EXAM 2

November 17–19 2009

Directions

- This exam is open notes, open book.
- You may not collaborate on this exam; do not work with others. Do not discuss any aspects of this exam with anyone.
- Do not ask the TAs any questions about physics or math while you are taking the exam. If you have any questions, ask me.
- 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 other arrangements are made, you should get this exam back to me by 12:30pm on Thursday November 19, 2009.
- Remember to include units.
- To receive full credit on these problems you must show your work clearly.

1. You place 100 grams of ice in a kilogram of water. The water is initially at 30 degrees Celsius and the ice as at 0 degrees Celsius. What is the final temperature of the water? Is there any ice left? If so, how much? Explain your reasoning.

2. Two 20 kg children are standing on the opposite sides on the edge of a spinning merry-go-round that makes one revolution every 3 seconds. The merry-go-round has a mass of 80 kg and a radius of 2 meters. The children moves so that they are .25 meters from the center of the merry-go-round. How fast is the merry-go-round turning now?

3. A 30 kg dragon flies in a counter-clockwise circle at a constant speed of 50 m/s. The radius of the circle is 700 meters.

   (a) What is the angular speed of the dragon? Be sure to state units for your answer.

   (b) What is the angular momentum of the dragon about the center of the circle?

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

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

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

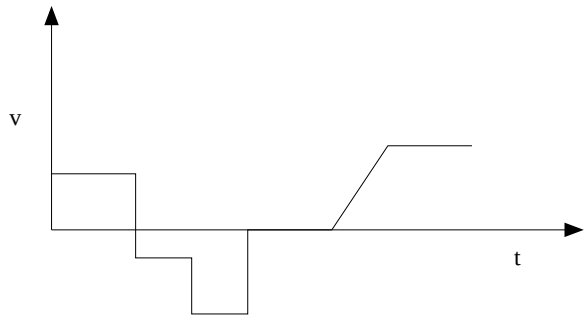

Figure 1:

5. Consider the velocity vs. time plot in Fig. 1. Sketch the position (x) and the acceleration (a) as a function of time.

6. A box of tofu sits on the back of a pickup truck. The truck q is moving east at 20 miles per hour and gradually comes to a stop so that the box of tofu does not slide in the truck. Draw a sketch of the situation, and then draw a free-body diagram and a net-force diagram for the box.

7. Consider the motion diagram of Fig. 2. The time interval between dots is 0.2 seconds. Estimate the magnitude of the acceleration at point 3. Show your work.

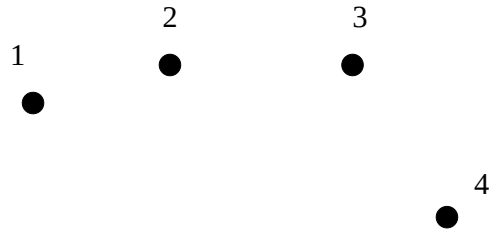

Figure 2: A motion diagram

8. A 50 kg physics student on rollerblades is skating due North at 5 m/s. Five second later she is skating due East at 7 m/s. What is her average acceleration over this five second interval? Remember that velocity and acceleration are vectors.

9. To heat your house you decide to leave your toaster on all day long.

   (a) About how many kilowatt hours would you use per day?
   (b) About how much would this cost per day?
   (c) About how many liters of gasoline would you have to burn to get the same amount of energy?
   (d) About how much would this gasoline cost?