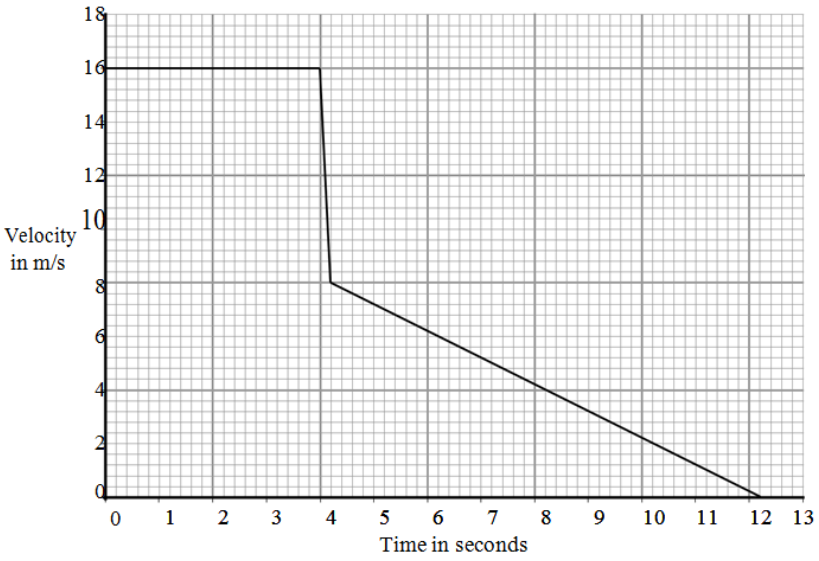
VELOCITY DISPLACEMENT AND ACCLERATION 1

Q:1 In an experiment at an accident research laboratory, a car driven by remote control was crashed into the back of an identical stationary car. On impact the two cars joined together and moved in a straight line.

(a)The graph shows how the velocity of the remote-controlled car changed during the experiment.



(i) How is the velocity of a car different from the speed of a car?

_____

(1 mark)

(ii)Use the graph to calculate the distance travelled by the remote-controlled car before the collision.

Show clearly how you work out your answer.

_____

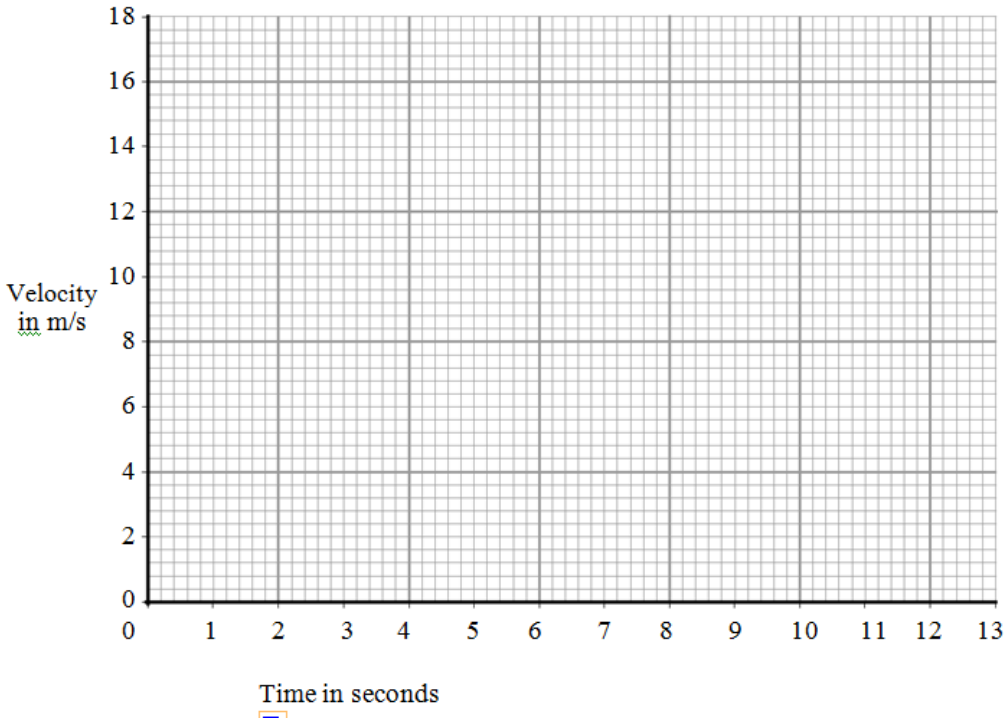
_____

_____

Distance =_____ m

(2 marks)

(iii)Draw, on the grid below, a graph to show how the velocity of the second car changed during the experiment.



