

GCSE Combined Science: Trilogy

Worksheet: Factors affecting braking distance 2

TIME 30 min	TOTAL 30 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Factors affecting braking distance 2

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.

0 1

0 1 . 1

When the brakes of a moving car are applied, work is done by the friction force between the brakes and the wheels.

What happens to the kinetic energy of the car?

Tick (✓) **one** box.

It decreases

☐

It increases

☐

It stays the same

☐

[1 mark]

0 1 . 2

What happens to the temperature of the brakes?

.....

.....

.....

[1 mark]

0 1 . 3

The brakes of a car exert a braking force of 6000 N while the car travels 20 m.
Calculate the work done by the brakes.
Use the equation:
work done = force $\times$ distance

.....

.....

.....

.....

Work done = J

[2 marks]

0 2

The brakes of a family car exert a constant braking force of 7500 N while the car travels 49 m.

0 2 . 1

Calculate the work done by the brakes.
Use the equation:
work done = force $\times$ distance

.....

.....

.....

.....

Work done = J

[2 marks]

0 3

0 3 . 1

As a car brakes to a stop, energy is transferred from the car's kinetic energy store. To which energy store is most of this energy transferred?

Tick (✓) **one** box.

Gravitational potential

☐

Chemical

☐

Thermal (of the brakes)

☐

Elastic potential

☐

[1 mark]

0 3 . 2

A car's brakes exert a force of 4500 N over a distance of 15 m.

Calculate the work done by the brakes.

Use the equation:

work done = force $\times$ distance

.....

.....

.....

.....

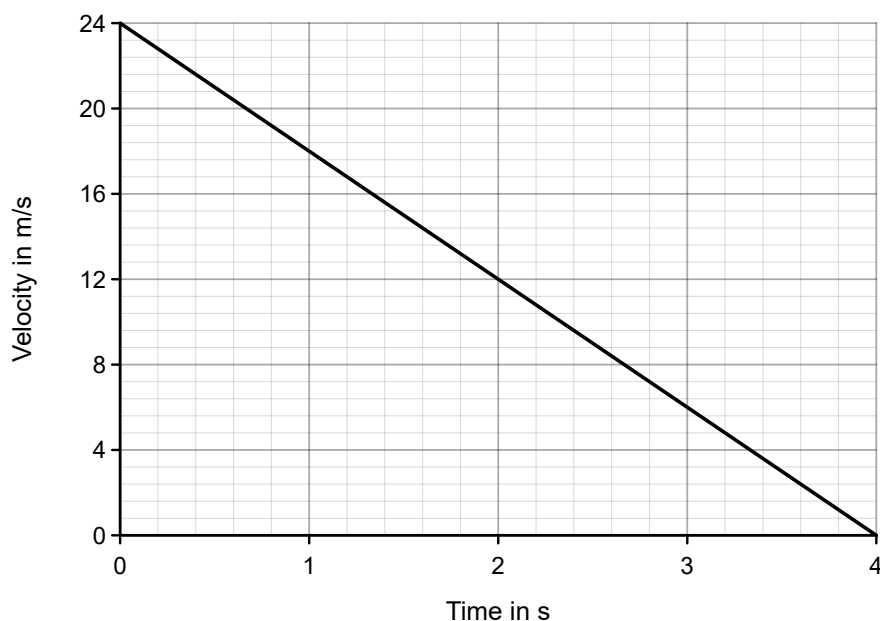
Work done = J

[2 marks]

0 4

Figure 1 shows the velocity–time graph for a motorbike of mass 220 kg braking to a stop.

Figure 1



0 4 . 1

Use Figure 1 to determine the deceleration of the motorbike.

.....

.....

.....

.....

Deceleration = m/s²

[2 marks]

0 4 . 2

Calculate the braking force on the motorbike.

.....

.....

.....

.....

Braking force = N

[2 marks]

0 5

A small lorry of mass 5000 kg, travelling at 26 m/s, brakes to a stop in a distance of 85 m.

0 5 . 1

Calculate the kinetic energy of the lorry before it brakes.

.....

.....

.....

.....

Kinetic energy = J

[2 marks]

0 5 . 2

Calculate the average braking force.

.....

.....

.....

