PHYSICS 207
Fall 1994

Prerequisites: Calculus (Math 221 or equivalent). Algebra, trigonometry and calculus will be used extensively.

Materials Needed: Text: Serway, *Physics for Scientists & Engineers with Modern Physics*, third edition (updated).

Lab manual: Rollefson and Richards, *Laboratory Experiments in General Physics*, 1994 edition.

Lab notebook: preferably hard bound with cross-hatched ruling. Bring it to your first laboratory meeting.

Calculator: preferably with trigonometric, exponential, and logarithmic functions. Know how to use it, and make sure batteries are charged for exams.

Lectures: 8:50 am MWF in 1300 Sterling Hall. Prof. J. C. Sprott (3285 Chamberlin Hall, 263-4449, sprott@juno.physics.wisc.edu). The lectures supplement but do not substitute for the reading. Read the assigned material before lecture. The Friday lectures are optional except for exams and for honors students. Everyone is encouraged to attend.

Discussion sections: Your discussion section will be led by your TA who will be your prime contact and source of assistance. General questions about the homework are allowed before it is due, but don't expect your TA to work out the solutions for you in advance. Quizzes will occasionally be given in your discussion section and will count toward your grade.

Laboratory: Follow the "General Instructions" in the laboratory manual (pages 1-3). The experiments are to be written up during the laboratory period in the lab notebook. Have your lab instructor initial and date the work before you leave the lab. The lab notebook is not to be taken from the lab except with permission of your instructor. The lab is in 4300 Sterling Hall.

Homework: The homework problems are assigned in the syllabus for each week and should be handed in at the first discussion section the following week. Late problem sets will not be accepted. Homework will count toward your grade. You may work with others on the homework, but make sure the paper you turn in is not simply copied from someone else. The solutions will be discussed in your discussion section and placed on reserve in the Physics Library (4220 Chamberlin Hall).

Hour Exams: Exams will be given during the Friday lecture as follows:

September 30, Chapters 1-5
October 28, Chapters 6-11
December 2, Chapters 12-18

The exams will be closed-book, but you will be allowed one 8½ X 11-inch sheet of notes. The exams will be graded and handed back in your first discussion section of the following week. Solutions will be discussed and placed on reserve in the Physics Library (4220 Chamberlin Hall). There will be no makeup exams.

Final Exam: The final exam will be at 10:05 am on Friday, December 23 (room to be announced). It will cover the entire course (Chapters 1-22) with equal weight. You will be allowed two 8½ X 11-inch sheets of notes.

Grading: The course grade will consist of the following components:

3 hour exams	300 points
Final exam	200 points
Laboratory	100 points
Homework & discussion	100 points
TOTAL	700 points

Lab, homework and discussion grades will be assigned by your TA and will be normalized to the distribution on the hour exams. Letter grades will be assigned based on the total number of points accumulated.

Consultation Room: Room 1402 Sterling is staffed by TA's from Physics 207 and 201 during much of the week. See the schedule card on the door. You may ask questions of any of the TA's or come during the hours that your TA is there. You may also make an appointment with your TA at any mutually convenient time and place.

Complaints and Concerns: If you have a non-subject matter question or concern that cannot be resolved by your TA or professor, contact Jean Buehlman, Instructional Program Manager (afternoons in 2520 Sterling Hall, 262-2629).

Alternate References: To see the same topics explained differently, try the following (on reserve in Physics library - 4220 Chamberlin):

Halliday and Resnick, *Fundamentals of Physics*
Giancoli, *General Physics*
Rusbult, *Tools for Problem-Solving*

General Advice: Physics is not something you read and memorize, rather it is something you learn how to do. Try the following study procedure:

1) Read the chapter prior to lecture, so that you will know what it's about.

2) Listen carefully to the lecture and take notes.

3) This is crucial: Do not go back and read and re-read the chapter until you "understand it." Rather, start working problems, going back through the chapter to clarify points as they come up.

PHYSICS 207
FALL 1994
SYLLABUS

References are to Serway, *Physics*, 3rd edition (updated).
Lab manual is Rollefson and Richards, 1994 edition.

Week	Reading	Problems	Lab
9/5	Ch 1	1:4,14,35,42,53,61	no lab
9/12	Ch 2,3	2:5,13,34,35,50,53; 3:7,14,17,43,52,69	M1
9/19	Ch 4,5	4:3,8,17,30,36,44; 5:22,29,38,50,76,87	M4
9/26	Review	Exam (9/30) Chapters 1-5	M5
10/3	6,7	6:9,19,24,32,38,49; 7:10,20,25,42,61,89	M6
10/10	Ch 8,9	8:2,11,18,25,36,49; 9:8,19,27,46,53,65	M14
10/17	Ch 10,11	10:2,10,21,26,36,52; 11:4,21,29,36,39,41	M9
10/24	Review	Exam (10/28) Chapters 6-11	M3
10/31	Ch 12,13	12:6,7,21,31,42,58; 13:8,16,23,32,49,59	M15
11/7	Ch 14,15	14:12,15,26,36,45,68; 15:3,13,21,28,43,74	S1
11/14	Ch 16,17	16:1,7,17,30,36,54; 17:1,12,26,38,46,57	S3
11/21	Ch 18,19	18:7,11,30,45,50,60; 19:5,8,31,45,64,75	makeup
11/28	Review	Exam (12/2) Chapters 12-18	H2
12/5	Ch 20,21	20:11,31,37,45,60,81; 21:6,14,24,31,39,75	H4
12/12	Ch 22	22:7,15,20,27,28,42	makeup
		Final Exam (12/23) Chapters 1-22	