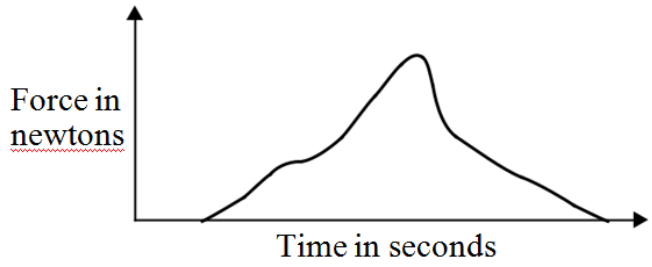
(iv)The total momentum of the two cars was not conserved. What does this statement mean?

_____

_____

(1 mark)

(b) The graph line shows how the force from a seat belt on a car driver changes during a collision.



Scientists at the accident research laboratory want to develop a seat belt that produces a constant force throughout a collision.

Use the idea of momentum to explain why this type of seat belt would be better for a car driver.

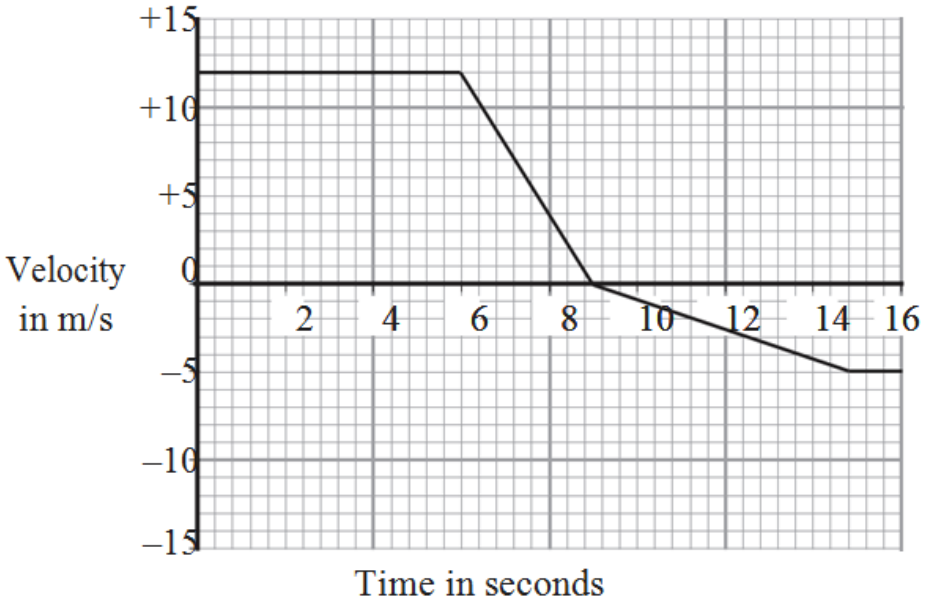
_____

_____

_____

(2 marks)

Q:2A car is driven along a straight road. The graph shows how the velocity of the car changes during part of the journey.



(a) Use the graph to calculate the deceleration of the car between 6 and 9 seconds. Show clearly how you work out your answer and give the unit.

_____

_____

_____

Deceleration = _____

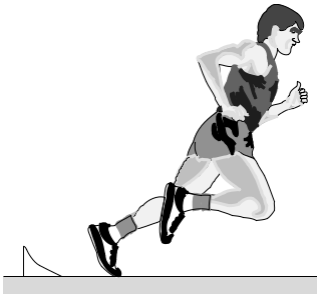
(3 marks)

(b) At what time did the car change direction?

_____ seconds

(1 mark)

Q:3 (a) The diagram shows an athlete at the start of a race. The race is along a straight track.



In the first 2 seconds, the athlete accelerates constantly and reaches a speed of 9 m/s.

(a)(i) Use the equation in the box to calculate the acceleration of the athlete.

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken for change}}$$

Show clearly how you work out your answer.

_____

_____

_____

Acceleration = ...

(2 marks)

(a)(ii) Which one of the following is the unit for acceleration?

Draw a ring around your answer.

