AQA GCSE Physics | 8463

SPECIFICATION POINT 4.5.6.2.1

Newton's First Law

Past-paper questions

Tier	**Foundation**
Question groups	**8**
Available paper years	**2003–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

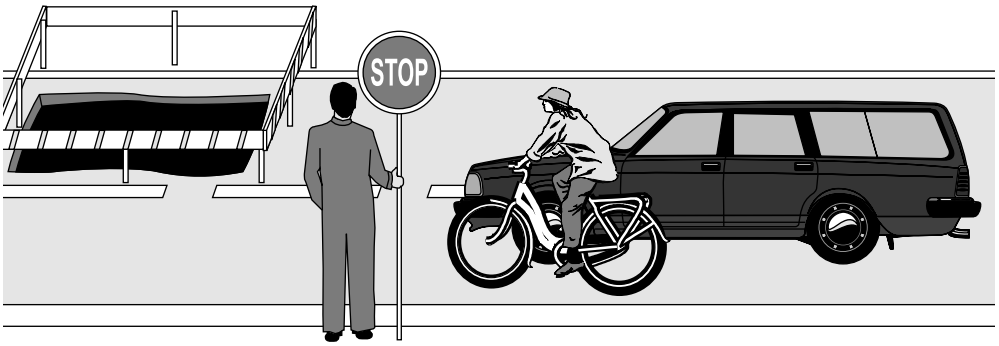
Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.5.6.2.1 Newton's First Law

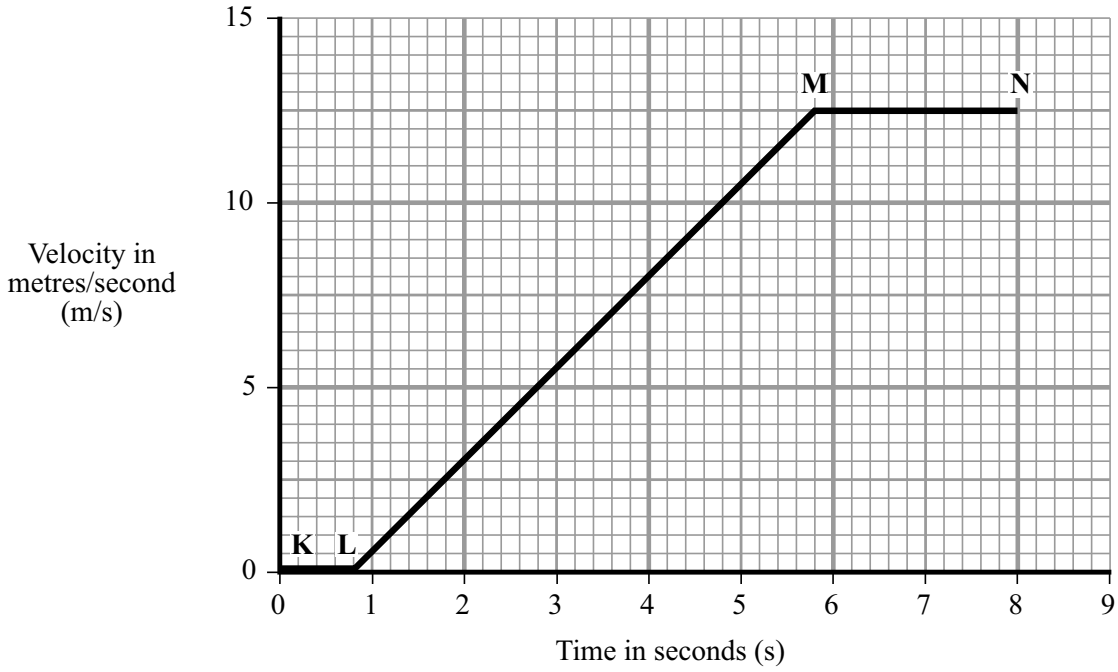
Question 01

June 2003 | 3451F | Original Q5 | Legacy

5 A car and a bicycle are travelling along a straight road. They have stopped at road works.



The graph shows how the velocity of the car changes after the sign is changed to GO.



(a) Between which two points on the graph is the car moving at constant velocity?

.....

(1 mark)

(b) Between which two points on the graph is the car accelerating?

.....

(1 mark)

4.5.6.2.1 Newton's First Law

Question 01 · continued

MARGIN BLANK

(c) Between the sign changing to GO and the car starting to move, there is a time delay. This is called the reaction time.

