Physics 121

Midterm Examination #2

November 6, 2007

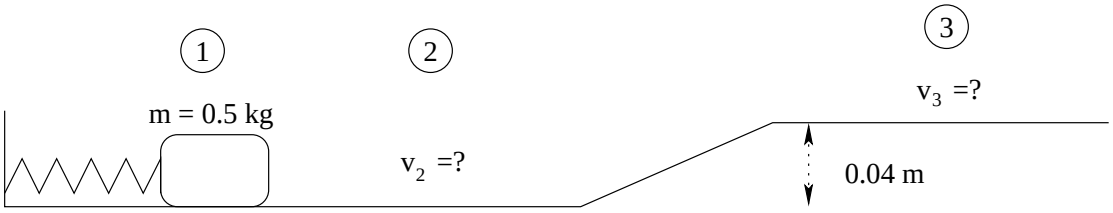
Name: _____

Recitation Section: _____

Lab Section: _____

	Score
Problem 1	
Problem 2	
Problem 3	
Problem 4	
Problem 5	
Total	

1. At moment 1, the $m = 0.5\ kg$ mass is compressing the spring of force constant $k = 100\ \frac{N}{m}$ by a distance of $x_1 = 0.1\ m$. The mass is released from rest, travels across a horizontal frictionless surface, and then up a hill to a second horizontal frictionless surface.



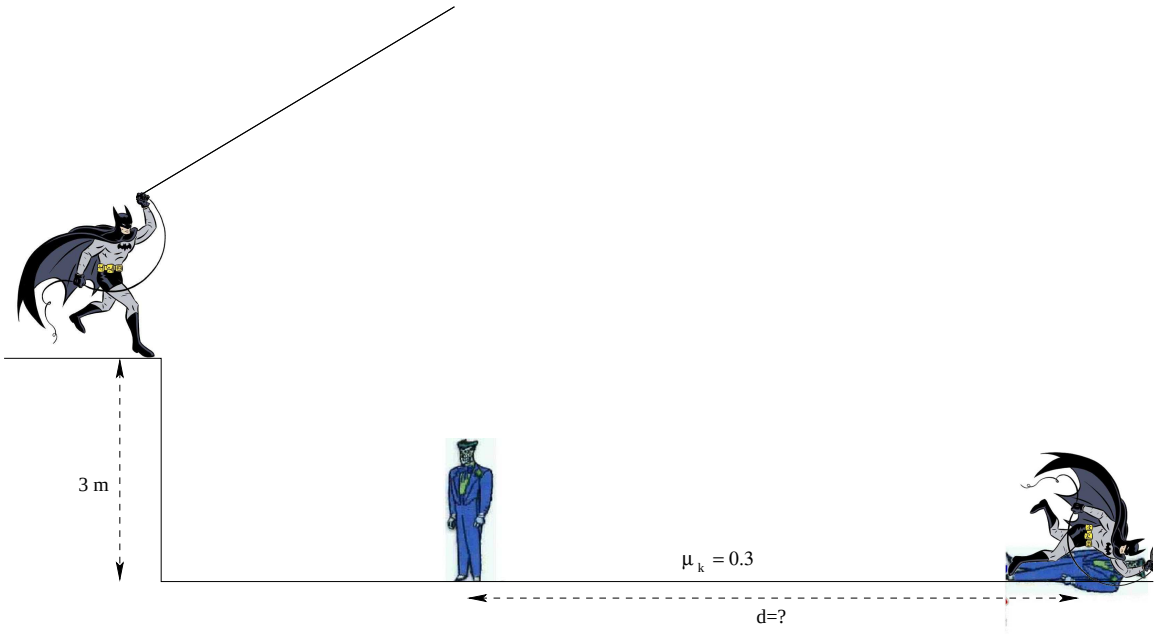
k = 100 N/m

Determine all the following:

(a) (10 pts) The velocity of the mass at moment 2.

(b) (10 pts) The velocity of the mass at moment 3.

