

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Department of Physics

Physics 8.01

Spring 2005

PROBLEM SET 1

Monday, January 31, 2005

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

Reading Assignment: Young and Freedman, pp. 1–13, and 40–47; Busza, Cartwright, and Guth: pp. 10–11.

Topics for the week: Definition of classical mechanics; units, unit conversions, and dimensional analysis; order of magnitude estimates; displacement, average velocity, instantaneous velocity; graphical representation of motion.

Instructions:

Note that the problems in the 8.01 Study Guide (SG) by Busza, Cartwright, and Guth come in three types: Problems marked “(S)” are worked examples, with full solutions contained later in the same chapter; problems marked “(H)” have hints (just after the worked solutions) to help you if you are stuck; and problems without designation have answers (printed just after the hints, still in the same chapter).

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. Problems marked **STUDY** need not be handed in, but you should study the worked solution so that you know how to solve such a problem even while sleeping. The quiz on this material, to be given at 10:05 am on Friday, February 4, 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 3. 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. Since the answers to most problems have been given, your homework grade will be determined by the clarity and quality of your written solution.

Remember: *Trying to learn physics without doing problems is like trying to learn to ride a bicycle by reading a book.*

Unit conversions:

- 1) **DO:** Y&F:1.4 The density of lead
- 2) **DO:** Y&F:1.9 How many miles per gallon?

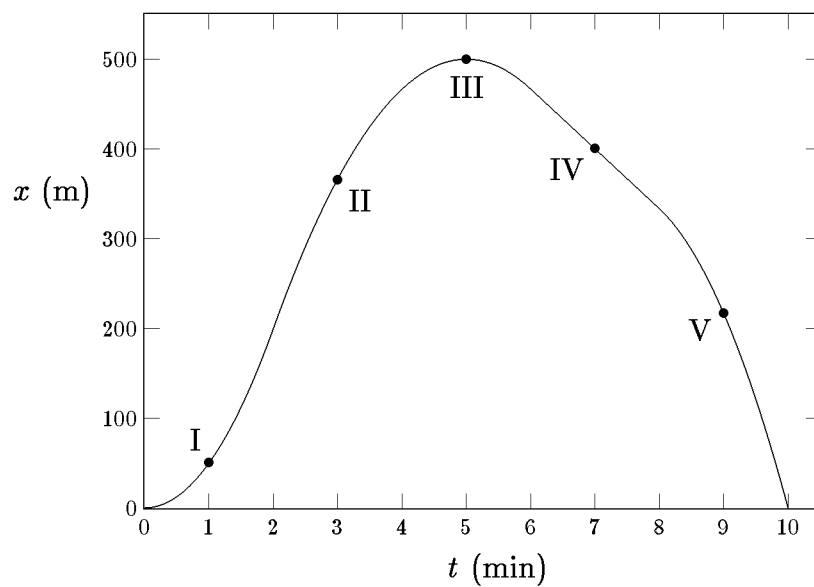
Velocity and speed in one dimension:

- 3) *DO:* SG:1A.1 Speed, distance, and time
- 4) *DO:* SG:1A.3 Average velocity — averaging over time vs. averaging over distance
- 5) *STUDY:* SG:1A.4 (S) Average speed and unit conversions
- 6) *DO:* Y&F:2.5 Two runners on a track. Note that when the problem asks how far from the starting point each person has run, they want the total distance run around the track, not the net displacement.
- 7) *DO:* Y&F:2.9 Instantaneous and average velocity. Replace the equation in the problem by

$$x(t) = bt^2 - ct^4 ,$$

where $b = 3.60 \text{ m/s}^2$ and $c = 0.0120 \text{ m/s}^4$.

- 8) *DO:* Y&F:2.10 Graphical representation of motion. Use the following graph instead of the one in the book:



Estimation:

- 9) *DO:* Y&F:1.24 Heart beats