

## 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 velocity of the light seen by the passenger will be smaller than that of the rail worker.

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

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

$$l_v = 22 \sqrt{1 - \frac{1.8 \times 10^8}{3 \times 10^8}} = 13.91 \text{ metres}$$

The rail worker would see the length of the carriage as 13.91 metres.