A

Surname ____________________

Other Names ____________________

Centre Number ____________________

Candidate Number ____________________

Candidate Signature ____________________

I declare this is my own work.

GCSE
PHYSICS

H

Higher Tier

Paper 2

8463/2H

Time allowed: 1 hour 45 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

J U N 2 1 8 4 6 3 2 H 0 1

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.**
- **Answer ALL questions in the spaces provided.**
- **Do not write 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.**

DO NOT TURN OVER UNTIL TOLD TO DO SO

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]

[Turn over]

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 =** $\dfrac{\text{mass}}{\text{acceleration}^2}$

☐ **resultant force =** $\dfrac{\text{mass}}{\text{acceleration}}$

01.3

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]

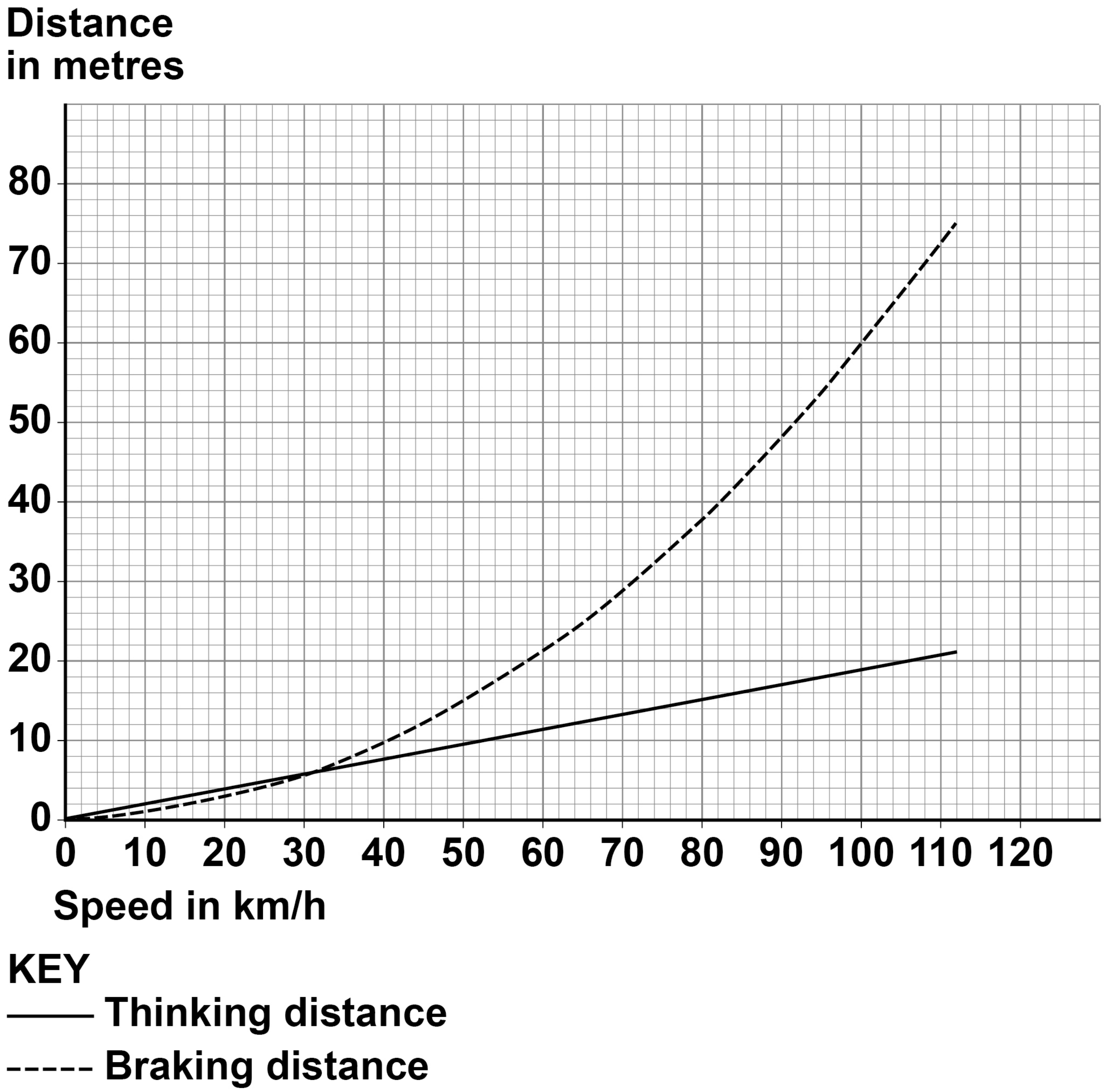
Deceleration = ______________________ m/s^2

[Turn over]

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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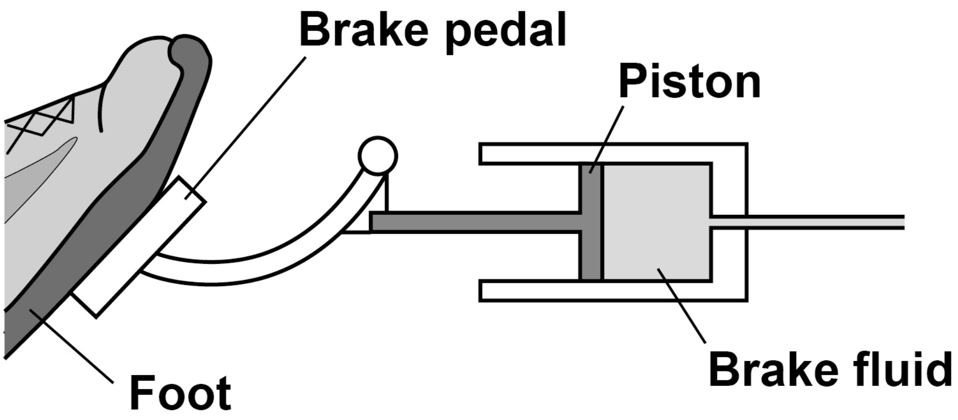
Stopping distance = ________________________ m

[Turn over]

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.