.....

Braking force = N

[3 marks]

0 6

0 6 . 1

Explain why a car travelling at a greater speed needs a greater braking force to stop in the same distance.

.....

.....

.....

.....

[2 marks]

0 6 . 2

Explain why a greater braking force gives a greater deceleration.

.....

.....

[1 mark]

0 6 . 3

Describe **two** dangers of very large decelerations of road vehicles.

.....

.....

.....

.....

[2 marks]

0 7

A car of mass 1200 kg is travelling at 15 m/s. The driver brakes and the car stops in a braking distance of 18 m.

0 7 . 1

Calculate the kinetic energy of the car before braking.

.....

.....

.....

.....

Kinetic energy = J

[2 marks]

0 7 . 2

Calculate the average braking force.

.....

.....

.....

.....

.....

Braking force = N

[3 marks]

0 7 . 3

Describe the energy transfer that takes place as the car brakes.

.....

.....

.....

.....

[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: Factors affecting braking distance 2 · 30 marks

Question 1 (4 marks)

01.1 [1 mark]

Correct: It decreases

01.2 [1 mark]

Answer: It increases.

- it increases (1)
-

01.3 [2 marks]

Answer: 120 000 J

- $W = 6000 \times 20$ (1)
 - 120 000 (J) (1)
-

Question 2 (2 marks)

02.1 [2 marks]

Answer: 367 500 J

- $W = 7500 \times 49$ (1)
 - 367 500 (J) (1)
-

Question 3 (3 marks)

03.1 [1 mark]

Correct: Thermal (of the brakes)

03.2 [2 marks]

Answer: 67 500 J

- $W = 4500 \times 15$ (1)
 - 67 500 (J) (1)
-

Question 4 (4 marks)

04.1 [2 marks]

Answer: 6.0 m/s^2

- $a = 24 \div 4$ (1)
 - $6.0 \text{ (m/s}^2\text{)}$ (1)
-

04.2 [2 marks]

Answer: 1320 N

- $F = 220 \times 6.0$ (1)
- 1320 (N) (1)

Notes: Allow ECF from the previous part.

Question 5 (5 marks)

05.1 [2 marks]

Answer: 1 690 000 J

- $E_k = 0.5 \times 5000 \times 26^2$ (1)
 - 1 690 000 (J) (1)
-

05.2 [3 marks]

Answer: 19 900 N

- work done by the brakes = kinetic energy lost = 1 690 000 (J) (1)
- $1\,690\,000 = F \times 85$ (1)
- $F = 19\,900 \text{ (N)}$ (1)

Notes: Allow ECF from the previous part.

Question 6 (5 marks)

06.1 [2 marks]

Answer: It has more kinetic energy, and to do more work in the same distance the force must be larger.

- the car has more kinetic energy (kinetic energy increases with the square of the speed) (1)
- work done = force $\times$ distance, so for the same distance a greater force is needed to do more work (1)

06.2 [1 mark]

Answer: $F = m a$, so for a fixed mass, larger force means larger deceleration.

- resultant force = mass $\times$ acceleration, so for the same mass a greater force gives a greater deceleration (1)

06.3 [2 marks]

Answer: The brakes may overheat, and the vehicle may skid so the driver loses control.

- the brakes may overheat (and become less effective) (1)
- the wheels may lock / the vehicle may skid, so the driver loses control (1)
- large forces act on the passengers, which may cause injury (1)

Any 2 of the points above.

Question 7 (7 marks)

07.1 [2 marks]

Answer: 135 000 J

- $E_k = 0.5 \times 1200 \times 15^2$ (1)
 - 135 000 (J) (1)
-

07.2 [3 marks]

Answer: 7500 N

- work done by the brakes = kinetic energy lost = 135 000 J (1)
- $135\,000 = F \times 18$ (1)
- $F = 7500$ (N) (1)

Notes: Allow ECF from the previous part.

07.3 [2 marks]

Answer: Work done by friction in the brakes transfers energy from the car's kinetic store to the thermal store of the brakes.

- work done by the friction force (between the brakes and the wheels) reduces the kinetic energy of the car (1)
 - energy is transferred to the thermal energy store of the brakes / the temperature of the brakes increases (1)
-