

Question 12**(6 marks)**

Muons are created in the upper atmosphere with speeds of $0.990c$ or more. Their average lifetime is $2.20\ \mu\text{s}$ measured at low speeds in the laboratory. A simple calculation shows that most should only travel about 660 m before decaying. Thus, very few muons should ever reach sea level.

- (a) Using relativistic mechanics, calculate how far a muon can travel according to an observer on Earth. (4 marks)

Answer _____ m

- (b) Explain why many more muons reach the surface of Earth than predicted classically. (2 marks)
