PHYSICS 2414 - Fall 1999
Unit 5 - Work, Energy, and Momentum

Reading: Sections 6.0 - 6.1, 6.3 - 6.10
Sections 7.0 - 7.10

Homework: Chapter 6 - Questions 2,7,18
Problems* 8,18,19,25,38,43,51,56,69,71,76
Chapter 7 - Questions 1,12,19
Problems 2,7,16,25,28,39,49,57,63
Problems (on this Assignment Sheet): A,B

Dates:

- Reading Questions (Chapter 6)…… Monday, October 18, 8:00 a.m.★
- Reading Questions (Chapter 7)…… Monday, October 25, 8:00 a.m.
- Homework Due …… Friday, October 29, 5:00 p.m.
- Midterm on Units 1-5…… Monday, November 1

*For Chapter 6 problems, please be sure to use energy techniques and not kinematic equations to solve the problems.
★This is a change from the syllabus.

Homework may be turned in during class on Friday, 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 Friday. If you want to use your homework to help you study for the midterm, 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 6:

1. What are the essential elements needed in order for work to be done? (Look at the definition of work and list at least three) 2. What is the difference between work done *by* an object and work done *on* an object? 3. What is meant by *net* work? 4. What is always the result of doing net work on a system? 5. What is kinetic energy? 6. What is potential energy? 7. How does potential energy relate to work? 8. What are some different types of potential energy? 9. How do nonconservative and conservative forces differ? 10. Name as many conservative forces as you can. 11. What is required for the total mechanical energy to be conserved? 12. When is total energy conserved? 13. The most important equation in this chapter is the equation which states in a mathematical form that total energy is never created or destroyed, that it is always conserved. Write that equation. 14. What is the definition of power? 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 7:

1. What is the definition of linear momentum? 2. How is momentum related to force? 3. What is required in order for momentum to be conserved? 4. What is an impulse and what is the result of an impulse? 5. Why is the total momentum is conserved in a collision even though the net external force is not necessarily equal to zero? 6. When two objects collide, what is the relationship between the two objects' *change* of momentum? 7. What is the difference between an elastic and an inelastic collision? 8. Is momentum conserved in both types of collisions? 9. Is momentum a vector or a scalar? 10. What does this imply about conservation of momentum along different axes? 11. What is the difference between an inelastic collision and a completely inelastic collision? 12. What is the

center of mass of an object? 13. Is it always found inside the physical dimensions of the object? 14. What path will the center of mass of an object follow in a constant gravitational field? 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 have a summer job at a company that specializes in the design of equipment for sports shows and exhibitions. The company has been given the contract to design a piece of apparatus for an ice skating show. In this show, an ice skater will start from rest and glide down an ice covered ramp. At the bottom of the ramp, the skater will continue gliding around an ice covered loop which is inside of a vertical circle. After going around the vertical circle, the skater will emerge at the bottom and glide out on the skating rink floor to the wild applause of the audience. The make a spectacular effect, the circular loop should have a diameter of 35 feet. Your task is to determine the minimum height of the top of the ramp to the rink floor so that the skater will not fall off the loop at the top.

B) You have been able to get a part time job with a medical physics group investigating ways to treat inoperable cancer. One form of cancer therapy being studied uses slow neutrons to knock a particle, (either a neutron or a proton) out of the nucleus of the atoms which make up the cancer cells. The neutron knocks out the particle it collides with in an inelastic collision. The heavy nucleus essentially does not move in the collision. After a single proton or neutron is knocked out of the nucleus, the nucleus decays, killing the cancer cell. To test this idea, your research group decides to measure the change in internal energy of a nitrogen nucleus after a neutron collides with one of the neutrons in its nucleus and knocks it out. Your realize that the change in internal energy is equal and opposite to the change in the energy of any particles interacting with the nucleus. In the experiment, one neutron goes into the nucleus with a speed of 2.0×10^{7} m/s and you detect two neutrons coming out at angles of 30° and 15° in the same plane. You look in your physics book to find that the mass of the neutron is 1.6749×10^{-27} kg. What is the change in internal energy of the nucleus?

Answers to even numbered problems: 6-8) 1.7×10^{2} J; 6-18) a) $\sqrt{2}$ b) 4; 6-38) 6.5 m/s; 6-56) 0.17 m; 6-76) a) $(2gL)^{1/2}$, b) –1.4 N; 7-16) 2.0 N·s, b) 4.0×10^{2} N; 7-28) x_1=0.28 m, x_2=1.1 m; A) 44 feet; B) 1.1×10^{-13} J