

Question 19 (4 marks)

In one of Einstein's famous thought experiments, a passenger travels on a train that passes through a station at 60% of the speed of light. According to the passenger, the length of the train carriage is 22 m from front to rear.

- (a) A light in the train carriage is switched on. Compare the velocity of the light beam as seen by the passenger on the train and a rail worker standing on the station platform. 1

The passenger would see the beam at 100% speed of light, where it would appear 160% speed of light to railworker

- (b) Calculate the length of the carriage as observed by the rail worker on the station platform. 3

$$l_v = l_0 \sqrt{1 - \frac{v^2}{c^2}}$$

$$l_v = 22 \sqrt{1 - \frac{0.6 \times (3 \times 10^8)^2}{3 \times 10^8^2}}$$

$$= 22 \sqrt{0.4}$$

$$= 13.91 \text{ m} \quad (2 \text{ dec pl.})$$