Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname ____________________

Forename(s) ____________________

Candidate signature ____________________
I declare this is my own work.

GCSE
COMBINED SCIENCE: TRILOGY

F

Foundation Tier
Physics Paper 2F

Friday 14 June 2024 Afternoon Time allowed: 1 hour 15 minutes

Materials
For this paper you must have:
- a protractor
- a ruler
- a scientific calculator
- the Physics Equations Sheet (enclosed).

Instructions
- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information
- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

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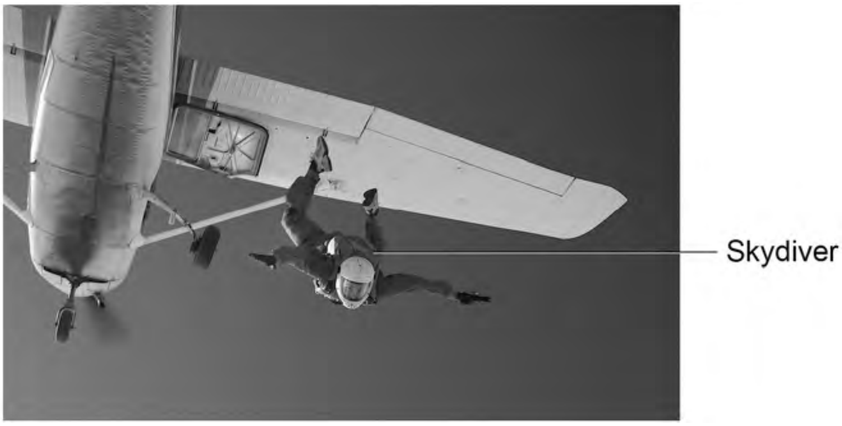
0 1 **Figure 1** shows a skydiver jumping from an aeroplane.

The skydiver is accelerating downwards.

Figure 1



0 1 . 1 Which force causes the skydiver to accelerate?

[1 mark]

Tick (✓) **one** box.

Electromagnetic force ☐

Gravitational force ☐

Magnetic force ☐

0 1 . 2 Which force increases as the skydiver accelerates?

[1 mark]

Tick (✓) **one** box.

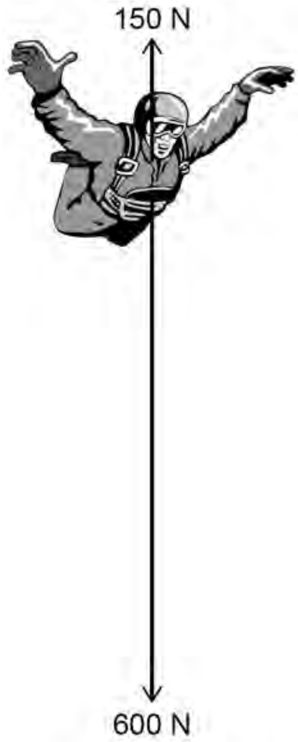
Air resistance ☐

Normal contact force ☐

Tension ☐

Figure 2 shows the two forces acting on the skydiver a few seconds after jumping from the aeroplane.

Figure 2



0 1 . 3 Calculate the resultant force acting on the skydiver in **Figure 2**.

[1 mark]

____

Resultant force = ________________________ N

Question 1 continues on the next page

0 1 . 4 Eventually the skydiver stops accelerating and falls at a constant velocity.

What is the resultant force acting on the skydiver when falling at a constant velocity?

[1 mark]

Tick (✓) **one** box.

0 N ☐

150 N ☐

600 N ☐

0 1 . 5 What name is given to the constant velocity of the skydiver?

[1 mark]

Tick (✓) **one** box.

