AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.5.4.3.4

Factors affecting braking distance 2

Past-paper questions

Tier	**Foundation**
Question groups	**7**
Available paper years	**2018–2025**

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.

6.5.4.3.4 Factors affecting braking distance 2

Question 01

June 2018 | 8464/P/2F | Original Q6

0 6 **Figure 10** shows a lorry.

Figure 10



0 6 . 1 The brakes of the lorry are in a poor condition.

What effect will the condition of the brakes have on thinking distance and the braking distance of the lorry?

[2 marks]

Thinking distance _____

_____

Braking distance _____

_____

6.5.4.3.4 Factors affecting braking distance 2

Question 01 · continued

0 6 . 2 Using a hand-held mobile phone while driving is illegal in the United Kingdom.

Table 1 shows the effect of using a mobile phone on thinking distance.

Table 1

	Thinking distance
Not using a mobile phone	19 m
Using a mobile phone with hands-free kit	23 m
Using a hand-held mobile phone	27 m

Explain why driving while using a hand-held mobile phone is more dangerous than using a mobile phone with a hands-free kit.

Use data from **Table 1**

[4 marks]

6

6.5.4.3.4 Factors affecting braking distance 2

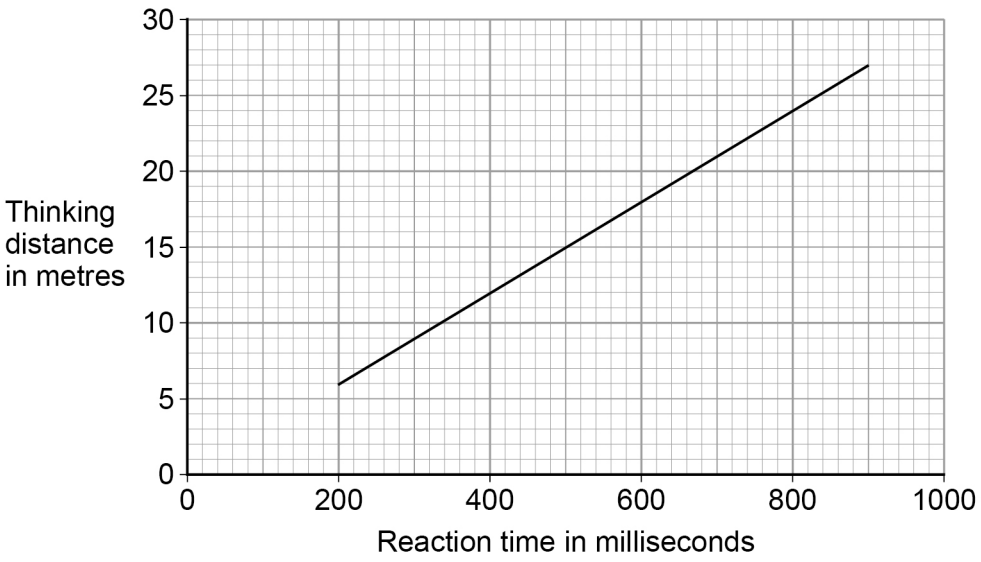
Question 02

June 2019 | 8464/P/2F | Original Q4

0 4 The thinking distance of a car depends on the reaction time of the driver.

Figure 6 shows how thinking distance varies with reaction time for a car travelling at 30 m/s

Figure 6



0 4 . 1 The reaction time of a driver can double if the driver is distracted.

Explain the effect doubling the reaction time has on the thinking distance.

Use data from **Figure 6**.

[2 marks]

0 4 . 2 Give the reason why there are no values of thinking distance for reaction times less than 200 milliseconds.

[1 mark]

6.5.4.3.4 Factors affecting braking distance 2

Question 02 · continued

A driver measured her reaction time using an online test. She did the test five times.

Table 2 shows the results.

Table 2

Reaction time in milliseconds				
258	265	302	248	327

0 4 . 3 How does the data in **Table 2** show that it was important that the driver did the test five times?

[1 mark]

0 4 . 4 Calculate the mean reaction time of the driver.

[2 marks]

Mean reaction time = _____ ms

0 4 . 5 The driver is driving her car at 30 m/s

Determine the thinking distance.

Use **Figure 6** and your answer from Question **04.4**

[1 mark]

Thinking distance = _____ m

6.5.4.3.4 Factors affecting braking distance 2

Question 02 · continued June 2019 | 8464/P/2F | Original Q4

0 4 . 6 The driver applies the brakes and the car comes to a stop.

