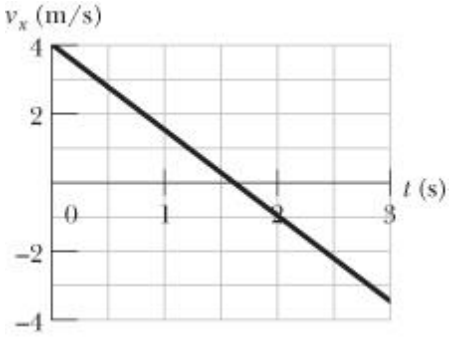
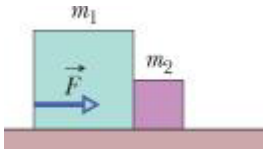
Homework #6

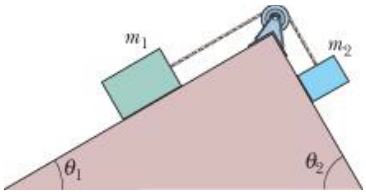
1) A dated box of dates, of mass 5.00 kg, is sent sliding up a frictionless ramp at an angle of θ to the horizontal. The graph gives, as a function of time t, the component v_x of the box's velocity along an x axis that extends directly up the ramp. What is the magnitude of the normal force on the box from the ramp?



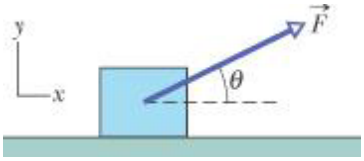
2) Two blocks are in contact on a frictionless table. A horizontal force is applied to the larger block, as shown in the figure. (a) If m_1 = 2.30 kg, m_2 = 1.20 kg, and F = 3.20 N, find the magnitude of the force between the two blocks. (b) Show that if a force of the same magnitude F is applied to the smaller block but in the opposite direction, the magnitude of the force between the blocks is 2.10 N, which is not the same value calculated in (a). (c) Explain the difference.



3) The figure shows a box of dirty money (mass m_1 = 3.00 kg) on a frictionless plane inclined at angle θ_1 = 30.0°. The box is connected via a cord of negligible mass to a box of laundered money (mass m_2 = 2.00 kg) on a frictionless plane inclined at angle θ_2 = 60.0°. The pulley is frictionless and has negligible mass. What is the tension in the cord?



4) The figure shows an initially stationary block of mass m on a floor. A force of magnitude 0.500mg is then applied at upward angle θ = 20.0°. What is the magnitude of the acceleration of the block across the floor if the friction coefficients are (a) μ_s = 0.600 and μ_k = 0.500 and (b) μ_s = 0.400 and μ_k = 0.300?



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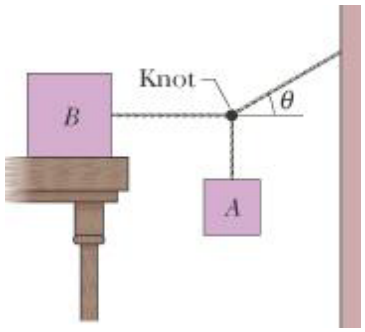
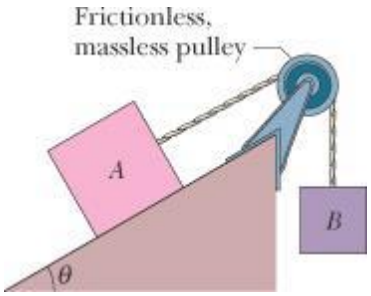
5) Block *B* in the figure weighs 711 N. The coefficient of static friction between block and table is 0.250; angle θ is 30.0°; assume that the cord between *B* and the knot is horizontal. Find the maximum weight of block *A* for which the system will be stationary.



6) Body *A* in the figure weighs 102 N, and body *B* weighs 32.0 N. The coefficients of friction between *A* and the incline are μ_s = 0.560 and μ_k = 0.250. Angle θ is 40.0°. Let the positive direction of an *x* axis be up the incline. In unit-vector notation, what is the acceleration of *A* if *A* is initially (a) at rest, (b) moving up the incline, and (c) moving down the incline?



7) Suppose the coefficient of static friction between the road and the tires on a car is 0.600 and the car has no negative lift. What speed will put the car on the verge of sliding as it rounds a level curve of 30.5 m radius?

8) A student of weight 667 N rides a steadily rotating Ferris wheel (the student sits upright). At the highest point, the magnitude of the normal force $\vec{F}_N$ on the student from the seat is 556 N. (a) Does the student feel "light" or "heavy" there? (b) What is the magnitude of $\vec{F}_N$ at the lowest point? If the wheel's speed is doubled, what is the magnitude F_N at the (c) highest and (d) lowest point?

9) An old streetcar rounds a flat corner of radius 9.10 m, at 16.0 km/h. What angle with the vertical will be made by the loosely hanging hand straps?