☐ $p = F \times A$

☐ $p = F \times A^2$

☐ $p = \frac{F}{A}$

☐ $p = \frac{A}{F}$

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[Turn over]

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 ______________________

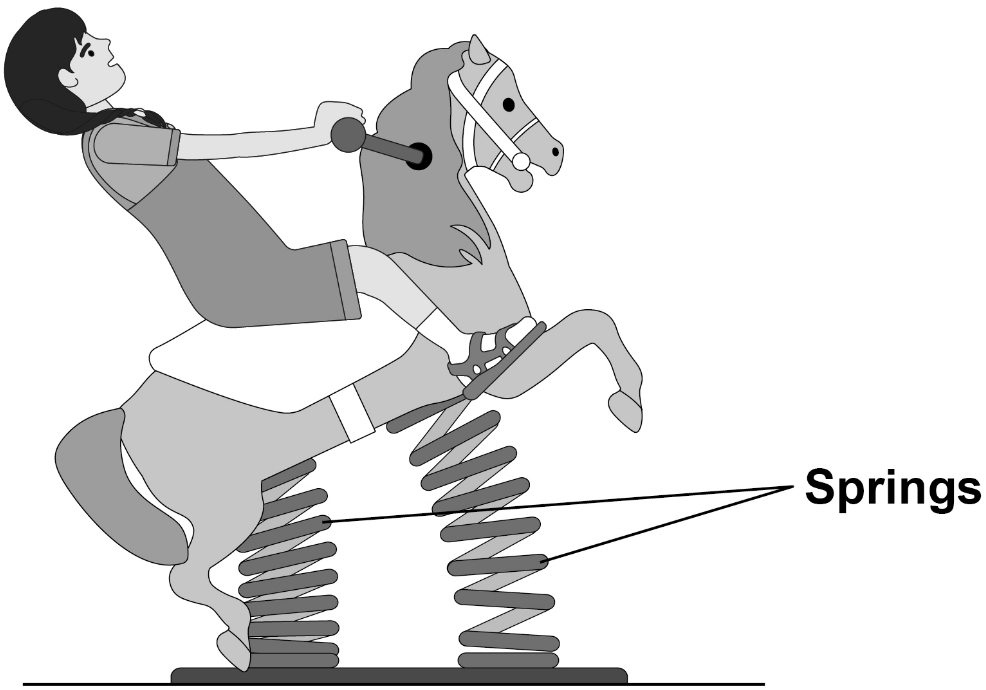
[Turn over]

16

0 2

FIGURE 3 shows a child on a playground toy.

FIGURE 3



0 2 . 1

The springs have been elastically deformed.

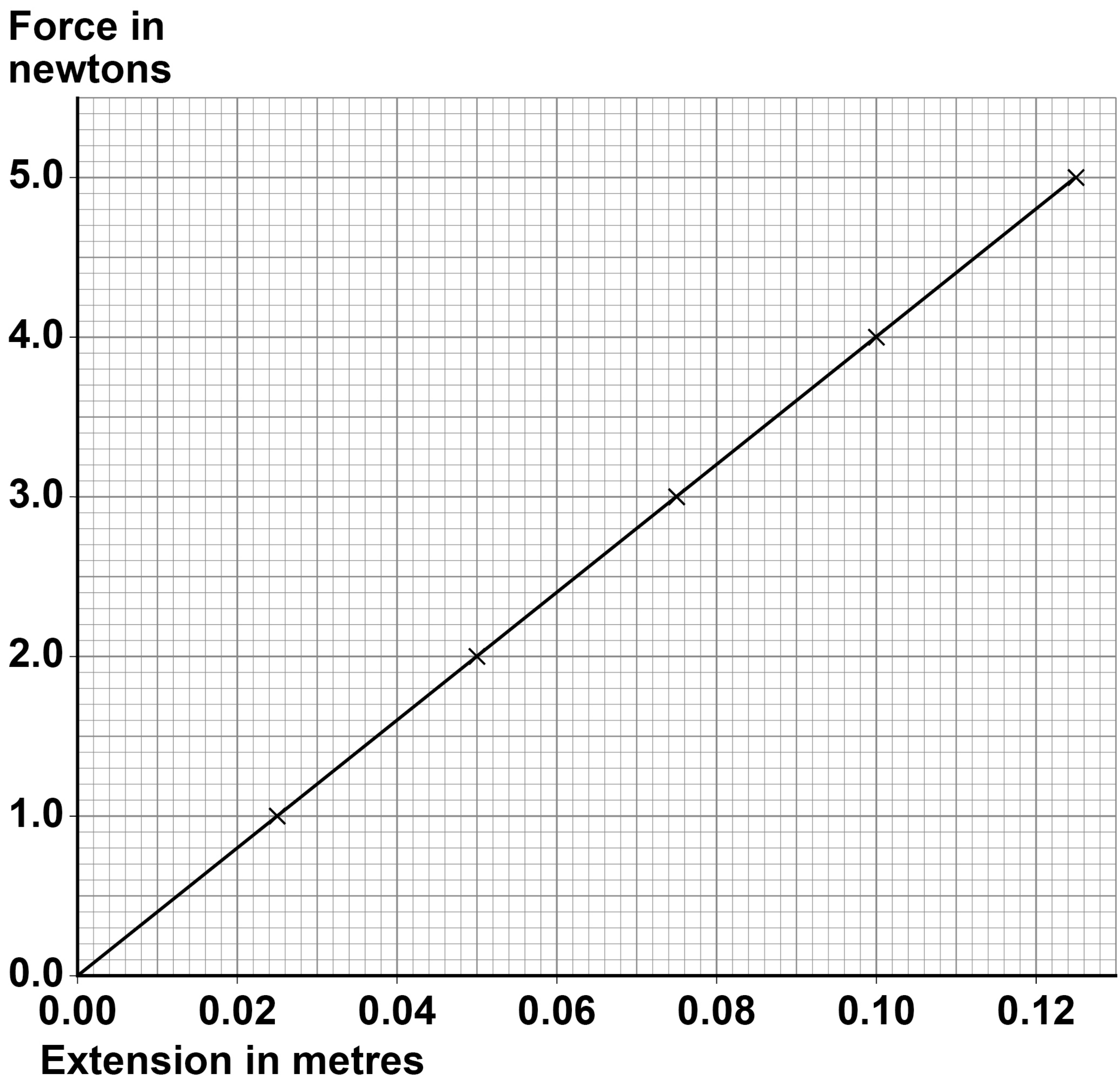
Explain what is meant by ‘elastically deformed’.
[2 marks]

[Turn over]

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



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]

[Turn over]

0 2 . 3

Which equation links extension (*e*), force (*F*) and spring constant (*k*). [1 mark]

Tick (✓) ONE box.