The force exerted by the brakes affects the braking distance.

Give **two** other factors that affect the braking distance.

[2 marks]

1 _____

2 _____

0 4 . 7 Write down the equation that links distance, force and work done.

[1 mark]

_____

0 4 . 8 When the driver applies the brakes, there is a constant resultant force of 6.0 kN on the car.

The car travels a distance of 75 m before stopping.

Calculate the work done in stopping the car.

[3 marks]

_____

_____

_____

_____

_____

_____

Work done = _____ J

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6.5.4.3.4 Factors affecting braking distance 2

Question 03

November 2021 | 8464/P/2F | Original Q3

0 3 The stopping distance of a car is the sum of the thinking distance and the braking distance.

0 3 . 1 The thinking distance is affected by the reaction time of the driver.

Which **two** of the following can affect the reaction time of the driver?

[2 marks]

Tick (✓) **two** boxes.

- Damaged brakes ☐
- Taking drugs ☐
- Tiredness ☐
- Wet roads ☐
- Worn tyres ☐

6.5.4.3.4 Factors affecting braking distance 2

Question 03 · continued

Scientists measured the reaction time for drivers of different ages.

Figure 6 shows the results.

Figure 6



0 3 . 2 At what age did the drivers have the lowest mean reaction time?

[1 mark]

Age = _____ years

0 3 . 3 What was the lowest mean reaction time?

[1 mark]

Time = _____ seconds

Question 3 continues on the next page

6.5.4.3.4 Factors affecting braking distance 2

Question 03 · continued

The braking distance of a car is the distance travelled between the driver applying the brakes and the car stopping.

0 3 . 4 Complete the sentences.

Choose answers from the box.

Each answer may be used once, more than once or not at all.

[2 marks]

decreases	**stays the same**	**increases**

When the brakes are applied, the kinetic energy of the

car _____ .

The temperature of the brakes _____ .

6.5.4.3.4 Factors affecting braking distance 2

Question 03 · continued

0 3 . 5 A car is travelling at a speed of 12 m/s.

The driver applies the brakes and the car decelerates at a constant 3.0 m/s^2.

Calculate the braking distance of the car.

Use the equation:

$$\text{braking distance} = \frac{(\text{speed})^2}{2 \times \text{deceleration}}$$

Choose the unit from the box.

[3 marks]

m	kg	s

Braking distance = _____ Unit _____

0 3 . 6 To pass the UK driving test, people must know the typical stopping distance of a car at certain speeds.

Suggest **one** reason why.

[1 mark]

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6.5.4.3.4 Factors affecting braking distance 2

Question 04

June 2022 | 8464/P/1F | Original Q2

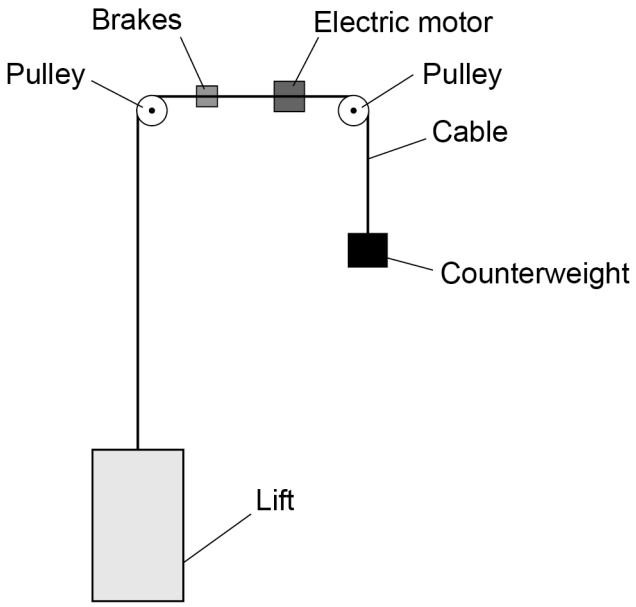
0 2 **Figure 3** shows a lift near the bottom of a building.

The lift is attached by a cable to a counterweight.

An electric motor moves the lift.

The lift is moving up.

Figure 3



0 2 . 1 As the lift moves up, how far does the counterweight move down?

[1 mark]

Tick (✓) **one** box.

A shorter distance than the lift. ☐

The same distance as the lift. ☐

A longer distance than the lift. ☐

6.5.4.3.4 Factors affecting braking distance 2

Question 04 · continued

0 2 . 2 What happens to the gravitational potential energy of the counterweight as it moves down?

