Principles of Physics: Problem Set #9

Energy Conservation and Exam Review

$$E^{\text{tot}} = K^{\text{tot}} + P^{\text{tot}} \;;\; K = \frac{1}{2}mv^2 \;;\; P_g = mgh \;;\; P_{\text{spring}} = \frac{1}{2}kx^2$$

$$E^{\text{tot}}_{\text{initial}} + W = E^{\text{tot}}_{\text{final}} + Q \quad ; \quad \text{Power} = \frac{\Delta W}{\Delta t}$$

Due: Wednesday Oct. 24 in class

Note: **Exam 2 is next Friday (10/26).** This exam will cover the material in chapters 4 and 6. The exam will consist of a number of short "quiz-like" problems and a few real calculation problems. The exam is closed book, closed notes but you may bring in **one-half of an 8.5x11" sheet of paper** with **handwritten** notes and equations (but not worked-out problem examples). Your crib sheet will be collected with the exam. Also, you will want a calculator, but no phones, i-pads, etc. are allowed. This problem set should provide some review and practice.

We will have our problem session on Tuesday evening (6:30-9:30 PM in G123) and I will hold an exam review session on Thursday evening 7:00-8:00 (in G123).

Reading assignment:

for Mon, Ch 6 (pp 118-125) [Work and energy revisited]
for Wed, review Ch 4, Ch 6 [Exam review]

Problem assignment:

(WARNING - The problem naming/numbering scheme in the text is confusing, so ALWAYS double check whether a problem is guided review (**GR**), skill building (**SB**), **Synthesis**, etc.)

CHAPTER 6

SB-4 (pg 128 ... bouncing ball)
SB-23 (pg 130 ... spring launch for a block)
SB-33 (pg 131 ... energy dissipation for a sliding block)
SB-34 (pg 131 ... energy to make toast)

A1. **Stopping a Bicycle:** You are riding on a bicycle with wheels of diameter 60 cm. Starting with an initial speed of 10 m/s, you gently apply the brakes, causing you to slow down and come to rest in 40 s.

a) What distance did the bicycle travel before you came to rest?
b) What was the angular speed of the wheels before you braked (give results in both rad/s and rev/s).
c) What was the angular acceleration of the bicycle wheels while you were slowing down?
d) How many revolutions did the wheels make before you came to rest? [Calculate the total θ for the wheels and convert this to revolutions ... verify that your answer here agrees with your part (a) result]
e) What is the force exerted by the brakes on the wheels (assume the wheels are hoops, each with mass 5 kg, and the brakes press on the wheel rim).

Answers: (a) 200m (b) 33.3 rad/s, 5.3 rev/s (c) 0.833 rad/s^2 (d) 106 rev (e) 1.25 N

– over –

A2. **Block on Incline:** A 2 kg block sits at rest on an incline that makes a 30º angle with the horizontal. The coefficients of static and kinetic friction between block and incline are 0.7 and 0.5, respectively.

a) Draw a force diagram and determine the friction force acting on the block.

b) What is the minimum force you must apply to put the block into motion down the incline and in what direction do you apply this force (show in a picture).

c) Determine the friction force acting on the block once it is in motion.

d) If the block is originally 1.5 m away from the end of the incline, how long will it take the moving block to slide to the bottom and what is its speed at the bottom?

e) If the kinetic friction coefficient between the ground and the block is 0.4, how long will it take the block to come to rest after it leaves the incline?

Answers: (a) 9.8 N (b) 2.08 N (c) 8.49 N (d) [a_x=0.655 m/s^2] 2.14 s, 1.4 m/s (e) [a_x=3.92 m/s^2] 0.36 s