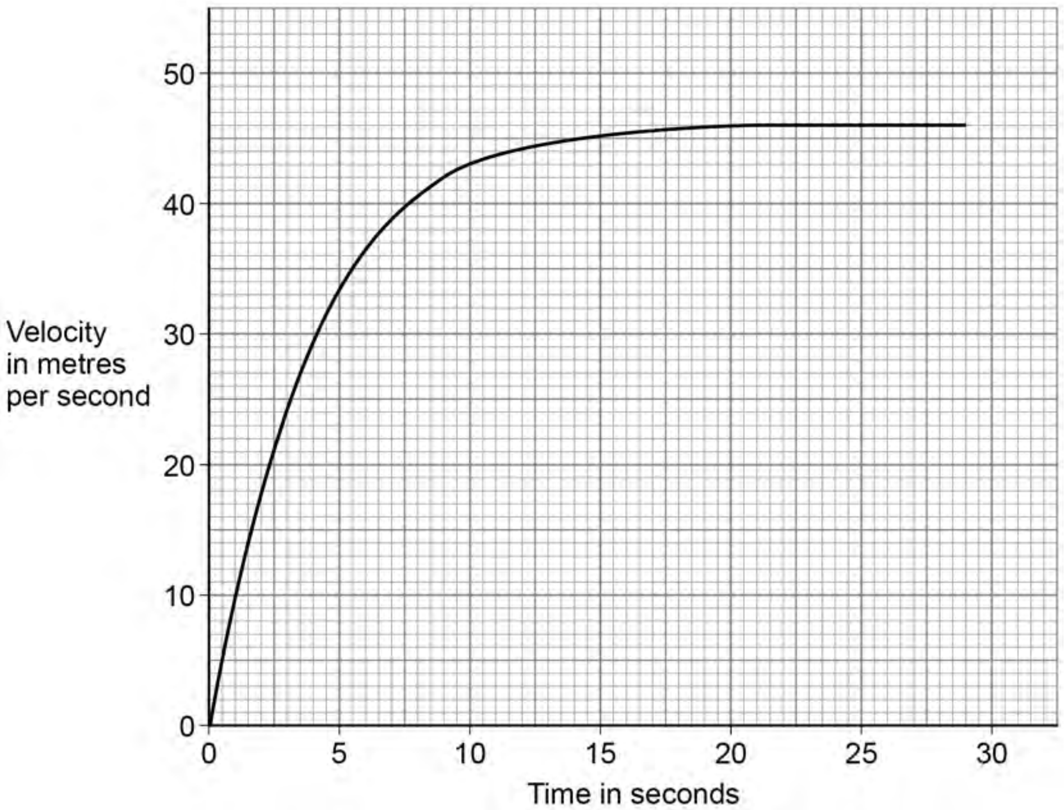
Average velocity ☐

Initial velocity ☐

Terminal velocity ☐

Figure 3 shows a velocity–time graph for the skydiver.

Figure 3



0 1 . 6 How many seconds did the skydiver accelerate for?

Use **Figure 3**.

[1 mark]

_______________________ s

0 1 . 7 What was the constant velocity of the skydiver?

Use **Figure 3**.

[1 mark]

_______________________ m/s

Turn over ►

Do not write outside the box

0 1 . 8 After opening a parachute, the skydiver fell at a constant speed of 3.6 m/s for 25 seconds.

Calculate the distance travelled by the skydiver during this time.

Use the equation:

distance travelled = speed × time

[2 marks]

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____

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Distance travelled = ____________________ m