[1 mark]

Tick (✓) **one** box.

It decreases ☐

It stays the same ☐

It increases ☐

0 2 . 3 Calculate the change in gravitational potential energy of the lift when it moves up 4.0 m

The mass of the lift is 1300 kg

gravitational field strength = 9.8 N/kg

Use the equation:

gravitational potential energy = mass × gravitational field strength × height

[2 marks]

Change in gravitational potential energy = _____ J

Question 2 continues on the next page

6.5.4.3.4 Factors affecting braking distance 2

Question 04 · continued

0 2 . 4 Complete the sentences.

Choose answers from the box.

[2 marks]

chemical	**elastic potential**	**gravitational potential**
internal		**kinetic**

Friction between the brakes and the cable causes the speed of the lift to decrease.

As the speed decreases, there is a decrease in the _____ energy of the lift.

As the speed decreases, there is an increase in the _____ energy of the brakes.

0 2 . 5 The motor transfers different amounts of energy each time people use the lift.

Which factors affect the amount of energy transferred by the motor as the lift moves?

[2 marks]

Tick (✓) **two** boxes.

- The distance moved by the lift ☐
- The height of the building ☐
- The length of the steel cable ☐
- The maximum power of the motor ☐
- The weight of the people in the lift ☐

6.5.4.3.4 Factors affecting braking distance 2

Question 04 · continued June 2022 | 8464/P/1F | Original Q2

0 2 . 6 The weight of the lift and the counterweight stretch the cable by 0.015 m

The cable acts like a spring with a spring constant of 880 000 N/m

Calculate the elastic potential energy of the stretched cable.

Use the equation:

$$\text{elastic potential energy} = 0.5 \times \text{spring constant} \times (\text{extension})^2$$

[2 marks]

Elastic potential energy = _____ J

0 2 . 7 A lift system using a counterweight is more efficient than a lift system that does not use a counterweight.

How does having a more efficient system affect the energy transferred by the motor?

[1 mark]

Tick (✓) **one** box.

- Less energy is transferred. ☐
- The same amount of energy is transferred. ☐
- More energy is transferred. ☐

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6.5.4.3.4 Factors affecting braking distance 2

