Relativity Problems II-a

1. a. What is the Lorentz factor for an object moving at 35 m/s?

   b. What is the Lorents factor for an object moving at 0.5c?

   c. What is the Lorentz factor for an object moving at 2.9×10^8 m/s?

   d. How fast does something have to travel for the Lorentz factor to be 3?

   e. How fast does something have to travel for the Lorentz factor to be 10?

2. Sketch the Lorentz factor vs the speed factor. ($\boldsymbol{\gamma}$ vs $\boldsymbol{\beta}$)

3. a. Who measures the proper time (t_0) between two events?

   b. Who measures a time-dilated time (t) between two events?

4. A spaceship flies by the earth with a relative speed of v. On the ship, there is a blinking light.
   a. On the ship, the time between flashes of light is 1 second. If the ship flies by the earth at 0.9c, what is the time interval between flashes as seen on the earth?

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b. If the flashes are 0.01 seconds apart on the ship, and 0.1 seconds apart on the earth, how fast is the ship traveling?

c. The ship flies by at 0.95c. If the flashes are 2 seconds apart on earth, how far apart are they on the ship?

5. A rocket flies across a field at a speed of 0.8c. People on the field determine that it takes the rocket 2.5 μs to cross the field. How long does it take according to the rocket?

6. An electron traveling at 0.99c takes 4 μs to travel down a particle accelerator tube, according to the electron. How long does it take to the scientists at the accelerator?

7. You watch the length of a spaceship pass by you in 0.6 μs. If the ship is traveling at 0.85c, how long did that take according to the ship?

Answers:

1. a) 1 b) 1.15 c) 3.91 d) 0.94c e) 0.995c

3. a) the RF with the 2 events at the same coordinates b) the RF with the 2 events at different coordinates

4. a) 2.29 sec b) 0.995c c) 0.62 sec 5) 1.5 μs 6) 28.4 μs 7) 1.14 μs