☐ force = spring constant × $(\text{extension})^2$

☐ force = spring constant × extension

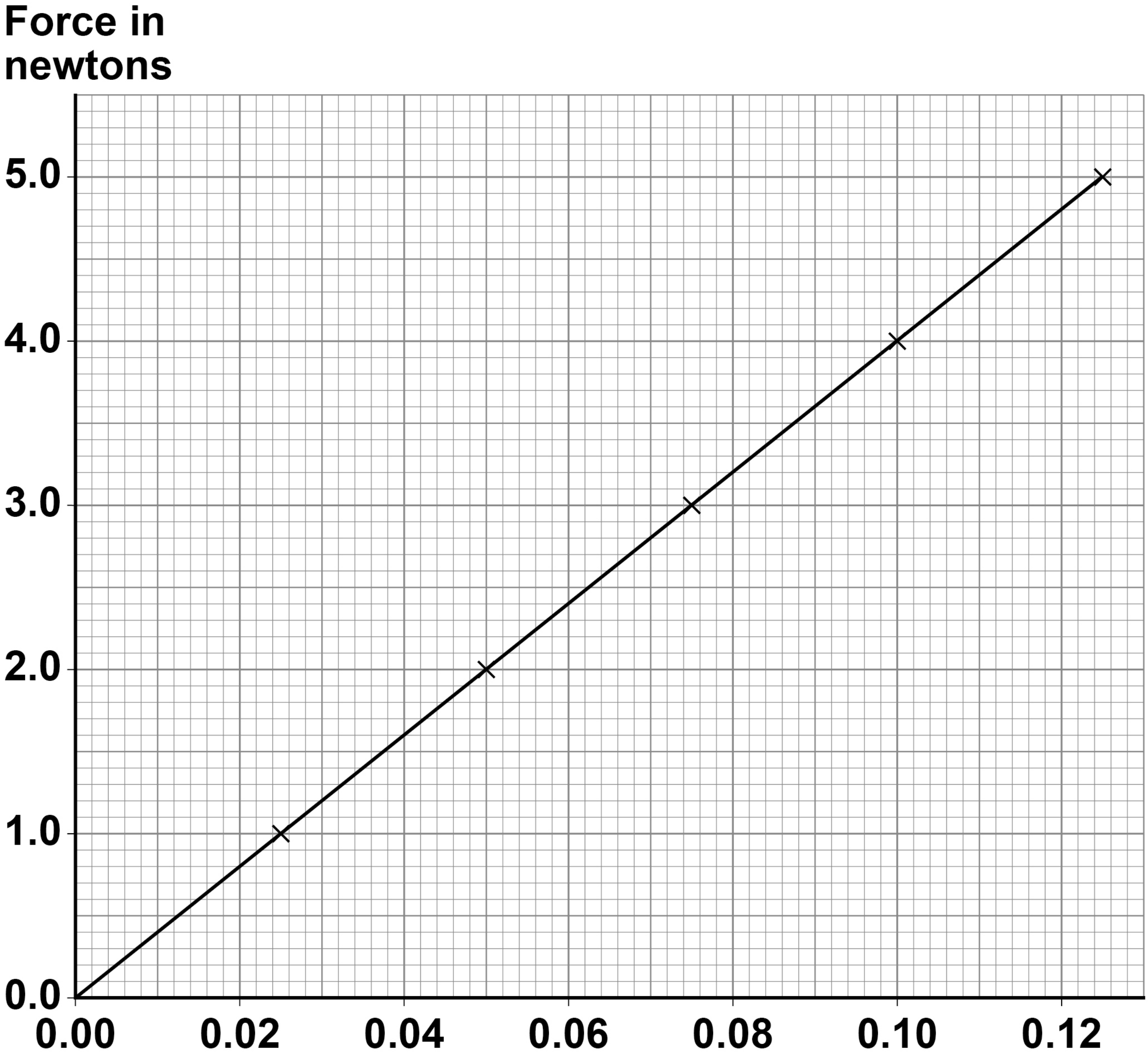
☐ force = $\dfrac{\text{extension}}{\text{spring constant}}$

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

[Turn over]

FIGURE 4 is repeated below.

FIGURE 4



0 2 . 4

Determine the spring constant of the spring.

Use FIGURE 4. [3 marks]

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Spring constant = ________________ N/m

[Turn over]

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, on page 20, supports the student's conclusion. [2 marks]

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]

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Elastic potential energy = ____________________ J

17

[Turn over]

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.

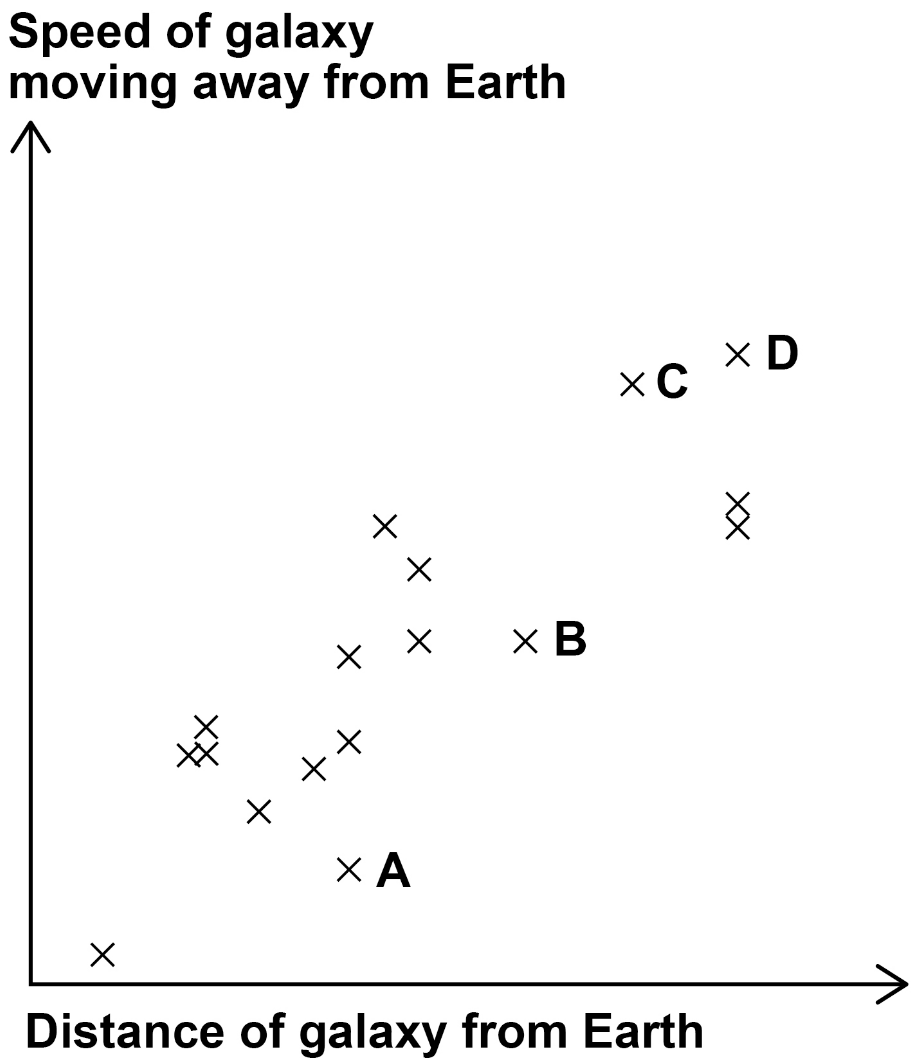
You should include the names of the stages in the life cycle of the star. [3 marks]

