

GCSE Physics

Worksheet: Factors affecting braking distance

TIME 20 min	TOTAL 20 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
-----------------------	--------------------------	------------------------------	-----------------------------------

Topics: Factors affecting braking distance

NAME	CLASS	DATE
-------------	--------------	-------------

- 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.

0 1

0 1 . 1 Which **two** of these decrease the maximum braking force a car's tyres can exert on the road?

Tick (✓) **two** boxes.

A wet or icy road

☐

New tyres with deep tread

☐

Worn tyres

☐

A heavier load in the car

☐

[2 marks]

0 2

0 2 . 1 Which **two** factors increase the braking distance of a car?

Tick (✓) **two** boxes.

An icy road

☐

A tired driver

☐

Worn tyres

☐

A driver who has drunk alcohol

☐

[2 marks]

0 2 . 2

Give **one** factor that affects the thinking distance but not the braking distance.

.....

.....

[1 mark]

0 2 . 3

Explain why a wet road increases the braking distance of a car.

.....

.....

.....

.....

[2 marks]

0 3

A car with a roof rack loaded with luggage has a much greater mass than the same car when empty. Both have identical brakes.

0 3 . 1

Explain why the loaded car needs a greater braking distance than the empty car, when braking from the same speed with the same braking force.

.....

.....

.....

.....

.....

.....

[3 marks]

0 4

Table 1 shows the braking distance of the same car, travelling at 20 m/s, on four different road surfaces.

Table 1

Road surface	Braking distance in m
Dry tarmac	29
Wet tarmac	40
Gravel	58
Ice	145

0 4 . 1

Rank the road surfaces in Table 1 from the shortest to the longest braking distance.

.....

.....

[1 mark]

0 4 . 2

Calculate the deceleration of the car on ice.
Use the Physics Equations Sheet.

.....

.....

.....

.....

.....

Deceleration = m/s²

[3 marks]

.....

0 5

A tyre company tested how the tread depth of car tyres affects the braking distance on a wet road. The car was travelling at 22 m/s each time. Table 2 shows the results.

Table 2

Tread depth in mm	Braking distance in m
8.0	36
6.0	37
4.0	40
3.0	43
2.0	48
1.6	51

0 5 . 1

Describe the trend shown in Table 2.

.....

.....

.....

.....

[2 marks]

0 5 . 2

Explain why worn tyres increase the braking distance on a wet road.

.....

.....

.....

.....

[2 marks]

0 5 . 3

The legal minimum tread depth for car tyres in the UK is 1.6 mm.
Calculate the percentage increase in braking distance between new tyres (8.0 mm) and tyres at the legal minimum.

.....

.....

.....

.....

Percentage increase = %

[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 Physics · Worksheet: Factors affecting braking distance · 20 marks

Question 1 (2 marks)

01.1 [2 marks]

Correct: A wet or icy road; Worn tyres

Question 2 (5 marks)

02.1 [2 marks]

Correct: An icy road; Worn tyres

02.2 [1 mark]

Answer: Tiredness (or alcohol, drugs, distractions).

- tiredness (1)
- alcohol (1)
- drugs (1)
- distractions / using a phone (1)

Any 1 of the points above.

02.3 [2 marks]

Answer: There is less friction between tyres and road, so the braking force and deceleration are smaller.

- there is less friction (grip) between the tyres and the road (1)
 - so the braking force is smaller / the deceleration is smaller (1)
-

Question 3 (3 marks)

03.1 [3 marks]

Answer: More mass means more kinetic energy at the same speed; with the same braking force, more distance is needed to do the extra work removing it.

- the loaded car has a greater mass, so (for the same speed) it has more kinetic energy (1)
 - work done by the brakes = braking force $\times$ braking distance; the brakes must do more work to remove this greater kinetic energy (1)
 - since the braking force is the same, a greater distance is needed to do this extra work, so the braking distance is greater (1)
-

Question 4 (4 marks)

04.1 [1 mark]

Answer: Dry tarmac, wet tarmac, gravel, ice.

- dry tarmac, wet tarmac, gravel, ice (1)

04.2 [3 marks]

Answer: 1.4 m/s^2

- $0 - 20^2 = 2 \times (-a) \times 145$ (1)
- $a = 400 \div 290$ (1)
- $1.4 \text{ (m/s}^2\text{)}$ (1)

Question 5 (6 marks)

05.1 [2 marks]

Answer: Braking distance increases as tread depth decreases, especially below about 4 mm.

- as the tread depth decreases, the braking distance increases (1)
- the braking distance increases more rapidly for tread depths below about 4 mm (1)

05.2 [2 marks]

Answer: Shallow tread removes less water, so there is less grip; the braking force and deceleration are smaller.

- worn tyres are less able to remove water from between the tyre and the road, so there is less friction / grip (1)
- so the maximum braking force is smaller and the deceleration is smaller (1)

05.3 [2 marks]

Answer: 42%

- $(51 - 36) \div 36 \times 100$ (1)
 - 42 (%) (1)
-