Assignments for 33-131: Matter & Interactions I Fall 2001

After each class discussion (or before, if you prefer), it is your responsibility to study carefully the assigned sections of the textbook before the next class discussion. *Not all assigned sections of the textbook will be discussed in class.* Read thoughtfully, do the "stop and think" activities, and write brief solutions to the exercises in a course notebook. Make a note in the textbook or your notebook of any questions you have about the material, and ask for clarification.

Some time before the end of the second week, come visit Dr. Sherwood or Dr. Chabay in their offices. Credit is given for the visit.

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Week 1: Aug. 27	Course overview and logistics; matter and interactions By Wednesday, read the course syllabus, the textbook preface, and study Sections 1.1 through 1.5.4 of the textbook. **DUE tomorrow: basic mechanics quiz**	**DUE at start of last class: basic mechanics quiz** Computer modeling, part 1 Study Appendix A, *Vector Review*, do the exercises, and check your answers. Omit section A.2 on dot and cross products. Be sure to get any questions answered right away, because we will use vectors extensively.	Discussion of Ch. 1 Assignment: Finish Ch. 1 More on programming (optional; if you have never written a computer program before, please come for additional help with programming) DH A325 7:30-9:30 PM	**DUE at start of last class: RQ1.3, RQ1.4, RQ1.5 (on pages 33-34), Prob. 1.2 (page 35)** Computer: visualizing vectors	**QUIZ on Ch. 1 and *Vector Review*** Law of gravitation; multiparticle systems; computer modeling Study Sec. 2.1-2.6.4 before Tuesday; note short assignment to turn in on Tuesday at the start of your class (needed for computer work)
Week 2: Sept. 3	***Labor Day—no class***	**DUE at start of class: Prob. 2.1 parts (a) and (b), needed for computer work** Computer: Prob. 2.1 (planetary orbits); if you finish early, go on to Prob. 2.2 (binary stars). You might like to do Prob. 2.6 for extra credit (3-body problem) DH A325 open 7-10 PM	Accuracy vs. speed; issues of physical modeling; circular motion Sec. 2.6.5-2.8.1 Workshop (optional; come to work with others on homework and to get help from instructors) DH A325 7:30-9:30 PM	**DUE by 11 PM: Turn in by FTP the program file for Prob. 2.1, and include answers to questions as comments in the program file** Work on selected Ch. 2 review questions and problems DH A325 open 7-10 PM	**QUIZ on Ch. 2 (through Sec. 2.8.1)** 3-body orbits; determinism Sec. 2.9-2.11 **Last day to obtain credit for office visit**

The offices of Bruce Sherwood (phone 8-8530) and Ruth Chabay (phone 8-5714) are in Hamburg Hall, the large building at the bottom of the hill on Forbes (4800 Forbes). This is not Hammerschlag Hall! Take the elevator to the third floor of Hamburg Hall and walk straight ahead. After you are forced to turn right, go through the glass door on your right (labeled Center for Innovation in Learning). Just past the CIL mailboxes, turn left down a hallway to room 3041 or 3039B.

