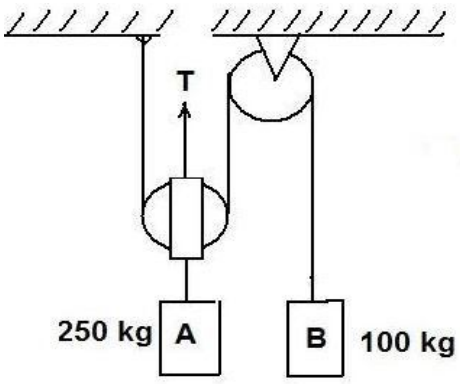
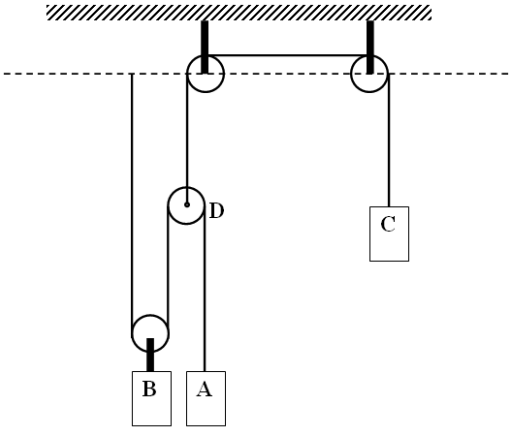
# Civil Engineering Department
# S. V. National Institute of Technology, Surat
# Engineering Mechanics Tutorial : Kinetics

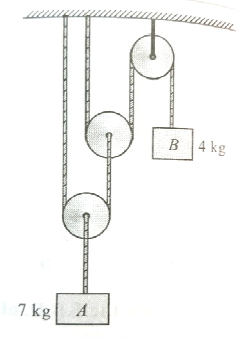
1 Determine the required tension T, if the acceleration of 250 kg Block is to be 2 $m/s^2$ upward.
[Ans: T =1790.5 N ]



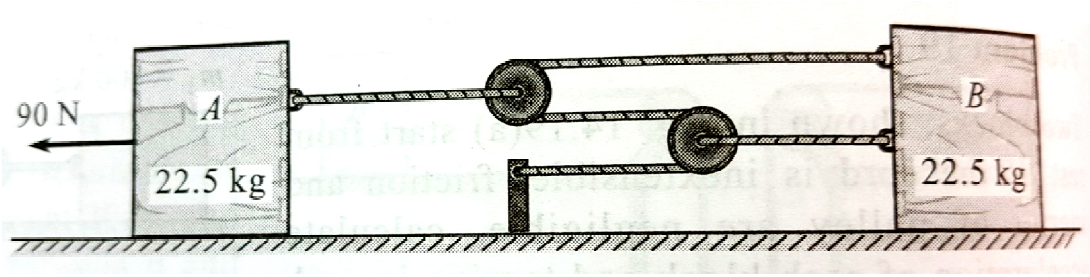

2 For given arrangement block C is moving up at a constant speed of 8 m/s. If elevations of blocks A and B are always equal, determine velocity of block B.
[Ans: $V_B$ = 5.33 m/s ]




3 Determine the tension developed in the chords attached to each block and the acceleration of the blocks when the system shown in figure is released from rest. Neglect the mass of the pulleys and the chords.
[Ans: $a_A$ = 1.241 $m/s^2$ (↑), $a_B$ = 4.975 $m/s^2$ (↓)
T= 19.34 N ( Tension in the cord attached to block B)
4T = 77.36 N ( Tension in cord attached to block A )



4 A system shown in figure is at rest initially. Neglecting friction, determine velocity of block A after it has moved 2.7 m when pulled by a force of 90 N.
[Ans: v = 3.87 m/s)



