

**Question 12** (4 marks)

A muon is a short-lived subatomic particle that can travel at 0.99 times the speed of light ( $\gamma = 7.1$ ) relative to an observer on Earth. The rest mass energy of a muon is 105.7 MeV.

- a. Determine the kinetic energy of the muon when it travels at 0.99 times the speed of light. Show your working. 2 marks

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MeV
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- b. Scientists observe muons travelling at 0.99 times the speed of light inside a chamber of length 1000 m. The scientists are at rest relative to the chamber. How long is the chamber in the frame of reference of the muons? Show your working. 2 marks

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m
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