MIT Department of Physics

Physics 8.01L Fall 2009

PROBLEM SET #8
Due Friday 6th November 9am

READING: Young and Freedman, Chapter 8 §§1-5.

FORMAT: Please read the instructions on the web page concerning the required format for problem sets.

8-1) Young and Freedman, exercise 8.78, page 280.

8-2) Young and Freedman, exercise 8.85, page 281.

8-3) Young and Freedman, exercise 8.89, page 281.

8-4) Young and Freedman, exercise 8.92, page 281.

8-5) Consider two different completely inelastic collisions between two cars, In the first collision car A has velocity $2v$ along the x-axis and car B has velocity $-v$ along the x-axis. In the second collision car A has velocity $2v$ along the x-axis and car B has velocity $+v$ along the x-axis. For both cases find the kinetic energy "of" the center of mass and the kinetic energy "in" the center of mass. What are these numbers as a fraction of the total kinetic energy? The energy "in" the center of mass goes into crumpling metal.

8-6) A projectile is launched with initial velocity v at at 45° to the horizontal. At its maximum height above the ground it explodes and breaks into two equal mass fragments. As a result of the explosion one of the fragments has zero kinetic energy (in the lab frame) and drops straight down.

a) How far does the other fragment travel?

b) How much energy was released in the explosion?

8-7) Consider the following variation on the "rocket ball" toy demonstrated in class. A squash ball rests atop a basketball. They are released together from a height H. The basketball collides 100% elastically with the ground. Milliseconds later the squash ball collides 100% elastically with the basketball. How high does the squash ball rise? You may make the following assumptions: that the diameters of the two balls can be ignored, and that the basketball is very much more massive than the squash ball.