[Turn over]

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 ____

____

____

[Turn over]

__
7

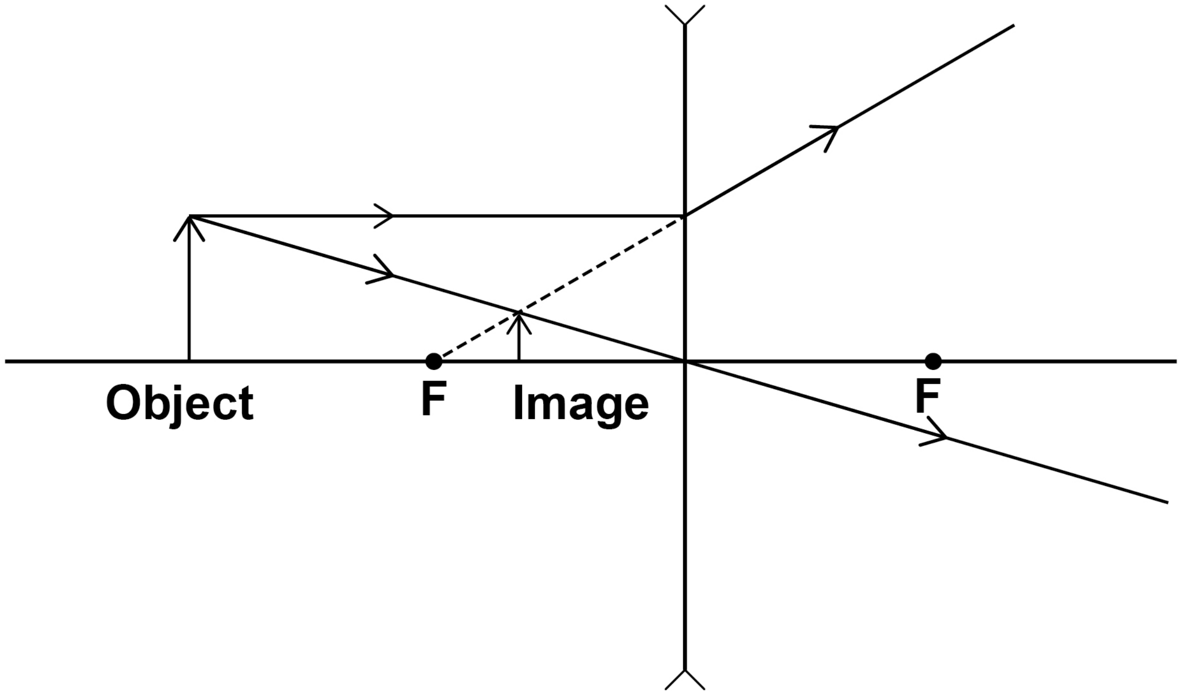
0 4

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 ____

[Turn over]

