

# Physics 22 Problem Set 1

Harry Nelson

due Monday, April 4 at 5pm

## Course Announcements:

Reading for these Problems: KK Chapter 11, RHK4 Chapter 21.

PSR Fellows, who are advanced Physics Majors, are available to help you in the PSR Wed. & Thurs. from 6-8pm, and Sunday in 1640 Broida, 6-8pm.

---

1. The mean lifetime of muons stopped in a lead block in the laboratory is measured to be  $2.20 \mu\text{s}$ . The mean lifetime of high-speed muons in a burst of cosmic rays observed from the Earth is measured to be  $16.0 \mu\text{s}$ . Find the speed of these cosmic ray muons.
  2. The length of a spaceship is measured to be exactly half its rest length.
    - (a) What is the speed of the spaceship relative to the observer's frame?
    - (b) By what factor do the spaceship's clocks run slow, compared to clocks in the observer's frame?
  3. What must be the value of the speed parameter  $\beta$  if the Lorentz factor  $\gamma$  is to be:
    - (a) 1.01?
    - (b) 10.0?
    - (c) 100?
    - (d) 1000?
  4. Inertial frame  $S'$  moves at a speed of  $0.60c$  with respect to frame  $S$  in the direction of increasing  $x$ . In frame  $S$ , event 1 occurs at the origin at  $t = 0$  and event 2 occurs on the  $x$  axis at  $x = 3.0 \text{ km}$  and at  $t = 4.0 \mu\text{s}$ . What times of occurrence does observer  $S'$  record for these same events?
-