Review Problems

12.122 The acceleration of a package sliding down section AB of incline ABC is 5 m/s^2. Assuming that the coefficient of kinetic friction is the same for each section, determine the acceleration of the package on section BC of the incline.

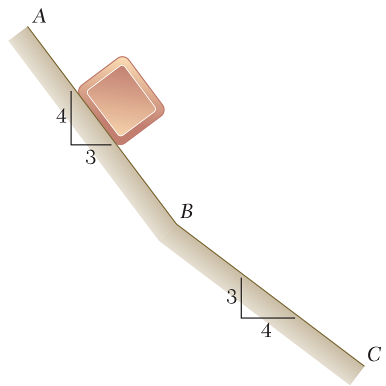

Fig. P12.122

12.123 The two blocks shown are originally at rest. Neglecting the masses of the pulleys and the effect of friction in the pulleys and assuming that the coefficients of friction between block A and the horizontal surface are $\mu_s = 0.25$ and $\mu_k = 0.20$, determine (*a*) the acceleration of each block, (*b*) the tension in the cable.

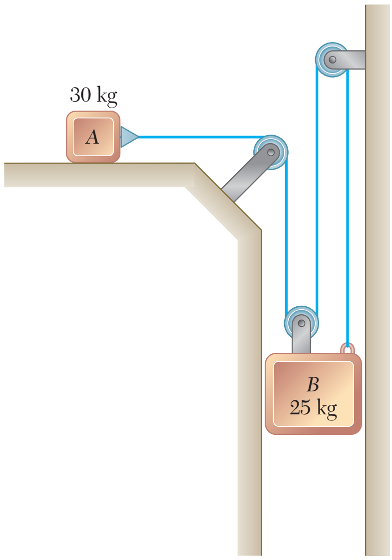

Fig. P12.123

12.124 The coefficients of friction between package A and the incline are $\mu_s = 0.35$ and $\mu_k = 0.30$. Knowing that the system is initially at rest and that block B comes to rest on block C, determine (*a*) the maximum velocity reached by package A, (*b*) the distance up the incline through which package A will travel.

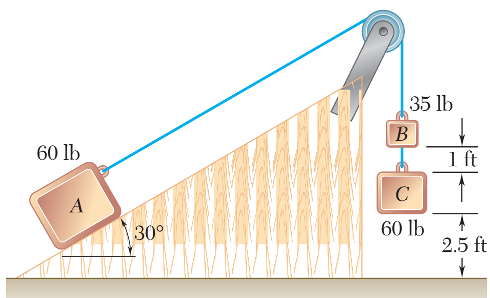

Fig. *P12.124*

12.125 The masses of blocks A, B, and C are $m_A = 4$ kg, $m_B = 10$ kg, and $m_C = 2$ kg. Knowing that $P = 0$ and neglecting the masses of the pulleys and the effect of friction, determine (*a*) the acceleration of each block, (*b*) the tension in the cord.

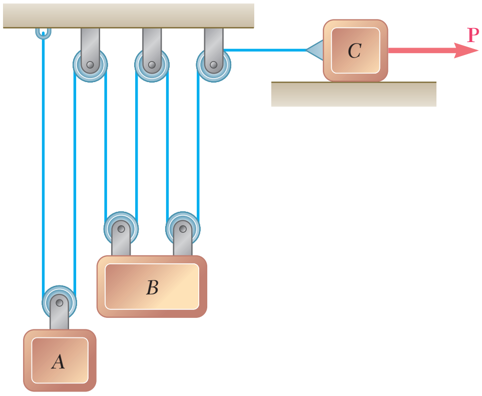

Fig. P12.125

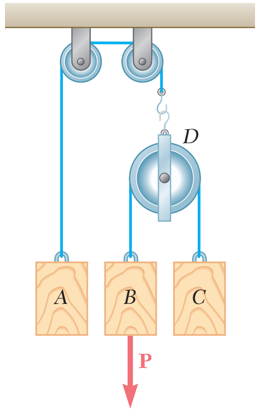

Fig. P12.126

12.126 Block A weighs 20 lb, and blocks B and C weigh 10 lb each. Knowing that the blocks are initially at rest and that B moves through 8 ft in 2 s, determine (*a*) the magnitude of the force **P**, (*b*) the tension in the cord AD. Neglect the masses of the pulleys and axle friction.

12.127 A 12-lb block B rests as shown on the upper surface of a 30-lb wedge A. Neglecting friction, determine immediately after the system is released from rest (*a*) the acceleration of A, (*b*) the acceleration of B relative to A.

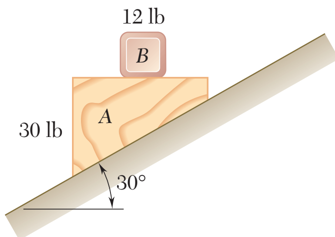

Fig. *P12.127*

12.128 The roller-coaster track shown is contained in a vertical plane. The portion of track between A and B is straight and horizontal, while the portions to the left of A and to the right of B have radii of curvature as indicated. A car is traveling at a speed of 72 km/h when the brakes are suddenly applied, causing the wheels of the car to slide on the track ($\mu_k = 0.25$). Determine the initial deceleration of the car if the brakes are applied as the car (*a*) has almost reached A, (*b*) is traveling between A and B, (*c*) has just passed B.

