

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Physics

Physics 8.01

Spring 2005

PROBLEM SET 3

Saturday, February 12, 2005

Due Date: Thursday, February 17, 2005, 3:00 p.m.

Reading Assignment: Young and Freedman, Chapter 4, Sections 5.1 and 5.2, and the statement of Hooke's law on p. 221; Busza, Cartwright, and Guth: pp. 60–65 of Chapter 2, through the paragraph that begins “If a body is at rest ...”, and the statement of Hooke's law in the last paragraph of p. 66.

Topics for the week: Newton's three laws of motion: inertia, force, weight and mass, Newton's law of gravity, Coulomb's law, normal forces, tension, and Hooke's law. (Problems involving frictional forces, circular motion and the banking of tracks, and the conical pendulum will be reserved for next week, and simple harmonic motion will be reserved for later in the course.)

Instructions:

If a problem is marked **DO**, you should write a solution to hand in to be graded. The graders will read your answers to one or two questions on each problem set, and they will check whether the other problems have at least been handed in.

The quiz on this material, to be given at 10:05 am on Friday, February 18, will include at least one problem that is at most a slight modification of one of the problems (**DO** or **STUDY**) on this problem set.

Your written solutions are due by 3:00 pm in room 4-339B on Thursday, February 17. Please indicate the number, instructor, and time of your recitation section, and be sure to submit your paper to the correct bin. Solutions will be made available on the 8.01 website shortly afterward, so that you will be able to use them in studying for the quiz.

Fundamental concepts (Force, Mass, and Newton's Second Law):

- 1) **DO:** SG:2A.1 Net force
- 2) **DO:** SG:2B.3 (H) Combined effect of springs
- 3) **DO:** Y&F:4.17 Weight and mass on the Earth and on Io
- 4) **DO:** SG:2B.6 Comparison of electrostatic forces and gravity

Newton's second law: force, mass, and acceleration:

- 5) **DO:** SG:2C.1 A block on an inclined plane
- 6) **STUDY:** SG:2C.2 (S) Forces on balls in “Newton's cradle”
- 7) **STUDY:** SG:2C.5 (S) Towing a sled
- 8) **DO:** SG:2C.4 (H) Tugboats pulling a liner
- 9) **DO:** Y&F:4.49 Blocks, ropes, and tension
- 10) **DO:** Y&F:5.15 Atwood's machine
- 11) **DO:** SG:3.15 What happens when a spring breaks?

Newton's third law: identifying 3rd law force pairs

- 12) **DO:** Y&F:4.22 Forces on an elevator passenger