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Week 3: Sept. 10	Ball & spring model of solids; analyzing dynamical systems; explanation of Young's modulus measurement for tomorrow's lab Sec. 3-1-3.4.4 Workshop (optional) DH A325 7:30-9:30 PM	**DUE: Prob. 2.9, 2.10, 2.11, 2.13, Ch. 2 reflection*** **DUE by 11 PM: Turn in by FTP the program file for Computer Problem 2.2, and include answers to questions as comments in the program file** Experiments: Young's modulus (Prob. 3.1); spring-mass (Prob. 3.3); brief lab worksheet due tomorrow DH A325 open 7-10 PM	**DUE at start of class: Turn in brief lab worksheet** Analytical solution to spring-mass system Sec. 3.4.5-3.4.12	Computer: modeling a spring-mass system (Prob. 3.4) A copy of last year's exam will be on the course web site	**QUIZ on sections 3.1-3.4.12 of Ch. 3** Speed of sound in a solid: computational model; dimensional analysis; measurement Sec. 3.5-3.5.1
Week 4: Sept. 17	Buoyancy; pressure; applying Newton's laws with unknown force laws Sec. 3.6-3.8.1	Work on selected Ch. 3 review questions and problems Workshop (optional) DH A325 7:30-9:30 PM	**DUE: Prob. 3.2, 3.4, 3.9, 3.11, 3.12, Ch. 3 reflection*** Work and kinetic energy; demonstration of Prob. 4.1 (work and energy in Moon voyage) Sec. 4.1-4.3 Exam review (optional) DH A325 7:30-9:30 PM	**EXAM 6:30-8:30 PM** Covers Ch. 1-3 Room to be announced No class today, but the instructors will be in the classrooms to answer questions	**NO QUIZ** Conservation of energy; general properties of potential energy; gravitational energy Sec. 4.4-4.4.10
Week 5: Sept. 24	Energy graphs; applications of gravitational potential energy Sec. 4.5-4.5.5	Work on selected Ch. 4 problems	Electric potential energy Sec. 4.6-4.6.2 Workshop (optional) DH A325 7:30-9:30 PM	**DUE: Short assignment; Prob. 4.6, 4.8** Computer: Energy in Moon voyage (Prob. 4.2); to be checked off in class, starting from an existing Moon voyage program, which will be provided	**QUIZ on sections 4.1-4.6.2 of Ch. 4** Rest energy in a multiparticle system; reflection on energy Sec. 4.7-4.8

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	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Week 6: Oct. 1	Macroscopic spring energy; thermal energy; power Sec. 5.1-5.5 Workshop (optional) DH A325 7:30-9:30 PM	**DUE: Prob. 4.9, 4.10, 4.15, 4.16, Ch. 4 reflection*** Computer: Spring-mass system with energy graphs (Prob. 5.1, to be checked off in class)	Open and closed systems Sec. 5.6	Work on selected Ch. 5 problems	**QUIZ on sections 5.1-5.6 of Ch. 5** Air resistance (brief); sliding friction; irreversibility Sec. 5.10-5.12 Not covered on exams: Sec. 5.7-5.9.4 (air resistance) and Sec. 5.13-5.13.2 (resonance)
Week 7: Oct. 8	Energy quantization; emission and absorption of light Sec. 6.1-6.2.5 Workshop (optional) DH A325 7:30-9:30 PM	**DUE: Prob. 5.10, 5.12, 5.13, 5.16, Ch. 5 reflection*** Work on and observe energy spectra, including doing Prob. 6.7 (H spectrum) A copy of last year's exam will be on the course web site DH A325 open 7-10 PM	Quantized vibrational energy levels; other quantized systems Sec. 6.3-6.7 Not covered on exams: Sec. 6.8 (lasers) DH A325 open 7-10 PM	**DUE: Computer Problem 5.4 (adding dissipation to the spring-mass system)** Work on selected Ch. 6 problems DH A325 open 7-10 PM	**QUIZ on Ch. 6** Multiparticle systems Sec. 7.1-7.2.4
Week 8: Oct. 15	**DUE: Prob. 6.1, 6.3, 6.5, 6.7** Energy in multiparticle systems; the point-particle system Sec. 7.3-7.4 Exam review (optional) DH A325 7:30-9:30 PM	**EXAM 6:30-8:30 PM** Covers Ch. 4-6 Room to be announced No class today, but the instructors will be in the classrooms to answer questions	More on the point particle system; application to friction Sec. 7.4-7.5.3	Work on selected Ch. 7 problems	***Midsemester break—no class***