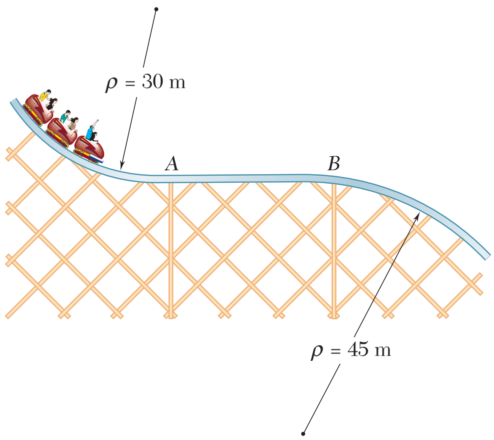

Fig. P12.128

12.129 A satellite is placed into a circular orbit about the planet Saturn at an altitude of 3400 km. The satellite describes its orbit with a velocity of 24.45 km/s. Knowing that the radius of the orbit about Saturn and the periodic time of Atlas, one of Saturn's moons, are 137.64×10^3 km and 0.6019 days, respectively, determine (*a*) the radius of Saturn, (*b*) the mass of Saturn. (The *periodic time* of a satellite is the time it requires to complete one full revolution about the planet.)

12.130 The periodic times (see Prob. 12.129) of the planet Uranus's moons Juliet and Titania have been observed to be 0.4931 days and 8.706 days, respectively. Knowing that the radius of Juliet's orbit is 40,000 mi, determine (*a*) the mass of Uranus, (*b*) the radius of Titania's orbit.

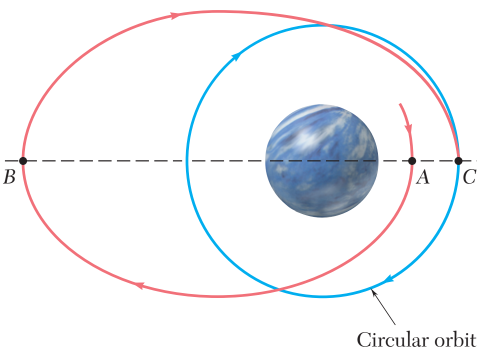

Fig. P12.131

12.131 A space probe is to be placed in a circular orbit of 6420-km radius about the planet Venus. As the probe approaches Venus, its speed is decreased so that, as it reaches point A, its speed and altitude above the surface of the planet are 7420 m/s and 288 km, respectively. The path of the probe from A to B is elliptic, and as the probe approaches B, its speed is increased by $\Delta v_B = 21.4$ m/s to insert it into the elliptic transfer orbit BC. Finally, as the probe passes through C, its speed is decreased by $\Delta v_C = -238$ m/s to insert it into the required circular orbit. Knowing that the mass and the radius of the planet Venus are 4.869×10^{24} kg and 6052 km, respectively, determine (*a*) the speed of the probe as it approaches B on the elliptic path, (*b*) its altitude above the surface of the planet at B.

12.132 To place a communications satellite into a geosynchronous orbit (see Prob. 12.79) at an altitude of 22,240 mi above the surface of the earth, the satellite first is released from a space shuttle, which is in a circular orbit at an altitude of 185 mi, and then is propelled by an upper-stage booster to its final altitude. As the satellite passes through A, the booster's motor is fired to insert the satellite into an elliptic transfer orbit. The booster is again fired at B to insert the satellite into a geosynchronous orbit. Knowing that the second firing increases the speed of the satellite by 4810 ft/s, determine (*a*) the speed of the satellite as it approaches B on the elliptic transfer orbit, (*b*) the increase in speed resulting from the first firing at A.

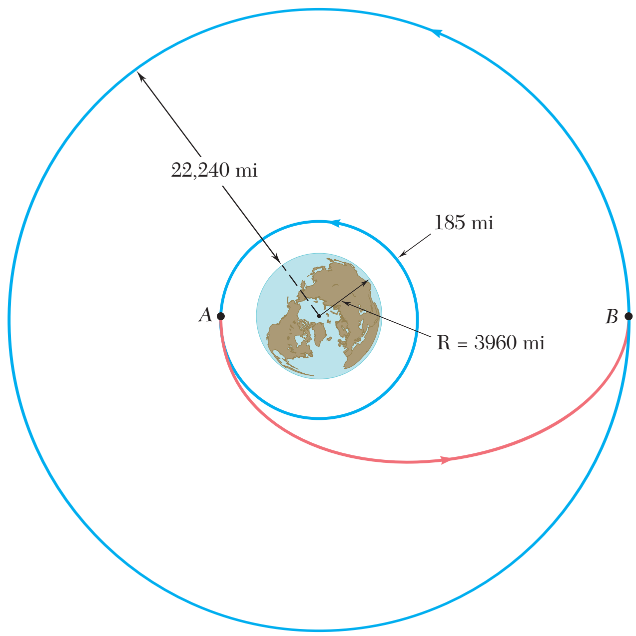

Fig. P12.132

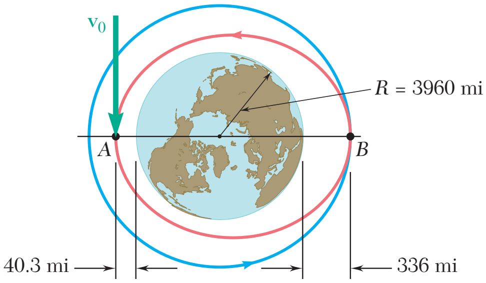

Fig. *P12.133*

12.133 At main engine cutoff of its thirteenth flight, the space shuttle Discovery was in an elliptic orbit of minimum altitude 40.3 mi and maximum altitudes 336 mi above the surface of the earth. Knowing that at point A the shuttle had a velocity $\mathbf{v}_0$ parallel to the surface of the earth and that the shuttle was transferred to a circular orbit as it passed through point B, determine (*a*) the speed v_0 of the shuttle at A, (*b*) the increase in speed required at B to insert the shuttle into the circular orbit.