

## Dilation of time for children and lay people - Why a clock delays when in flight

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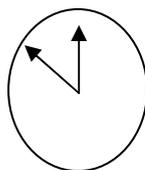
**Abstract: Why a watch in flight is slower? Every year, millions of physicists are trained in higher education courses around the world. However, they fail to explain or understand the dilation of time. Some use hundreds of pages with complicated formulas to explain something so simple. Others just say, "The reason is relativity," and they do not explain anything else. This article is simple for children and lay people.**

Do you have the strength to push something at 281kg? Not even an adult man does. Suppose you have two watches, one small weighs 1kg and another, large, 281kg. They have no battery and you will rotate it with your hands and nothing else. Which of the two watches is the easiest for you to turn? Of course, if the little one requires small strength, the big one requires 281 times more strength, since he is heavier. The physics school would say that the little one has mass  $m_{1kg}$  and the big one has mass  $m_{281kg}$ . The effort you make to rotate the two watches is called INERTIA. So the inertia to rotate the large is 281 times larger than the inertia to rotate the small. As the ancient scientist Newton said in his first law "**Inertia is the resistance that a body (a thing) presents to be moved.**"

Suppose there are two equal  $m_{1kg}$  watches and they are each moved by its proper battery and enough to move it. The two always record the same time.

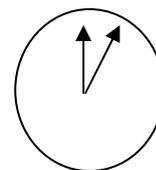
One of the watches is carried by your friend in a spaceship at a speed of 99.99937%  $c$  (almost light speed) and you get the other one here on Earth. When your clock completes 281.7 hours (over 11 days) here on Earth your friend says that on the trip, his clock only marked 1 hour, that is, 281.7 hours less.

Why was there a time difference between the clock at rest on Earth and the clock in flight? It is because the clock in flight is at very high speed and high speed generates great kinetic energy. The scientist Einstein taught that ENERGY HAS INERTIA (the thing becomes difficult to push or move). So the machine of the clock in flight, braked by inertia, turns slower. Children and adults understand: the reason for the dilation of time, or difference between clocks, is due to "the difficulty of Newton's INERTIA movement," JUST THIS. The formula with the Lorentz factor  $\gamma$  (gamma) proves that. Higher speed generates higher kinetic energy and greater inertia too. That's why the clock works slower.



EQUAÇÃO FATOR DE LORENTZ

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}}$$



**281,7 hours on Earth ..... equals ..... 1 hour on spaceship**