Name _____ Date _____

PH 102 Quiz 1: Relativity and so forth

$\Delta t' = \gamma \Delta t_p$ $\quad$ $L' = \dfrac{L_p}{\gamma} = L_p\sqrt{1 - \dfrac{v^2}{c^2}}$ $\quad$ $c = 3.00 \times 10^8\,\text{m/s}$ $\quad$ $\gamma = \dfrac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$

1. An astronaut traveling at $v = 0.80c$ taps her foot 3.0 times per second. What is the frequency of taps determined by an observer on earth? (*Hint: be careful about the difference between time and frequency!*)

- ◯ 5.0 taps/sec
- ◯ 6.7 taps/sec
- ◯ 1.8 taps/sec
- ◯ 3.0 taps/sec

2. A spaceship moves away from earth at high speed. How do experimenters on earth measure a clock in the spaceship to be running? How do those in the spaceship measure a clock on earth to be running?

- ◯ slow; fast
- ◯ slow; slow
- ◯ fast; slow
- ◯ fast; fast

3. If you are moving in a spaceship at high speed relative to the earth, would you notice a difference in your pulse rate? In the pulse rate of the people back on earth?

- ◯ no; yes
- ◯ no; no
- ◯ yes; no
- ◯ yes; yes

4. The period of a pendulum is measured to be 3.00 in its own reference frame. What is the period as measured by an observer moving at a speed of $0.950c$ with respect to the pendulum?

- ◯ 6.00 sec
- ◯ 13.4 sec
- ◯ 0.938 sec
- ◯ 9.61 sec

5. The Stanford Linear Accelerator (SLAC) can accelerate electrons to velocities very close to the speed of light (up to about $0.99999999995c$ or so). If an electron travels the 3 km length of the accelerator at $v = 0.999c$, how long is the accelerator from the *electron's* reference frame?

- ◯ 134 m
- ◯ 67.1 km
- ◯ 94.9 m
- ◯ 300 m