Even More Connected Systems Practice
Physics 621

1. A 2.25 kg cart is placed on a horizontal bench. It is attached to a light string that passes over a pulley. The other end of the string is tied to a 0.600 kg mass, which is held motionless by a hand. When the suspended mass is released by the hand and allowed to fall, the cart is accelerated east along the bench. The force of friction for the opposing the motion of the cart is 2.25 N. What is the acceleration of the cart?

2. A wood block of unknown mass is placed on a horizontal table. The coefficient of kinetic friction for the wood-table interface is 0.211. The block of wood is attached by a light string that passes over a pulley. The other end of the string is suspending a 346 g roll of tape in the air. When you release the system, the system accelerates at a magnitude of 0.109 m/s^2. What is the mass of the wood block?

3. A 750. g pencil case is rested on a lab bench. It is tied by a light string, that is suspended over a pulley, to a stuffed toy that is suspended in the air. When released, the system does not move. So, you give the stuffed toy a little push of 0.7616 N downward causing the system to accelerate at 0.296 m/s^2. The coefficient of kinetic friction for the case-bench interface is 0.138.

   a. What is the mass of the stuffed toy?
   b. What is the magnitude of the tension force in the string during the push?
   c. Would the tension in the string be the same if you had of pushed the pencil case instead?
   d. Once the hand stops pushing, what is the acceleration of the system? What would the system be doing?

4. A 120 g mass is hanging from a string suspended over a pulley. The other end of the string is connected to a 150 g mass resting on an incline of 25^0 from the horizontal. What is the minimum value for the coefficient of static friction that will still prevent to masses from moving?

5. Consider a basic Atwood machine:
   a. What is the acceleration of the system if the lighter mass is 25% the mass of the heavier mass?
   b. If instead of being released from rest, the lighter mass was given an initial velocity of 4.6 m/s [down]. How far will the lighter mass descend until it comes to rest?
   c. How long does it take before the lighter mass comes to rest?
   d. Once the lighter mass starts moving up again, you apply 1.00 N of force in order to stop the masses from accelerating. What is the mass of the heavier object?

Answers:

1. 1.28 m/s^2 [E]
2. 1.54 kg
3. a) 5.0×10^{-2} kg b) 1.2 N c) no, would be less....0.48N d) -0.066 m/s^2 [sys dir], slowing down
4. 0.42
5. a. 5.89 m/s^2 b) 1.8 m c) 0.78 s d) 136 g