A

AQA

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Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

GCSE
PHYSICS

H

Higher Tier Paper 2

8463/2H

Friday 14 June 2019 Morning

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]

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

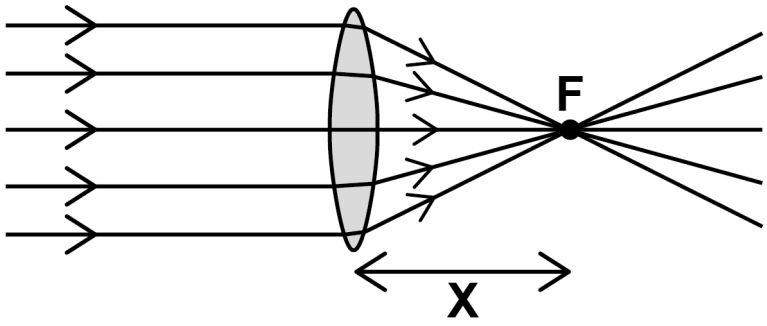
- **The maximum mark for this paper is 100.**
- **The marks for questions are shown in brackets.**
- **You are expected to use a calculator where appropriate.**
- **You are reminded of the need for good English and clear presentation in your answers.**

DO NOT TURN OVER UNTIL TOLD TO DO SO

Answer ALL questions in the spaces provided.

0 1 . 1 **FIGURE 1 shows parallel rays of light being refracted by a convex lens.**

FIGURE 1



What is distance 'X' called? [1 mark]

0 1 . 2 **Lenses can be used to form the image of an object.**

Complete the ray diagram in FIGURE 2 to show how a CONVEX lens forms the image of the object.

Use an arrow to represent the image.
[2 marks]

