Physics CS 33 **Spring 2011**

Set #8 - for Wd May 25

Read K&K	Ch.12, Sects. 12.1 - 12.6
Read Ohanian	Ch. 2, Sects. 2.1-2.6
Read HR&K	Ch. 20, Sects. 20.1 - 20.7
Feynman Vol. I	Ch. 16, 17

From K&K:

Ch. 12 Problems 12.5, 12.6, 12.11, 12.12.

From Ohanian:

Ch. 2 Problems 7, 21, 23.

1. An observer A is in a rocketship that passes the Earth at a speed of 0.6c. An observer B on Earth sets her watch so that it reads zero, the same as A's watch when the ship passes. If observer B looks at A's watch through a telescope, what time does B see on A's watch when B's watch reads 30.0 seconds?

2. (Do K&K problems 12.11 and 12.12 first.)

The twin paradox: Assume that a rocketship leaves the Earth in the year 2005. One of a set of twins born in 1985 remains on Earth; the other rides in the rocket. The rocketship is so constructed that it has an acceleration $g = 9.8$ m/s^2 in its own rest frame. It accelerates in a straight line path for 5 years (by its own clocks), decelerates for 5 years, turns around, accelerates for 5 years, decelerates for 5 years, and lands on Earth. The twin in the rocketship in 40 years old. What year is it on Earth?

Hint: Show that in Earth's frame, the rocket acceleration is: $\frac{dv}{dt} = g(1-v^2/c^2)^{\frac{3}{2}}$ *and integrate.*

3. A physics student is arrested for going through a red light. In court, he pleads that he approached the light at such a speed that the red light appeared green to him. The judge changes the accused crime to speeding and fines the student one dollar for every

kilometer per hour by which he exceeded the speed limit of 50 km/h. What is the fine? The wavelength of green light is 5.3×10^{-7}m, while that of red light is 6.5×10^{-7}m. (*Read pages 477, 478 in K&K.*)

Extra Credit

1. K&K Problem 12.10 (*The pole-vaulter paradox*)

2. Show: a) If two events in spacetime are separated by a timelike interval, then it is possible to find a Lorentz transformation such that the two events happen at the same space point but are not simultaneous. b) If two events are separated by a spacelike interval, then there exists a Lorentz transformation whereby the two events are simultaneous but happen at two different space points.