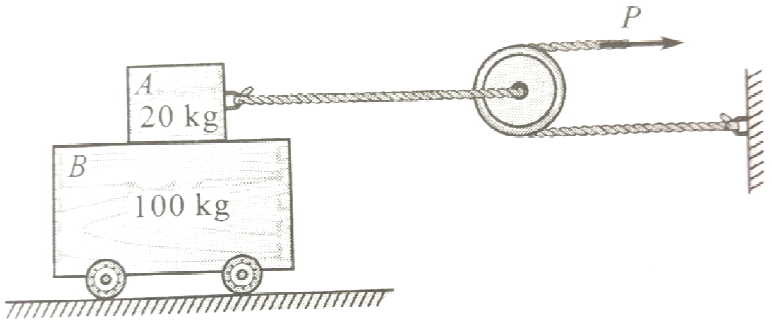

5 If the coefficient of static and kinetic friction between 20 kg block A and 100 kg block B are both essentially the same value of 0.5 and there is no friction between wheels of cart B and surface. Determine the acceleration of each part for (Assume pulley to be massless and friction less)

(i) P = 60 N

(ii) P = 40 N

[Ans: (i) $a_A = 1.095\ m/s^2$ , $a_B = 0.981\ m/s^2$

(ii) Both the blocks will move together with $a = 0.67\ m/s^2$ ]

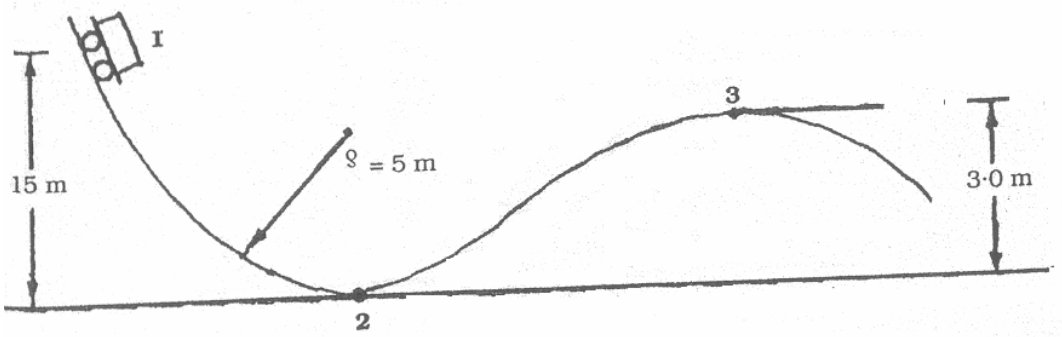



6 A 1500 kg car starts from rest at point 1 and moves without friction down the track as shown in figure. Determine

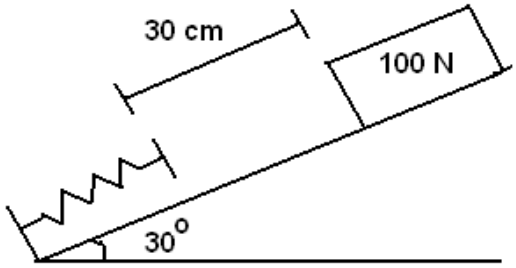
(i) the force exerted by the track on the car at point 2 where radius of curvature is 5 m

(ii) the minimum safe value of radius of curvature at point 3 show that normal reaction become zero.

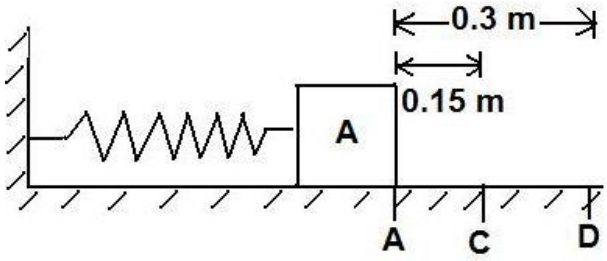
[Ans: (i) 102.95 kN, (ii) 24m]



7 A 100 N block released from rest along a $30^0$ inclined plane. After moving 30 cm, it strikes a spring whose constant is 2500 N/m. if coefficient of friction between block and inclined surface is 0.2. Determine the maximum deformation of the spring and maximum velocity of the block.
[Ans : (i) 10.26 cm, (ii) 1.402 m/sec ]