9

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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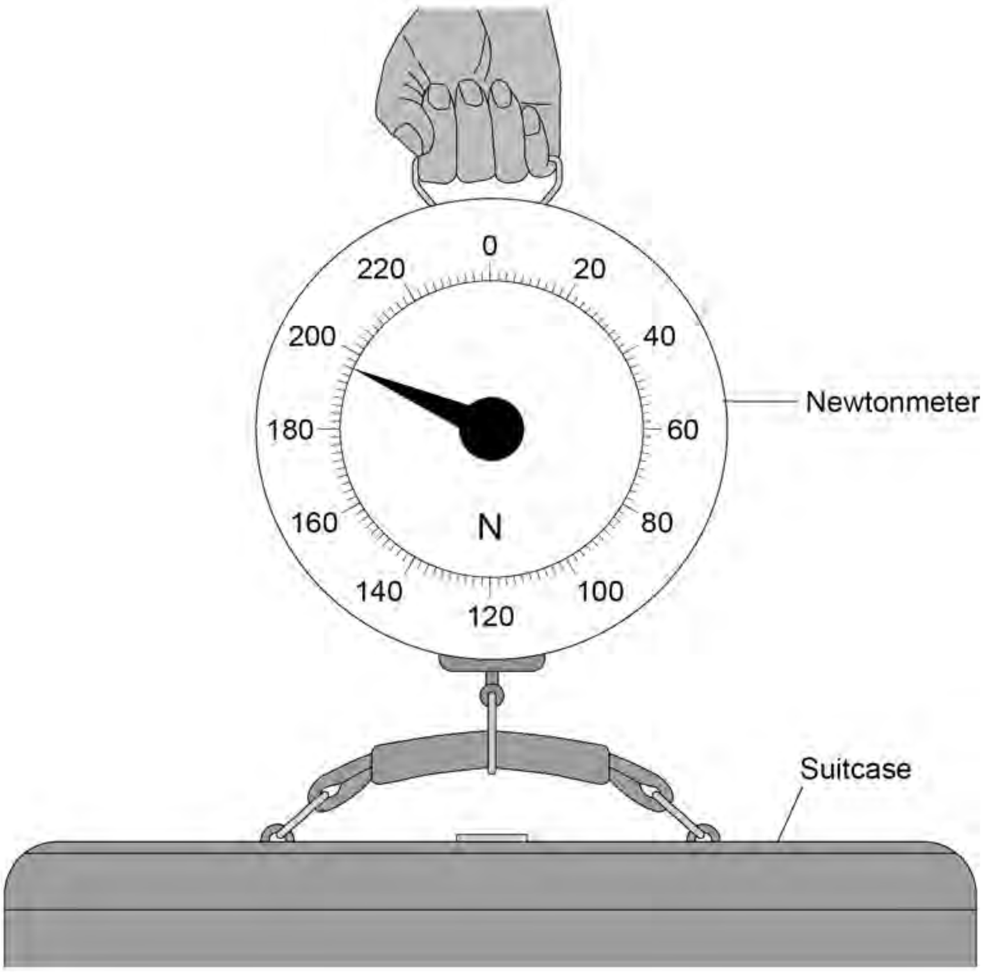
0 2 **Figure 4** shows a person using a newtonmeter to measure the weight of a suitcase.

Figure 4



There is a pair of forces acting between the suitcase and the newtonmeter.

0 2 . 1 How does the force on the suitcase compare with the force on the newtonmeter?

[1 mark]

Tick (✓) **one** box.

The force on the suitcase is smaller. ☐

The forces are the same size. ☐

The force on the suitcase is bigger. ☐

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0 2 . 2 Which sentence describes the directions in which the pair of forces act?

[1 mark]

Tick (✓) **one** box.

They act in opposite directions. ☐

They act in the same direction. ☐

They act in perpendicular directions. ☐

0 2 . 3 What is the weight of the suitcase shown on the newtonmeter in **Figure 4**?

[1 mark]

Weight = ______________________ N

0 2 . 4 Calculate the mass of the suitcase.

gravitational field strength = 9.8 N/kg

Use your answer from Question **02.3** and the equation:

$$\text{mass} = \frac{\text{weight}}{\text{gravitational field strength}}$$

[2 marks]

