**5** (a) A car driver sees a rabbit on the road.

The driver makes an emergency stop after he sees the rabbit.

Figure 6 shows the speed of the car from the time the driver sees the rabbit until the car stops.

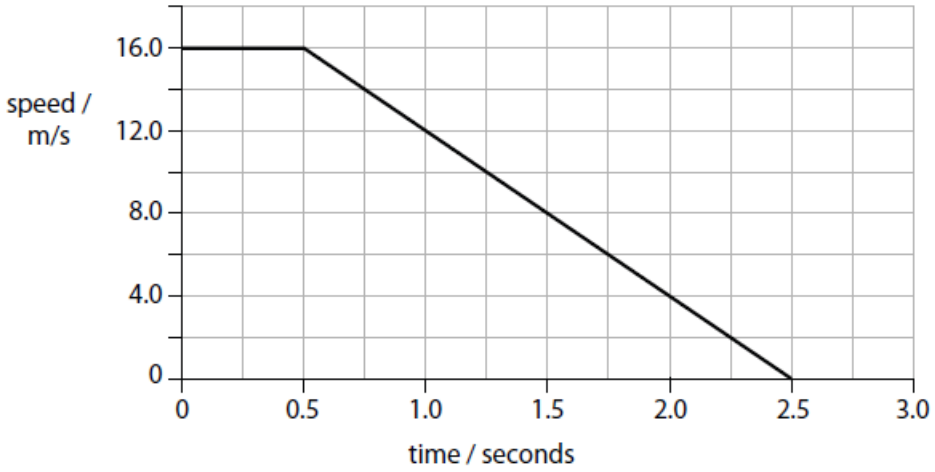


**Figure 6**

(i) The distance travelled by the car from the time the driver first sees the rabbit to when car starts to slow down is the

**(1)**

☐ **A** average distance

☐ **B** braking distance

☐ **C** stopping distance

☐ **D** thinking distance

(ii) Calculate the distance that the car travels in the first 0.5 seconds.

**(3)**

distance = ..... m

(iii) Which equation relates acceleration to change in velocity and time?

(1)

☐ **A** $a = \frac{(v - u)}{t}$

☐ **B** $a = \frac{t}{(v - u)}$

☐ **C** $a = t(v - u)$

☐ **D** $a = v - \frac{u}{t}$

(iv) Calculate the deceleration of the car.

(3)

deceleration = ..... m/s$^2$

(b) Two students, Alice and Bob, carry out an experiment to measure the speed of cars.

Alice paces out the distance between two lamp posts.

She records:

*'Distance between lamp posts = 20 paces'*

Bob starts to count when a car passes the first lamp post. He stops counting when he thinks it has passed the second lamp post.

He records:

*'My estimate for the time taken for the car to pass between the two lamp posts = 3'*

Give **three** ways the students could improve their experimental procedure.

**(3)**

1 .....

.....

2 .....

.....

3 .....

.....

**(Total for Question 5 = 11 marks)**

| Question number | Answer | Mark |
|---|---|---|
| 5(a)(i) | D | (1) |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| 5(a)(ii) | 16.0 (m/s) read from graph (1)<br><br>Substitution (1)<br>(distance travelled =) 16 × 0.5<br><br>Answer (1)<br>8.0 (m) (1) | award full marks for correct numerical answer without working<br><br>ecf for substitution and answer using wrong speed value | (3) |

| Question number | Answer | Mark |
|---|---|---|
| 5(a)(iii) | A | (1) |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| 5(a)(iv) | Obtain readings from graph (1)<br><br>Substitution (1)<br>$\frac{16}{2.0}$<br><br>Answer (1)<br>8.0 ($m/s^2$) | award full marks for correct numerical answer without working | (3) |

| Question number | Answer | Additional guidance | Mark |
|---|---|---|---|
| 5(b) | Any three improvements from:<br>• suitable instrument to measure distance (1)<br>• using a greater distance (to reduce effect of reaction times) (1)<br>• suitable instrument to measure time (1)<br>• use of one student at the {first/second} lamp post to signal when to {start/stop} timing (1) | allow tape measure, trundle wheel<br><br>allow stop watch/clock or timing app. on phone | (3) |
| | • two of three sets of students taking readings for the same car (1) | | |