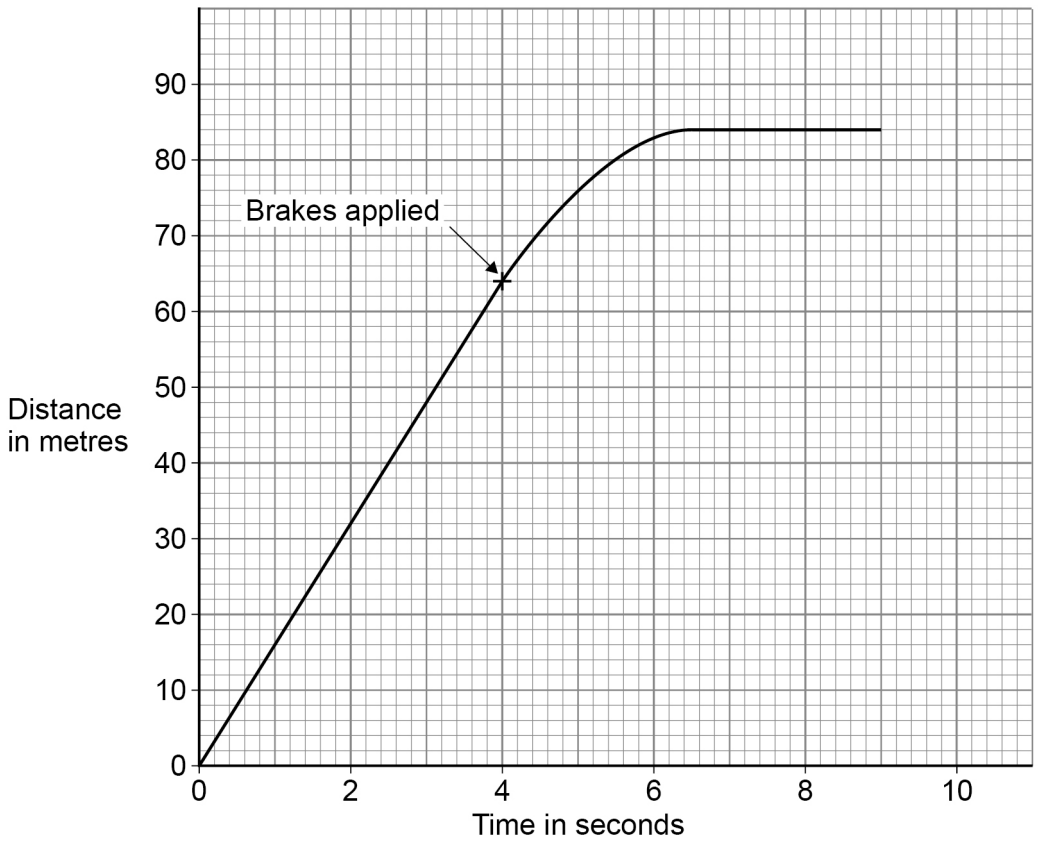
Question 05

June 2023 | 8464/P/2F | Original Q2

0 2 A car contains a device called a black box. The black box records the distance travelled and the time taken for each journey.

Figure 3 shows the distance–time graph for part of a journey.

Figure 3



0 2 . 1 Which feature of **Figure 3** shows that the car travels at a constant speed for the first 4 seconds?

[1 mark]

Tick (✓) **one** box.

The line becomes horizontal. ☐

The line goes through the origin. ☐

The line is straight. ☐

6.5.4.3.4 Factors affecting braking distance 2

Question 05 · continued

0 2 . 2 After 4 seconds the driver applied the brakes and the car slowed down and stopped.

The distance the car travelled after the brakes were applied is called the braking distance.

Determine the braking distance of the car.

Use **Figure 3**.

[2 marks]

Braking distance = _____ m

The black box also records the deceleration of the car.

0 2 . 3 As the car decelerates, the velocity of the car changes by 16 m/s.

The car decelerates for 2.5 seconds.

Calculate the deceleration of the car.

Use the equation:

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

[2 marks]

Deceleration = _____ m/s^2

6.5.4.3.4 Factors affecting braking distance 2

Question 05 · continued

0 2 . 4 If the black box records large decelerations, it identifies that the driving may be dangerous.

Why can large decelerations be dangerous?

[2 marks]

Tick (✓) **two** boxes.

- The brakes on the car can overheat. ☐
- The driver may lose control of the car. ☐
- The force applied by the brakes is very small. ☐
- The reaction time of the driver increases. ☐
- The thinking distance is very short. ☐

0 2 . 5 The black box monitors the speed of the car.

Describe how speed affects braking distance.

[1 mark]

8

6.5.4.3.4 Factors affecting braking distance 2

Question 06

June 2024 | 8464/P/2F | Original Q5

0 5 The stopping distance of a car depends on the thinking distance and the braking distance.

0 5 . 1 Which of the following affects the thinking distance?

[1 mark]

Tick (✓) **one** box.

- Condition of the brakes ☐
- Icy road conditions ☐
- Reaction time of the driver ☐

A car manufacturer tested three different types of tyre which were fitted to three identical cars.

This is the method used.

1. Drive the car along a road.
2. Apply the brakes until the car stops.
3. Measure the distance travelled while braking.
4. Repeat steps 1 to 3 for each car when the road is dry and when the road is wet.

0 5 . 2 The brakes were applied with the same force for each test.

Give **one other** variable that should have been kept the same for each test.

