

GCSE Combined Science: Trilogy

Worksheet: Stopping distance

TIME 35 min	TOTAL 31 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Stopping distance

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

01

01.1

What is meant by the thinking distance of a car?

Tick (✓) **one** box.

- The distance travelled during the driver’s reaction time
- The distance travelled while the brakes are applied
- The total distance needed to stop
- The distance between the car and the car in front

[1 mark]

01.2

What is meant by the braking distance of a car?

[1 mark]

0 1 . 3

A car has a thinking distance of 12 m and a braking distance of 24 m.
Calculate the stopping distance of the car.

.....

.....

.....

Stopping distance = m

[1 mark]

0 1 . 4

For a given braking force, how does the stopping distance change if the speed of the car increases?

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.....

.....

.....

[1 mark]

0 2

0 2 . 1

Which of these is the best description of thinking distance?
Tick (✓) **one** box.

- The distance travelled while the brakes are applied ☐
- The distance travelled during the driver's reaction time, before the brakes are applied ☐
- The total distance needed to stop the car ☐
- The distance between two cars on a motorway ☐

[1 mark]

0 2 . 2

Which **two** of these affect braking distance but do **not** affect thinking distance?

Tick (✓) **two** boxes.

The condition of the road surface

☐

The driver's tiredness

☐

The tread depth of the tyres

☐

Alcohol consumption by the driver

☐

[2 marks]

0 3

A family car travels at 27 m/s. The driver's reaction time is 0.50 s.

0 3 . 1

Calculate the thinking distance.

Use the equation:

distance travelled = speed $\times$ time

.....

.....

.....

.....

Thinking distance = m

[2 marks]

0 4

A driver travels at 24 m/s with a reaction time of 0.65 s.

0 4 . 1

Calculate the driver's thinking distance.

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.....

Thinking distance = m

[2 marks]

0 4 . 2

The driver is using a hands-free phone, which increases their reaction time to 0.90 s.
Calculate the increase in thinking distance this causes.

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.....

.....

.....

Increase in thinking distance = m

[2 marks]

0 5

A small lorry travels at 27 m/s. It brakes to a stop with a constant deceleration of 3.5 m/s².

0 5 . 1

Calculate the braking distance.
Use the Physics Equations Sheet.

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.....

.....

Braking distance = m

[3 marks]

0 6

Table 1 shows the thinking distance and braking distance for a car at different speeds on a dry road.

Table 1

Speed in m/s	Thinking distance in m	Braking distance in m
10	8	8
15	12	18
20	16	32
25	20	50
30	24	72

0 6 . 1

Calculate the stopping distance at 20 m/s.

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.....

.....

Stopping distance = m

[1 mark]

0 6 . 2

Describe the relationship between speed and thinking distance.

.....

.....

[1 mark]

0 6 . 3

Calculate the reaction time of the driver.

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.....

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.....

Reaction time = s

[2 marks]

0 6 . 4

When the speed doubles from 10 m/s to 20 m/s, the braking distance increases by a factor of 4.
Explain why.

