EXAM 2

November 15–18 2005

Directions

- This exam is open notes, open book.
- You may not collaborate on this exam; do not work with others.
- When you are done with the exam, give it to me or put it in my office. Don't put it in my mailbox.
- Unless we make other arrangements, you should get the exam back to me by 5:00 pm, Friday Nov. 18.
- Remember to include units.
- To receive full credit on these problems you must show your work clearly.

1. Suppose you are going for a walk on a winter day and you suddenly die and fall in a pile of snow.
   (a) How much snow would your body melt as it cooled off? Assume that your body temperate was 37 degrees Celsius, and that all of your internal energy eventually goes to the snow.
   (b) How much would it cost if you used electrical power to melt this much snow?
2. You have 0.5 kg of water at a temperature of 20 degrees Celsius in a well-insulated thermos. You have at your disposal some Aluminum that happens to be at 200 Celsius. What mass of this hot metal would you have to add to the water to increase the water's temperature to 50 Celsius?
3. A 20 kg child is standing on the edge of a spinning merry-go-round that makes one revolution every 4 seconds. The merry-go-round has a mass of 80 kg and a radius of 2 meters. The child moves so that she is .25 meters from the center of the merry-go-round. How fast is the merry-go-round turning now?
4. A 0.2 kg goose flies in a counter-clockwise circle at a constant speed of 13 m/s. The radius of the circle is 700 meters.
   (a) What is the angular speed of the goose? Be sure to state units for your answer.
   (b) What is the angular momentum of the goose about the center of the circle?

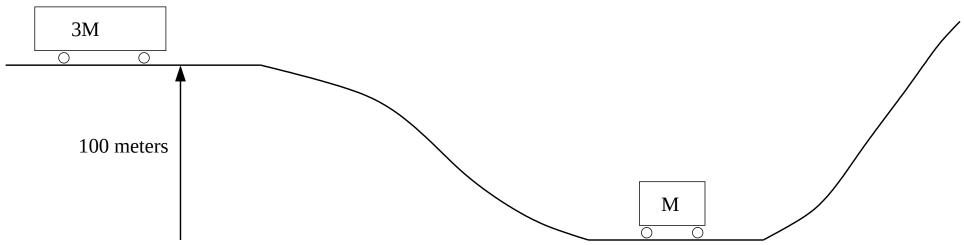

Figure 1:

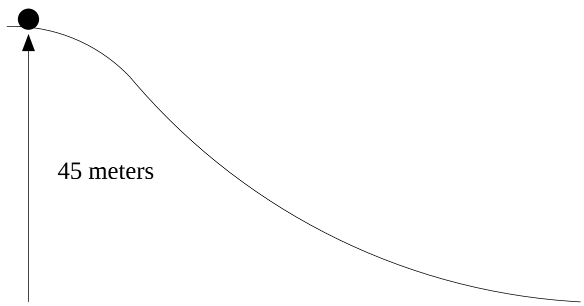

Figure 2:

(c) What is the acceleration (magnitude and direction) of the goose when it's flying due North?

(d) What is the net force (magnitude and direction) acting on the goose when it's flying due North?

5. Consider the scenario in the Fig 1. A train car starts at rest 100 meters above the ground. It rolls down and sticks to the smaller car. How high up the incline do the two trains go? The large car has a mass three times that of the smaller car.

6. A lacrosse ball is resting on the top of the hill as shown in Fig. 2. The ball is given a shove so that it leaves its resting place with a speed of 12 m/s. What is the speed of the ball at the bottom of the hill? Assume the ball rolls without slipping.

7. An anguished student throws a mechanical pencil skyward. The pencil travels in a graceful arc, up and then down. Draw a free-body diagram for the pencil when it is moving up, half-way toward the peak of its trajectory.

8. Consider the velocity vs. time plot in Fig. 3. Sketch the position (x) and the acceleration (a) as a function of time.

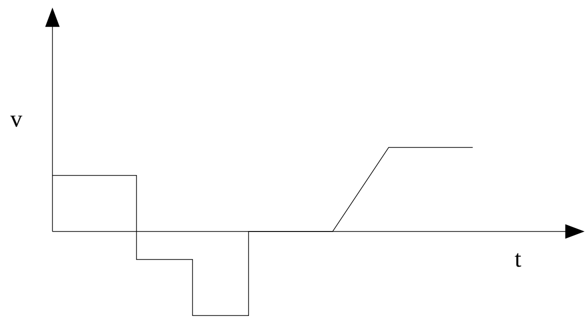

Figure 3:

9. To heat your house you decide to leave your toaster on all day long. About how much would this cost per day?