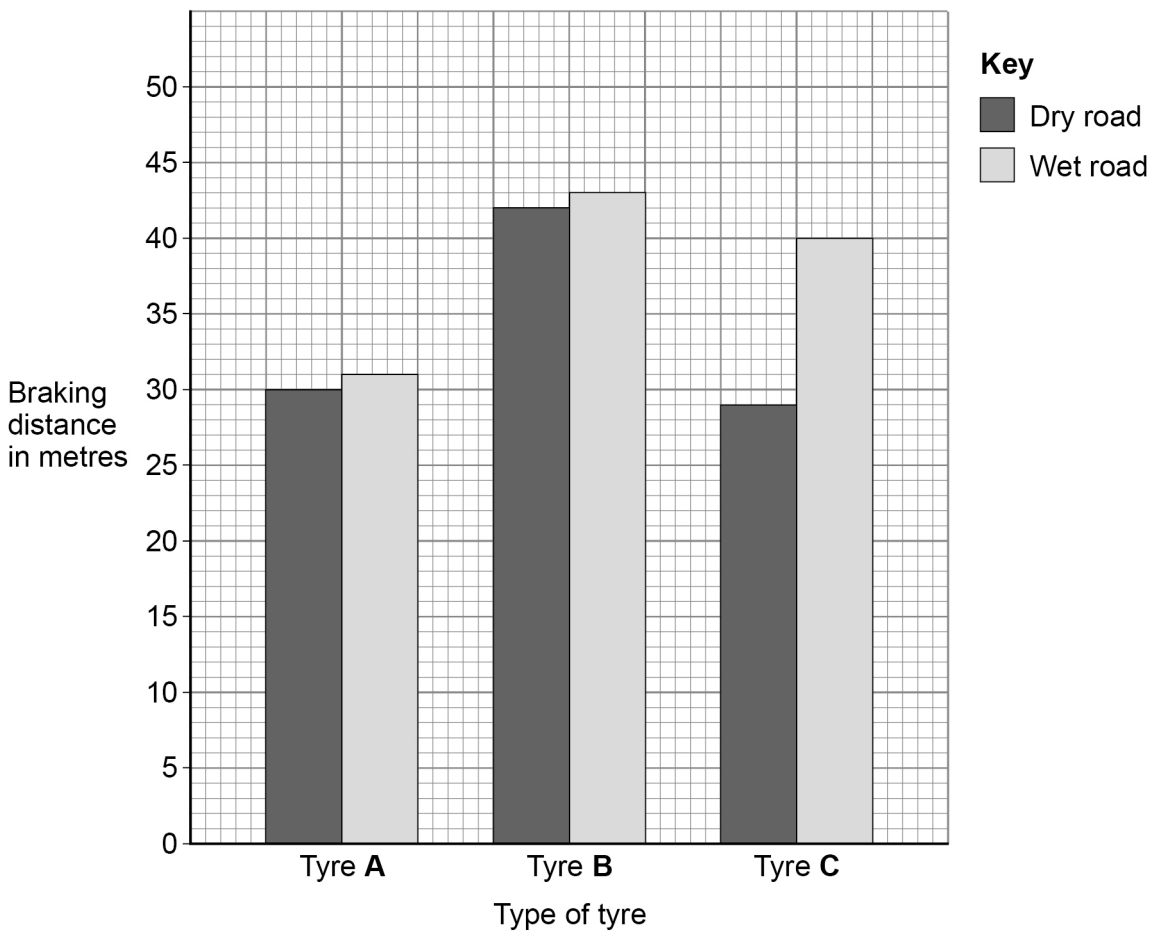
[1 mark]

6.5.4.3.4 Factors affecting braking distance 2

Question 06 · continued

Figure 10 shows the results.

Figure 10



6.5.4.3.4 Factors affecting braking distance 2

Question 06 · continued

0 5 . 3 The manufacturer wants to put the safest tyres on a new car.

Evaluate the safety of each type of tyre.

Use **data** from **Figure 10**.

[6 marks]

Question 5 continues on the next page

6.5.4.3.4 Factors affecting braking distance 2

Question 06 · continued

When the brakes are applied, a force does work to stop the car.

Use the Physics Equations Sheet to answer questions **05.4** and **05.5**.

0 5 . 4 Write down the equation that links distance (*s*), force (*F*) and work done (*W*).

[1 mark]

0 5 . 5 The braking force acting on a car is 6000 N.

The work done to stop the car is 300 000 J.

Calculate the braking distance of the car.

[3 marks]

Braking distance = _____ m

0 5 . 6 Explain how the force applied by the brakes affects the braking distance of the car.

[2 marks]

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6.5.4.3.4 Factors affecting braking distance 2

Question 07

0 7 The stopping distance of a car is affected by the condition of the brakes and tyres.

A car is being driven around a corner when the driver sees some roadworks.

0 7 . 1 The driver applies the brakes when the car is 24 m away from the roadworks.

The velocity of the car changes from 18 m/s to 0 m/s.

Calculate the constant deceleration needed to stop the car in a distance of 24 m.

Use the Physics Equations Sheet.

[3 marks]

Deceleration = _____ m/s^2

6.5.4.3.4 Factors affecting braking distance 2

Question 07 · continued

0 7 . 2 As a safety measure, the speed limit on the road was reduced.

Explain how the safety of road users is affected by:

- the condition of the brakes and tyres
- reduced speed.

You should refer to thinking distance and braking distance.

[6 marks]

Extra space

Question 7 continues on the next page

6.5.4.3.4 Factors affecting braking distance 2

Question 07 · continued

0 7 . 3 Two identical cars were driven along a straight, level road.

One car had a greater speed than the other car.

The driver of each car applied the brakes until the cars stopped.

Both cars travelled the same distance while braking.

Explain how braking from a greater speed affected the risk of the brakes overheating.

[3 marks]

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