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	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Week 9: Oct. 22	***Midsemester break—no class***	Work on selected Ch. 7 problems	Collisions Sec. 8.1-8.2.5 Workshop (optional) DH A325 7:30-9:30 PM	**DUE: Prob. 7.1, 7.6, 7.8, 7.10, Ch. 7 reflection*** Work on selected Ch. 8 review questions and problems	**QUIZ on Ch. 7** Scattering Sec. 8.3-8.4.3
Week 10: Oct. 29	Scattering distributions; relativistic collisions Sec. 8.4.4-8.5	Work on selected Ch. 8 problems	Inelastic collisions; center of momentum reference frame Sec. 8.6-8.7.2 Workshop (optional) DH A325 7:30-9:30 PM	**DUE at start of your class: Part (a) of Prob. 8.1 on a separate sheet (needed for computer work)** **DUE: Prob. 8.4, 8.10, 8.11, 8.13, Ch. 8 reflection*** Computer: The Rutherford experiment (Prob. 8.1) DH A325 open 7-10 PM	**QUIZ on Ch. 8** Angular momentum; angular momentum in multiparticle systems Sec. 9.1-9.2.2
Week 11: Nov. 5	Quantization of angular momentum; the angular momentum principle Sec. 9.3-9.4 DH A325 open 7-10 PM	**DUE: Computer Problem 8.1; Exercises 9.11, 9.12, 9.13 on page 303; answers are given, show your work** Computer: Angular momentum in an elliptical orbit (Prob. 9.1) DH A325 open 7-10 PM	Torque and angular momentum; angular momentum conservation; multiparticle systems Sec. 9.4.1-9.7.1 Workshop (optional) DH A325 7:30-9:30 PM	**DUE: Computer Prob. 9.1** Work on selected Ch. 9 problems A copy of last year's exam will be on the course web site DH A325 open 7-10 PM	**Quiz on Ch. 9** Applications and demos of the angular momentum principle Sec. 9.8-9.9.3

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	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Week 12: Nov. 12	**DUE: Prob. 9.13, 9.14, 9.22, 9.24, Ch. 9 reflection*** Gyroscopes; precession Not covered on exams: Sec. 9.10-9.12 (gyroscopes) Exam review (optional) DH A325 7:30-9:30 PM	**EXAM 6:30-8:30 PM** Covers Ch. 7-9 Room to be announced No class today, but the instructors will be in the classroom to answer questions	Statistical mechanics Sec. 10.1-10.3	Computer: Probability distribution and its logarithm (Computer problems 10.1 and 10.2; see note at bottom of page).	**NO QUIZ** Entropy; temperature Sec. 10.3.1-10.5.2
Week 13: Nov. 19	**DUE: Computer problems 10.1 and 10.2** Heat capacity of a solid Sec. 10.6-10.6.1 **Pick up styrofoam cup for home experiment due next Monday** DH A325 open 7-10 PM	Computer: Temperature (Computer problem 10.3). If you finish early, go on to computer problem 10.4.	***Thanksgiving vacation***	***Thanksgiving vacation***	***Thanksgiving vacation***

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For statistical mechanics calculations:

from visual.factorial import *
factorial(N) is N!
combin(a,b) is a!/(b!(a-b)!)

Natural logarithm is “log” in VPython, not “ln’

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	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Week 14: Nov. 26	**DUE: Computer problem 10.3; Prob. 10.8 (take-home heat capacity experiment)** The Boltzmann distribution; application to a diatomic gas Sec. 10.7-10.8.1 DH A325 open 7-10 PM	Computer: Heat capacity (Prob. 10.4) DH A325 open 7-10 PM	More on a diatomic gas Sec. 10.8.2-10.8.7 DH A325 open 7-10 PM	**DUE: Computer problem 10.4** Work on selected Ch. 10 problems DH A325 open 7-10 PM	**QUIZ on sections 10.1-10.8.7 of Ch. 10** More on a diatomic gas Sec. 10.8.8-10.8.10
Week 15: Dec. 3	Modeling gases; gas leak; mean free path Sec. 11.1-11.3 Workshop (optional) DH A325 7:30-9:30 PM	**DUE: Prob. 10.6, 10.11, 10.13, 10.15, Ch. 10 reflection*** Work on selected Ch. 11 problems	Microscopic explanation of the ideal gas law; applications Sec. 11.4-11.4.7	Work on selected Ch. 11 problems A copy of last year's final exam will be on the course web site	**Quiz on sections 11.1-11.4.7 of Ch. 11** Constant-temperature (isothermal) and no-heat (adiabatic) processes; heat capacity Sec. 11.5-11.5.4; you are not responsible for Sec. 11.6 (a random walk)
Week 16: Dec. 10	Limitations on the efficiency of engines (an application of the second law of thermodynamics) Not covered on exams: Sec. 12.1-12.2.4 Workshop (optional) DH A325 7:30-9:30 PM	**DUE: Prob. 11.4, 11.5** Last day of class Work on last year's final	**Reading day**		

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Final exam time and place will be scheduled by the registrar. The 3-hour final exam will cover Chapters 1-11.

01/08/27