FIGURE 2

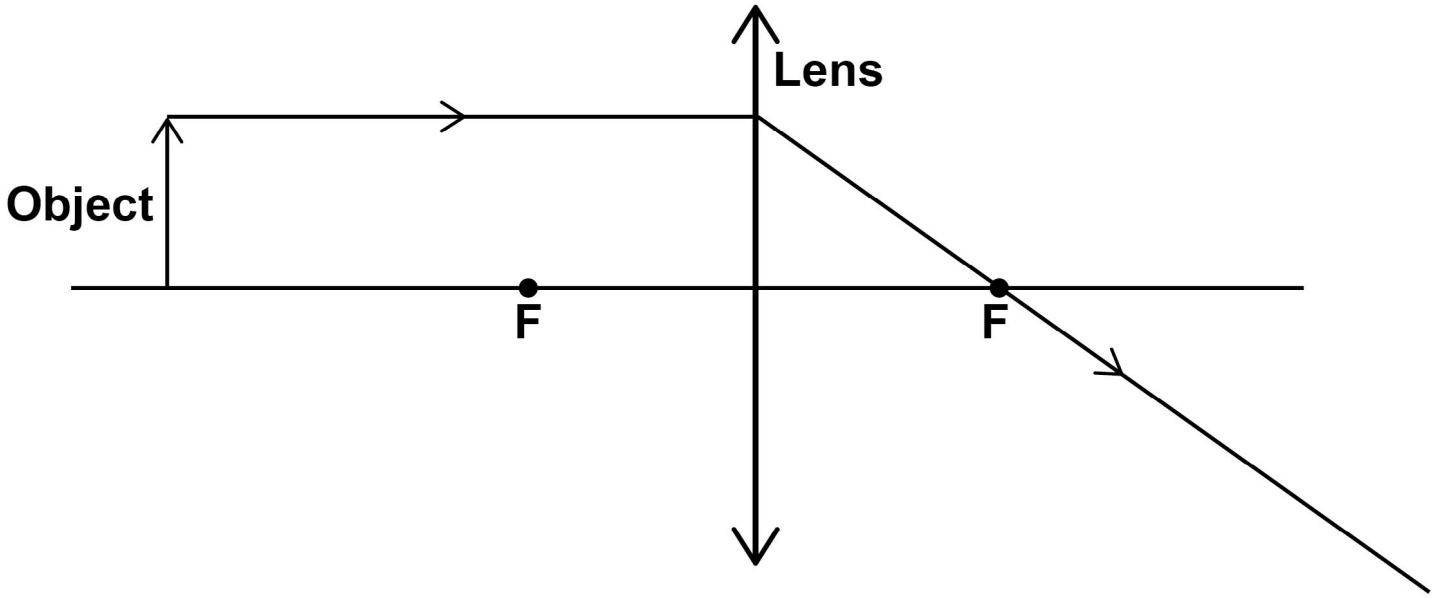
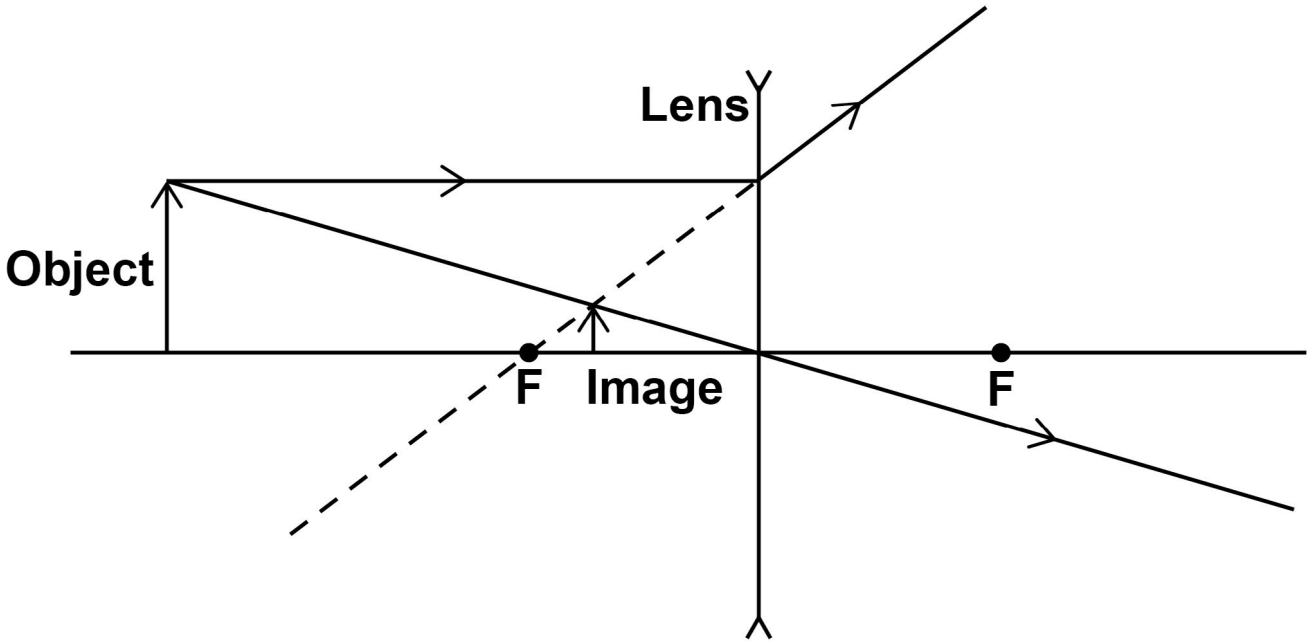


FIGURE 3 shows how a CONCAVE lens forms the image of an object.

FIGURE 3



0 1 . 3 **Give ONE similarity and ONE difference between the image formed by the convex lens and the image formed by the concave lens. [2 marks]**

Similarity _____

_____

_____

Difference _____

_____

_____

[Turn over]

0 1 . 4 **A person uses a lens to read the letters on the back of a coin.**

The image height of the letters on the coin is 9.0 mm

The magnification produced by the lens is 6.0

Calculate the height of the letters on the coin.

Use the Physics Equations sheet. [3 marks]

