AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.5.2

Work done and energy transfer

Past-paper questions

Tier	**Foundation**
Question groups	**9**
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.

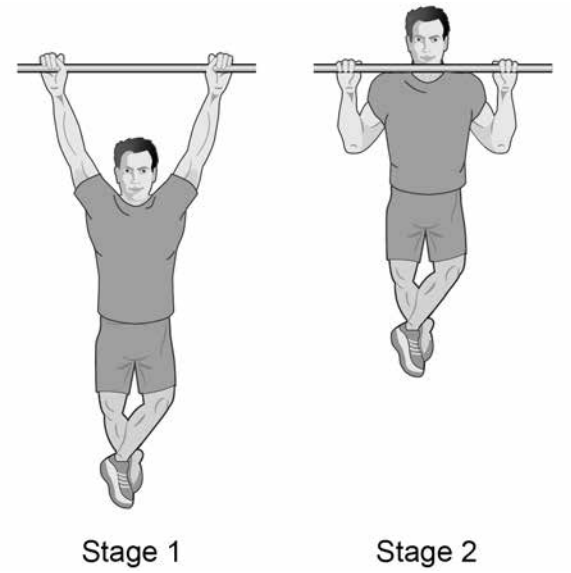
6.5.2 Work done and energy transfer

Question 01

June 2018 | 8464/P/2F | Original Q3

0 3 **Figure 4** shows a man doing two stages of a pull up. In both diagrams the man is stationary.

Figure 4



0 3 . 1 Complete the sentence.

Choose the answer from the box.

[1 mark]

equal to	**less than**	**more than**

In stage 1 the downwards force of the man on the bar is _____ the upwards force of the bar on the man.

0 3 . 2 The man has a mass of 85 kg

Gravitational field strength = 9.8 N/kg

Calculate the weight of the man.

Use the equation:

weight = mass × gravitational field strength

[2 marks]

_____

_____

Weight = _____ N

6.5.2 Work done and energy transfer

Question 01 · continued

June 2018 | 8464/P/2F | Original Q3

0 3 . 3 The man raises his body a vertical distance of 0.63 m to go from stage 1 to stage 2

Calculate the work done by the man.

Use your answer to question **03.2**

Use the equation:

work done = force × distance

[2 marks]

Work done = _____ J

0 3 . 4 The man was **not** moving at stage 2

How much work is done by the man at stage 2?

[1 mark]

Work done = _____ J

0 3 . 5 A woman uses the bar to do a pull up.

The woman has a mass of 62 kg

She accelerates at 11 m/s^2

Calculate the resultant force on the woman.

Use the equation:

force = mass × acceleration

[2 marks]

Force = _____ N

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6.5.2 Work done and energy transfer

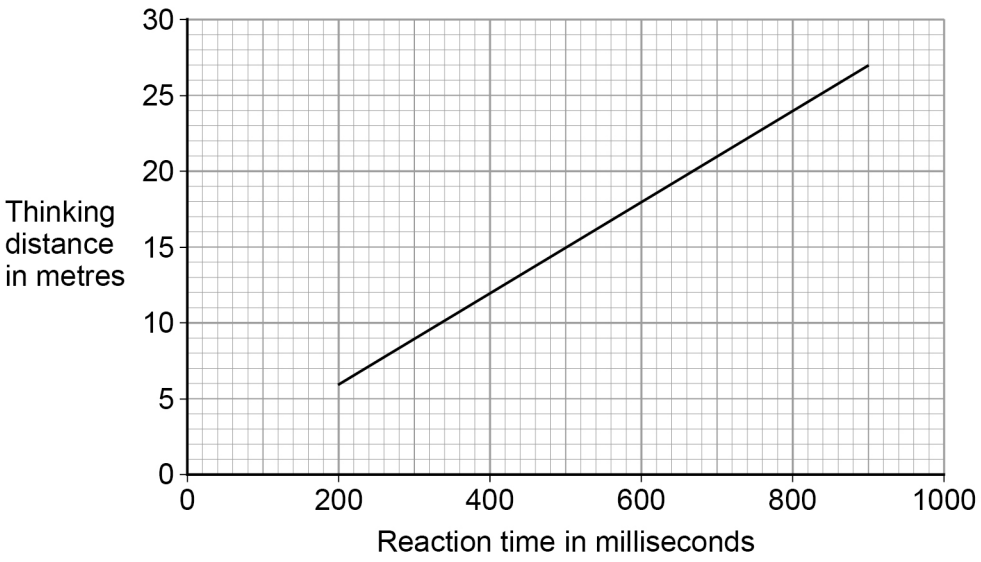
Question 02

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]

