14 Muons are produced by cosmic rays in the Earth's upper atmosphere.

In 1940, Bruno Rossi and David Hall made observations of the decay of these muons.

They measured the number of muons reaching the bottom of a mountain and the number reaching a position 1600 m higher up the mountain.

The muons were travelling at a speed of $0.994c$.

Rossi and Hall found that 74% of the muons detected at 1600 m reached the bottom of the mountain. The average lifetime of muons at rest is only 2.2×10^{-6} s, so they suggested that their observations could be explained using ideas from relativity.

(a) Explain whether these observations are consistent with ideas from relativity.

Your answer should include a calculation.

(5)

(b) After muons were discovered in 1936 they were known for many years as mu mesons.

Explain why muons are not described as mesons in the standard model.

(2)

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(Total for Question 14 = 7 marks)