Please write clearly in block capitals.

Centre number [ ][ ][ ][ ][ ]   Candidate number [ ][ ][ ][ ]

Surname ____________________

Forename(s) ____________________

Candidate signature ____________________
I declare this is my own work.

GCSE PHYSICS

Higher Tier Paper 2

H

Time allowed: 1 hour 45 minutes

Materials
For this paper you must have:
- a ruler
- a scientific calculator
- a protractor
- 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.
- Do not write outside the box around each page or on blank pages.
- 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 100.
- 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	
8	
9	
TOTAL	

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ANSWER IN THE SPACES PROVIDED

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Answer **all** questions in the spaces provided.

0 1 The thinking distance and braking distance for a car vary with the speed of the car.

0 1 . 1 Explain the effect of **two** other factors on the **braking** distance of a car.

Do **not** refer to speed in your answer.

[4 marks]

Question 1 continues on the next page

Do not write outside the box

0 1 . 2 Which equation links acceleration (a), mass (m) and resultant force (F).

[1 mark]

Tick (✓) **one** box.

resultant force = mass × acceleration ☐

resultant force = mass × acceleration^2 ☐

resultant force = $\frac{\text{mass}}{\text{acceleration}^2}$ ☐

resultant force = $\frac{\text{mass}}{\text{acceleration}}$ ☐

0 1 . 3 The mean braking force on a car is 7200 N.

The car has a mass of 1600 kg.

Calculate the deceleration of the car.

[3 marks]

____

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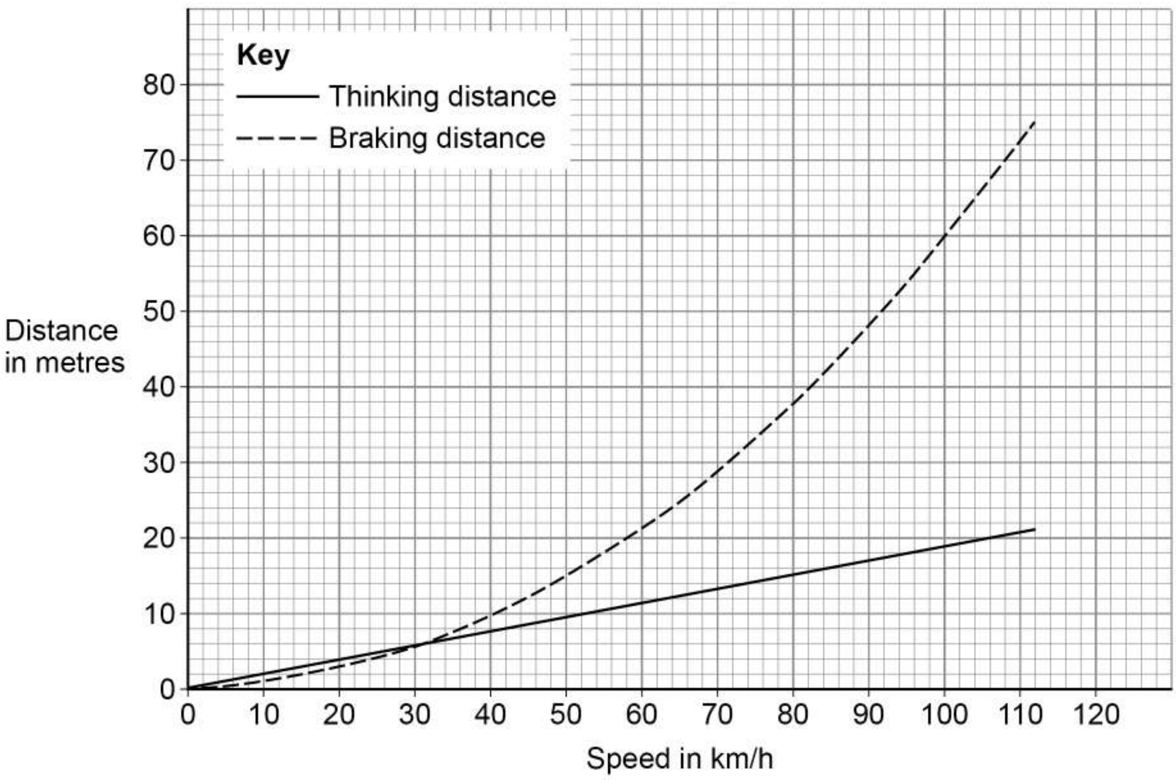
____

Deceleration = ________________ m/s^2

Do not write outside the box

0 1 . 4 **Figure 1** shows how the thinking distance and braking distance for a car vary with the speed of the car.

Figure 1



Determine the stopping distance when the car is travelling at 80 km/h.