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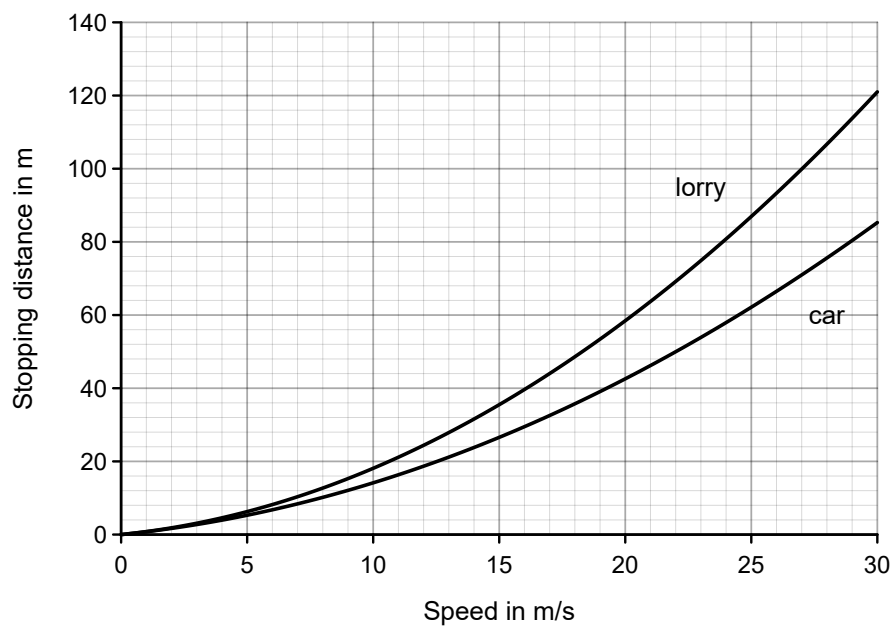
.....

[2 marks]

0 7

Figure 1 shows how the stopping distance of a car and of a lorry depend on speed. The driver’s reaction time is the same for both vehicles.

Figure 1



0 7 . 1

Use Figure 1 to determine the stopping distance of the car at 25 m/s.

.....

.....

.....

Stopping distance = m

[1 mark]

0 7 . 2

Determine how much further the lorry travels than the car when both stop from 25 m/s.

.....

.....

.....

.....

Extra distance = m

[2 marks]

0 7 . 3

Suggest why the lorry needs a greater braking distance than the car.

.....

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.....

[2 marks]

0 7 . 4

Explain why the lines on Figure 1 are curves and not straight lines.

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.....

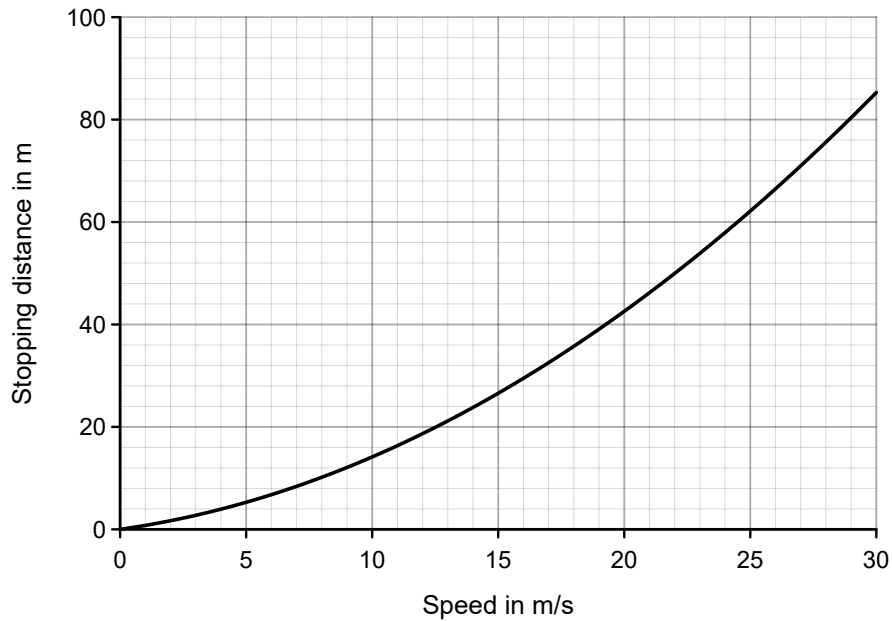
[1 mark]

.....

0 8

Figure 2 shows how the stopping distance of a car depends on its speed, for a driver with a typical reaction time on a dry road.

Figure 2



0 8 . 1

Use Figure 2 to estimate the stopping distance at 20 m/s.

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.....

.....