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

6.5.2 Work done and energy transfer

Question 02 · continued

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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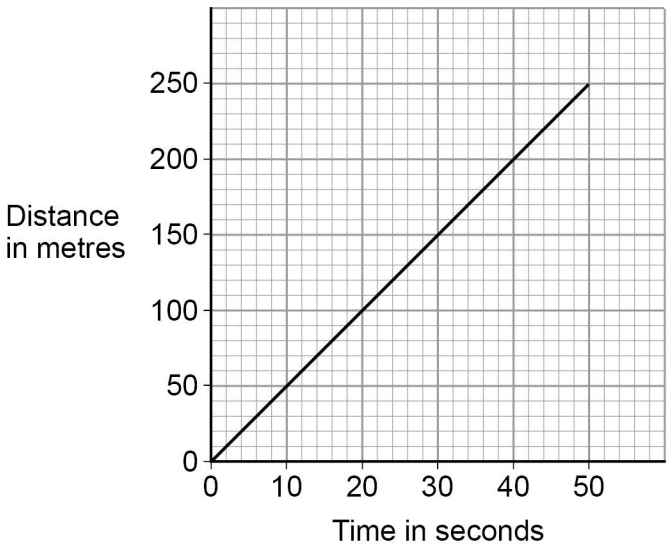
6.5.2 Work done and energy transfer

Question 03

November 2020 | 8464/P/2F | Original Q4

0 4 **Figure 5** shows a distance-time graph for 50 seconds of a bicycle ride.

Figure 5



0 4 . 1 The gradient of the distance-time graph gives the speed of the bicycle.

Determine the speed of the bicycle.

[2 marks]

Speed = _____ m/s

Question 03 · continued

0 4 . 2 Which force acting on the moving bicycle is a non-contact force?

[1 mark]

Tick (✓) **one** box.

- Air resistance ☐
- Friction ☐
- Gravitational force ☐
- Normal contact force ☐

0 4 . 3 The bicycle travels a distance of 250 m

The bicycle exerts a constant horizontal force of 30 N on the ground.

Calculate the work done.

Use the equation:

work done = force × distance

Choose the unit from the box.

[3 marks]

J	**kg**	**m**

Work done = _____ Unit _____

Question 03 · continued

0 4 . 4 The bicycle travels at a constant speed.

Complete the sentences.

Choose answers from the box.

[3 marks]

chemical	**frictional**	**kinetic**
magnetic		**tension**

As the bicycle moves, work is done against _____ forces.

There is no change in the cyclist's _____ store of energy.

There is a decrease in the cyclist's _____ store of energy.

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6.5.2 Work done and energy transfer

Question 04

November 2021 | 8464/P/2F | Original Q5

0 5 Scientists are developing a rocket aeroplane designed to travel much faster than jet aeroplanes.

0 5 . 1 The rocket aeroplane must accelerate along a runway to take off.

What would happen to the air resistance acting on the rocket aeroplane as it accelerates?

[1 mark]

0 5 . 2 An upward force called lift will act on the wings of the rocket aeroplane when it moves.

Complete the sentence.

Choose the answer from the box.

[1 mark]

less than	**the same as**	**greater than**

As the rocket aeroplane starts to accelerate along the runway, the lift force on the wings will be _____ the weight of the rocket aeroplane.

Question 5 continues on the next page

6.5.2 Work done and energy transfer

Question 04 · continued

0 5 . 3 During the first 14 seconds the average speed of the rocket aeroplane on the runway will be 35 m/s.

Calculate the distance that the rocket aeroplane will travel during the first 14 seconds.

Use the equation:

distance travelled = average speed × time

[2 marks]

Distance travelled = _____ m

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

[1 mark]

0 5 . 5 When the rocket aeroplane travels a distance of 270 m on the runway the engines will do 54 000 000 J of work.

