Oberlin College Physics 110, Fall 2011

Assignment 9

Wednesday, 9 November

Reading: Finish your reading of HRW chapters 10 ("Rotation"), and 11 ("Rolling, Torque, and Angular Momentum").

Workshops: The Wednesday–Thursday workshop for this week is "Car Collisions". The usual warm-up question rule applies.

Informal Friday: At the optional Friday class meeting for this week, on 11 November, Dan Styer will speak concerning "Quantum Mechanics: The Big, the Small, and the Spooky". The usual extra credit rule applies.

Problems: There are *no* assigned problems this week. Instead, there will be an exam on Wednesday, 16 November. Be sure to look at the sample exam below.

Exam: On Wednesday, 16 November. You may use a calculator, your textbook (HRW), and one $8\frac{1}{2}$ by 11 inch page of notes, but no other material. No collaboration is permitted. Exam topics are:

Dimensional analysis
Significant figures
Strategies for solving problems: e.g., making estimates, checking results for reasonableness, investing an equation with meaning
Scaling arguments: e.g., the range depends on initial velocity v_0 as v_0^2, not as v_0 nor as v_0^3
Forces: Newton's three laws, gravitational and contact forces
Circular orbits; simple harmonic motion
Impulse and momentum
Work, kinetic energy, and potential energy
Collisions

There will be no questions concerning rotational motion.

Sample exam: In order to give you an idea of what to expect, I'll tell you the exam I used a few years ago:

1. Additional problem 71: *Skier*
2. Additional problem 58: *Monkey business*
3. Additional problem 80: *Ice mound, part III*
4. Additional problem 66: *Simple harmonic motion graph, II*

If you want still more practice, try the problems on the next page.

5. Additional problem 70: *Work with force preconceptions*

6. Additional problem 89: *Impulse with force preconceptions*

7. *Cracked up cantaloupe.* A bullet enters a stationary cantaloupe and splits it into two equal pieces that fly away, one carrying an embedded bullet. Although some of the bullet's kinetic energy goes into heat, structural damage, and so forth, most of it goes into kinetic energy of the two cantaloupe fragments. Assume that the cantaloupe weighs about one thousand times as much as the bullet, that kinetic energy is conserved, and that all motion takes place along a single axis. Do the cantaloupe halves fly off in the same direction or in opposite directions?

8. *Atomic collision.* An alpha particle collides with a stationary oxygen nucleus. After the collision the alpha particle is scattered at an angle of 64.0° from its initial direction of motion, while the oxygen nucleus recoils at an angle of 51.0° on the opposite side of that initial direction. The final speed of the nucleus is 1.20×10^5 m/s. (In atomic mass units, the mass of an alpha particle is 4.0 u, while that mass of an oxygen nucleus is 16 u.)

   a. What is the final speed of the alpha particle?

   b. What is the initial speed of the alpha particle?