J/s m/s m/s2 Nm

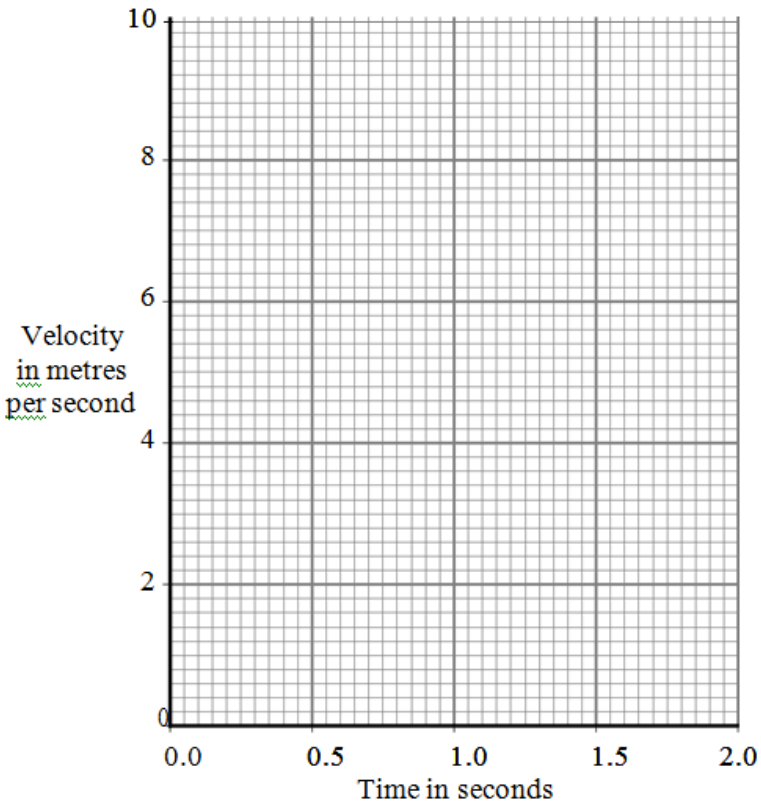
(1 mark)

(a)(iii) Complete the following sentence.

The velocity of the athlete is the _____ of the athlete in a given direction.

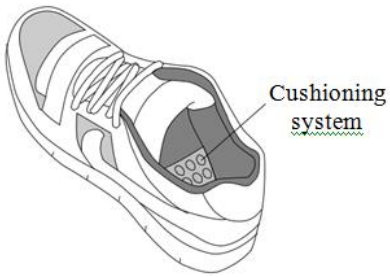
(1 mark)

(a)(iv) Complete the graph to show how the velocity of the athlete changes during the first 2 seconds of the race.

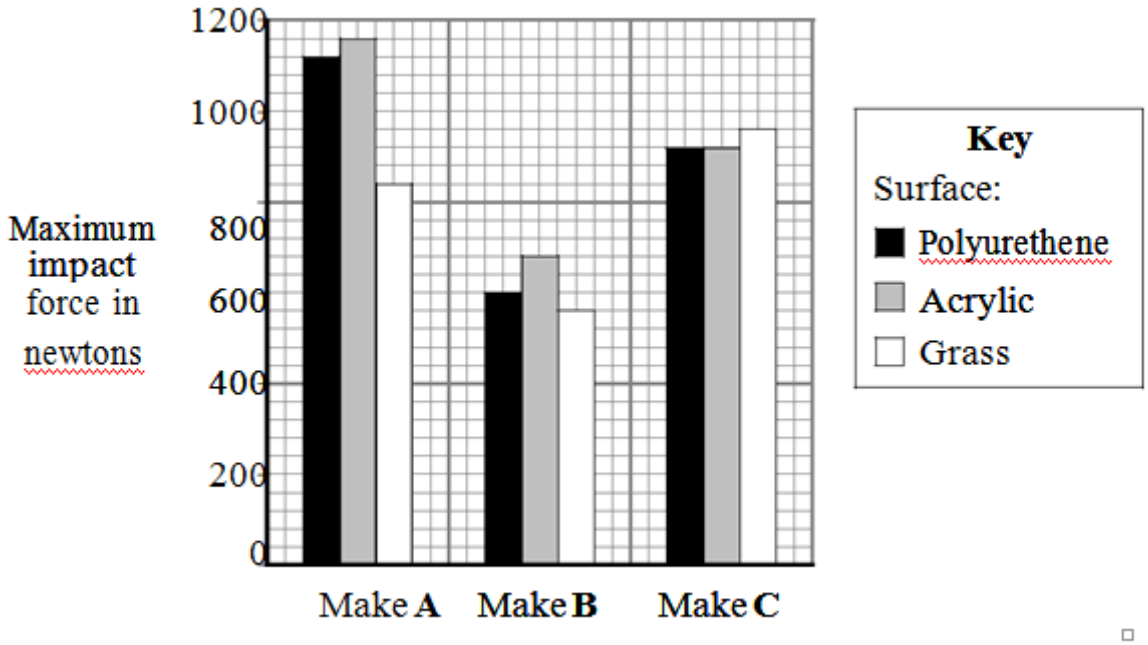


(2 marks)

(b) Many running shoes have a cushioning system. This reduces the impact force on the athlete as the heel of the running shoe hits the ground.



The bar chart shows the maximum impact force for three different makes of running shoe used on three different types of surface.



(b)(i) Which one of the three makes of running shoe, A, B or C, has the best cushioning system?

_____

Explain the reason for your answer.

_____

_____

_____

(3 marks)

(b)(ii) The data needed to draw the bar chart was obtained using a robotic athlete fitted with electronic sensors.

Why is this data likely to be more reliable than data obtained using human athletes?

_____

_____

(1 mark)

TOTAL MARKS=40