Calculate the average force exerted by the engines.

[3 marks]

Average force = _____ N

Question 04 · continued

0 5 . 6 The rocket aeroplane will fly at a greater height than a jet aeroplane.

The height that an aeroplane flies at affects the radiation dose a passenger will receive each hour.

Table 2 shows the speed of each aeroplane and the radiation dose a passenger will receive each hour.

Table 2

Aeroplane	Speed in metres per second	Radiation dose each hour in millisieverts
Rocket aeroplane	8000	0.006
Jet aeroplane	250	0.003

Exposure to ionising radiation has risks and possible consequences.

Evaluate the risks and possible consequences of flying in a rocket aeroplane and in a jet aeroplane.

Assume the same journey is made in each aeroplane.

Use values from **Table 2**.

[6 marks]

14

6.5.2 Work done and energy transfer

Question 05

0 7 **Figure 10** shows competitors in the wheelchair race at the London Marathon.

The distance of the London Marathon is 42 000 m

Figure 10



Question 05 · continued

Use the Physics Equations Sheet to answer questions **07.1** and **07.2**.

0 7 . 1 Write down the equation that links distance (*s*), force (*F*) and work done (*W*).

[1 mark]

0 7 . 2 During the race competitors work against air resistance.

The work done against air resistance by the winner of the race was 3 360 000 J

Calculate the average air resistance acting on the winner of the race.

[3 marks]

Average air resistance = _____ N

Question 7 continues on the next page

Question 05 · continued

Use the Physics Equations Sheet to answer questions **07.3** and **07.4**.

0 7 . 3 Which equation links distance travelled, speed and time?

[1 mark]

Tick (✓) **one** box.

distance travelled = speed × time ☐

time = distance travelled × speed ☐

speed = distance travelled × time ☐

0 7 . 4 The distance of the London Marathon is 42 000 m

The winning time for the race was 5600 seconds.

Calculate the average speed of the winner of the race.

[3 marks]

Average speed = _____ m/s

6.5.2 Work done and energy transfer

Question 05 · continued

0 7 . 5 Explain why the speed of a competitor changes during the race.

[4 marks]

12

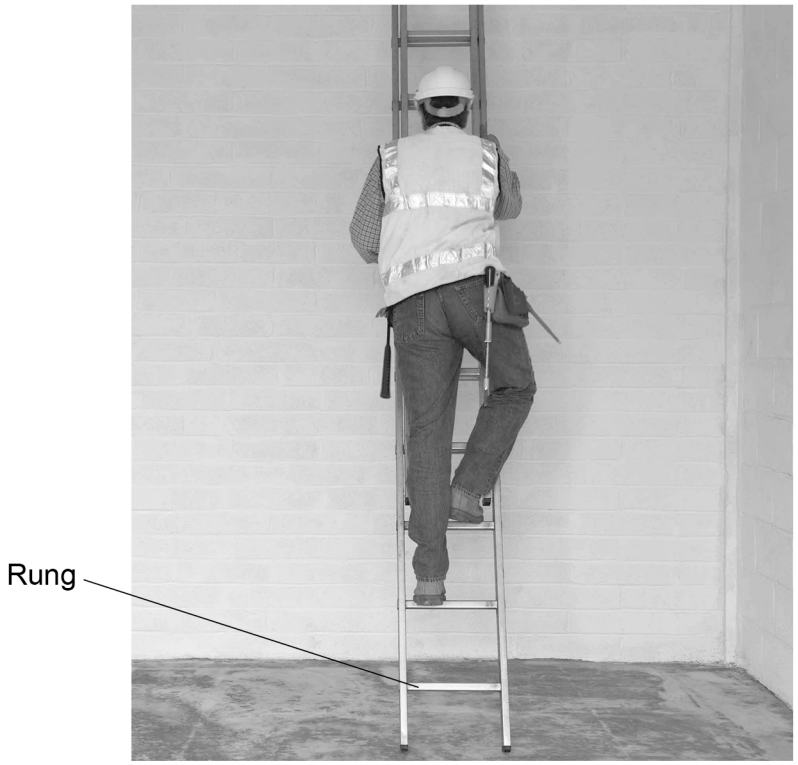
6.5.2 Work done and energy transfer

Question 06

June 2023 | 8464/P/2F | Original Q5

0 5 **Figure 13** shows an engineer climbing up a ladder.