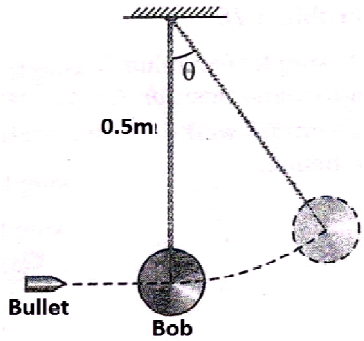



8 A 8 kg block rests on the horizontal surface as shown in Figure. The spring which is not attached to the block, has a stiffness k=500 N/m and is initially compressed by 0.15 m from C to A. After the block is released from rest at A, determine its velocity when it passes point D. The coefficient of kinetic friction between the block and plane is $\mu_k$= 0.2.
[Ans: $V_D$ = 0.48 m/s ]

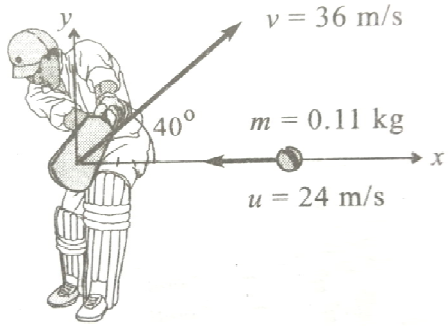



9 A wooden block of weight 40 N rests on a rough horizontal plane having coefficient of friction, μ=0.35. The block is struck by a bullet travelling horizontally with a velocity of 750 m/s and weighing 0.25 N. Workout the distance by which the block is displaced from initial position. It may be presumed that the bullet after striking the block gets embedded in it.
[Ans: 3.097 m]

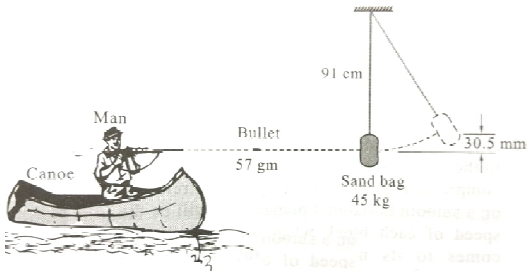
10 A bullet of mass 10 gm is moving with a velocity of 100 m/s and hits a 2 kg bob of a simple pendulum, horizontally as shown in Figure .Determine the maximum angle θ through which the pendulum string 0.5 m long may swing if
(i) The bullet gets embedded in the bob.
(ii) The bullet escapes from the other end of the bob with a velocity 10 m/s.
[Ans : (i) $12.94^o$, (ii) $11.66^o$ ]



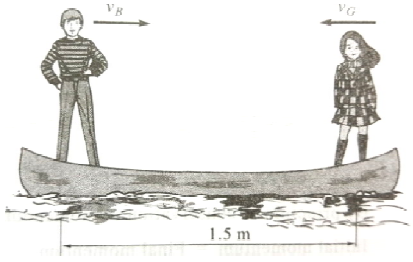
11 A ball of mass 110 gm is moving towards a batsman with a velocity of 24 m/s as shown in figure. The batsman hits the ball by bat, the ball attains a velocity of 36 m/s. If the ball and bat are in contact for a period of 0.015 sec, determine the average impulsive force exerted on the ball during the impact.
[Ans: $F_X$ = 378.24 N (→),$F_Y$ = 169.7 N (↑), F = 414.56 N, θ = $24.16^0$ ]




12 A 68 kg man sitting in a 79.8 kg Canoe fires a gun, discharging a 57 gm bullet into 45 kg sandbag suspended on a rope of 91 cm long on a bank of river as shown in figure. It was calculated from the observation of angle of the swing that the bag with the bullet embedded in it swings through a height of 30.5 mm. What is the velocity of the Canoe.
[Ans : 0.236 m/s (←)]




13 A boy having a mass of 60 kg and a girl having a mass of 50 kg stand motionless at the end of a boat which has a mass of 30 kg as shown in figure. If they exchange their positions in same time, determine the final position of boat. Neglect friction.
[Ans: x = 0.107 m (←) ( backward displacement of boat)




14 A man weighing 60 kg stands in a boat so that he is 15 m from a pier on the shore. He walks 5m in the boat towards the pier and then stops. How far from the pier will he be at the end of this time. The boat weighs 90 kg and there is assumed to be no friction between it and the water
[Ans : 12 m]