____

____

____

Mass = ______________________ kg

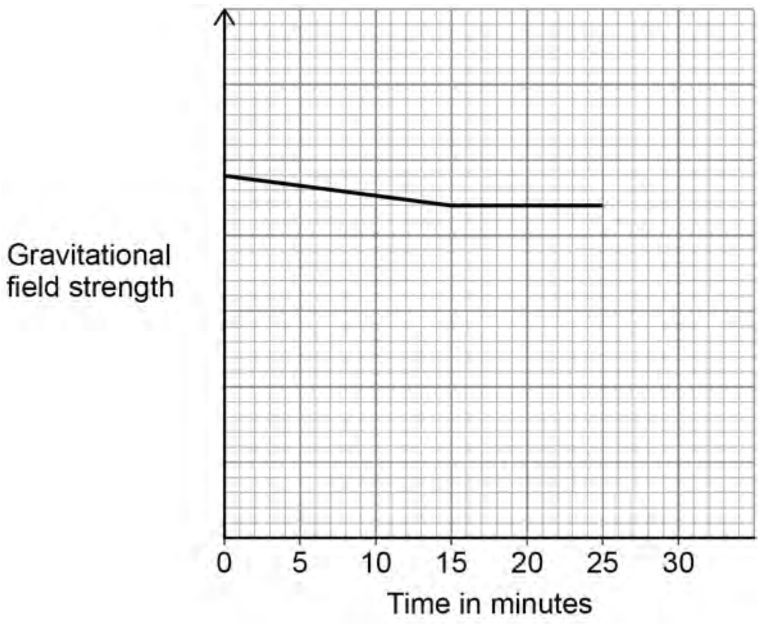
Question 2 continues on the next page

Do not write outside the box

0 2 . 5 The suitcase is loaded into an aeroplane. The aeroplane takes off and its height above the ground increases. The aeroplane then flies at a constant height.

Figure 5 shows how the gravitational field strength in the aeroplane varies for the first 25 minutes of the flight.

Figure 5



Describe how the weight of the suitcase will change during the first 25 minutes of the flight.

Use **Figure 5**.

[3 marks]

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8

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0 3 **Figure 6** shows an electronic whistle used by a referee in a football match.

Figure 6

When the button is pressed the whistle emits sound waves that travel through the air.

0 3 . 1 What is transferred by the sound waves as they travel through the air?

[1 mark]

Tick (✓) **one** box.

Energy ☐

Mass ☐

Temperature ☐

Question 3 continues on the next page

0 3 . 2 What is a typical value for the speed of sound in air?

[1 mark]

Tick (✓) **one** box.

33 m/s ☐

330 m/s ☐

3300 m/s ☐

33 000 m/s ☐

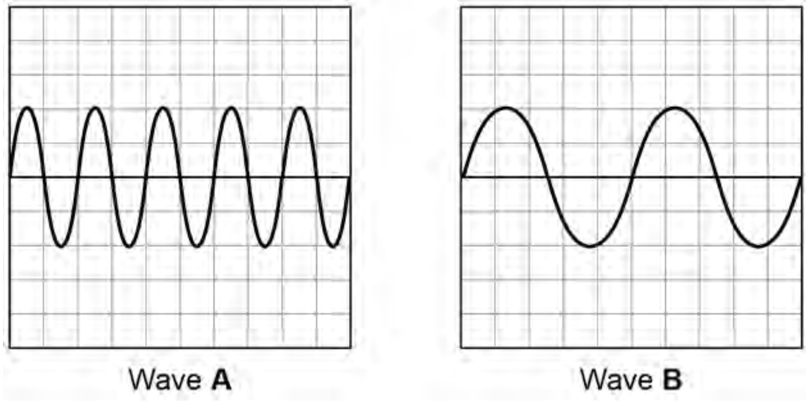
Do not write outside the box

The whistle can emit two different sound waves, **A** and **B**.

Figure 7 shows the two different sound waves as displayed on a screen.

The sound waves are drawn to the same scale.

Figure 7



0 3 . 3 Complete the sentences to describe a difference and a similarity between the two waves.

Choose answers from the box.

[2 marks]

amplitude	**frequency**	**wavelength**	**period**

Difference

Wave **A** has a greater ________________________ than wave **B**.

Similarity

Wave **A** has the same ________________________ as wave **B**.

Question 3 continues on the next page

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0 3 . 4 Wave **A** has a frequency of 4.0 kHz.

Which of the following is the same as 4.0 kHz?

[1 mark]

Tick (✓) **one** box.

4.0 Hz ☐

4000 Hz ☐

4 000 000 Hz ☐

4 000 000 000 Hz ☐

0 3 . 5 Calculate the period of wave **A**.