Figure 13



The distance between each rung on the ladder is 30 cm.

0 5 . 1 What is 30 cm in metres?

[1 mark]

Tick (✓) **one** box.

0.030 m ☐ 0.30 m ☐ 3.0 m ☐ 30 m ☐

6.5.2 Work done and energy transfer

Question 06 · continued

0 5 . 2 The engineer has a weight of 710 N.

Calculate the work done when climbing up one rung of the ladder.

Use your answer to Question **05.1** and the equation:

work done = force × distance

[2 marks]

Work done = _____ Nm

0 5 . 3 The engineer climbs the ladder carrying some equipment.

Give the reason why carrying equipment increases the work done by the engineer when climbing the ladder.

[1 mark]

Question 5 continues on the next page

6.5.2 Work done and energy transfer

Question 06 · continued

0 5 . 4 The engineer is stationary at the top of the ladder.

Which energy stores of the engineer increase due to the engineer climbing the ladder?

[2 marks]

Tick (✓) **two** boxes.

- Chemical ☐
- Elastic potential ☐
- Gravitational potential ☐
- Kinetic ☐
- Thermal ☐

6.5.2 Work done and energy transfer

Question 06 · continued

Use the Physics Equations Sheet to answer questions **05.5** and **05.6**.

05.5 Write down the equation that links gravitational field strength (*g*), mass (*m*) and weight (*W*).

[1 mark]

05.6 The engineer has a weight of 710 N.

gravitational field strength = 9.8 N/kg

Calculate the mass of the engineer.

Give your answer to 2 significant figures.

[4 marks]

Mass (2 significant figures) = _____ kg

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6.5.2 Work done and energy transfer

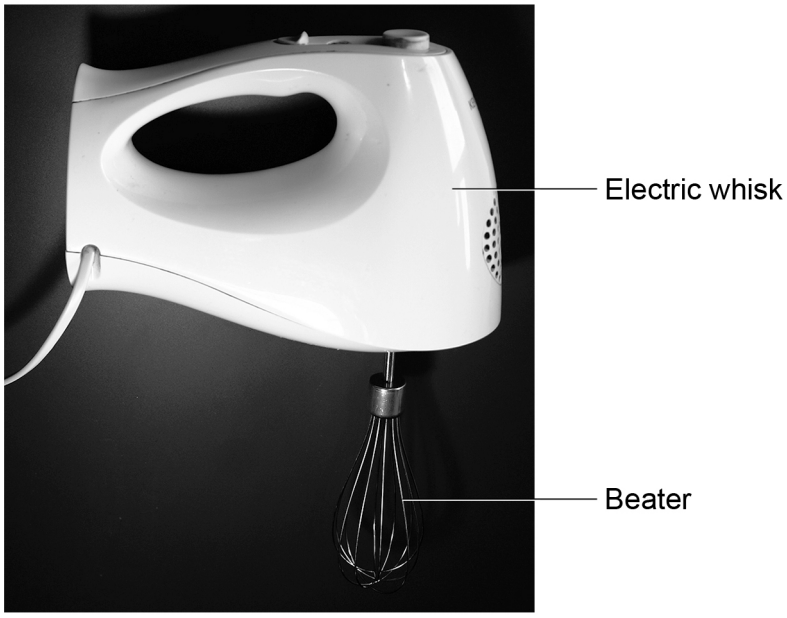
Question 07

June 2024 | 8464/P/1F | Original Q6

0 6 **Figure 10** shows an electric whisk that plugs into the mains electricity supply.

The whisk can mix food by spinning a beater.

Figure 10



0 6 . 1 Give **two** energy stores that increase when the whisk is switched on.

[2 marks]

1 _____

_____

2 _____

_____

Question 07 · continued

Use the Physics Equations Sheet to answer questions **06.2** and **06.3**.

0 6 . 2 Work is done by the whisk when it is used to mix food.

Write down the equation that links power (*P*), time (*t*) and work done (*W*).