2. Batman ($m = 80\ kg$) has spotted the Joker ($M = 100\ kg$) lurking below on the floor of the museum. Batman swings down on a rope and collides with the Joker. After the collision, the two of them slide across the floor together and come to a stop.

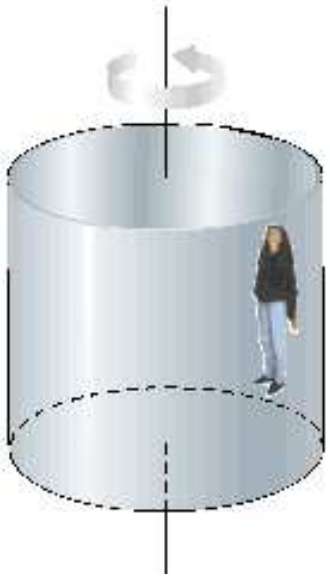


(a) (7 pts) Find the velocity of Batman just before the collision.

(b) (7 pts) Find the velocity of Batman+Joker just after the collision.

(c) (6 pts) Find the distance, d, they travel across the floor.

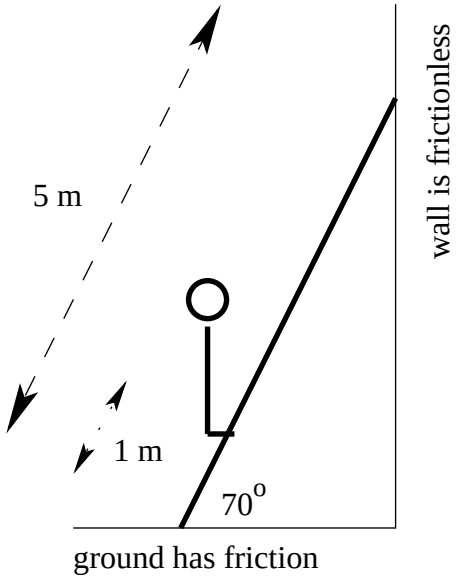
3. In a popular amusement park ride, a rotating cylinder of radius 2.00 m is set in rotation at an angular speed of 7.00 rad/s, as in the Figure. The floor then drops away, leaving the riders suspended against the wall in a vertical position.



What minimum coefficient of friction between a rider's clothing and the wall is needed to keep the rider from slipping?

(**Hint:** Recall that the magnitude of the maximum force of static friction is equal to μN, where N is the normal force - in this case, the force causing the centripetal acceleration.)

4. Shown in the figure below is a person climbing a ladder. The ladder is 5 meters long and has a mass of 10 kg. The person is standing one meter from the bottom of the ladder and has a mass of 80 kg.



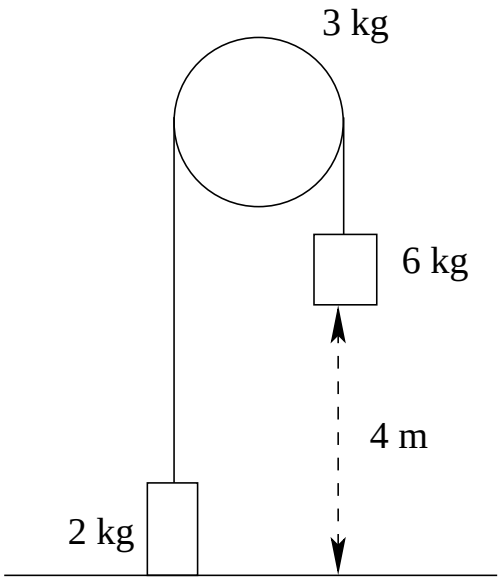
(a) (6 pts) Find the normal force (N_1) of the ground on the ladder.

(b) (10 pts) Find the normal force (N_2) of the wall on the ladder.

(c) (4 pts) Find the frictional force on the bottom of the ladder.

NOTE: We will assume that the ground provides *more* than enough friction so that the ladder does not slide out from under the person.

5. Shown in the figure below is Atwood's machine. The masses are as labeled in the figure. Approximate the pulley as a solid cylinder.



(20 pts) Find the velocity of the 6 kg mass just before it strikes the floor.