Height = _____ mm

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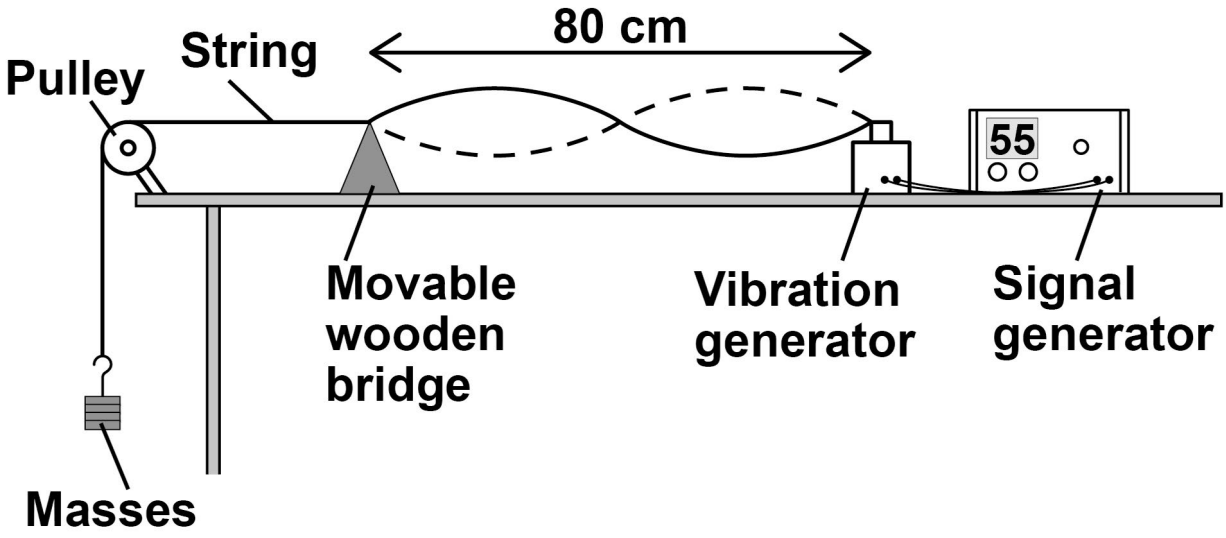
[Turn over]

0 2 **FIGURE 4 shows the apparatus used to investigate the waves in a stretched string.**

FIGURE 4



The frequency of the signal generator is adjusted so that the wave shown in FIGURE 4 is seen.

At this frequency the string vibrates between the two positions shown in FIGURE 4.

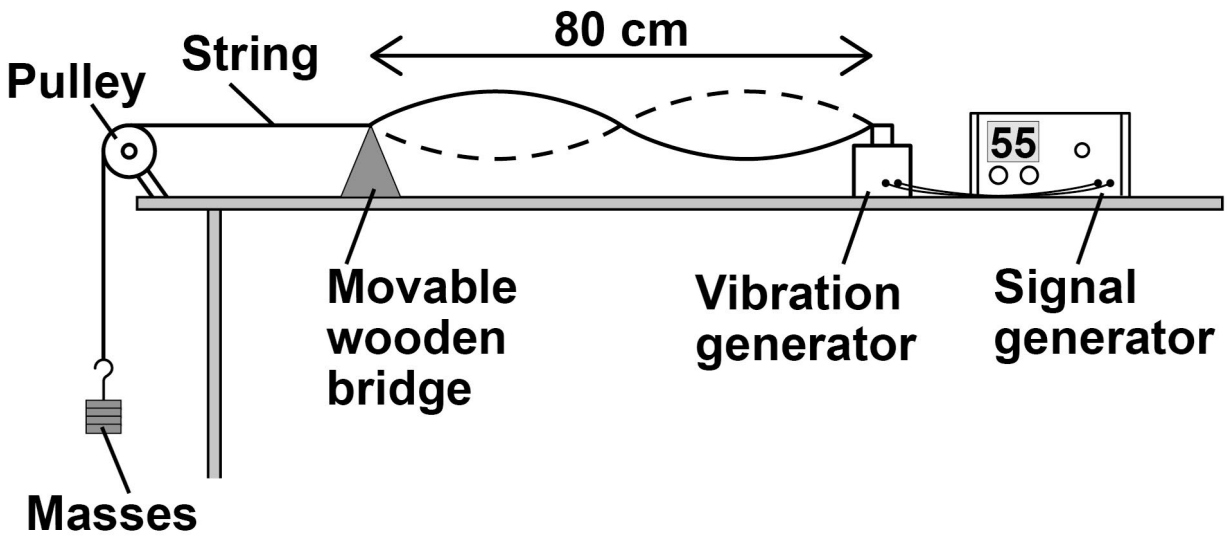
0 2 . 1 **The wavelength of the wave shown in FIGURE 4 was measured as 80 cm**

What piece of apparatus would have been suitable for measuring this wavelength? [1 mark]

0 2 . 2 **Write down the equation which links frequency, wavelength and wave speed. [1 mark]**

[Turn over]

Repeat of FIGURE 4



0 2 . 3 **The string in FIGURE 4 vibrates at 55 Hz**

Calculate the wave speed of the wave shown in FIGURE 4.