Stopping distance = m

[1 mark]

0 8 . 2

Explain why the graph is a curve, becoming steeper at higher speeds, rather than a straight line through the origin.

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[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Stopping distance · 31 marks

Question 1 (4 marks)

01.1 [1 mark]

Correct: The distance travelled during the driver's reaction time

01.2 [1 mark]

Answer: The distance travelled under the braking force.

- the distance the car travels under the braking force (after the brakes are applied) (1)
-

01.3 [1 mark]

Answer: 36 m

- 36 (m) (1)
-

01.4 [1 mark]

Answer: It increases.

- it increases (1)
-

Question 2 (3 marks)

02.1 [1 mark]

Correct: The distance travelled during the driver's reaction time, before the brakes are applied

02.2 [2 marks]

Correct: The condition of the road surface; The tread depth of the tyres

Question 3 (2 marks)

03.1 [2 marks]

Answer: 13.5 m

- $s = 27 \times 0.50$ (1)
 - 13.5 (m) (1)
-

Question 4 (4 marks)

04.1 [2 marks]

Answer: 15.6 m

- $s = 24 \times 0.65$ (1)
 - 15.6 (m) (1)
-

04.2 [2 marks]

Answer: 6.0 m

- increase in reaction time = $0.90 - 0.65 = 0.25$ (s) (1)
 - increase in thinking distance = $24 \times 0.25 = 6.0$ (m) (1)
-

Question 5 (3 marks)

05.1 [3 marks]

Answer: 104 m

- $0^2 - 27^2 = 2 \times (-3.5) \times s$ (1)
 - $s = 729 \div 7$ (1)
 - 104 (m) (1)
-

Question 6 (6 marks)

06.1 [1 mark]

Answer: 48 m

- 48 (m) (1)
-

06.2 [1 mark]

Answer: Thinking distance is directly proportional to speed.

- thinking distance is directly proportional to speed (1)
-

06.3 [2 marks]

Answer: 0.8 s

- $t = 8 \div 10$ (or any other correct pair of values) (1)
 - 0.8 (s) (1)
-

06.4 [2 marks]

Answer: Kinetic energy $\propto$ speed², so four times as much work must be done by the same braking force, which needs four times the distance.

- kinetic energy is proportional to (speed)², so the kinetic energy increases by a factor of 4 (1)
 - the (same) braking force must do 4 times as much work, so the braking distance is 4 times greater (work done = force $\times$ distance) (1)
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Question 7 (6 marks)

07.1 [1 mark]

Answer: 62 m (allow 60–64 m)

- 62 (m) (allow 60–64) (1)

07.2 [2 marks]

Answer: 25 m (allow 21–29 m)

- stopping distance of the lorry = 87 m (allow 85–89 m) (1)
- difference = 25 (m) (allow 21–29) (1)

07.3 [2 marks]

Answer: The lorry has more mass (more kinetic energy) but not proportionally more braking force, so its deceleration is smaller.

- the lorry has a greater mass, so it has more kinetic energy at the same speed (1)
- the braking force is not (proportionally) larger, so the deceleration is smaller / the brakes must do more work (1)

07.4 [1 mark]

Answer: Braking distance depends on speed squared.

- braking distance increases with $(\text{speed})^2$ / is not proportional to speed (1)

Question 8 (3 marks)

08.1 [1 mark]

Answer: 43 m (allow 41–45 m)

- 43 (m) (allow 41–45) (1)

08.2 [2 marks]

Answer: Thinking distance $\propto$ speed, but braking distance $\propto$ speed², so stopping distance rises increasingly steeply with speed.

- thinking distance is directly proportional to speed, but braking distance is proportional to $(\text{speed})^2$ (from kinetic energy = $0.5 \times \text{mass} \times \text{speed}^2$) (1)
 - so, as speed increases, the braking-distance part grows much faster than the thinking-distance part, making the total stopping distance rise ever more steeply (1)
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