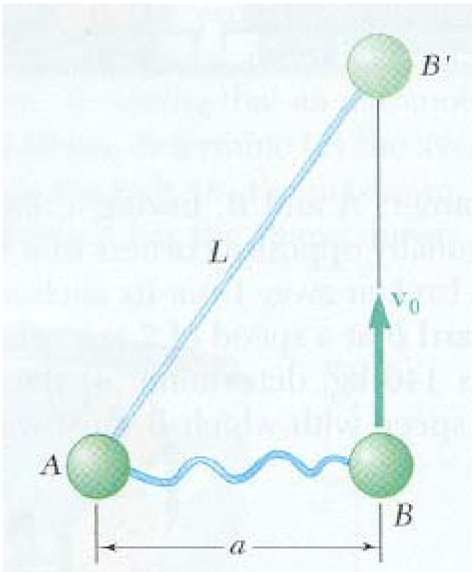
과제 # 4

배부일: 10월 23일
제출 기한: 11월 7일 (금)

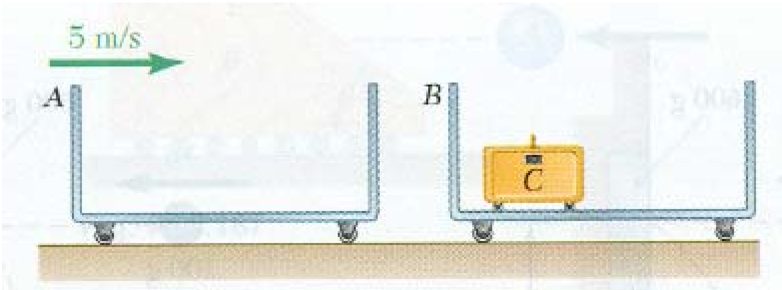
1.

13.149 Two identical spheres A and B, each of mass m, are attached to an inextensible inelastic cord of length L, and are resting at a distance a from each other on a frictionless horizontal surface. Sphere B is given a velocity $\mathbf{v}_0$ in a direction perpendicular to line AB and moves without friction until it reaches B' when the cord becomes taut. Determine (a) the magnitude of the velocity of each sphere immediately after the cord has become taut, (b) the energy lost as the cord becomes taut.



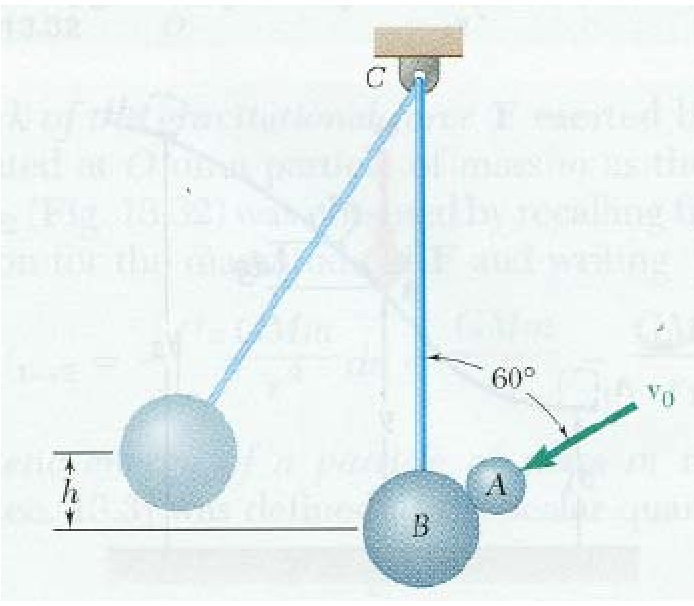
2.

13.179 After having been pushed by an airline employee, an empty 40 kg luggage carrier A hits with a velocity of 5 m/s an identical carrier *B* containing a 15 kg suitcase equipped with rollers. The impact causes the suitcase to roll into the left wall of carrier *B*. Knowing that the coefficient of restitution between the two carriers is 0.80 and the coefficient of restitution between the suitcase and the wall of the carrier is 0.30, determine (*a*) the velocity of carrier *B* after the suitcase hits its wall for the first time, (*b*) the total energy lost in the impact.