(i) What is the reaction time of the car driver?

Reaction time = ...seconds
(1 mark)

(ii) Which **one** of the following could increase the reaction time of a car driver? Tick the box next to your choice.

Drinking alcohol ☐

Wet roads ☐

Worn car brakes ☐

(1 mark)

(d) The cyclist starts to move at the same time as the car. For the first 2 seconds the cyclist's acceleration is constant and is greater than that of the car.

Draw a line on the graph to show how the velocity of the cyclist might change during the first 2 seconds of its motion.

(2 marks)

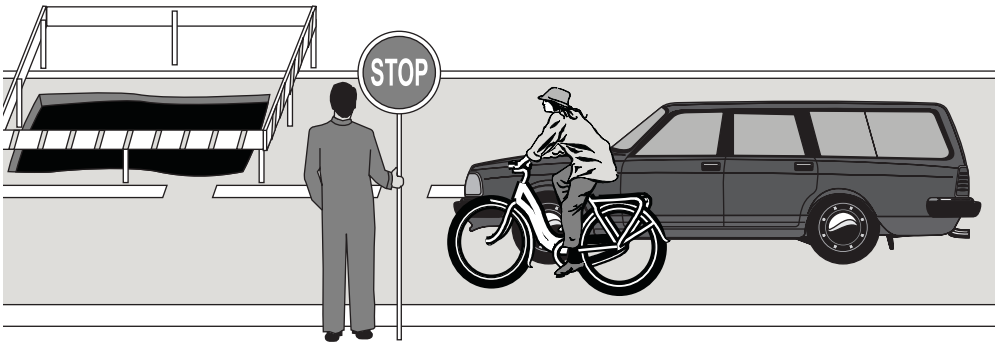
6

4.5.6.2.1 Newton's First Law

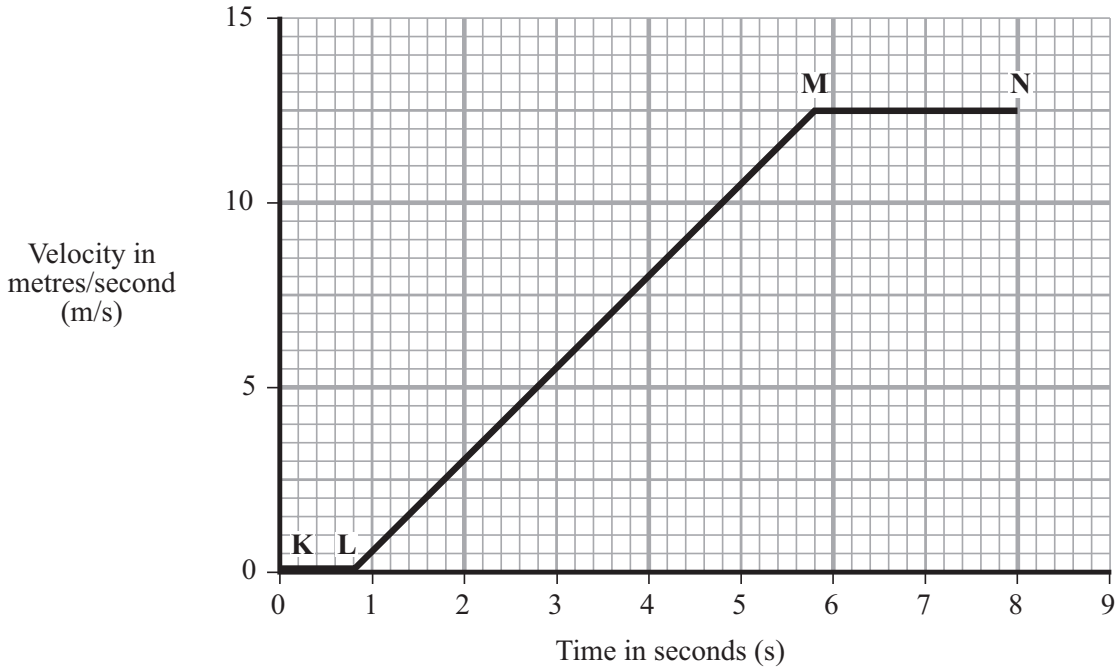
Question 02

June 2003 | 3462F3 | Original Q5 | Legacy

5 A car and a bicycle are travelling along a straight road. They have stopped at road works.



The graph shows how the velocity of the car changes after the sign is changed to GO.



