## Set #9 - for Tues Nov. 30

Read HR&K	Ch. 6, Ch. 7, Ch. 12 (skip 12.4), Ch. 13
Read K&K	Ch. 3, Ch. 4 - Sects. 4.11, 4.12, 4.13, 4.14.
<u>Read Feynman Vol. 1</u>	Ch. 10

## From HR&K:

- **Ch. 6** Problems 3, 7, 17.
- **Ch. 7** Exercises 6, 20.
- **Ch. 12** Problem 6.
- **Ch. 13** Exercise 15.

## From K&K:

Ch. 4 Problems 4.4, 4.20, 4.23, 4.27. Extra Credit 4.3, 4.11, 4.21

1. Consider the problem of a water droplet falling in the atmosphere. As the droplet passes through a cloud it acquires mass at a rate proportional to its instantaneous mass M(t). That is, if M is the mass of the droplet at time t, then  $\frac{dM}{dt} = kM$ , where k is a proportionality constant. Consider a droplet of initial mass  $M_0$  that enters a cloud with velocity  $v_0$ . Assume no resistive force and find:

a) The mass of the droplet as a function of time.

b) The velocity of the droplet as a function of time.

2. A lunar module of total mass  $M_0$  is at height H above the surface of the Moon and is descending vertically at speed  $v_0$ , when a rocket is ignited to produce a soft landing. The mass of the fuel decreases at a constant rate with respect to time, and the gas is ejected at a speed of 2400 m/s relative to the module. If the module touches the lunar surface with zero velocity and the module's mass at the end of the burn lasting 350 sec is  $\frac{2}{3}M_0$ , evaluate  $v_0$  and H. (Assume that the acceleration due to gravity at the surface of the Moon is 1.62 m/s<sup>2</sup>). **3.** Two railway cars of masses  $m_1$  and  $m_2$  are moving along a track with velocities  $v_1$  and  $v_2$  respectively. The cars collide, and after the collision the velocities are  $v'_1$  and  $v'_2$  respectively. Show that the change in kinetic energy of the system will be a maximum if the cars couple together.

4. An electron, mass m, collides head-on with an atom, mass M, initially at rest. As a result of the collision, a characteristic amount of energy E is stored internally in the atom. What is the minimum initial speed  $v_0$  that the electron must have?