2001 HIGHER SCHOOL CERTIFICATE EXAMINATION

Physics

Centre Number

Section I (continued)

Student Number

Part B – 60 marks
Attempt Questions 16–26
Allow about 1 hour and 45 minutes for this part

Answer the questions in the spaces provided.

Show all relevant working in questions involving calculations.

Marks

Question 16 (4 marks)

Muons are very short-lived particles that are created when energetic protons collide with each other. A beam of muons can be produced by very-high-energy particle accelerators.

The high-speed muons produced for an experiment by the Fermilab accelerator are measured to have a lifetime of 5.0 microseconds. When these muons are brought to rest, their lifetime is measured to be 2.2 microseconds.

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(a) Name the effect demonstrated by these observations of the lifetimes of the muons.

Time dilation.

1

(b) Calculate the velocity of the muons as they leave the accelerator.

Considering the short life span of the muons it could be said that the velocity of the muons would be approaching c, speed of light 3.00 x 10⁸ ms⁻¹

3

434

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Marks

Question 17 (6 marks)

A rocket was launched vertically to probe the upper atmosphere. The vertical velocity of the rocket as a function of time is shown in the graph.
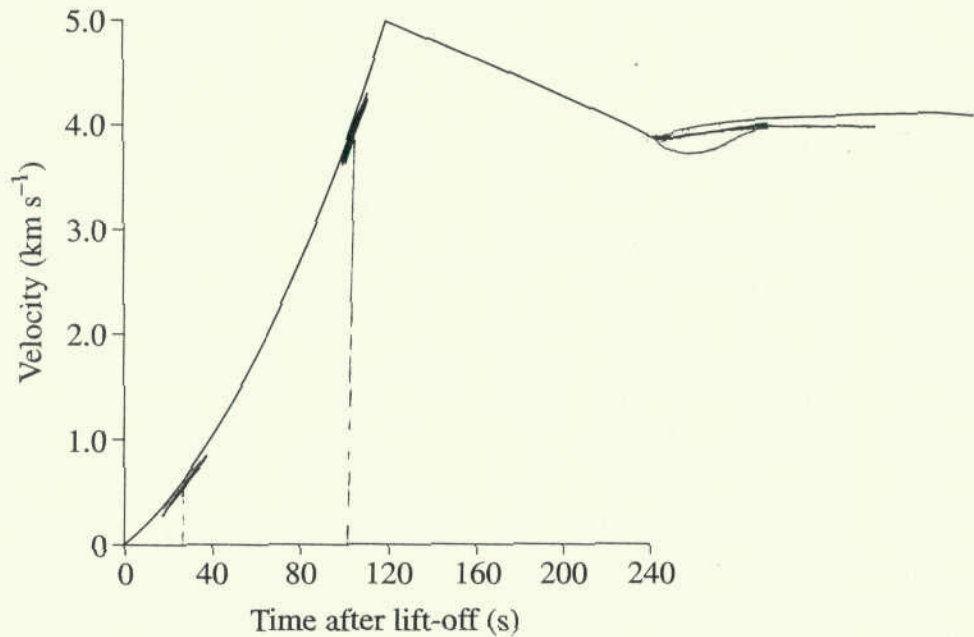
(a) Using either words or calculations, compare the acceleration of the rocket at $t = 20$ s with its acceleration at $t = 100$ s.

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at t = 100s the acceleration of the rocket is much greater then at t=20. This can be deduced from the tangents of these points on the graph.

(b) Account for the shape of the graph over the range of time shown.

4

when the rocket reaches the upper atmosphere it will be in an orbit of the earth and thus having constant acceleration according to the graph due to the ...

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