(a) Between which two points on the graph is the car moving at constant velocity?

.....

(1 mark)

(b) Between which two points on the graph is the car accelerating?

.....

(1 mark)

4.5.6.2.1 Newton's First Law

Question 02 · continued

MARGIN BLANK

(c) Between the sign changing to GO and the car starting to move, there is a time delay. This is called the reaction time.

(i) What is the reaction time of the car driver?

Reaction time = ...seconds
(1 mark)

(ii) Which **one** of the following could increase the reaction time of a car driver? Tick the box next to your choice.

Drinking alcohol ☐

Wet roads ☐

Worn car brakes ☐

(1 mark)

(d) The cyclist starts to move at the same time as the car. For the first 2 seconds the cyclist's acceleration is constant and is greater than that of the car.

Draw a line on the graph to show how the velocity of the cyclist might change during the first 2 seconds of its motion.

(2 marks)

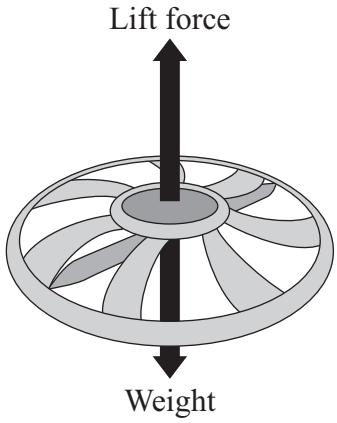
6

4.5.6.2.1 Newton's First Law

Question 03

June 2008 | PHY2F | Original Q4 | Legacy

4 The diagram shows the forces on a small, radio-controlled, flying toy.



4 (a) (i) The mass of the toy is 0.06 kg.
Gravitational field strength = 10 N/kg

Use the equation in the box to calculate the weight of the toy.

weight = mass × gravitational field strength

Show clearly how you work out your answer and give the unit.

.....

.....

Weight = ...

(3 marks)

4 (a) (ii) Complete the following sentence by drawing a ring around the correct line in the box.

When the toy is hovering stationary in mid-air, the lift force is

bigger than
the same as
smaller than

the weight of the toy.

(1 mark)

4.5.6.2.1 Newton's First Law

Question 03 · continued

for mark

4 (b) When the motor inside the toy is switched off, the toy starts to *accelerate* downwards.

4 (b) (i) What does the word *accelerate* mean?

.....

(1 mark)

4 (b) (ii) What is the direction of the resultant force on the falling toy?

.....

(1 mark)

4 (b) (iii) Does the momentum of the toy increase, decrease or stay the same?

.....

Give a reason for your answer.

.....

(2 marks)

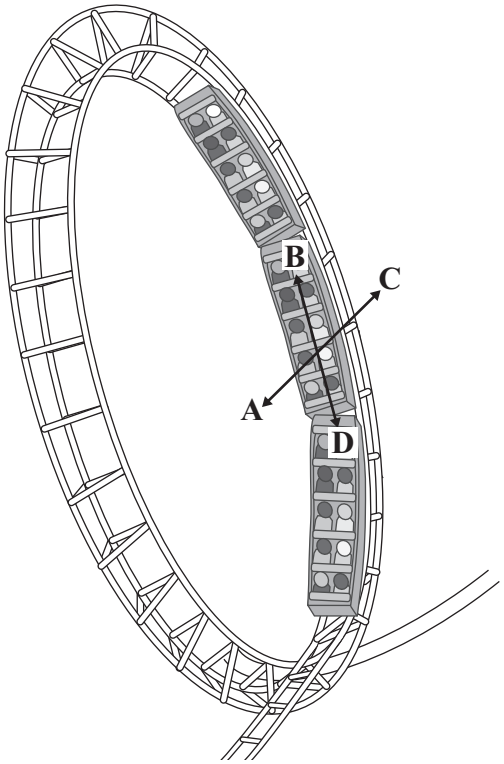
8

4.5.6.2.1 Newton's First Law

Question 04

June 2009 | PHY3F | Original Q2 | Legacy

2 The drawing shows a set of carriages on a roller coaster.
The carriages are moving upwards in a nearly circular path at a constant speed.



2 (a) Complete the following sentences by drawing a ring around the correct line in each box.

2 (a) (i) The carriages will accelerate because of a change in their

direction
mass
speed

.