Physics 207

Fall 1994

Special Friday Lectures

(Tentative)

Sep 2	Sprott - Introduction to the Course
Sep 9	Sprott - Problem Solving and Error Analysis
Sep 16	Frames of Reference (film)
Sep 23	Cameron - Physics of Imagination and Creativity
Sep 30	Exam (Chap 1 - 5)
Oct 7	The Pleasure of Finding Things Out (Feynman video)
Oct 14	Sprott - Seasons, Tides, and Phases of the Moon
Oct 21	Cameron - Physics of the Body
Oct 28	Exam (Chap 6 - 11)
Nov 4	Sprott - Chaos and Randomness
Nov 11	Barschall - Bubbles and Einstein's Footprints
Nov 18	Fry - Physics of the Violin
Nov 25	Thanksgiving
Dec 2	Exam (Chap 12 - 18)
Dec 9	Sprott - The Wonders of Physics (Fun lecture)

Name _____ Section _____

Physics 207

Final Exam

Time limit: 2 hours
Closed book

December 23, 1994
10:05 am

Problem #1	(20 points) _____	Problem #6	(20 points) _____
Problem #2	(20 points) _____	Problem #7	(20 points) _____
Problem #3	(20 points) _____	Problem #8	(20 points) _____
Problem #4	(20 points) _____	Problem #9	(20 points) _____
Problem #5	(20 points) _____	Problem #10	(20 points) _____
		TOTAL	(200 points) _____

You are allowed to use two 8-1/2 X 11" sheets of notes during the exam.

1. An aircraft has a lift-off speed of 120 km/hr.

(a) Calculate the minimum acceleration required for it to depart from a runway of length 240 m.

(b) Calculate the number of seconds required for the aircraft to become airborne at the above acceleration.

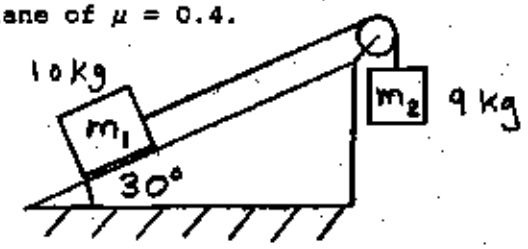
2. A bullet is shot horizontally from a gun that is 1.5 m above the ground. Ignore air resistance.

(a) Calculate the initial speed of the bullet if it hits the ground 500 m from the gun.

(b) Calculate the initial speed required to put the bullet in a circular orbit around the Earth. The radius of the Earth is 6.4×10^6 m.

3. Two blocks are connected as shown by a massless string that passes over a maseless, frictionless pulley. The block on the left has a coefficient of friction with the inclined plane of $\mu = 0.4$.

(a) Calculate the magnitude of the acceleration of the blocks.



(b) Calculate the amount of heat produced while the blocks move through a distance of 2 m.

4. A spring-loaded gun with a spring constant k = 2000 N/m launches an 80-g projectile in a horizontal direction. The projectile strikes the ground 50 m from the gun at a 45° angle.

(a) Calculate the speed of the bullet when it strikes the ground.

(b) By how much was the spring initially compressed from its equilibrium length?

5. A stationary ice skater with a mass of 50 kg catches a ball with a mass of 0.5 kg and a speed of 10 m/s thrown directly toward her, and she rebounds without friction.

(a) Calculate her speed after she catches the ball.

(b) Now she throws the ball back with the same speed of 10 m/s but with her arm outstretched by 80 cm causing her to spin around at a rate of 1.2 revolutions per second. Calculate her moment of inertia.

6. A horizontal pipe with a diameter of 4 cm supplies 2000 g of water per second at a pressure of 0.5 atmospheres. Neglect friction and viscosity.

(a) Calculate how much power the pump must produce.

(b) Calculate the velocity of the water exiting the pipe.

7. A steel wire with a diameter of 2 mm and a length of 30 cm is fixed at the ends and has a tension of 8 N. The density of steel is 8 g/cm^3.

(a) Calculate the frequency (in cycles per second) of the fundamental mode of vibration of the wire.

(b) If the vibrating string produces a spherical sound wave with an intensity of 50 dB at a distance of 10 m, how much sound power is produced by the string?

8. The driver of a 1500-kg automobile traveling 30 m/s slams on the brakes and slowly skids to a stop on a horizontal layer of ice at 0° C.

(a) Calculate the mass of ice melted in the process. Assume the water remains in thermal equilibrium with the surrounding ice.

(b) Calculate the change in entropy of the Universe as a result of the driver's action.

9. In the cylinder of an automobile engine, 200 cm^3 of air initially at 1 atmosphere and 20° C is adiabatically compressed to 20 cm^3.

(a) Calculate the temperature of the air after compression. Assume air is an ideal diatomic gas with $C_v = 5R/2$.

(b) Calculate the work done by the piston in compressing the air.

10. In the lecture there were many demonstrations. Name or describe a demonstration you saw that illustrated each of the following principles:

(a) Constancy of g

(b) Newton's first law

(c) Newton's third law

(d) Conservation of energy

(e) Conservation of momentum

(f) Conservation of angular momentum

(g) The weight (or pressure) of air

(h) The Bernoulli effect

(i) The variation of sound speed with atomic mass

(j) Heat radiation