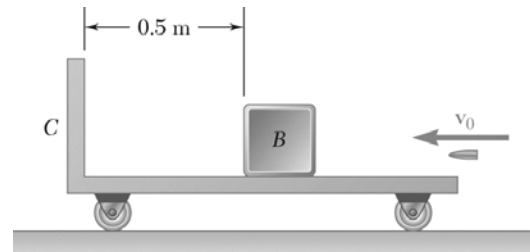
1) A huckey puck is travelling to the left with a velocity of $V_1=10$ m/s when it is struck by a hockey stick and given a velocity of $V_2= 20$ m/s as shown. Determine the magnitude of the net impulse exerted by the hockey stick on the puck. The puck has a mass of 0.2 kg. (Ans: $T=5.68$ N.s)



2) Determine the velocity of each block 2 seconds after the blocks are released from rest. Neglect the mass of the pulleys and the cord. $m_A= 5$ kg , $m_B= 25$ kg (Ans: $V_A=8.57$ m/s , $V_B=17.14$ m/s)

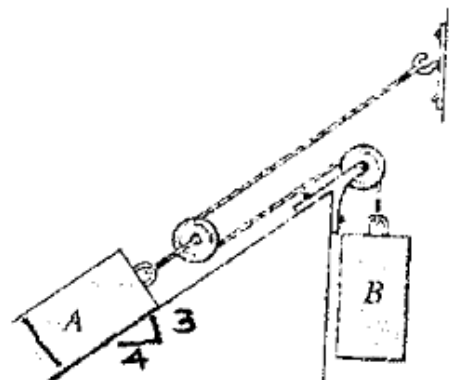


3) A 30-g bullet is fired with a horizontal velocity of 450 m/s and becomes embedded in block B which has a mass of 3 kg. After the impact, block B slides on 30-kg carrier C until it impacts the end of the carrier. Knowing the impact between B and C is perfectly plastic and the coefficient of kinetic friction between B and C is 0.2, determine

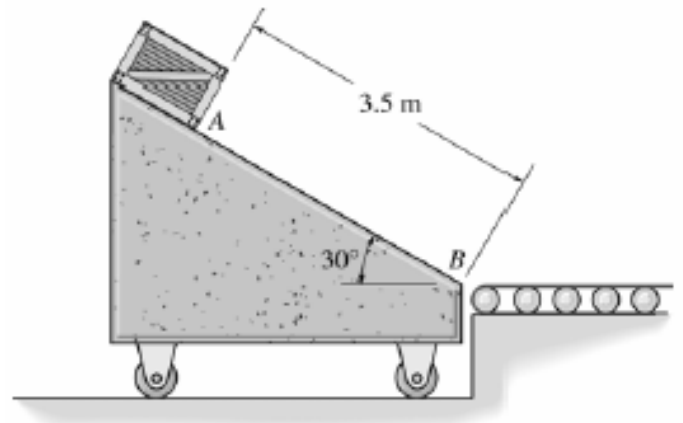


(a) the velocity of the bullet and B after the first impact,
 (b) the final velocity of the carrier. (Ans: $V'=4.46$ m/s (\leftarrow), $V''=0.409$ m/s (\leftarrow))

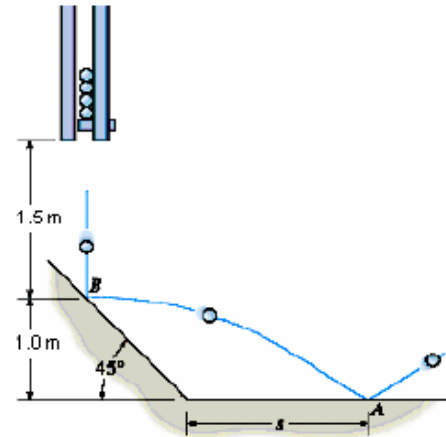
4) Block A has a weight of 300 N and block B has a weight of 50 N. If the coefficient of kinetic friction between the block and incline is $\mu_k = 0.2$, determine the speed of block A after it moves 1 m down the plane, starting from rest. Neglect the mass of the cord and pulleys. (Ans: $V_A = 1.12$ m/s)



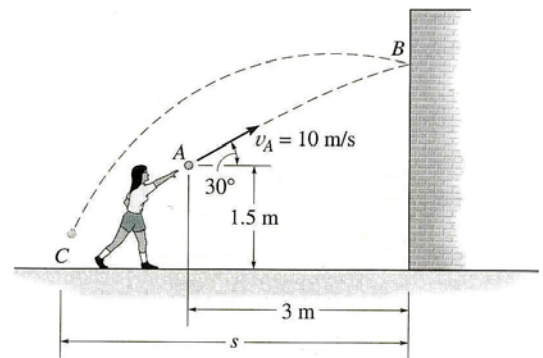
5) The free rolling ramp has a mass of 40 kg. A 10-kg crate is released from rest at A and slides down 3.5 m to point B. If the surface of the ramp is smooth, determine the ramp's speed when the crate reaches B. Also, what is the velocity of the crate? (Ans: $V_B=1.1$ m/s , $V_C=5.43$ m/s)



