

Mechanics and Special Relativity, Spring 2006

Homework Assignment # 10

(Due Wednesday, April 26, before the lecture.)

Lectures and Reading Assignments:

Readings are from “*An Introduction to Mechanics*” by Kleppner and Kolenkow.

- Lec 36, 4/21 (Fri): Simultaneity and the Order of Events. The Lorentz Contraction and Time Dilation. **Sec. 12.1–12.3 (pp. 462–472).**
- Lec 37, 4/24 (Mon): The Relativistic Transformation of Velocity. Doppler Effect. **Sec. 12.4, 12.5 (pp. 472–480).**
- Lec 38, 4/26 (Wed): Relativistic Momentum and Energy. **Sec. 13.1, 13.2 (pp. 490–500).**

Problems:

Numbered problems are from “*An Introduction to Mechanics*” by Kleppner and Kolenkow, Chapter 12 (pp. 484–487).

1. Problem 12.3
2. Problem 12.5
3. Problem 12.10
4. Problem 12.14
5. The diameter of a proton is 2.0×10^{-15} m in its own reference frame. What is the longitudinal diameter of a proton when its speed is within 100 m/s of the speed of light?
6. We want to send a spaceship from the Earth to the Large Magellanic Cloud, at a distance of 1.6×10^5 light-years from the Earth. By taking advantage of the time dilation, the astronauts on the spaceship plan to reach their destination in 5 years of their own time. At what speed, relative to the earth must the spaceship travel? When the spaceship reaches the Large Magellanic Cloud, how many years have elapsed on Earth?