Use your answer from Question **03.4** and the equation:

$$\text{period} = \frac{1}{\text{frequency}}$$

[2 marks]

____

____

____

Period = ____________________ s

0 3 . 6 Sound waves in air are longitudinal waves.

Complete the sentence to describe a sound wave.

Choose answers from the box.

[2 marks]

compression	**deflection**	**diffraction**	**rarefaction**	**reflection**

When sound waves travel through air they create areas

of ______________________________ and ______________________________.

9

Turn over for the next question

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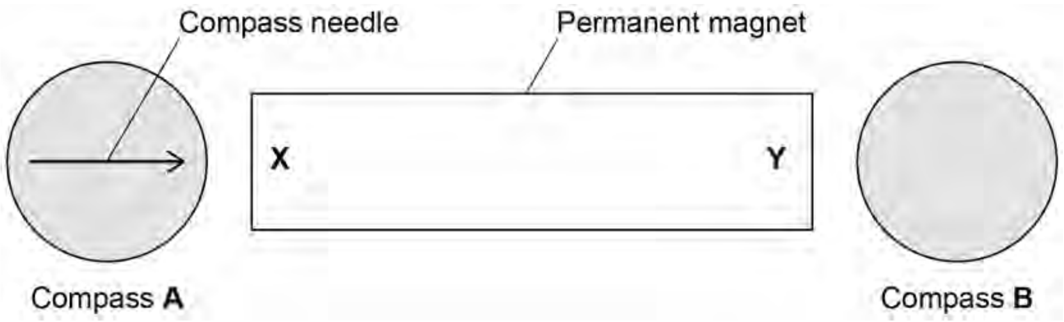
0 4 **Figure 8** shows a permanent magnet and two magnetic compasses.

The poles of the magnet are labelled **X** and **Y**.

Figure 8



0 4 . 1 The direction of the compass needle in compass **A** is shown.

Give the names of the poles labelled **X** and **Y** in **Figure 8**.

[2 marks]

X ____________________

Y ____________________

0 4 . 2 Draw an arrow on compass **B** in **Figure 8** to show the direction of the magnetic field at that position.

[1 mark]

Do not write outside the box

Figure 9 shows security tags on some clothes in a shop.

Security tags can be detected if clothes are taken out of the shop with tags still attached.

Figure 9

The tags are attached to the clothes by pins made from a magnetic material.

A shop assistant can use a magnet to remove the pins.

0 4 . 3 Which of the following are magnetic materials?

[2 marks]

Tick (✓) **two** boxes.

Aluminium ☐

Copper ☐

Iron ☐

Lead ☐

Nickel ☐

Tin ☐

Do not write outside the box

0 4 . 4 Which of the following describes the force between a magnetic material and a magnet?

[1 mark]

Tick (✓) **one** box.

The force is always attractive. ☐

The force is always repulsive. ☐

The force can be either attractive or repulsive. ☐

0 4 . 5 The shop assistant removes a security tag and drops the tag into a collecting bin.

As it falls, the tag accelerates at 9.8 m/s^2.

The mass of the tag is 0.030 kg.

Calculate the resultant force acting on the tag.

Use the equation:

resultant force = mass × acceleration

[2 marks]

____

____

____

Resultant force = ________________ N

8

Do not write outside the box

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]