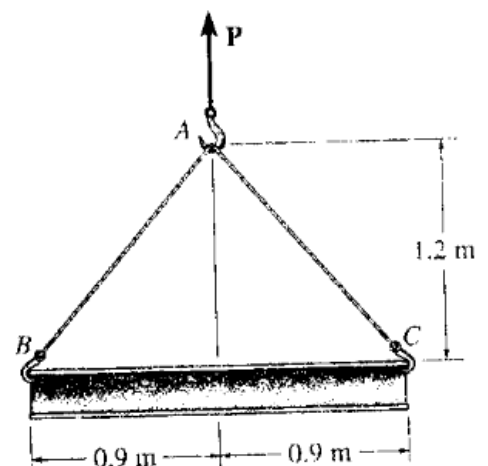
6) The test the manufactured properties of 1-kg steel balls, each ball is released from rest as shown and strikes the 45° smooth inclined surface. If $e=0.8$, determine the distance s to where the ball must strike the horizontal plane at A. At what speed does the ball strike point A? (Ans: $s=0.95$ m , $V=6.68$ m/s)



7) The girls throws the 0.5-kg ball toward the wall with an initial velocity $V_A = 10$ m/s. Determine (a) the velocity at which it strikes the wall at B, (b) the velocity at which it rebounds from the wall if the coefficient of restitution $e = 0.5$, and (c) the distance s from the wall to where it strikes the ground at C. (Ans: $V_{B,1}=8.81$ m/s, $\theta=10.5^\circ$, $V_{B,1}=4.62$ m/s, $\theta=20.3^\circ$)



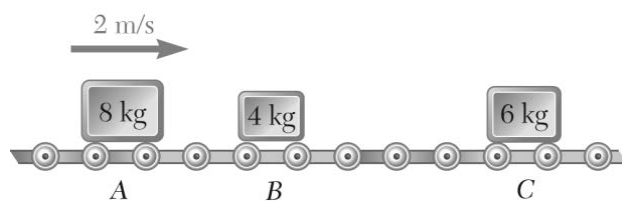
8) Each of the cables sustain a maximum tension of 25 kN, determine the shortest time possible to lift the beam with a speed of 3 m/s starting from rest. (Ans: $t= 0.510$ s)



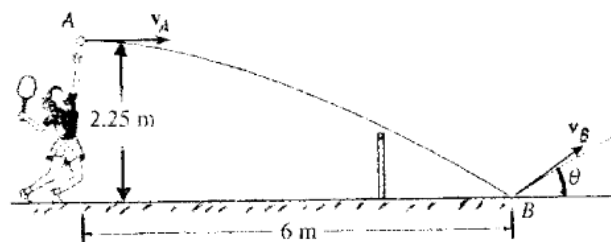
9) Packages in an automobile parts supply house are transported to the loading dock by pushing them along on a roller track with very little friction. At the instant shown, packages B and C are at rest and package A has a velocity of 2 m/s . Knowing that the coefficient of restitution between the packages is 0.3 , determine

- (a) the velocity of package C after A hits B and B hits C ,
 (b) the velocity of A after it hits B for the second time.

(Ans: (a) $V'_A = 1.133 \text{ m/s}$ (\rightarrow), $V'_B = 1.733 \text{ m/s}$ (\rightarrow),
 $V'_C = 0.901 \text{ m/s}$ (\rightarrow); (b) $V''_A = 0.807 \text{ m/s}$ (\rightarrow))



10) The tennis ball is struck with a horizontal velocity V_A , strikes the smooth ground at B , and bounces upward at $\theta = 30^\circ$. Determine the initial velocity V_A and V_B , and the coefficient restitution between the ball and the ground. (Ans: $V_A = 8.86 \text{ m/s}$, $V_B = 10.2 \text{ m/s}$, $e = 0.77$)



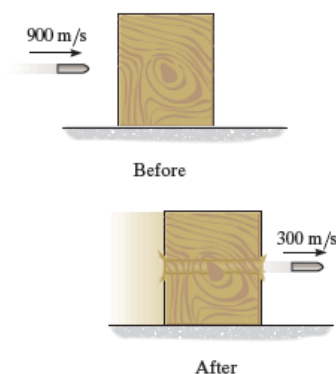
11) The 50-kg boy jumps on the 5-kg skateboard with a horizontal velocity of 5 m/s . Determine the distance s the boy reaches up the inclined plane before momentarily coming to rest. Neglect the skateboard's rolling resistance.

(Ans: $s = 2.11 \text{ m}$)



12) The 200-g projectile is fired with a velocity of 900 m/s towards the center of the 15-kg wooden block, which rests on a rough surface. If the projectile penetrates and emerges from the block with a velocity of 300 m/s , determine the velocity of the block just after the projectile emerges. How long does the block slide on the rough surface, after the projectile emerges, before it comes to rest again? The coefficient of kinetic friction between the surface and the block is $\mu_k = 0.2$.

(Ans: $(V_B)_2 = 2.11 \text{ m/s}$, $t = 4.08 \text{ s}$)



13) The 1-kg ball is dropped from rest at point A , 2 m above the smooth plane. If the coefficient of restitution between the ball and the plane is $e = 0.6$, determine the distance d where the ball again strikes the plane.

(Ans: $d = 3.84 \text{ m}$, $t = 0.77 \text{ s}$)