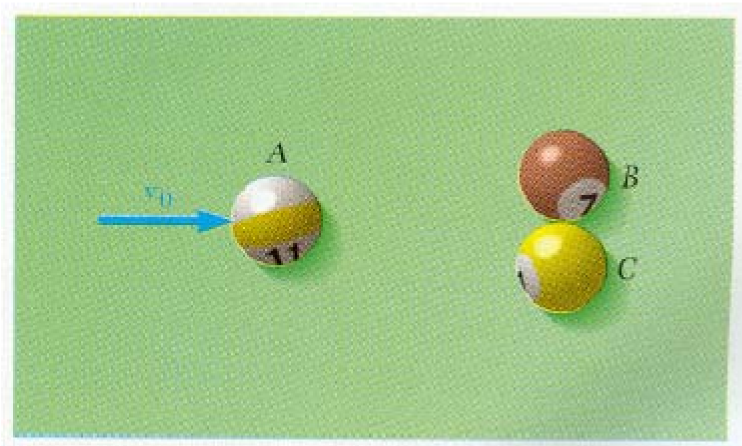
3.

13.189 A 340-g ball *B* is hanging from an inextensible cord attached to a support *C*. A 170-g ball *A* strikes *B* with a velocity $\mathbf{v}_0$ of magnitude 1.5 m/s at an angle of 60° with the vertical. Assuming perfectly elastic impact ($e = 1$) and no friction, determine the height h reached by ball *B*.



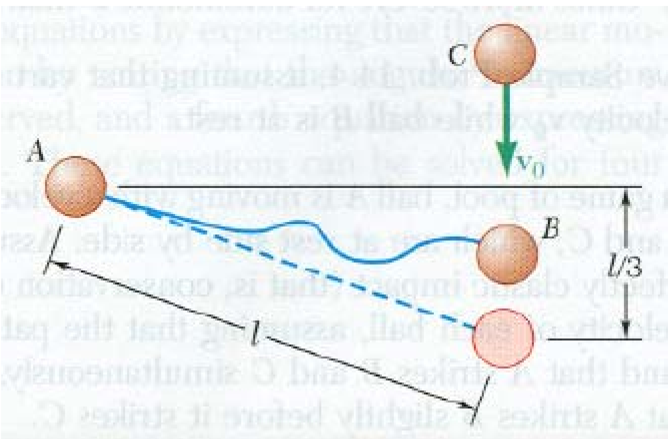
4.

14.38 In a game of pool, ball A is moving with a velocity $\mathbf{v}_0 = v_0\mathbf{i}$ when it strikes balls B and C, which are at rest side by side. Assuming frictionless surfaces and perfectly elastic impact (that is, conservation of energy), determine the final velocity of each ball, assuming that the path of A is (a) perfectly centered and that A strikes B and C simultaneously, (b) not perfectly centered and that A strikes B slightly before it strikes C.



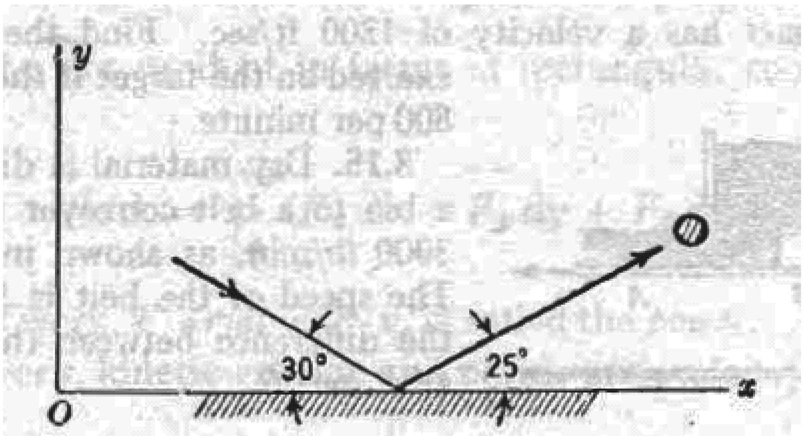
5.

14.44 Three spheres, each of mass m, can slide freely on a frictionless, horizontal surface. Spheres A and B are attached to an inextensible, inelastic cord of length l and are at rest in the position shown when sphere B is struck squarely by sphere C which is moving with a velocity $\mathbf{v}_0$. Knowing that the cord is slack when sphere B is struck by sphere C and assuming perfectly elastic impact between B and C, determine (a) the velocity of each sphere immediately after the cord becomes taut, (b) the fraction of the initial kinetic energy of the system which is dissipated when the cord becomes taut.



6.