[2 marks]

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____

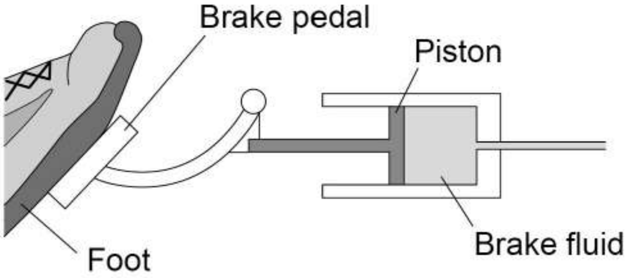
Stopping distance = ________________ m

Question 1 continues on the next page

Do not write outside the box

Figure 2 shows part of the braking system for a car.

Figure 2



0 1 . 5 Which equation links area of a surface (A), the force normal to that surface (F) and pressure (p).

[1 mark]

Tick (✓) **one** box.

$p = F \times A$ ☐

$p = F \times A^2$ ☐

$p = \frac{F}{A}$ ☐

$p = \frac{A}{F}$ ☐

Do not write outside the box

0 1 . 6 When the brake pedal is pressed, a force of 60 N is applied to the piston.

The pressure in the brake fluid is 120 000 Pa.

Calculate the surface area of the piston.

Give your answer in standard form.

Give the unit.

[5 marks]

Surface area (in standard form) = ____________________ Unit ____________

16

Turn over for the next question

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED

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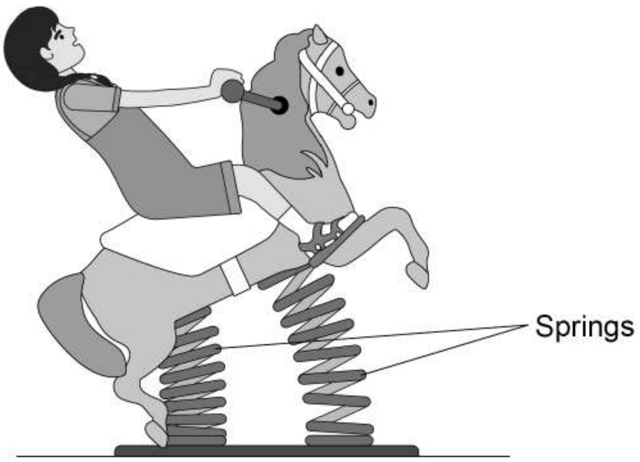
0 2 **Figure 3** shows a child on a playground toy.

Figure 3



0 2 . 1 The springs have been elastically deformed.

Explain what is meant by 'elastically deformed'.

[2 marks]