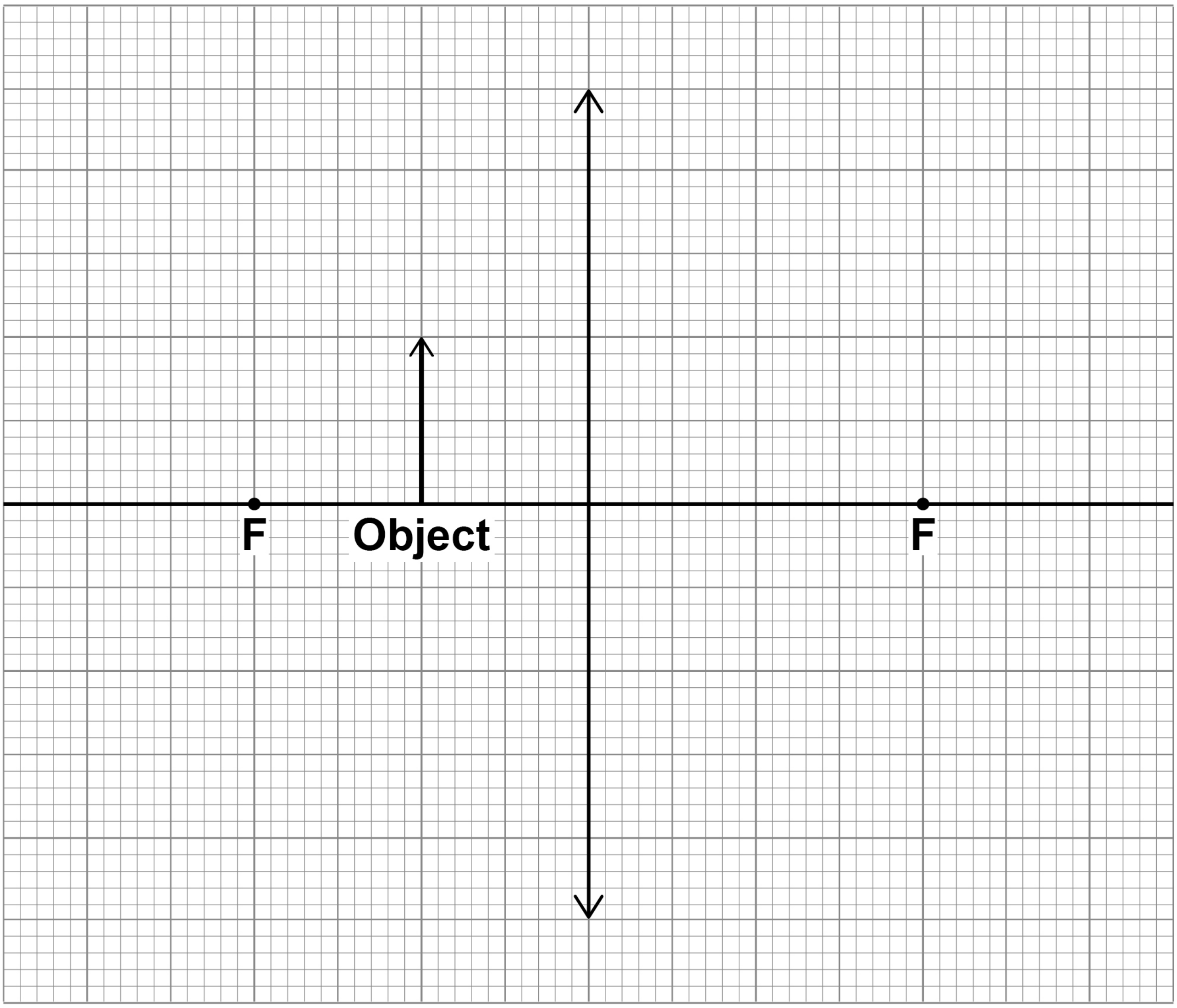
0 4 . 2

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



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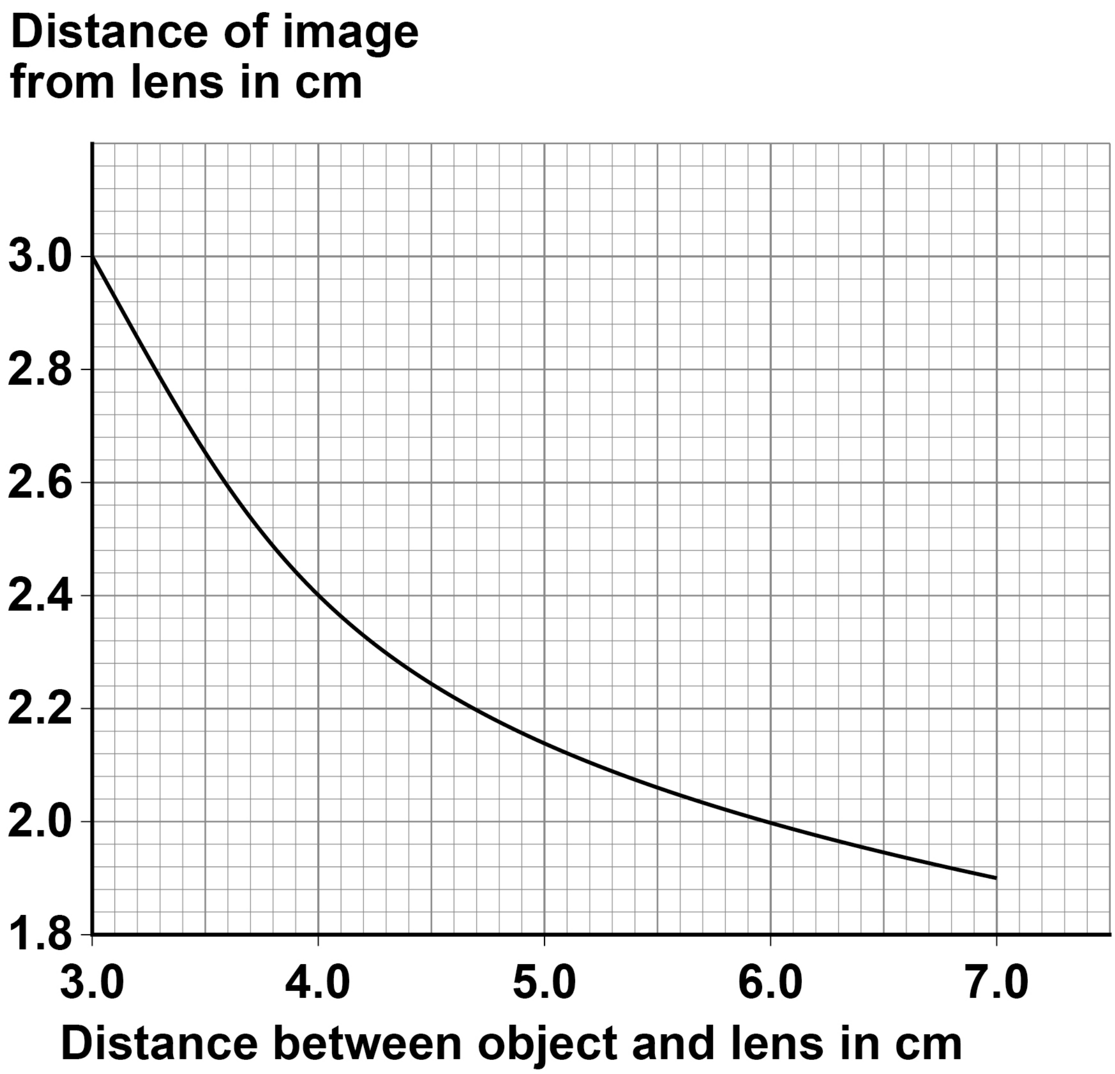
[Turn over]

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



04.3

Describe how the distance of the image from the lens decreases as the distance between the object and the lens increases. [1 mark]

[Turn over]

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]

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____

____

____

Uncertainty = ± ____________________ cm

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[Turn over]

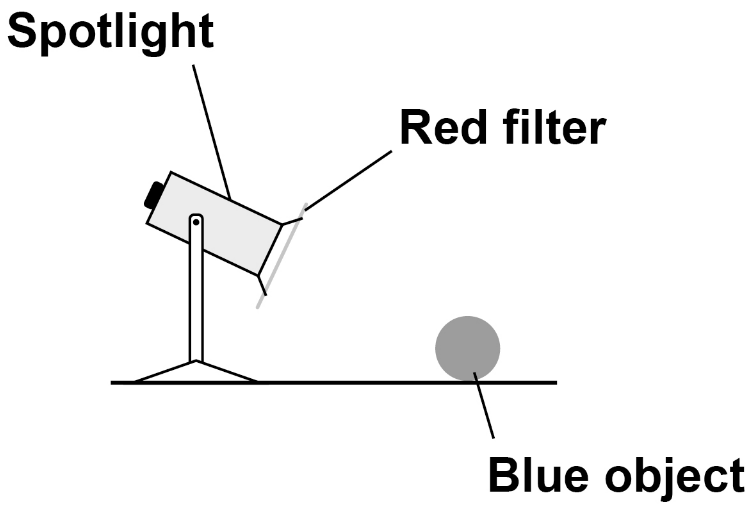
0 4 . 5

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]