(1 mark)

2 (a) (ii) The resultant force which causes the carriages to accelerate is the

circular
centripetal
gravity

force.

(1 mark)

4.5.6.2.1 Newton's First Law

Question 04 · continued

for mark

2 (b) In which direction, **A**, **B**, **C** or **D**, does the resultant force act?

Write your answer in the box. ☐

(1 mark)

2 (c) Complete the following sentence by drawing a ring around the correct line in the box.

The resultant force will need to be greater if the

mass of the passengers is greater
radius of the circle is greater
speed of the carriages is less

.

(1 mark)

4

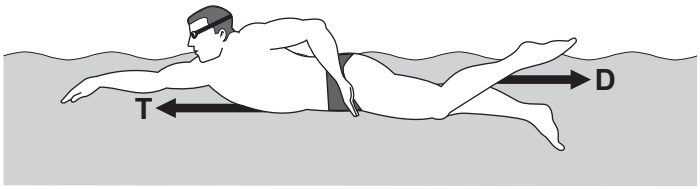
Turn over for the next question

4.5.6.2.1 Newton's First Law

Question 05

January 2011 | PHY2F | Original Q7 | Legacy

7 (a) The diagram shows the horizontal forces acting on a swimmer.



7 (a) (i) The swimmer is moving at constant speed.
Force **T** is 120 N.

What is the size of force **D**?

..... N
(1 mark)

7 (a) (ii) By increasing force **T** to 140 N, the swimmer accelerates to a higher speed.

Calculate the size of the initial resultant force acting on the swimmer.

.....

.....

Initial resultant force = ... N
(1 mark)

7 (a) (iii) Even though the swimmer keeps the force **T** constant at 140 N, the resultant force on the swimmer decreases to zero.

Explain why.

.....

.....

.....

.....

.....

.....
(3 marks)

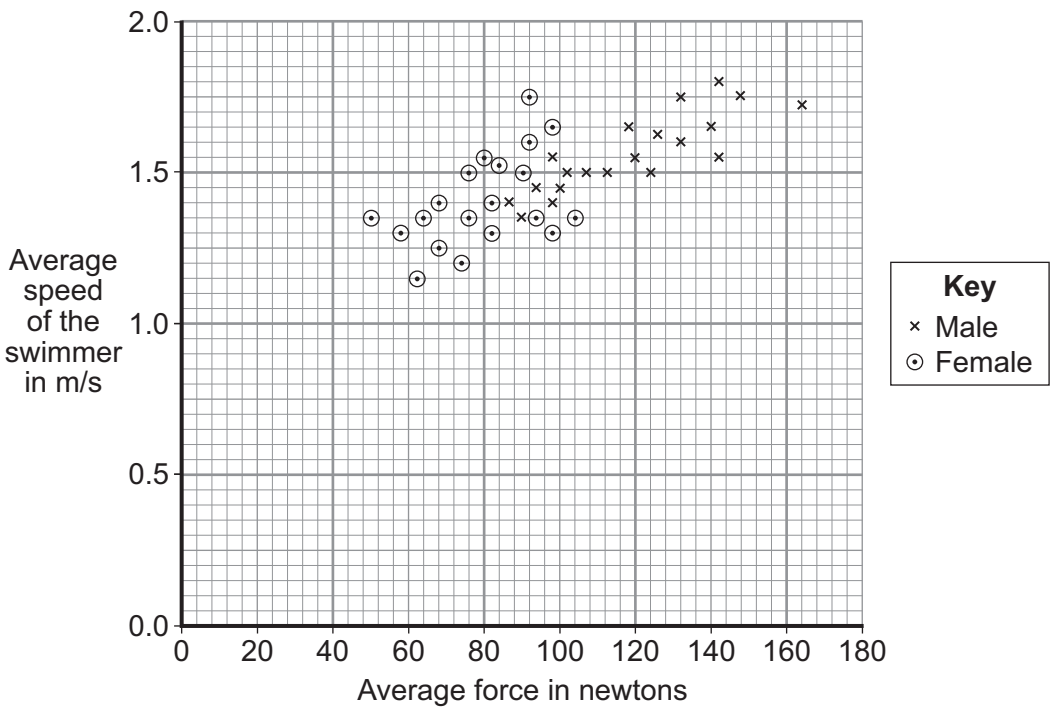
Question 7 continues on the next page

4.5.6.2.1 Newton's First Law

Question 05 · continued

7 (b) A sports scientist investigated how the force exerted by a swimmer's hands against the water affects the swimmer's speed.
The investigation involved 20 males and 20 females swimming a fixed distance.
Sensors placed on each swimmer's hands measured the force 85 times every second over the last 10 metres of the swim.
The measurements were used to calculate an average force.
The average speed of each swimmer over the last 10 metres of the swim was also measured.