[1 mark]

0 6 . 3 The power output of the whisk is 92 W.

Calculate the time for the whisk to do 23 000 J of work.

[3 marks]

Time = _____ s

Question 6 continues on the next page

6.5.2 Work done and energy transfer

Question 07 · continued

Use the Physics Equations Sheet to answer questions **06.4** and **06.5**.

0 6 . 4 Which equation links current (I), power (P) and resistance (R)?

[1 mark]

Tick (✓) **one** box.

$P = \frac{I}{R^2}$ ☐

$P = I R^2$ ☐

$P = \frac{I^2}{R}$ ☐

$P = I^2 R$ ☐

0 6 . 5 The current in the whisk is 500 mA.

The resistance of the whisk is 640 Ω.

Calculate the power of the whisk.

[3 marks]

Power = _____ W

6.5.2 Work done and energy transfer

Question 07 · continued

The whisk has several settings that allow the beater to spin at different speeds.

A faster beater speed needs a greater power input from the mains electricity supply.

0 6 . 6 What is the potential difference between the live wire and neutral wire in the mains electricity supply?

[1 mark]

_____ V

0 6 . 7 Changing the beater speed does **not** change the potential difference between the live wire and neutral wire.

The power input to the whisk changes because the current in the whisk changes.

Complete the sentence.

[1 mark]

When the beater speed increases, the current in the whisk increases because the resistance of the whisk _____.

12

6.5.2 Work done and energy transfer

Question 08

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.

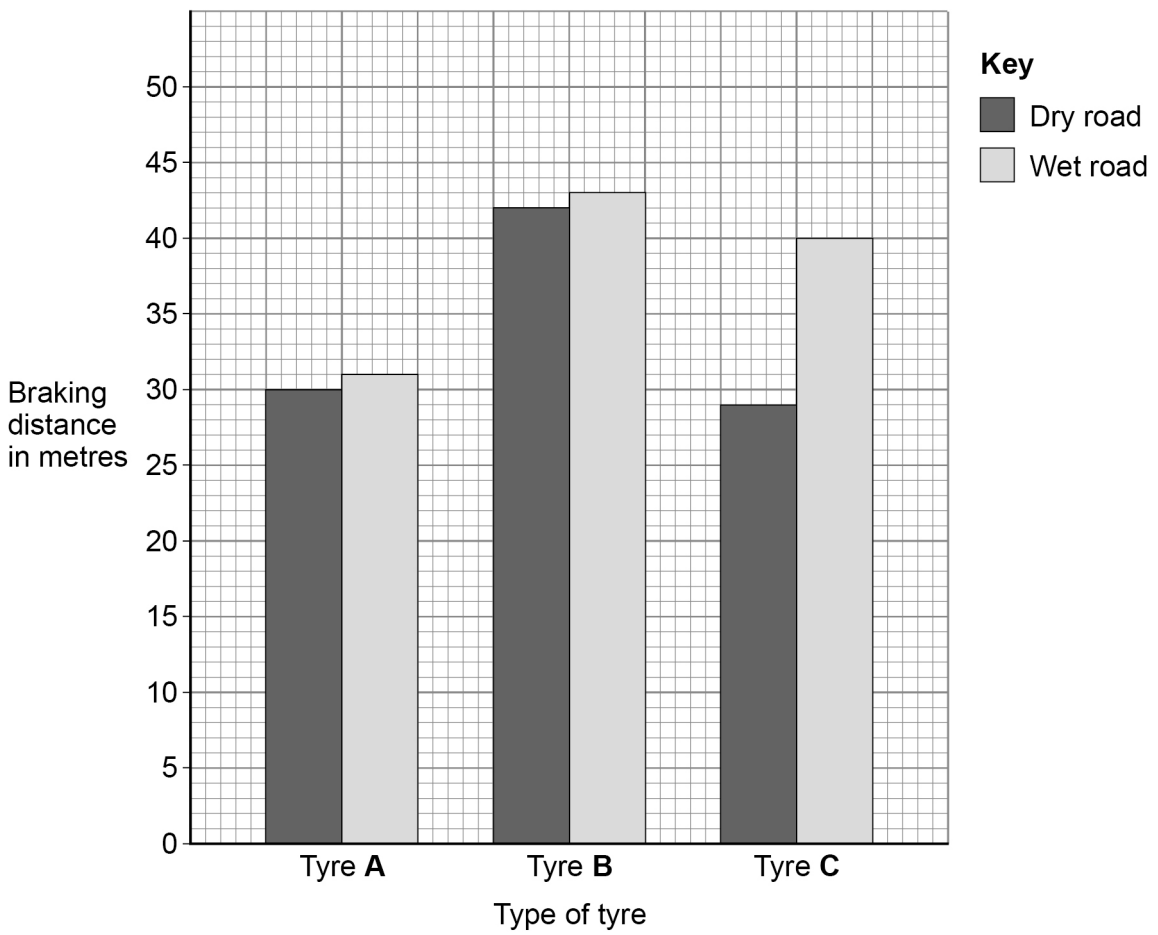
Give **one other** variable that should have been kept the same for each test.