____

____

____

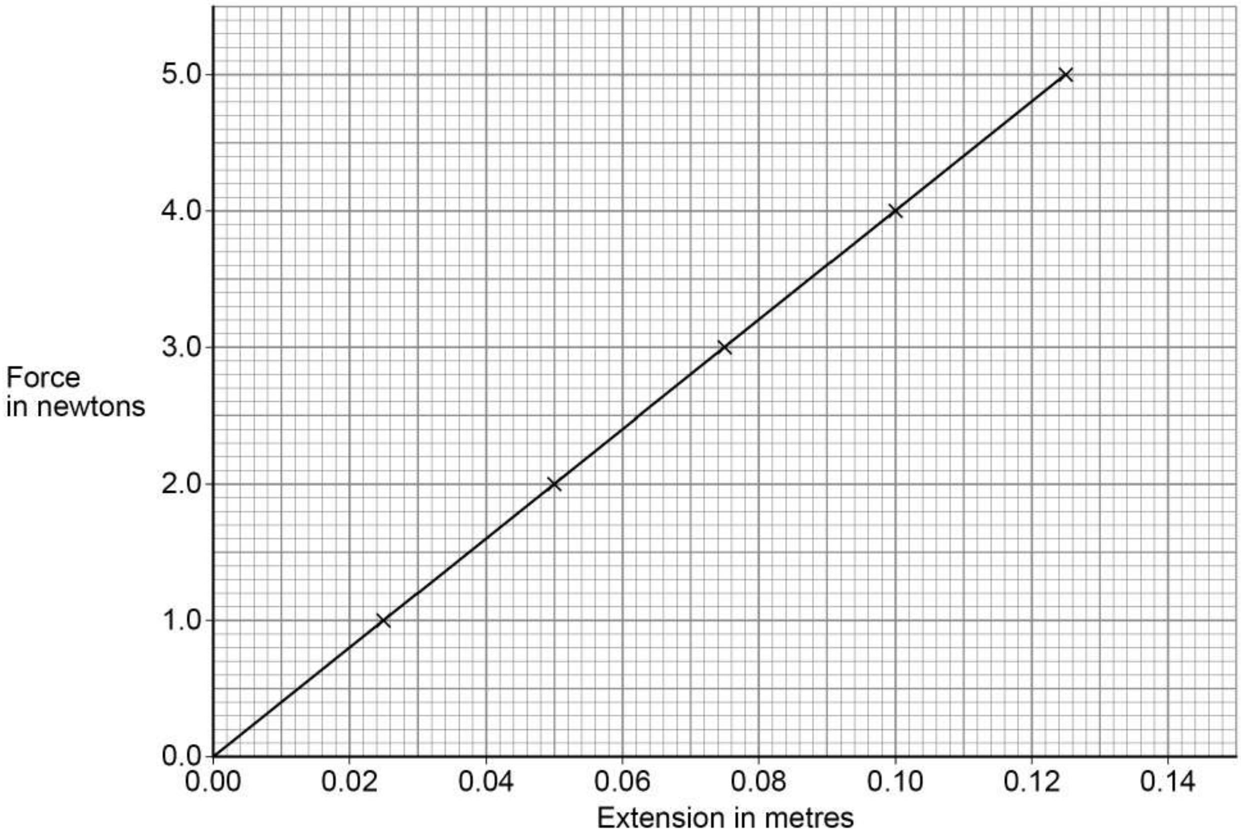
____

Question 2 continues on the next page

A student investigated the relationship between the force applied to a spring and the extension of the spring.

Figure 4 shows the results.

Figure 4



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0 2 . 2 Describe a method the student could use to obtain the results given in **Figure 4**.

You should include a risk assessment for **one** hazard in the investigation.

Your answer may include a diagram.

[6 marks]

Question 2 continues on the next page

Do not write outside the box

0 2 . 3 Which equation links extension (e), force (F) and spring constant (k).

[1 mark]

Tick (✓) **one** box.

force = spring constant × (extension)^2 ☐

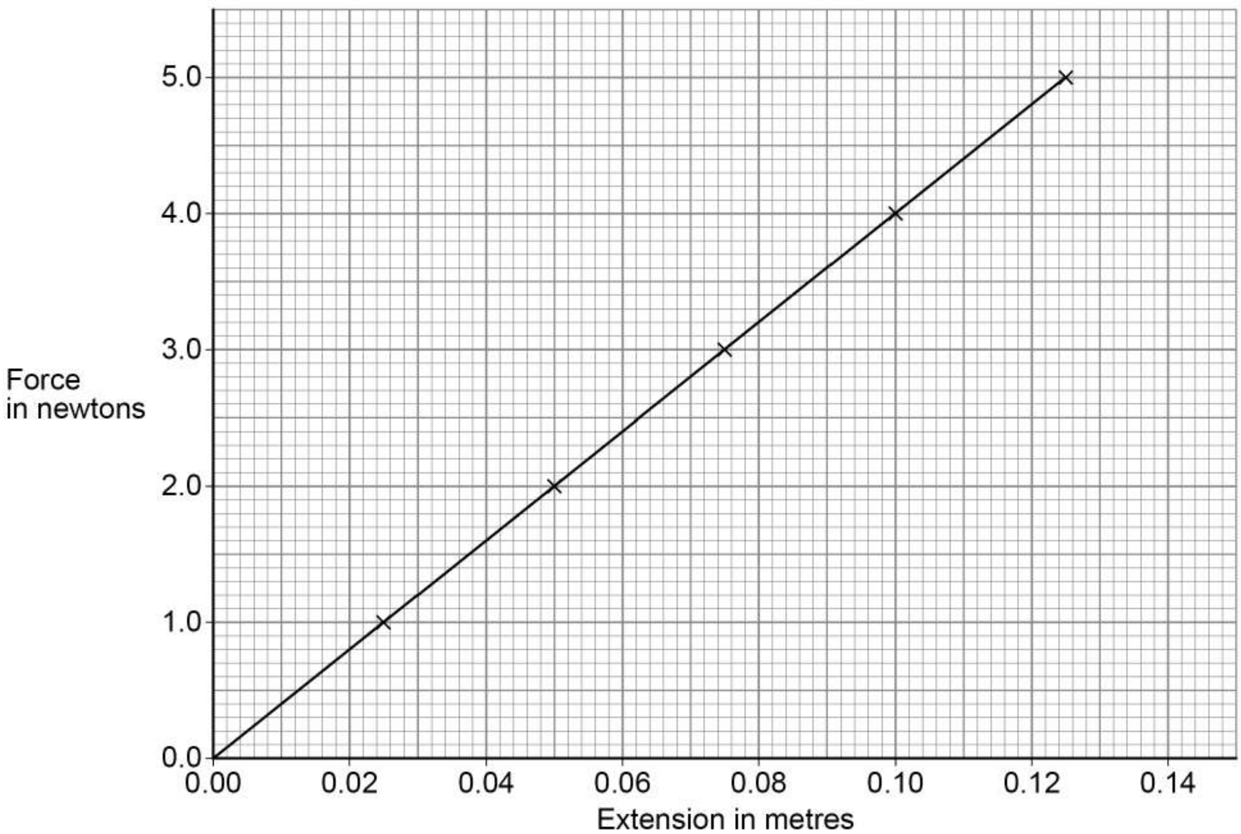
force = spring constant × extension ☐

force = $\frac{\text{extension}}{\text{spring constant}}$ ☐

force = $\frac{\text{spring constant}}{\text{extension}}$ ☐

Figure 4 is repeated below.

Figure 4



0 2 . 4 Determine the spring constant of the spring.