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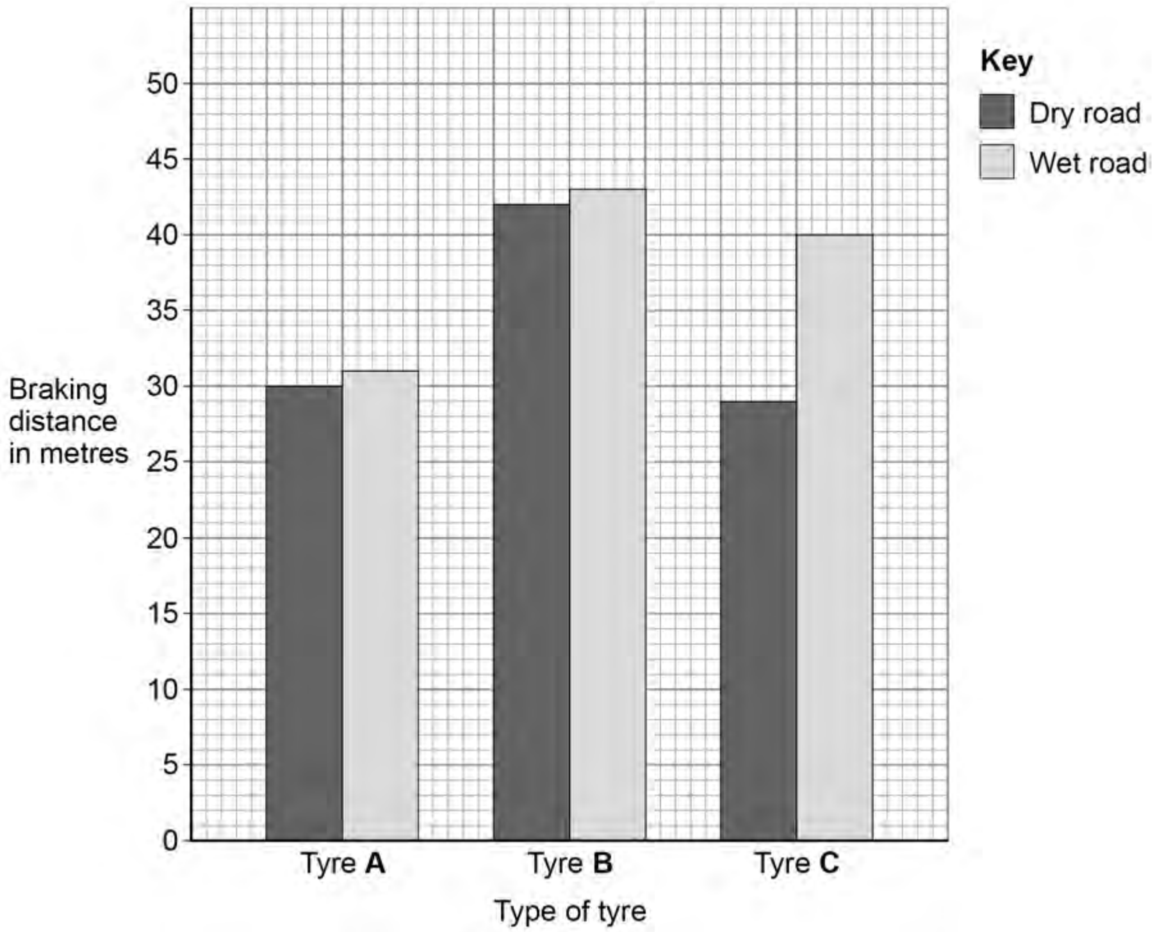
Figure 10 shows the results.

Figure 10



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

Do not write outside the box

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

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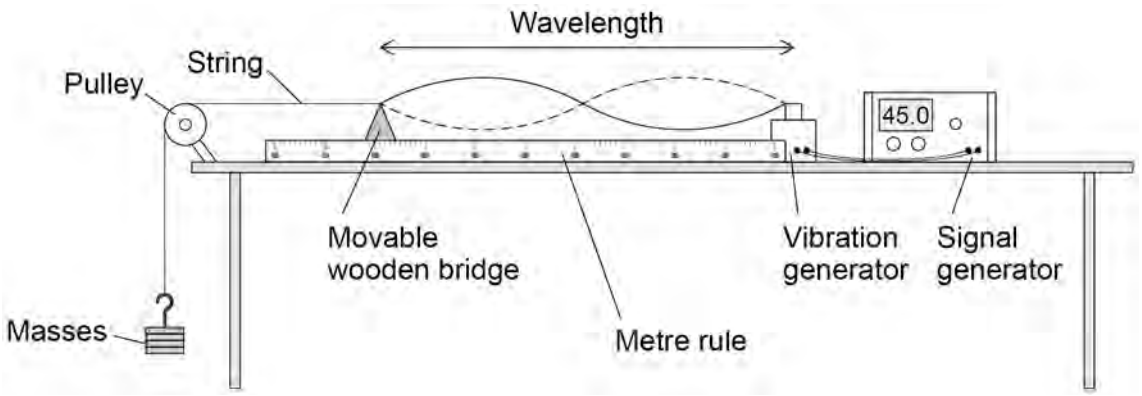
0 6 A teacher demonstrated how the frequency of a wave on a string affects the wavelength of the wave.

