

## DAY 9

### Homework Assignment (see syllabus for homework collection information)

1. Calculate the terminal velocity of a wooden ball, an iron ball, and a lead ball -- each of which is 4 inches in diameter.
2. In the above problem, how long (in seconds) can each fall from rest before air resistance will cause a 5% change in the ball's acceleration? How far (in meters) can each fall before air resistance will cause a 5% change in the ball's acceleration?
3. For a falling object released from rest, make a graph of the *velocity* vs. time. Plot for  $t = 0$  to  $t = 20$  seconds. Ignore air resistance.

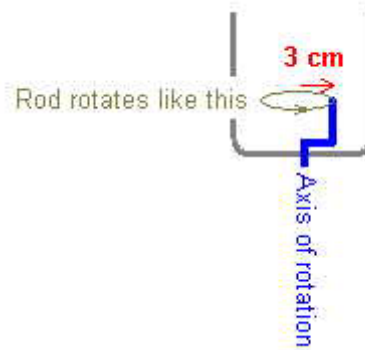
For a falling object released from rest, make a graph of the *velocity* vs. time. Plot for  $t = 0$  to  $t = 20$  seconds. Air resistance is not ignorable and the object hits terminal velocity at  $t = 12$  seconds. Put this graph on the same set of axes as the previous plot. You will have to make some educated estimates in making this plot.

4. For a falling object released from rest, make a graph of the *distance dropped* vs. time. Plot for  $t = 0$  to  $t = 20$  seconds. Ignore air resistance.

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5. A cyclist is pedaling at 20 mph. Her frontal area is  $3 \text{ ft}^2$ . Her drag coefficient is 0.45. What is the force of air drag on her (in lb and N)? If she bikes 2 miles on level ground at this speed, how much work has she done? What is her power output (in W and Hp)?
6. In the above problem, what energy changes are taking place?
7. You are making instant pudding. You add powder to milk and attack the mixture with a hand-cranked eggbeater. At first, the powder dissolves, the pudding mixture has the consistency of milk, and the eggbeater is easy to crank. Within a couple of minutes, however, it becomes noticeably more difficult to crank the beater. Explain the increased force needed to operate the eggbeater in terms of friction.
8. Discuss whether the following statements are true: "Static friction never does work and never generates heat. Kinetic friction always does work and always generates heat."

9. A bread machine mixes dough by rotating an "L" - shaped stirring paddle around in a circle. If it takes 0.25 Hp to rotate the stirring paddle at a rate of 80 revolutions per minute, determine the force of viscous friction on the paddle and the "b" value for the viscous friction. The radius of the stirring paddle is 3 cm.



10. A 1000 kg elevator is designed to move downward at 3 ft/s. If the cable breaks, emergency brakes automatically press against the walls of the elevator shaft and bring the elevator to a halt. The brakes are steel and so is the shaft wall. If the elevator needs to come to a halt in 10 ft, with what force do the brakes need to be applied against the shaft wall?
11. A kid and her bike weigh 90 lbs total. The bike has coaster brakes. She can skid from 15 mph to zero in 2 seconds. What is the coefficient of friction between the tires and the sidewalk?
12. What force will be required to get a 100 lb wood crate moving across a wood floor? What force will be required to keep it moving once it is moving?
13. The following information refers to the figure at right:

$$m_A = 2 \text{ kg}$$

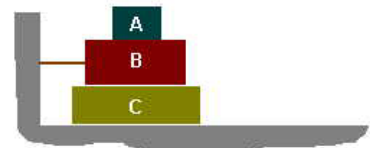
$$m_B = 4 \text{ kg}$$

$$m_C = 3 \text{ kg}$$

$$\mu_{AonB} = 0.5$$

$$\mu_{BonC} = 0.5$$

$$\mu_{ConFloor} = 0.8$$



Block B is tied to the wall. All the  $\mu$  values are for static friction. What minimum force is required to pull block C out from under block B?