[Turn over]

10

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**

05.3

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 on page 38. [3 marks]

Frequency = ____________________ Hz

[Turn over]

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]

[Turn over]

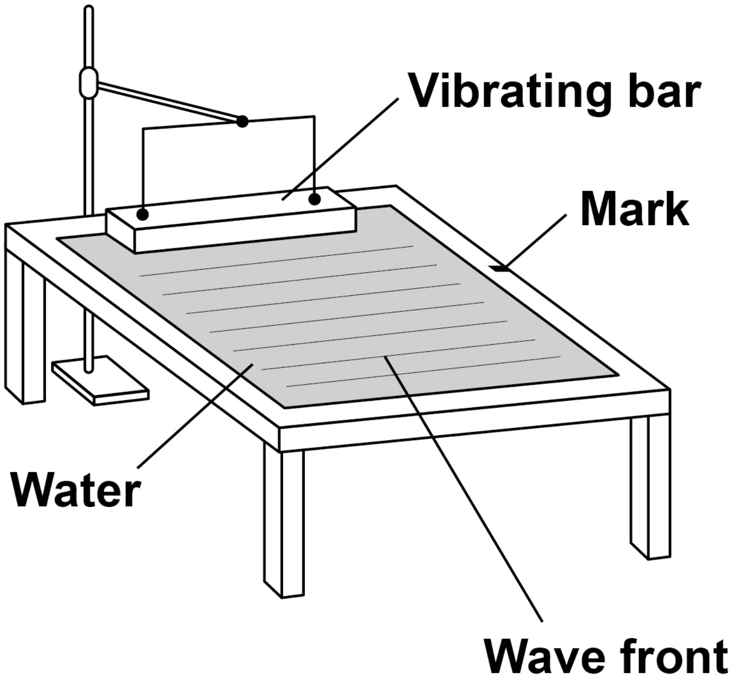
8

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]

____

____

____

[Turn over]

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

[Turn over]

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]

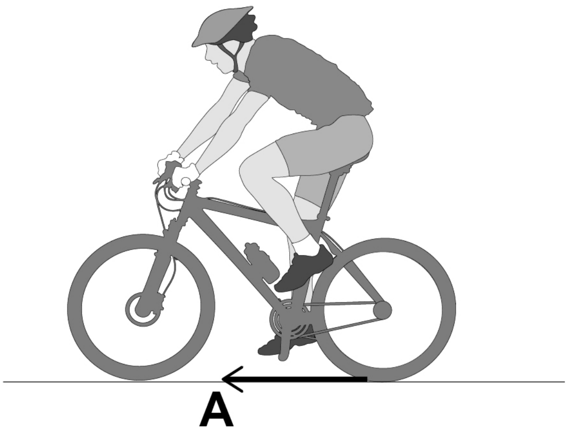
9

0 7

FIGURE 11 shows a cyclist riding a bicycle.

Force A causes the bicycle to accelerate forwards.

FIGURE 11



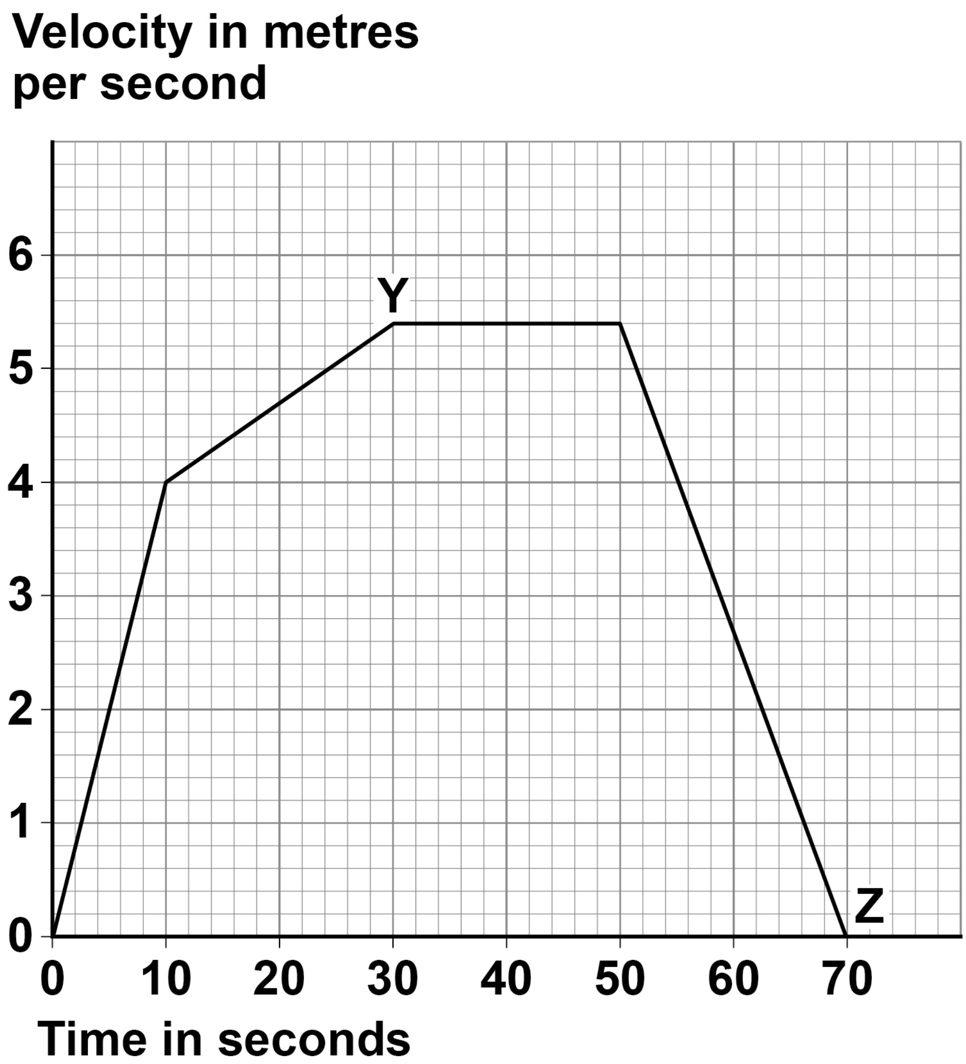
0 7 . 1

What name is given to force A? [1 mark]