Figure 11 shows the equipment used.

Figure 11



The frequency of the signal generator is adjusted so that the wave shown in **Figure 11** is seen.

At this frequency the string vibrates between the two positions shown in **Figure 11**.

0 6 . 1 Describe a method the teacher could use to investigate how the frequency of the wave affects the wavelength.

[4 marks]

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Turn over ►

Do not write outside the box

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

0 6 . 2 Which equation links frequency (f), wavelength (λ) and wave speed (v)?

[1 mark]

Tick (✓) **one** box.

$f = \lambda \times v$ ☐

$\lambda = f \times v$ ☐

$v = f \times \lambda$ ☐

0 6 . 3 The wave on the string has a frequency of 45.0 Hz.

The wave speed is 35.1 m/s.

Calculate the wavelength of the wave.

[3 marks]

____

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____

____

Wavelength = ____________________ m

8

0 7 **Figure 12** shows an Olympic gymnast performing a floor routine.

Figure 12

The floor contains springs.

When the gymnast lands on the floor, a force compresses the springs in the floor.

0 7 . 1 When a spring is compressed, the elastic potential energy of the spring increases.

Explain why compressing the springs in the floor helps the gymnast to jump higher.

Use ideas about energy in your answer.

[2 marks]

Question 7 continues on the next page

Do not write outside the box

0 7 . 2 When the gymnast lands on the floor, one of the springs compresses by 1.2 cm.

spring constant = 8500 N/m

Calculate the elastic potential energy stored in the spring.

Use the Physics Equations Sheet.

Give the unit.

[4 marks]

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Elastic potential energy = ____________________ Unit __________

Do not write outside the box

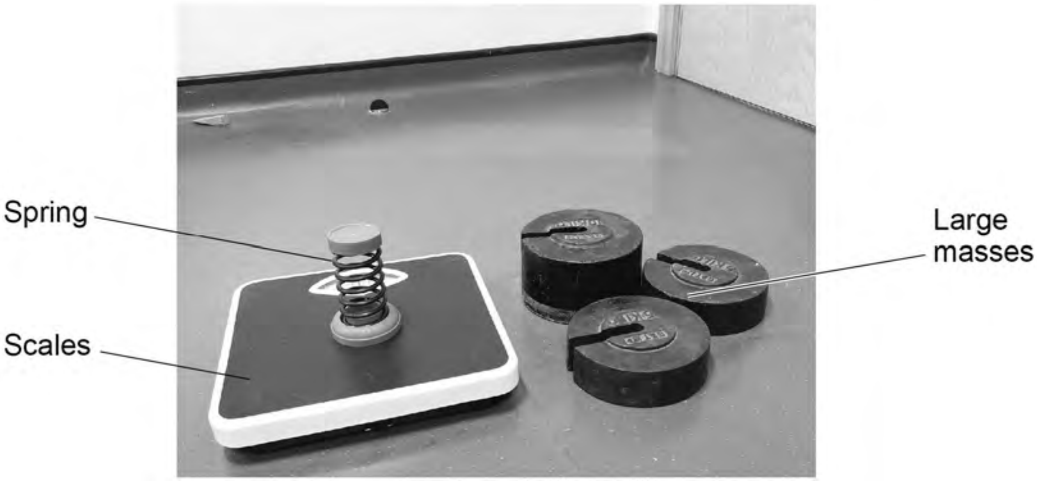
A student investigated a spring with a different spring constant.

When masses are placed on the spring it compresses.

The student measured the compression of the spring for different masses.