The data from the investigation is displayed in the graph.



7 (b) (i) What was the dependent variable in this investigation?

.....

(1 mark)

7 (b) (ii) Explain **one** advantage of measuring the force 85 times every second rather than just once or twice every second.

.....

.....

.....

.....

(2 marks)

4.5.6.2.1 Newton's First Law

Question 05 · continued

7 (b) (iii) Give **one** way in which the data for the male swimmers is different from the data for the female swimmers.

.....

.....

(1 mark)

7 (b) (iv) Considering only the data from this investigation, what advice should a swimming coach give to swimmers who want to increase their average speed?

.....

.....

(1 mark)

10

Turn over for the next question

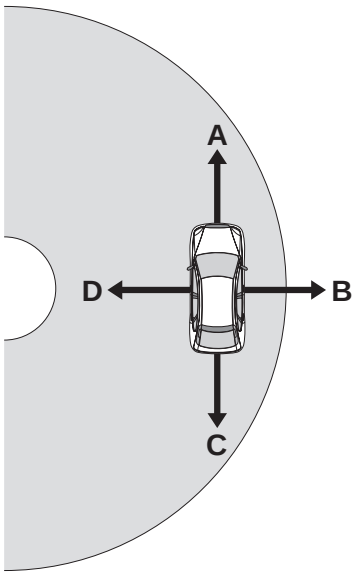
4.5.6.2.1 Newton's First Law

Question 06

June 2015 | PH3FP | Original Q8 | Legacy

8 (a) **Figure 15** shows a car travelling around a bend in the road. The car is travelling at a constant speed.

Figure 15



There is a resultant force acting on the car. This resultant force is called the centripetal force.

8 (a) (i) In which direction, **A**, **B**, **C** or **D**, does the centripetal force act on the car?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

8 (a) (ii) State the name of the force that provides the centripetal force.

[1 mark]

.....

4.5.6.2.1 Newton's First Law

Question 06 · continued

8 (a) (iii) State **two** factors that affect the size of the centripetal force acting on the car.

[2 marks]

1 .....

2 .....

8 (b) **Figure 16** shows a racing car.

Figure 16



The racing car should not roll over when racing.

State **two** features of the car that make it difficult for the car to roll over.

[2 marks]

1 .....

.....

2 .....

.....

6

4.5.6.2.1 Newton's First Law

Question 07

June 2019 | 8463/2F | Original Q6

0 6 The following statements describe parts of a short train journey between two railway stations.

Part A: The train accelerates at a constant rate from 0 m/s to 20 m/s in 40 s

Part B: The train travels at a constant velocity for 260 s

Part C: The train decelerates at a constant rate coming to a stop in 60 s

0 6 . 1 During which part of the journey is the resultant force on the train zero?

[1 mark]

Tick (✓) **one** box.

