Answer on question #52484, Physics, Relativity

Question An astronaut at rest on Earth has a heart rate of 70 beats/min. When the astronaut is traveling in a spaceship at 0.90c, what will this rate be as measured by an observer also in the ship and an observer at rest on Earth?

Solution Rate measured by an observer also in the ship will be the same as astronaut at rest on Earth, as observer will not be moving relative the astronaut.

To find rate measured by an observer at rest on Earth, recall that time dilation in relativity is

$$\delta t = \frac{\delta t'}{\sqrt{1 - \frac{v^2}{c^2}}}$$

For moving observer the period of the clock is longer than in the frame of the clock itself. Hence, rate measured by an observer at rest on Earth is

$$\frac{1}{\frac{1/70}{\sqrt{1-0.9^2}}} \approx 3.6 \,\mathrm{hits/min}$$

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