Use **Figure 4**.

[3 marks]

Spring constant = ____________________ N/m

0 2 . 5 The student concluded:

'The extension of the spring is directly proportional to the force applied to the spring.'

Describe how **Figure 4** supports the student's conclusion.

[2 marks]

Question 2 continues on the next page

Do not write outside the box

0 2 . 6 The student repeated the investigation using a different spring with a spring constant of 13 N/m.

Calculate the elastic potential energy of the spring when the extension of the spring was 20 cm.

Use the Physics Equations Sheet.

[3 marks]

Elastic potential energy = ________________ J

17

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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0 3 A main sequence star in a distant galaxy is the same size and mass as the Sun.

0 3 . 1 Explain why the star is stable while it is in the main sequence stage of its life cycle.

[2 marks]

0 3 . 2 Describe what will happen to the star between the main sequence stage and the end of the star's life cycle.

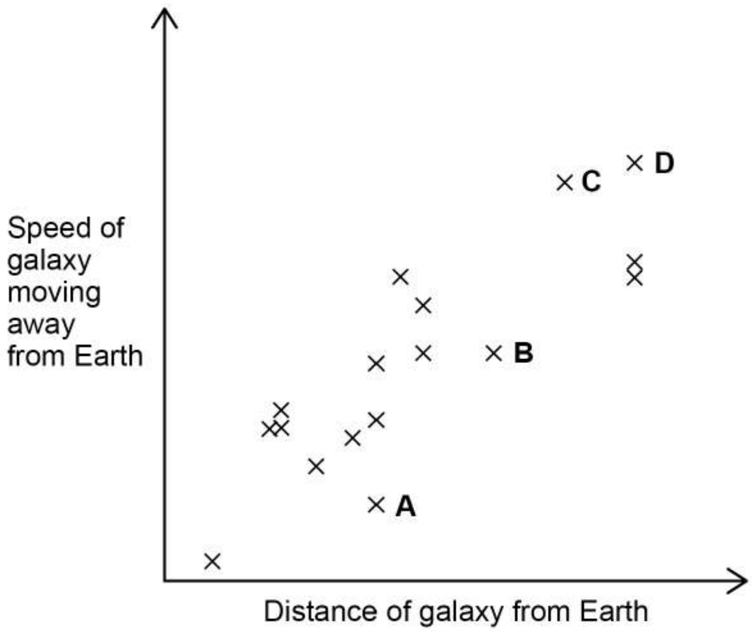
You should include the names of the stages in the life cycle of the star.

[3 marks]

Do not write outside the box

0 3 . 3 **Figure 5** shows how the speed of galaxies moving away from Earth varies with the distance of the galaxies from Earth.

Figure 5



Which galaxy would show the smallest observed change in the wavelength of visible light?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

Reason ____

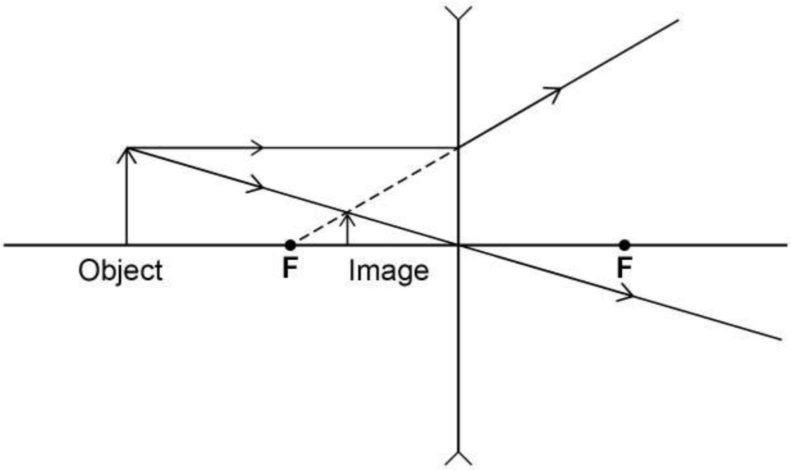
____

7

0 4 Lenses are used to form images of objects.

0 4 . 1 **Figure 6** shows how a concave lens forms an image of an object.

Figure 6



The image of the object in **Figure 6** is upright.

Give **two** other words that describe the image.

[1 mark]