[1 mark]

Question 08 · continued

Figure 10 shows the results.

Figure 10



6.5.2 Work done and energy transfer

Question 08 · 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

Question 08 · continued June 2024 | 8464/P/2F | Original Q5

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]

14

6.5.2 Work done and energy transfer

Question 09

0 3 A student went on a cycling journey that lasted for three days.

The student recorded information about the journey using a cycling app on a mobile phone.

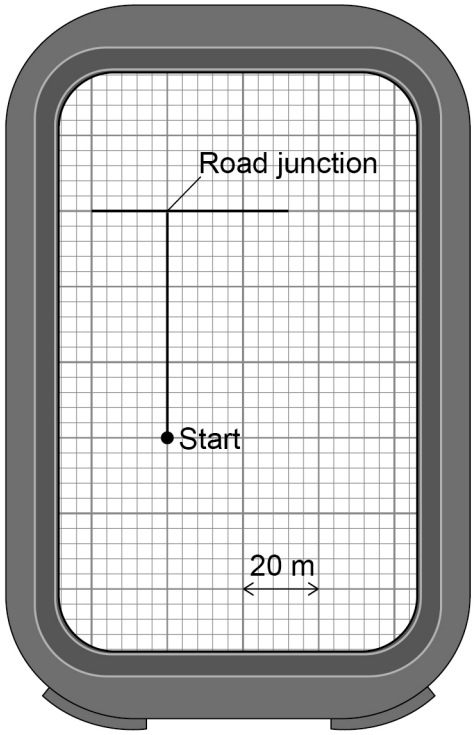
0 3 . 1 At the start of the journey, the student travelled along a straight road to a road junction.

A map on the cycling app showed the road.

Figure 5 shows the map.

The scale of the map is 1 cm **:** 20 m

Figure 5



Question 09 · continued

Calculate the distance travelled by the student between the start and the road junction.

Use **Figure 5**.

[2 marks]

Distance travelled = _____ m

0 3 . 2 The bicycle had a mass of 15 kg.

gravitational field strength = 9.8 N/kg

Calculate the weight of the bicycle.

Use the equation:

weight = mass × gravitational field strength

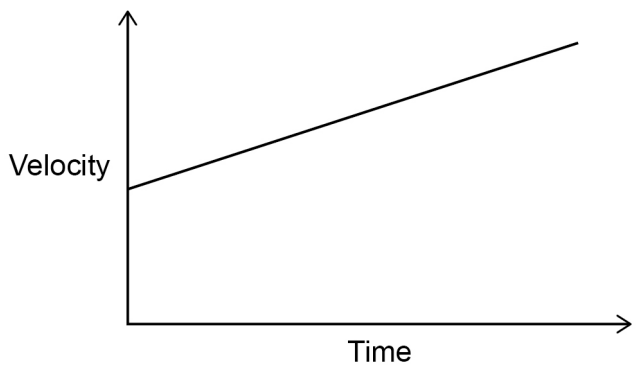
[2 marks]

Weight = _____ N

Question 3 continues on the next page

0 3 . 3 **Figure 6** shows a velocity–time graph for a downhill part of the journey.

Figure 6



The gradient of the graph represents acceleration.

How does **Figure 6** show that the acceleration was constant?

[1 mark]

0 3 . 4 As the student accelerated downhill, the forward force on the student was 250 N.