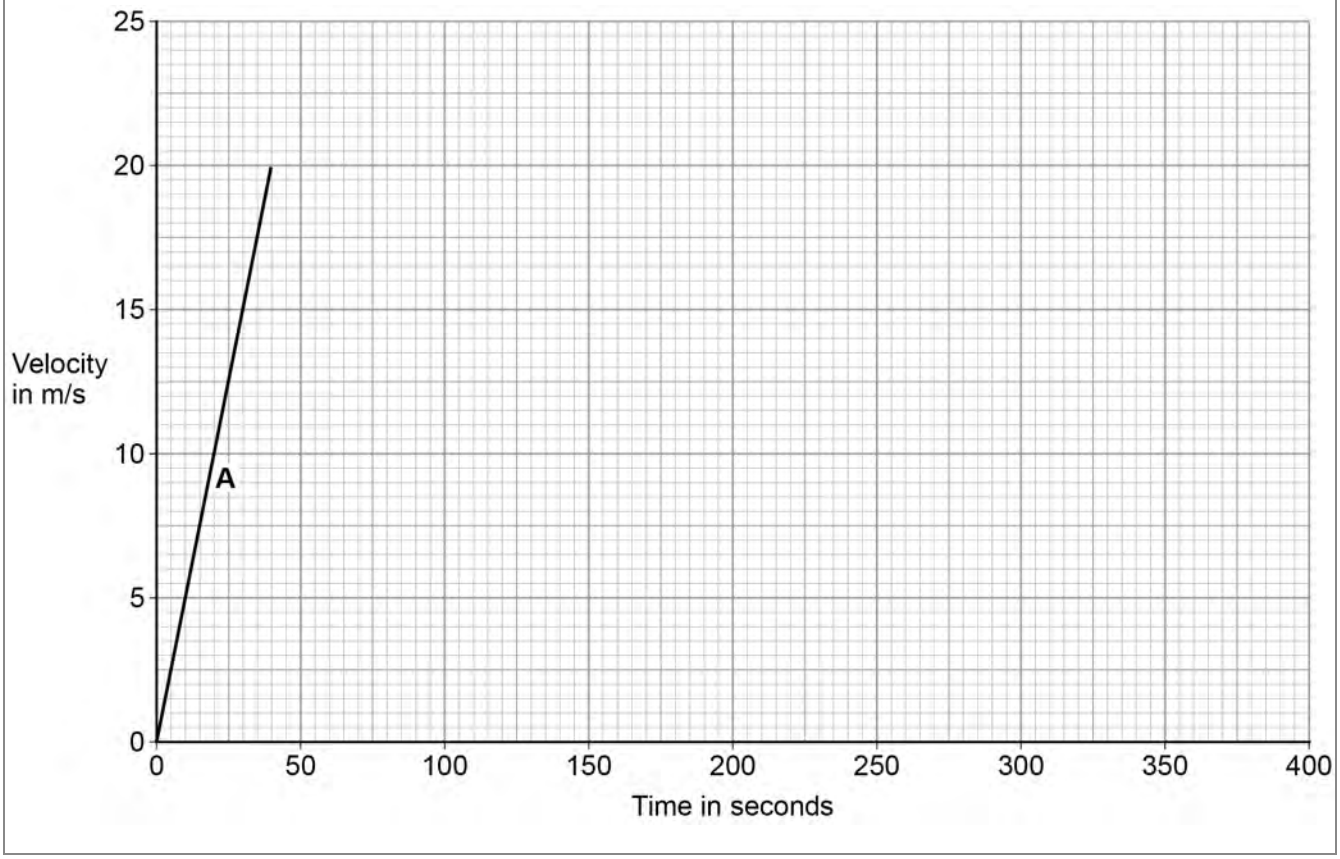
A ☐ **B** ☐ **C** ☐

0 6 . 2 **Figure 16** shows part of the velocity-time graph for the train journey.

Complete **Figure 16** showing part **B** and part **C** of the train journey.

[3 marks]

Figure 16



4.5.6.2.1 Newton's First Law

Question 07 · continued

0 6 . 3 Write down the equation which links acceleration, change in velocity and time taken.

[1 mark]

0 6 . 4 Another train accelerated at 1.15 m/s^2 for 22.0 s

Calculate the increase in velocity of the train.

[3 marks]

Increase in velocity = _____ m/s

8

4.5.6.2.1 Newton's First Law

Question 08

June 2025 | 8463/2F | Original Q4

0 4 Car **X** and car **Y** have engines that produce the same maximum forward force.

The cars are the same shape, but car **X** has a greater mass than car **Y**.

0 4 . 1 How does the maximum acceleration of car **X** and car **Y** compare?

[1 mark]

Tick (✓) **one** box.

Car **X** has a greater maximum acceleration. ☐

Car **X** and car **Y** have the same maximum acceleration. ☐

Car **X** has a smaller maximum acceleration. ☐

0 4 . 2 Car **Y** has a mass of 900 kg.

Car **Y** accelerates at 2.5 m/s^2.

Calculate the resultant force on car **Y**.

Use the equation:

resultant force = mass × acceleration

[2 marks]

Resultant force = _____ N

Question 4 continues on the next page

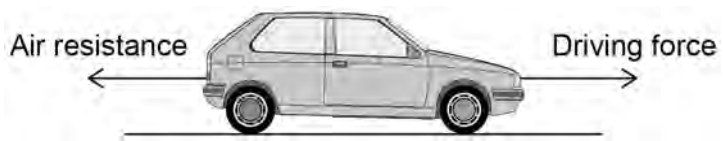
4.5.6.2.1 Newton's First Law

Question 08 · continued

0 4 . 3 A car moves at a constant speed on a level road.