1 ____

2 ____

Do not write outside the box

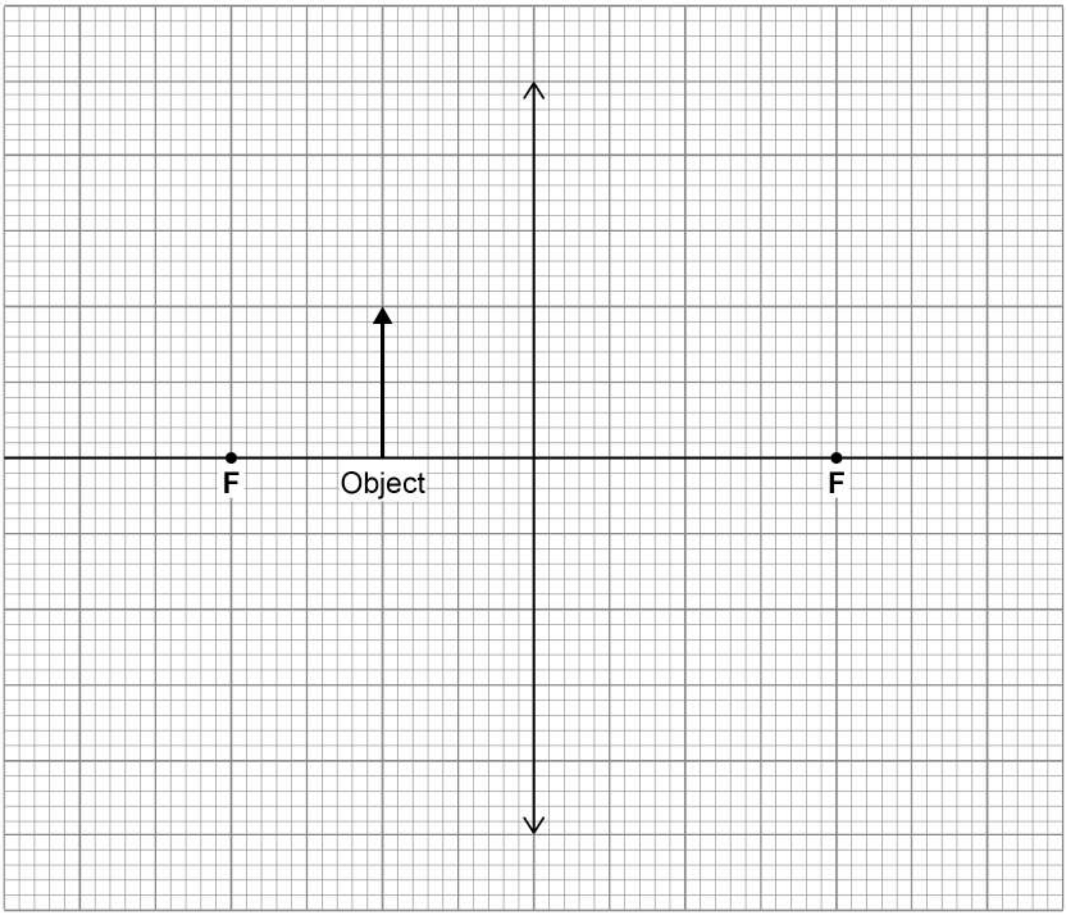
0 4 . 2 **Figure 7** shows an object near to a **convex** lens.

Complete the ray diagram to show how the image is formed.

Use an arrow to represent the image.

[3 marks]

Figure 7

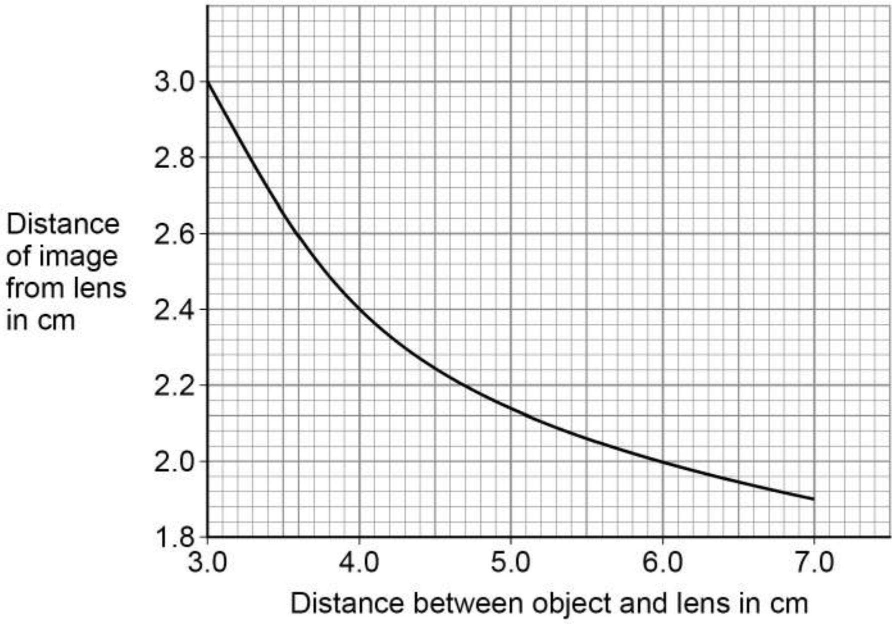


Question 4 continues on the next page

The position of an image formed by a convex lens varies with the distance between the object and the lens.

Figure 8 shows the results of a student's investigation using a convex lens.

Figure 8



0 4 . 3 Describe how the distance of the image from the lens decreases as the distance between the object and the lens increases.

[1 mark]

____

____

Do not write outside the box

0 4 . 4 The student measured the distance from the image to the lens four times.

