Problems 4.10 and 4.11

Consider a 1500 kg car whose speed is increased by 45 km/h over a distance of 50 m while traveling up an incline with a 15% grade.

Figure P4.10 and P4.11

Problem 4.10 Modeling the car as a particle, determine the work done on the car if the car starts from rest.

Problem 4.11 Modeling the car as a particle, determine the work done on the car if the car has an initial speed of 60 km/h.

Problem 4.59

The resistance of a material to fracture is assessed with a fracture test. One such test is the *Charpy impact test*, in which the fracture toughness is assessed by measuring the energy required to break a specimen of a specified geometry. This is done by releasing a heavy pendulum from rest at an angle θ_i and by measuring the maximum swing angle θ_f reached by the pendulum after the specimen is broken. Suppose that in an experiment $\theta_i = 45°$, $\theta_f = 23°$, the weight of the pendulum's bob is 3 lb, and the length of the pendulum is 3 ft. Neglecting the mass of any other component of the testing apparatus, assuming that the pendulum's pivot is frictionless, and treating the pendulum's bob as a particle, determine the fracture energy of the specimen tested. Assume that the fracture energy is the energy required to break the specimen.

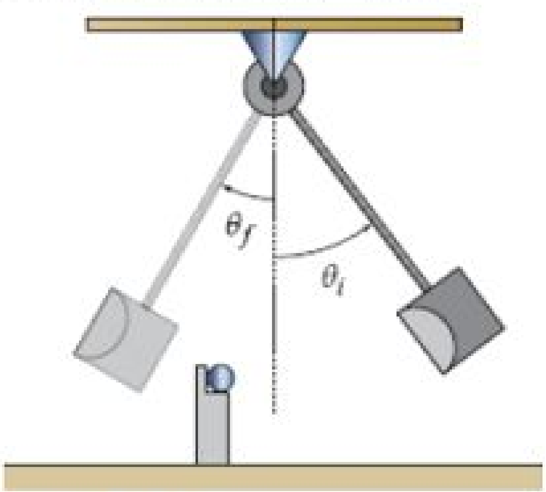

Figure P4.59

Problem 4.84

Solve Example 4.14 by applying the work-energy principle to each block individually, and show that the net work done by the cord on the two blocks is zero.

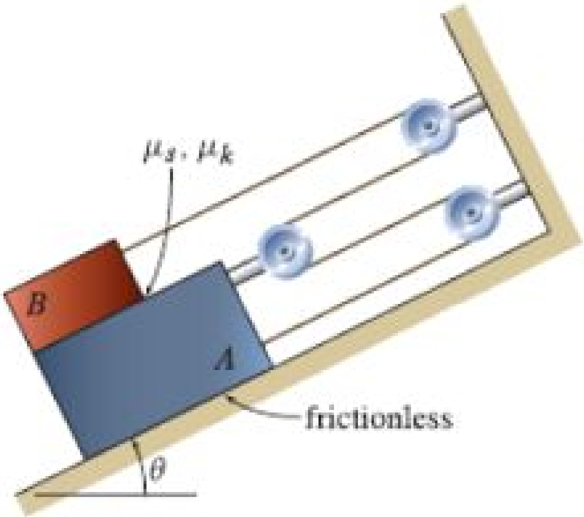

Figure P4.84

Problems 5.94 and 5.95

Ball B is stationary when it is hit by an identical ball A as shown, with $\beta = 45°$. The preimpact speed of ball A is $v_0 = 1$ m/s.

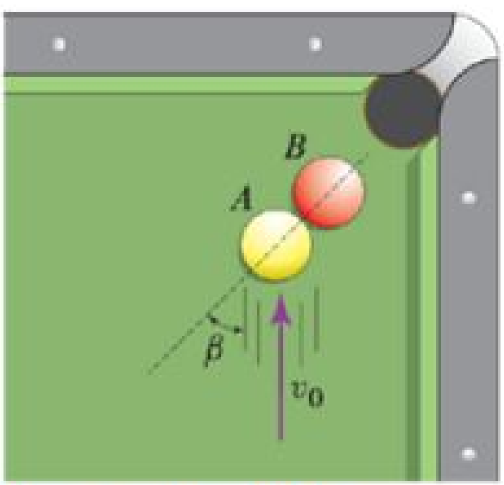

Figure P5.94 and P5.95

Problem 5.94 Determine the postimpact velocity of ball B if the COR of the collision $e = 1$.

Problem 5.95 Determine the postimpact velocity of ball A if the COR of the collision $e = 0.8$.

Problem 5.133

The body of the satellite shown has a weight that is negligible with respect to the two spheres A and B that are rigidly attached to it, which weigh 150 lb each. The distance between A and B from the spin axis of the satellite is R = 3.5 ft. Inside the satellite there are two spheres C and D weighing 4 lb mounted on a motor that allows them to spin about the axis of the cylinder at a distance r = 0.75 ft from the spin axis. Suppose that the satellite is released from rest and that the internal motor is made to spin up the internal masses at an absolute constant time rate of 5.0 rad/s^2(measured relative to an inertial observer) for a total of 10 s. Treating the system as isolated, determine the angular speed of the satellite at the end of spin-up.

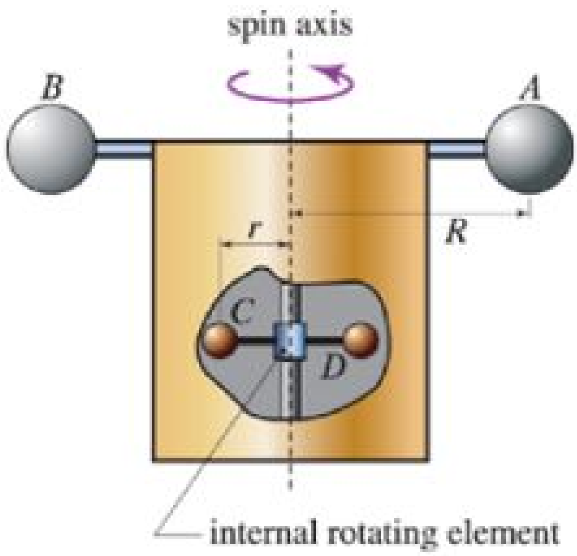

Figure P5.133