The work done by the forward force was 4500 J.

Calculate the distance travelled as the student accelerated downhill.

Use the equation:

$$\text{distance travelled} = \frac{\text{work done}}{\text{force}}$$

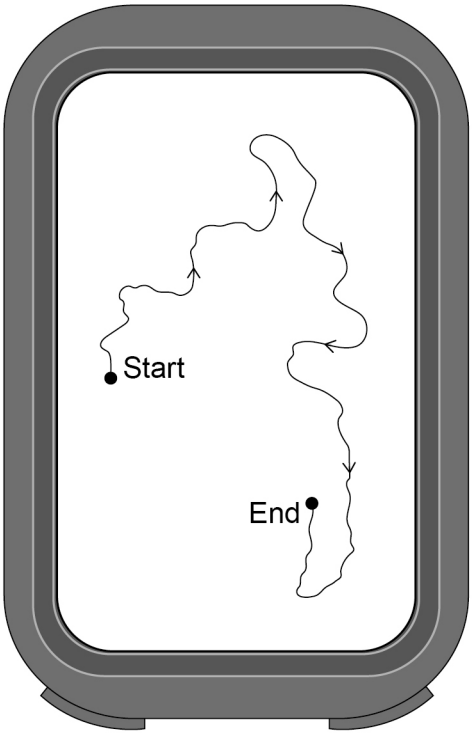
[2 marks]

Distance travelled = _____ m

0 3 . 5 Most of the roads on the journey were not straight.

Figure 7 shows a map of the route taken for the whole journey.

Figure 7



The line in **Figure 7** represents the total distance travelled when the student reached the end of the journey.

How does the total distance travelled compare with the magnitude of the displacement of the student from the start?

[1 mark]

Tick (✓) **one** box.

Total distance travelled is less than the displacement. ☐

Total distance travelled is equal to the displacement. ☐

Total distance travelled is greater than the displacement. ☐

6.5.2 Work done and energy transfer

Question 09 · continued

0 3 . 6 Why is distance a scalar quantity?

[1 mark]

Tick (✓) **one** box.

Distance has direction only. ☐

Distance has magnitude only. ☐

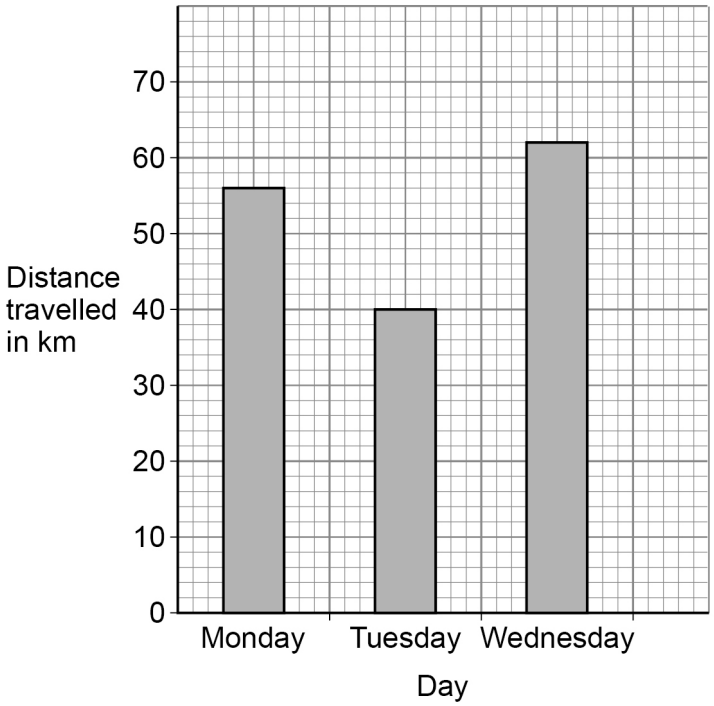
Distance has direction and magnitude. ☐

6.5.2 Work done and energy transfer

Question 09 · continued

0 3 . 7 **Figure 8** shows the distance travelled by the student each day.

Figure 8



Calculate the total distance travelled by the student.

Use **Figure 8**.

[2 marks]

Total distance travelled = _____ km

11