

19. (a) The Lorentz factor is

$$\gamma = \frac{1}{\sqrt{1 - \beta^2}} = \frac{1}{\sqrt{1 - (0.600)^2}} = 1.25 .$$

- (b) In the unprimed frame, the time for the clock to travel from the origin to  $x = 180 \text{ m}$  is

$$t = \frac{x}{v} = \frac{180 \text{ m}}{(0.600)(3.00 \times 10^8 \text{ m/s})} = 1.00 \times 10^{-6} \text{ s} .$$

The proper time interval between the two events (at the origin and at  $x = 180 \text{ m}$ ) is measured by the clock itself. The reading on the clock at the beginning of the interval is zero, so the reading at the end is

$$t' = \frac{t}{\gamma} = \frac{1.00 \times 10^{-6} \text{ s}}{1.25} = 8.00 \times 10^{-7} \text{ s} .$$