The distance between the object and the lens did not change.

The 4 measurements from the image to the lens were:

1.9 cm 1.7 cm 2.2 cm 1.4 cm

Calculate the uncertainty in the measurements.

[2 marks]

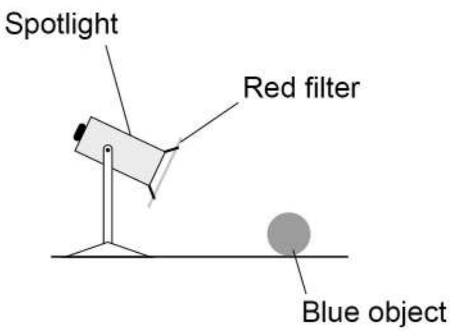
Uncertainty = ± ____________ cm

0 4 . 5 **Figure 9** shows a spotlight containing a convex lens.

A red filter is placed in front of the spotlight.

The spotlight is directed at a blue object.

Figure 9



Explain why the blue object appears black.

[3 marks]

10

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0 5 Ultraviolet is a type of electromagnetic wave.

0 5 . 1 Give **one** use of ultraviolet.

[1 mark]

____

0 5 . 2 An ultraviolet wave has a wavelength of 300 nanometres.

Which of the following is equal to 300 nanometres?

[1 mark]

Tick (✓) **one** box.

3×10^{7} m ☐

3×10^{-7} m ☐

3×10^{9} m ☐

3×10^{-9} m ☐

0 5 . 3 The speed of ultraviolet waves is 3×10^{8} m/s.

Calculate the frequency of the ultraviolet wave.

Use your answer to Question **05.2**

[3 marks]

____

____

____

____

____

Frequency = ____________________ Hz

Do not write outside the box

0 5 . 4 **Table 1** gives the wavelength of an ultraviolet wave and three other electromagnetic waves.

Table 1

	Ultraviolet	**Wave E**	**Wave F**	**Wave G**
Wavelength in nanometres	300	0.1	600	100 000

Draw **one** line from each wave to the name of the wave.

[1 mark]

Wave	**Name**
Wave E	Infrared
Wave F	Visible light
Wave G	X-rays

0 5 . 5 Electromagnetic waves are transverse.

Some other types of wave are longitudinal.

Describe the difference between transverse and longitudinal waves.

[2 marks]

____

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____

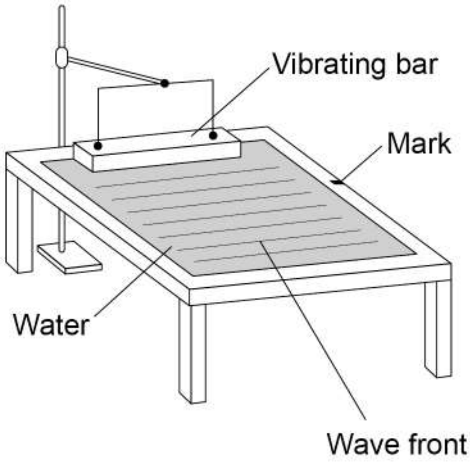
8

Do not write outside the box

0 6 A teacher demonstrated some features of waves using a ripple tank.

Figure 10 shows the ripple tank.

Figure 10



0 6 . 1 The teacher measured the time taken for 10 wave fronts to pass the mark.

The teacher repeated this measurement three times and calculated the mean.

What is the advantage of repeating measurements and calculating a mean?

[1 mark]

____

____

Do not write outside the box

0 6 . 2 The teacher's measurements for the time taken for 10 wave fronts to pass the mark were:

8.4 s 7.8 s 8.1 s

Calculate the mean frequency of the wave.

Give your answer to 2 significant figures.

[5 marks]

Mean frequency (2 significant figures) = ____________ Hz

0 6 . 3 In a different investigation, the teacher wanted to determine the speed of water waves in the ripple tank.

The teacher did **not** measure the wavelength of the wave.

Explain how the teacher could determine the speed of the wave.

[3 marks]

9

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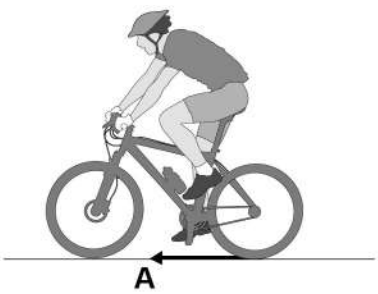
0 7 **Figure 11** shows a cyclist riding a bicycle.

Force **A** causes the bicycle to accelerate forwards.