[Turn over]

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

FIGURE 12



07.2

Determine the distance travelled by the cyclist between Y and Z. [3 marks]

Distance travelled by the cyclist between Y and Z =

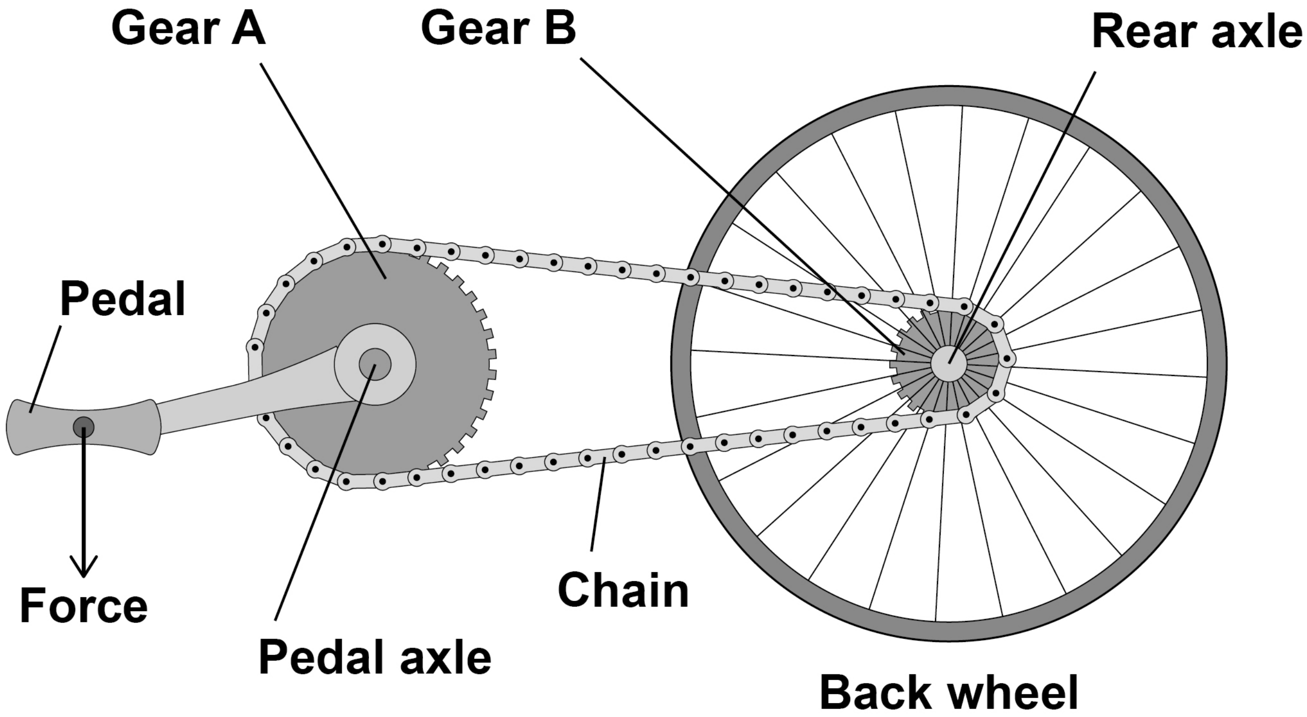
______________________ m

[Turn over]

0 7 . 3

FIGURE 13 shows the gears on the bicycle.

FIGURE 13

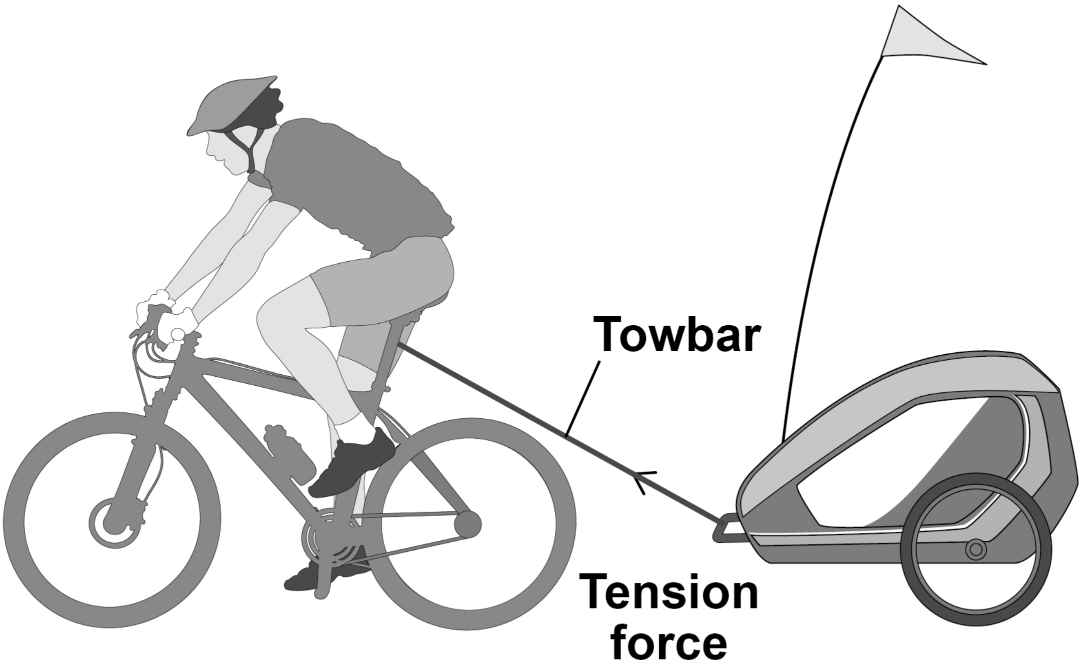


Describe how the force on the pedal causes a moment about the rear axle. [2 marks]

[Turn over]

FIGURE 14 shows a different cyclist towing a trailer.

