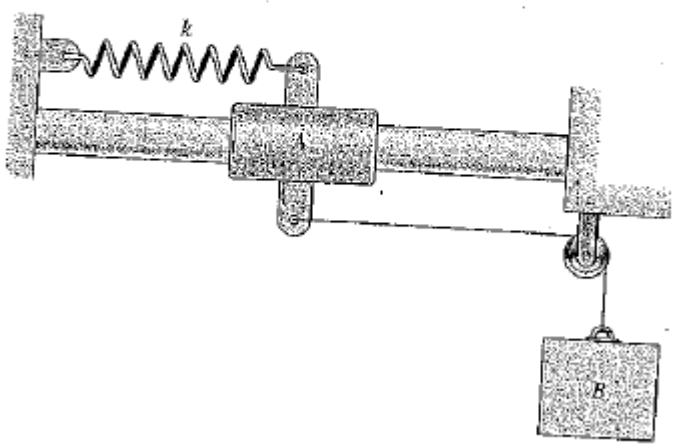
Homework 3

Note: All six problems are worth 5 points each

1.

15.91 The spring constant $k = 700$ N/m, $m_A = 14$ kg, and $m_B = 18$ kg. The collar A slides on the smooth horizontal bar. The system is released from rest with the spring unstretched. Use conservation of energy to determine the velocity of the collar A when it has moved 0.2 m to the right.



P15.91

Figure 1

2. A 50 kg block is released at the position shown (Fig. 2) and falls straight onto a linear elastic spring of spring constant K=5000 N/m. How far down does the block travel after contacting the spring?

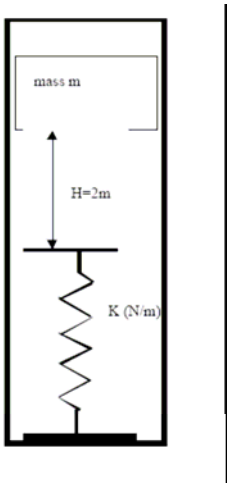
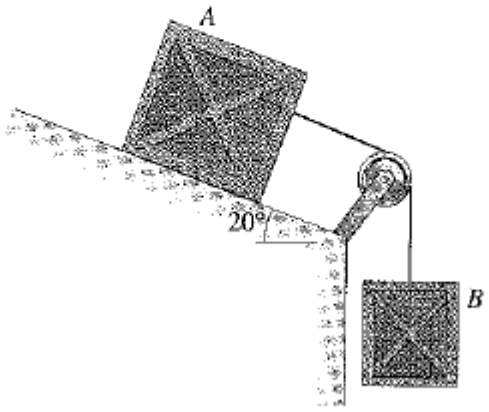


Figure 2

3.

5.17 The two crates are released from rest. Their masses are $m_A = 40$ kg and $m_B = 30$ kg, and the coefficient of kinetic friction between crate A and the inclined surface is $\mu_k = 0.15$. What is the magnitude of their velocity after 1 s?

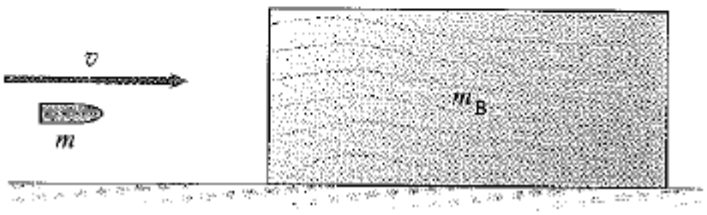


P5.17

4.

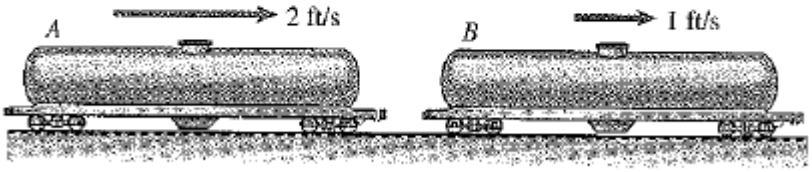
5.38 A bullet (mass m) hits a stationary block of wood (mass m_B) and becomes embedded in it. The coefficient of kinetic friction between the block and the floor is μ_k. As a result of the impact, the block slides a distance D before stopping. What was the velocity v of the bullet?

Strategy: First solve the impact problem to determine the velocity of the block and the embedded bullet after the impact in terms of v, then relate the initial velocity of the block and the embedded bullet to the distance D that the block slides.



5.

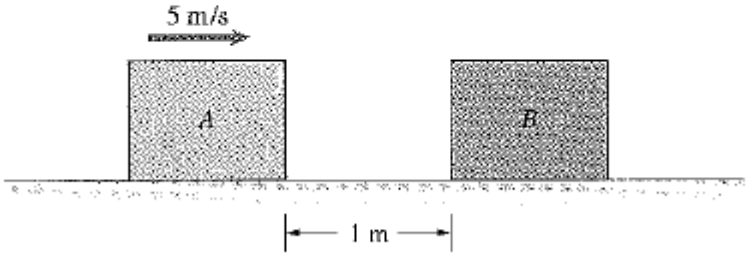
5.34 Two railroad cars ($m_A = 1.7m_B$) collide and become coupled. Car A is full and car B is half-full of carbolic acid. When the cars impact, the acid in B sloshes back and forth violently.
(a) Immediately after the impact, what is the velocity of the common center of mass of the two cars?
(b) A few seconds later, when the sloshing has subsided, what is the velocity of the two cars?



P5.34

6.

5.51 The 10-kg mass A is moving at 5 m/s when it is one meter from the stationary 10-kg mass B. The coefficient of kinetic friction between the floor and the two masses is $\mu_k = 0.6$, and the coefficient of restitution of the impact is $e = 0.5$. Determine how far B moves from its initial position as a result of the impact.



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