Figure 11



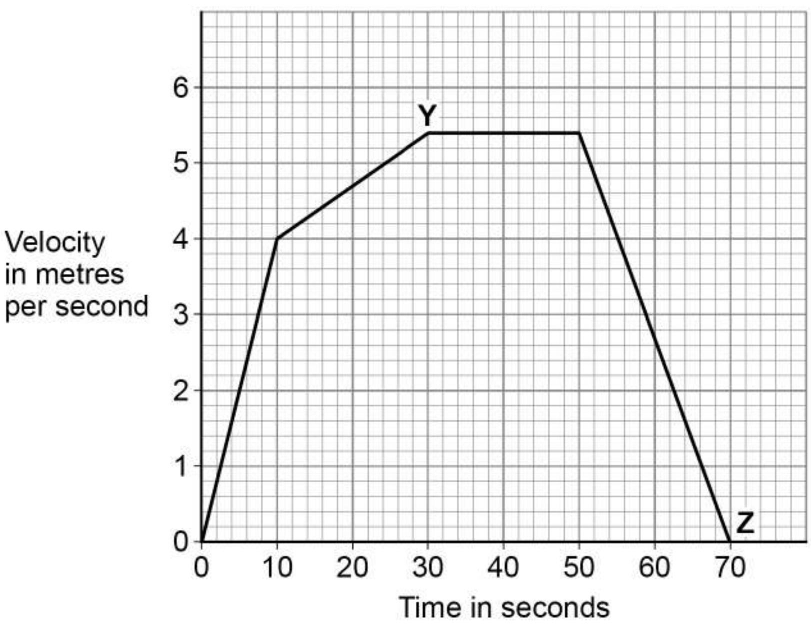
0 7 . 1 What name is given to force **A**?

[1 mark]

____

Figure 12 shows how the velocity of the cyclist changes during a short journey.

Figure 12



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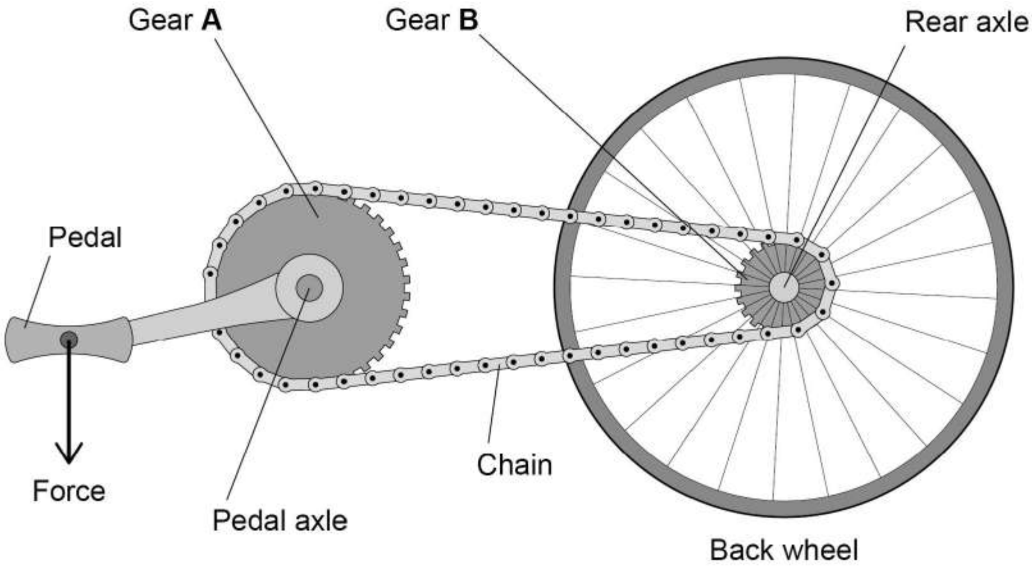
0 7 . 2 Determine the distance travelled by the cyclist between **Y** and **Z**.

[3 marks]

Distance travelled by the cyclist between **Y** and **Z** = ____________________ m

0 7 . 3 **Figure 13** shows the gears on the bicycle.

Figure 13



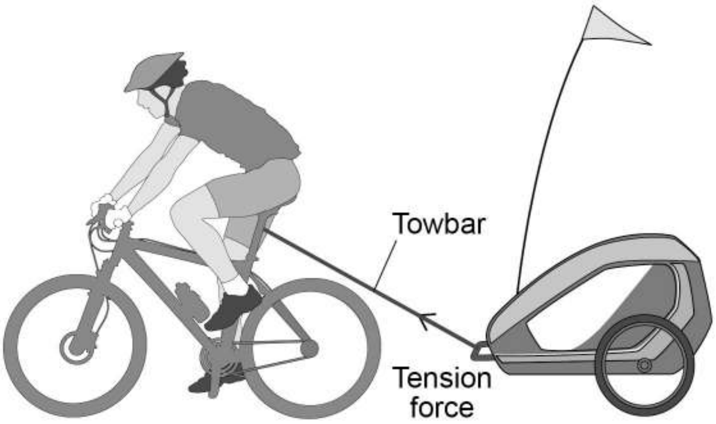
Describe how the force on the pedal causes a moment about the rear axle.

[2 marks]

Question 7 continues on the next page

Figure 14 shows a different cyclist towing a trailer.

Figure 14



0 7 . 4 The speed of the cyclist and trailer increased uniformly from 0 m/s to 2.4 m/s.

The cyclist travelled 0.018 km while accelerating.

Calculate the initial acceleration of the cyclist.