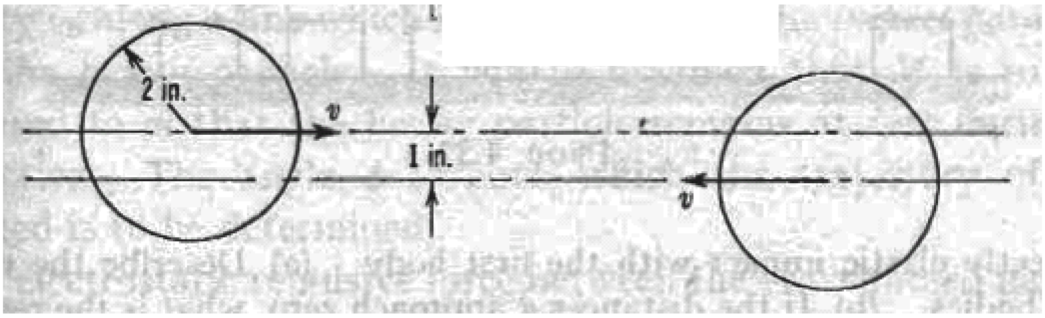
3.9. A particle weighing 5 lb bounces against a surface as shown in the diagram. If the approach velocity is 20 ft/sec and the velocity of departure is 15 ft/sec, find the magnitude and direction of the impulse to which the mass is subjected.



7.

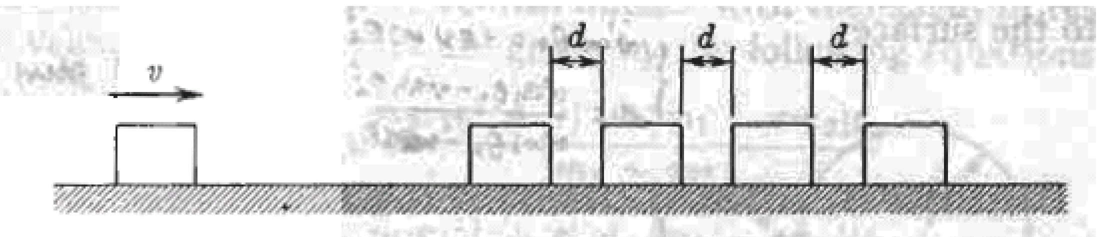
4.30. The centers of mass of two identical smooth steel spheres move along two straight parallel lines a distance 1 in. apart, as shown in the figure.

The spheres are approaching each other with equal speeds of $v = 10$ ft/sec. The radii of the spheres are 2 in., and the coefficient of restitution is 5/9. Find the velocity of the spheres after impact.



8.

4.33. Four identical bodies each of mass m are set up in a straight line on a smooth horizontal plane with distances d between them. A fifth body, identical to the other four, approaches with a velocity v and makes a perfectly elastic impact with the first body. (a) Describe the motion of the bodies. (b) If the distances d approach zero, what is the resulting motion?

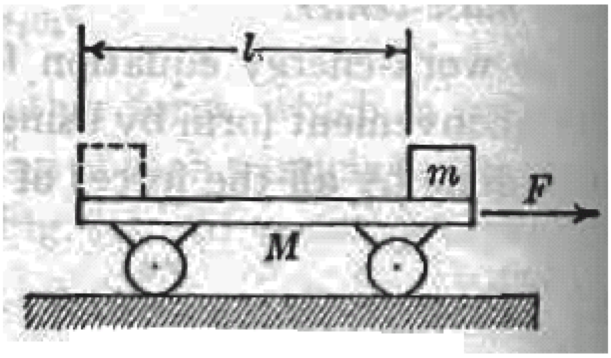


9.

6.4. A cart of mass M, initially at rest, can move horizontally along a frictionless track. When $t = 0$, a force F is applied to the cart as shown. During the acceleration of M by the force F, a small mass m slides along the cart from the front to the rear. The coefficient of friction between m and M is μ, and it is assumed that the acceleration of M is sufficient to cause sliding.

(a) Write two equations of motion, one for m and one for M, and show that they can be combined to give the equation of motion of the mass center of the system of two bodies.

(b) Find the displacement of M at the time when m has moved a distance l along the cart.



10.

6.6. Two smooth prisms of similar right-triangular sections are arranged on a smooth horizontal plane as shown in the diagram. The upper prism weighs W lb, and the lower prism weighs nW lb. The prisms are held in an initial position as shown, and are then released, so that the upper prism slides down the lower prism until it just touches the horizontal plane. Find the distance moved by the lower prism during this process.