PHYSICS 2414 - Fall 1999
Unit 6 - Rotational Motion and Equilibrium

Reading:	Sections 8.0 – 8.9
	Sections 9.0 – 9.7
Homework:	Chapter 8 - Questions 5,10,12
	Problems 4,19,27,30,37,43,45,54,65,66,75
	Chapter 9 - Problems 7,13,27,31,37,45,57,60
	Problems (on this Assignment Sheet): A,B

Dates:

- Reading Questions (Chapter 8)…… Wednesday, November 4, 8:00 a.m.
- Reading Questions (Chapter 9)…… Friday, November 12, 8:00 a.m.
- Homework Due …… Tuesday, November 16, 5:00 p.m.
- Exam on Unit 6…… Wednesday, November 17

Homework may be turned in during class on Tuesday, or placed in the box outside of my office before 5:00 p.m. Solutions to the homework will be in Bizzell library, the Physics library, and on the web page by 5:00 p.m. on Tuesday. If you want to use your homework to help you study for the exam, I suggest you photocopy your homework before turning it in, then compare your copied homework with the solutions.

Reading questions are to be submitted directly from the World Wide Web using the form available at http://www.nhn.ou.edu/~strauss/phys2414. If you try to submit answers to the reading questions on the web, but the answers are rejected, please e-mail me at *mgstrauss@ou.edu* and describe the problem in detail.

READING QUESTIONS FOR CHAPTER 8:

1. Define the unit of angular measurement that is usually used when dealing with angular motion and describe why is it used? 2. What are the angular quantities that are analogous to linear distance, linear velocity, and linear acceleration, respectively? 3. For circular motion, how is the tangential velocity related to the angular velocity? 4. When a wheel is rolling at a velocity v, what is the linear velocity of the point on the wheel which is touching the ground? 5. What is required to produce a torque? (Look at the definition of torque and list at least three things). 6. What effect does a net torque produce? 7. What is the moment of inertia of an object? 8. If a block and ball with the same mass are moving with the same linear velocity, but the block is sliding and the ball is rolling, which will have the greater kinetic energy? Why? 9. What is required in order to for angular momentum to always remain unchanged? 10. Describe the similarities and differences between torque and force, moment of inertia and mass, angular kinetic energy and linear kinetic energy, and angular momentum and linear momentum. Final Question (must be answered to receive any credit on the reading assignment): What is one thing from the reading that you didn't understand or need clarified?

READING QUESTIONS FOR CHAPTER 9:

1. What are the three conditions for equilibrium to occur for an object existing in two dimensions? 2. How do you solve problems involving static equilibrium? 3. Describe three different kinds of equilibrium. 4. What equations listed in section 9-6 are valid in the "elastic region" of a material, and which are valid all the time (Consider all numbered equations and the definitions of stress and strain)?

5. In the equation using the elastic modulus, how does the direction of L relate to the direction of ΔL?

6. In the equation using the shear modulus, how does the direction of L relate to the direction of ΔL? Final Question (must be answered to receive any credit on the reading assignment): What is one thing from the reading that you didn't understand or need clarified?

ADDITIONAL HOMEWORK PROBLEMS (not Reading Questions)

(These problems must be solved using the form and all the steps in *The Competent Problem Solver*)

A) You are designing a prank for a Halloween party. This prank consists of a bag filled with Jello that you will want to fall on top of your friend's head. Because you don't want to hurt your friend with the Jello bag, you want to make sure that the bag is only traveling at a rate of 3.0 m/s when it hits your friend. You attach the bag of Jello to a light string and loop the string over a pulley. The other end of the string is attached to a bag filled with sand, called the counterweight. They bag of Jello has a mass of 0.45 kg. The pulley has a mass of .33 kg and a radius of .20 m. The pulley is mounted 1.5 meters above the point where it will hit your friend on the head. What should be the mass of the counterweight so that the Jello bag will not hurt your friend when it hits?

B) Your friend, who is an artist, has asked you to help her purchase a spring for her latest sculpture. For this sculpture, some kind of object, with a mass of 120 kg, which you can't identify (after all, it is art), will have a rope attached to one side of the object and the spring attached to the other side of the object. The end of the rope not attached to the object will then be attached to the ceiling and the end of the spring not attached to the object will be attached to the wall. When the sculpture is set up, the spring should be horizontal and the rope should hang at an angle of 35° from the ceiling. (This is very much like figure 9-51 in your book, with the horizontal rope replaced by a spring). The spring should be .85 m long when unstretched, and 1.10 m long when it is in its stretched position attached to the sculpture. What should the spring constant of the spring be? You can ignore the weight of the spring and rope.

Answers to even numbered problems: 8-4) 2.9×10^{3} m; 8-30 a) 38 N·m, b) 38 N·m; 8-54 a) 8.37 m/s, 41.8 rad/s, b) 2.50, c) None depend on mass and rotational speed depends on radius; 8-66 a) 1.2 rad/s, b) Lost 8.0×10^{2} J or 40% of the kinetic energy; 9-60) 1.2 cm; A) .20 kg; B) 3300 N/m