[3 marks]

Acceleration = ____________________ m/s^2

Do not write outside the box

0 7 . 5 The resultant force of the towbar on the trailer has a horizontal component and a vertical component.

horizontal force = 200 N

vertical force = 75 N

Determine the magnitude and direction of the resultant force of the towbar on the trailer by drawing a vector diagram.

[4 marks]

Magnitude of force = ________________ N

Direction of force = __________ degrees

13

Turn over for the next question

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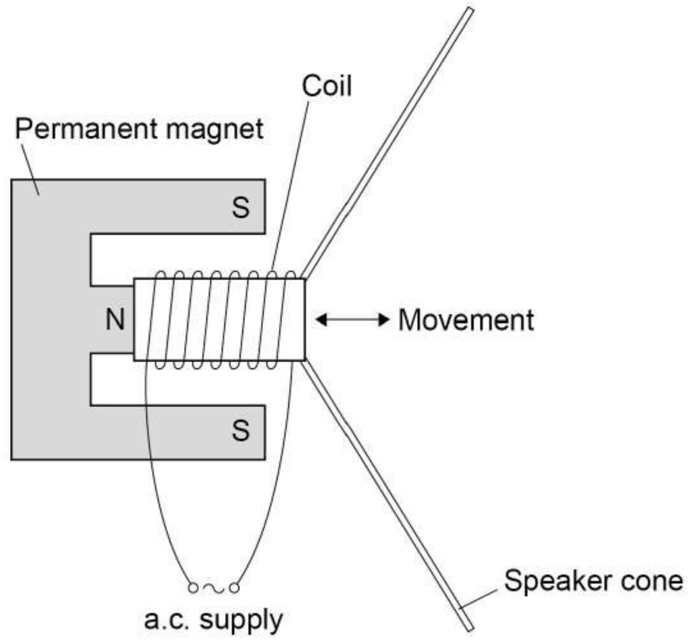
0 8 A student made a moving-coil loudspeaker.

Figure 15 shows a diagram of the loudspeaker.

Figure 15



0 8 . 1 What is the name of the effect used by the moving-coil loudspeaker to produce sound waves?

[1 mark]

____

Do not write outside the box

0 8 . 2 Explain how a moving-coil loudspeaker produces a sound wave.

[4 marks]

Question 8 continues on the next page

Do not write outside the box

0 8 . 3 A student investigated how the loudness of sound from the loudspeaker depends on:

- the number of turns on the coil
- the frequency of the supply.

Table 2 shows the results.

Table 2

Number of turns	Frequency of supply in Hz	Loudness of sound in arbitrary units
100	200	32
200	400	47
300	600	63

Explain why the results **cannot** be used to make a valid conclusion.

[2 marks]

7

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Turn over for the next question

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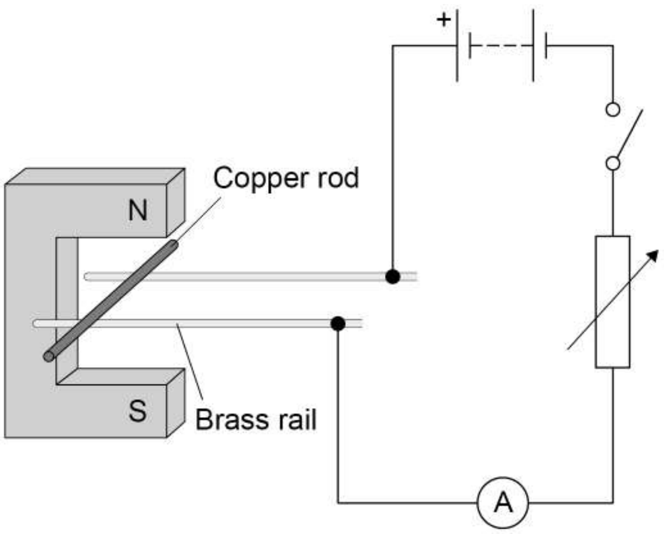
0 9 A teacher demonstrated how a magnetic field can cause a copper rod to accelerate.

The teacher placed the copper rod on two brass rails in a magnetic field.

The copper rod was able to move.

Figure 16 shows the equipment used.

Figure 16



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0 9 . 1 The teacher closes the switch and the copper rod accelerates.

Explain how Fleming's left hand rule can be used to predict the direction in which the copper rod will move.

[5 marks]

0 9 . 2 Suggest **two** changes to the equipment that would increase the force on the copper rod.

[2 marks]

1

2

Question 9 continues on the next page

Do not write outside the box

0 9 . 3 The teacher closed the switch and the copper rod accelerated uniformly from rest for 0.15 s.

The current in the copper rod was 1.7 A.

mass of copper rod = 4.0 g

length of copper rod in the magnetic field = 0.050 m

magnetic flux density = 0.30 T

Calculate the maximum possible velocity of the copper rod when it left the magnetic field.

[6 marks]

Maximum velocity = ____________ m/s

13

END OF QUESTIONS

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

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