FIGURE 14



07.4

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

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, on the opposite page. [4 marks]

Magnitude of force = ____________________ N

Direction of force = ____________________ degrees

[Turn over]

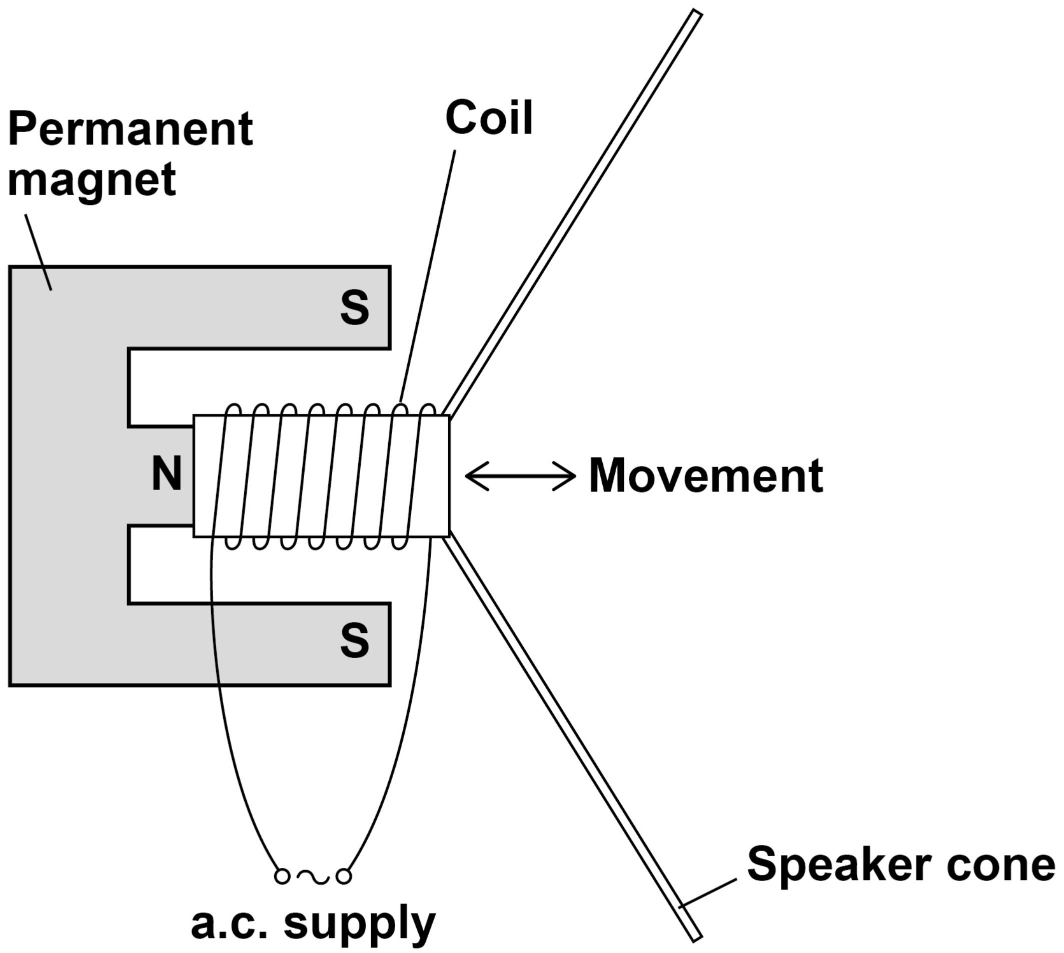
13

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]

0 8 . 2

Explain how a moving-coil loudspeaker produces a sound wave. [4 marks]

[Turn over]

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]

[Turn over]

7

0 9

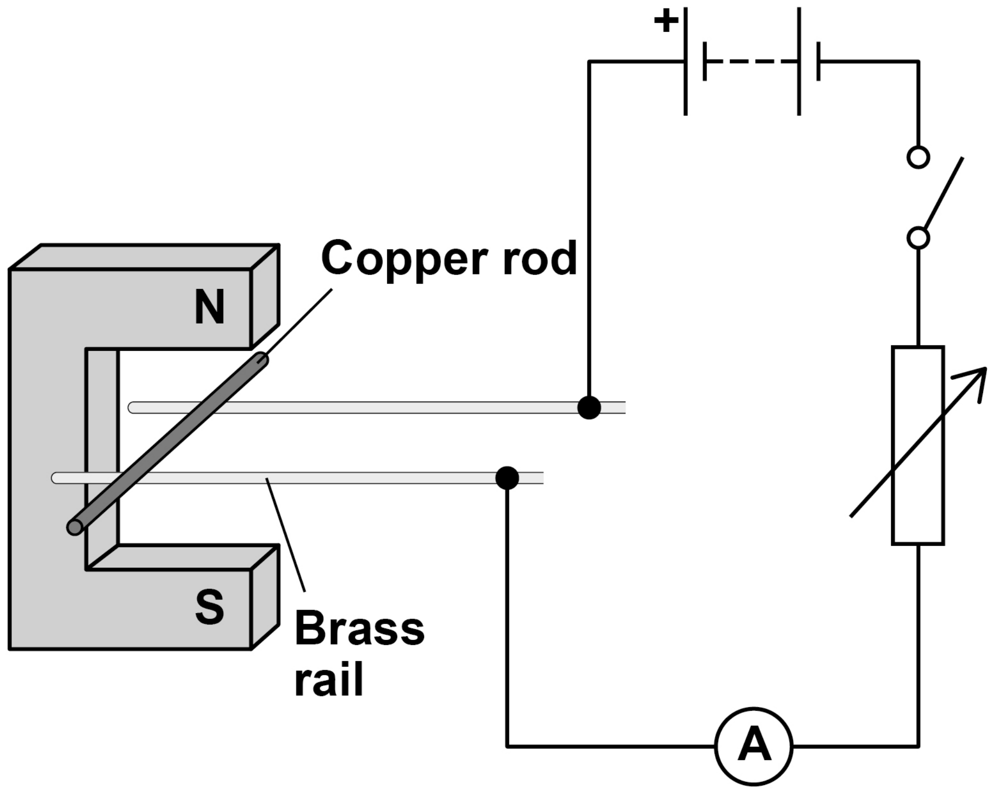
A teacher demonstrated how a magnetic field can cause a copper rod to accelerate.

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



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]

[Turn over]

0 9 . 2

Suggest TWO changes to the equipment that would increase the force on the copper rod. [2 marks]

1 ____________________

2 ____________________

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]

[Turn over]

Maximum velocity = ______________________ **m/s**

13

END OF QUESTIONS

Additional page, if required.

Write the question numbers in the left-hand margin.

Additional page, if required.

Write the question numbers in the left-hand margin.

Additional page, if required.

Write the question numbers in the left-hand margin.

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For Examiner's Use	
Question	Mark
1	
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