Figure 13 shows some of the equipment used.

Figure 13



0 7 . 3 Describe how the compression of the spring could be determined.

[2 marks]

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0 7 . 4 Explain why the investigation should be done on the laboratory floor rather than on a table.

[2 marks]

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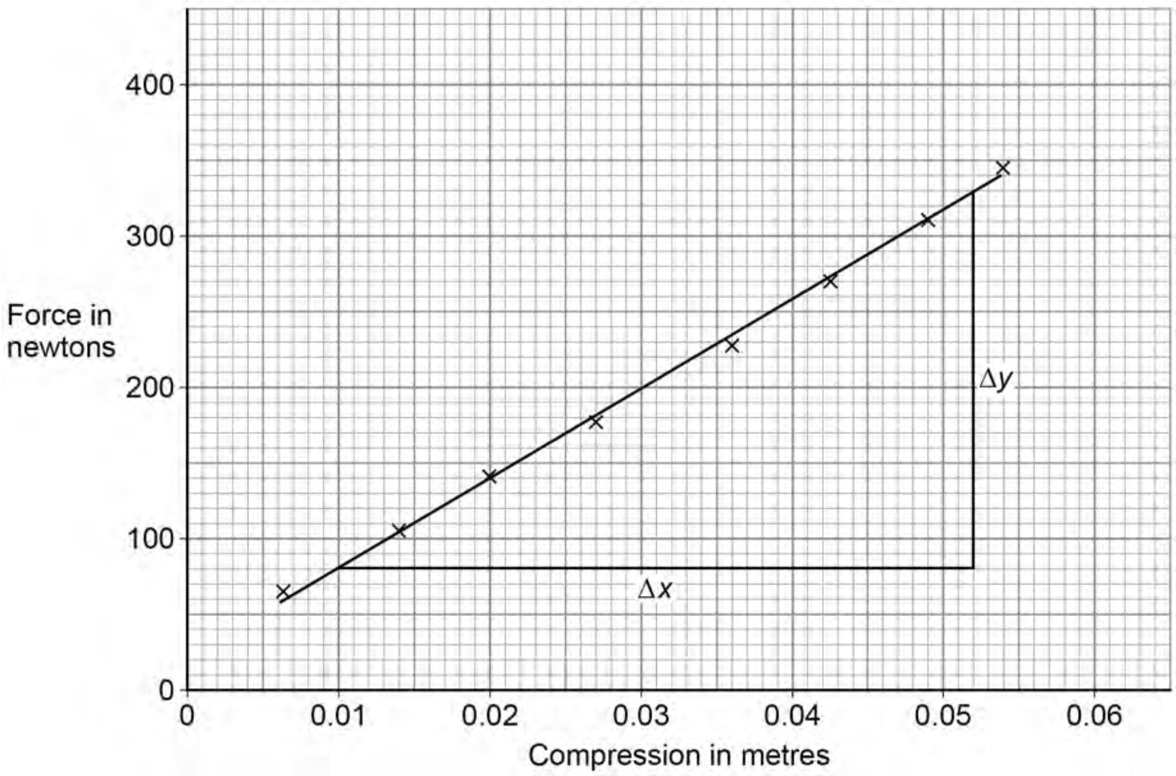
Figure 14 shows the results.

Figure 14



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The spring constant is the gradient of the line of best fit shown on **Figure 14**.

0 7 . 5 Determine the value Δy on **Figure 14**.

[1 mark]

____

Δy = ______________________ N

0 7 . 6 Determine the value Δx on **Figure 14**.

[1 mark]

____

Δx = ______________________ m

0 7 . 7 Determine the spring constant of the spring.

Use your answers to Question **07.5** and Question **07.6**.

Give your answer to 3 significant figures.

[2 marks]

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Spring constant (3 significant figures) = ______________________ N/m

14

END OF QUESTIONS

There are no questions printed on this page

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Question number	**Additional page, if required.** **Write the question numbers in the left-hand margin.**

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Question number	**Additional page, if required. Write the question numbers in the left-hand margin.**