Figure 4 shows the horizontal forces on the car.

Figure 4



The driver makes the car accelerate until the car reaches its maximum speed.

Explain how the horizontal forces on the car change as the car accelerates to its maximum speed.

[4 marks]

4.5.6.2.1 Newton's First Law

Question 08 · continued

To pass a driving test, drivers need to understand the difference between thinking distance and braking distance.

0 4 . 4 Complete the sentence.

Choose the answer from the box.

[1 mark]

force	length	time

The thinking distance is affected by the driver's reaction _____.

0 4 . 5 Complete the sentence.

Choose the answer from the box.

[1 mark]

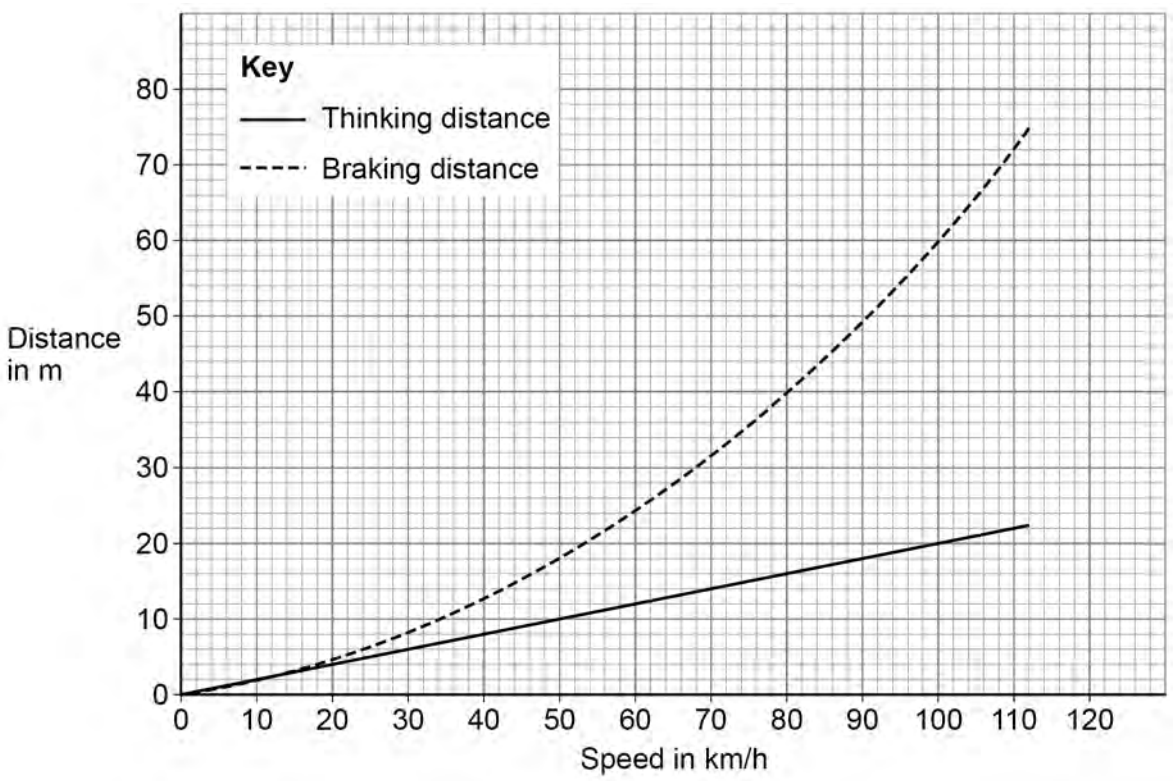
force	length	time

The braking distance is the distance travelled by the car under the braking _____.

Question 4 continues on the next page

0 4 . 6 **Figure 5** shows how speed affects the thinking distance and braking distance of a car.

Figure 5



The car is moving at a speed of 100 km/h.

Calculate the stopping distance of the car.

Use **Figure 5**.

[3 marks]

Stopping distance = _____ m

4.5.6.2.1 Newton's First Law

Question 08 · continued

0 4 . 7 Which **two** of the following would **increase** the stopping distance of a car?

[2 marks]

Tick (✓) **two** boxes.

- Fitting new brakes to the car ☐
- Fitting new tyres to the car ☐
- The driver becoming tired ☐
- Driving uphill ☐
- Driving on a wet road ☐

14

Turn over for the next question