Physics 20, Fall 2011
Homework Set 8
Due: 5pm Wednesday, November 30, 2011

Turn homework into the **Phys 20 box on the 2nd floor of Broida Hall,** directly in front of the elevators. Please show your work, and write neatly.

Object	Speed (mph)	Mass (kg)	Kin. En. (Joules)	Gal. Gas.	Tons TNT	Fat Men
Car	65	1.8×10^3				
767 Plane	500	1.8×10^5				
Freight Train	55	9.1×10^6				

Table 1: Problem 1.

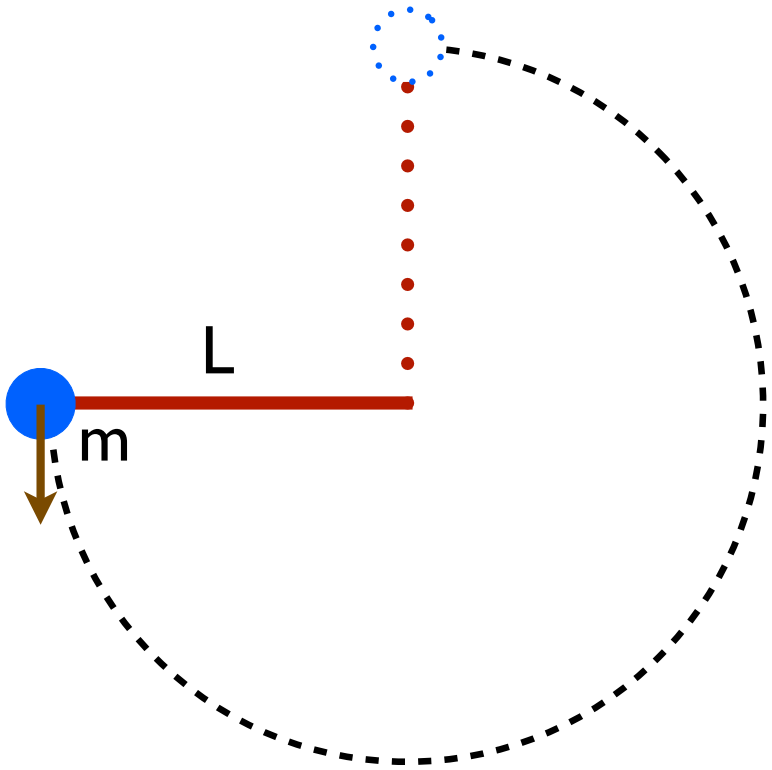

Figure 1: Problem 2.

1. Calculate the kinetic energies in Joules of the moving objects in Table 1. Then convert these numbers for the last three columns: one gallon of gasoline releases 1.3×10^8 Joules, one Ton of TNT releases 4.2×10^9 Joules, and one 'Fat Man' atomic bomb releases 9×10^{13} Joules.

(a) Concerning the 767 plane: the energy in a full *fuel* tank of a 767 corresponds to 1000 Tons of TNT. How does that compare to the kinetic energy of the 767? In the horrible collision of a 767 with the World Trade Center on 9/11/2001, which source of energy was greater, kinetic energy of the plane, or energy available in the fuel? What fraction of a Fat Man bomb was released by the fuel?

(b) Trains are stopped by brakes applied to the wheels. The best braking strategy involves no skidding of wheels on the tracks, and the resulting coefficient of friction is about $\mu = 1/4$. In what distance could the train in Table 1 be brought to rest? If skidding commences, $\mu = 1/40$.... in that case, what is the distance the train goes before being brought to rest?

2. KK 4.1.

3. KK 4.4.

4.

A ball of mass m is attached to the end of a massless rod of length L. The other end of the rod pivots so that the ball moves in a vertical circle. The rod is pulled aside to a horizontal position and given a downward push as shown in Fig. 1 so that the rod swings down and then up, finally just reaching the vertically upward position. What initial speed was imparted to the ball?