CLO 4

1. When two objects of unequal mass are hung vertically over a frictionless pulley of negligible mass, Find the magnitude of the acceleration and the string tension for an Atwood machine in which m_1=2.00 kg and m_2= 4.00 kg.
2. A ball of mass m_1=10kg and a block of mass m_2=5kg are attached by a lightweight cord that passes over a frictionless pulley of negligible mass. The block lies on a frictionless incline of angle 45^0. Find the magnitude of the acceleration of the two objects and the tension in the cord.
3. A simple accelerometer is constructed by suspending a mass m from a string of length L that is tied to the top of a cart. As the cart is accelerated the string-mass system makes a constant angle with the vertical. (a) Assuming that the string mass is negligible compared with m, derive an expression for the cart's acceleration in terms of and show that it is independent of the mass m and the length L. (b) Determine the acceleration of the cart when 23.0°.
4. A box of dirty money (mass m_1 = 3kg) on a frictionless plane inclined at angle 30º. The box is connected via a cord of negligible mass to a box of laundered money (mass m_2 =2kg) on a frictionless plane inclined at angle 60º. The pulley is frictionless and has negligible mass. (i) What is the tension in the cord? (ii) Calculate the acceleration.
5. A person weighs a fish of mass 40N on a spring scale attached to the ceiling of an elevator. Show that if the elevator accelerates at rate of $2m/s^2$ either upward or downward, the spring scale gives a reading that is different from the weight of the fish.
6. A hockey puck on a frozen pond is given an initial speed of 20.0 m/s. If the puck always remains on the ice and slides 115 m before coming to rest, determine the coefficient of kinetic friction between the puck and ice.
7. For every surface there is always a fixed value of Coefficient of Static Friction and a fixed value of Coefficient of Kinetic Friction. Why then static frictional force and kinetic frictional force offered by the surface does not have a constant value? Explain briefly.
8. Suppose you are driving a car along a highway at a high speed. Why should you avoid slamming on your brakes if you want to stop in the shortest distance? That is, why should you keep the wheels turning as you brake?
9. A weight lifter stands on a bathroom scale. He pumps a barbell up and down. What happens to the reading on the scale as this is done? Suppose he is strong enough to actually throw the barbell upward. How does the reading on the scale vary now?
10. A 5.00-g bullet leaves the muzzle of a rifle with a speed of 320 m/s. The expanding gases behind it exert what force on the bullet while it is traveling down the barrel of the rifle, 0.820 m long? Assume constant acceleration and negligible friction
11. The average speed of a nitrogen molecule in air is about 6.70×10^2 m/s, and its mass is 4.68×10^{-26} kg. (a) If it takes 3.00×10^{-13} s for a nitrogen molecule to hit a wall and rebound with the same speed but moving in the opposite direction, what is the average acceleration of the molecule during this time interval? (b) What average force does the molecule exert on the wall?
12. The distance between two telephone poles is 50.0 m. When a 1.00-kg bird lands on the telephone wire midway between the poles, the wire sags 0.200 m. Draw a free-body diagram of the bird. How much tension does the bird produce in the wire? Ignore the weight of the wire.
13. A 72.0-kg man stands on a spring scale in an elevator. Starting from rest, the elevator ascends, attaining its maximum speed of 1.20 m/s in 0.800 s. It travels with this constant speed for the next 5.00 s. The elevator then undergoes a uniform acceleration in the negative y direction for 1.50 s and comes to rest. What does the spring scale register (a) before the elevator starts to move? (b) during the first 0.800 s? (c) while the elevator is

traveling at constant speed? (d) during the time it is slowing down?

14. . A 9.00-kg hanging weight is connected by a string over a pulley to a 5.00-kg block that is sliding on a flat table (Fig. P5.49). If the coefficient of kinetic friction is 0.200, find the tension in the string.

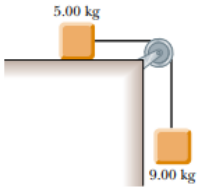
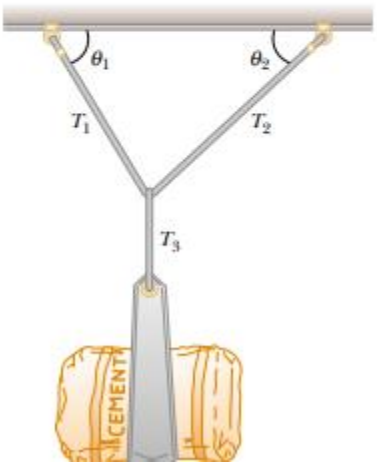


Figure P5.49

Three forces, given by $\mathbf{F}_1 = (-2.00\mathbf{i} + 2.00\mathbf{j})$ N, $\mathbf{F}_2 = (5.00\mathbf{i} - 3.00\mathbf{j})$ N, and $\mathbf{F}_3 = (-45.0\mathbf{i})$ N, act on an object to give it an acceleration of magnitude 3.75 m/s^2. (a) What is the direction of the acceleration? (b) What is the mass of the object? (c) If the object is initially at rest, what is its speed after 10.0 s? (d) What are the velocity components of the object after 10.0 s?

A bag of cement of weight 325 N hangs from three wires as shown in Figure P5.24. Two of the wires make angles $\theta_1 = 60.0°$ and $\theta_2 = 25.0°$ with the horizontal. If the system is in equilibrium, find the tensions T_1, T_2, and T_3 in the wires.



A block of mass m_1 on a rough, horizontal surface is connected to a ball of mass m_2 by a lightweight cord over a lightweight, frictionless pulley, as shown in Figure 5.21a. A force of magnitude F at an angle θ with the horizontal is applied to the block as shown. The coefficient of kinetic friction between the block and surface is μ_k. Determine the magnitude of the acceleration of the two objects.