Use data given in FIGURE 4. [3 marks]

Wave speed = _____ m/s

[Turn over]

0 2 . 4 **The frequency of the signal generator is increased.**

This makes the wavelength of the wave change.

The wave speed stays the same.

Describe how the apparatus could be adjusted to show one complete wave without reducing the frequency. [2 marks]

0 2 . 5 **A student wants to investigate how the speed of a wave on a stretched string depends on the tension in the string.**

The student uses the apparatus in FIGURE 4, on page 12.

Describe a method the student could use for this investigation. [4 marks]

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0 3 . 1 **The driver of a vehicle sees a hazard on the road.**

The driver uses the brakes to stop the vehicle.

Explain the factors that affect the distance needed to stop a vehicle in an emergency.
[6 marks]

0 3 . 2 **Write down the equation which links distance, force and work done. [1 mark]**

[Turn over]

0 3 . 3 **The work done by the braking force to stop a vehicle was 900 000 J**

The braking force was 60 000 N

Calculate the braking distance of the vehicle. [3 marks]

Braking distance = _____ m

0 3 . 4 **The greater the braking force, the greater the deceleration of a vehicle.**

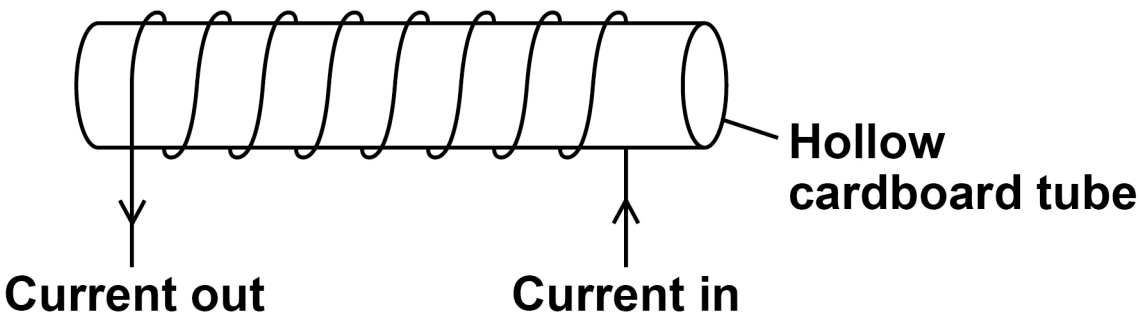
Explain the possible dangers caused by a vehicle having a large deceleration when it is braking. [2 marks]

12

0 4 . 1 **FIGURE 5 shows a solenoid.**

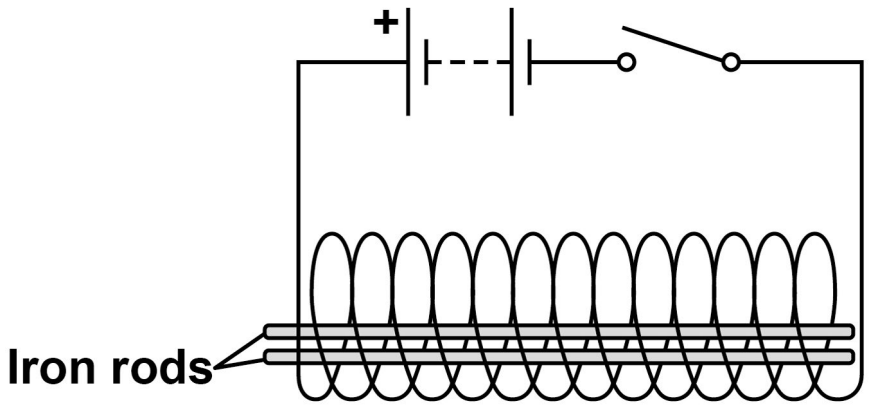
Draw the magnetic field of the solenoid on FIGURE 5. [2 marks]

FIGURE 5



0 4 . 2 **FIGURE 6 shows two iron rods placed inside a solenoid.**

FIGURE 6



Explain why the iron rods move apart when the switch is closed. [2 marks]

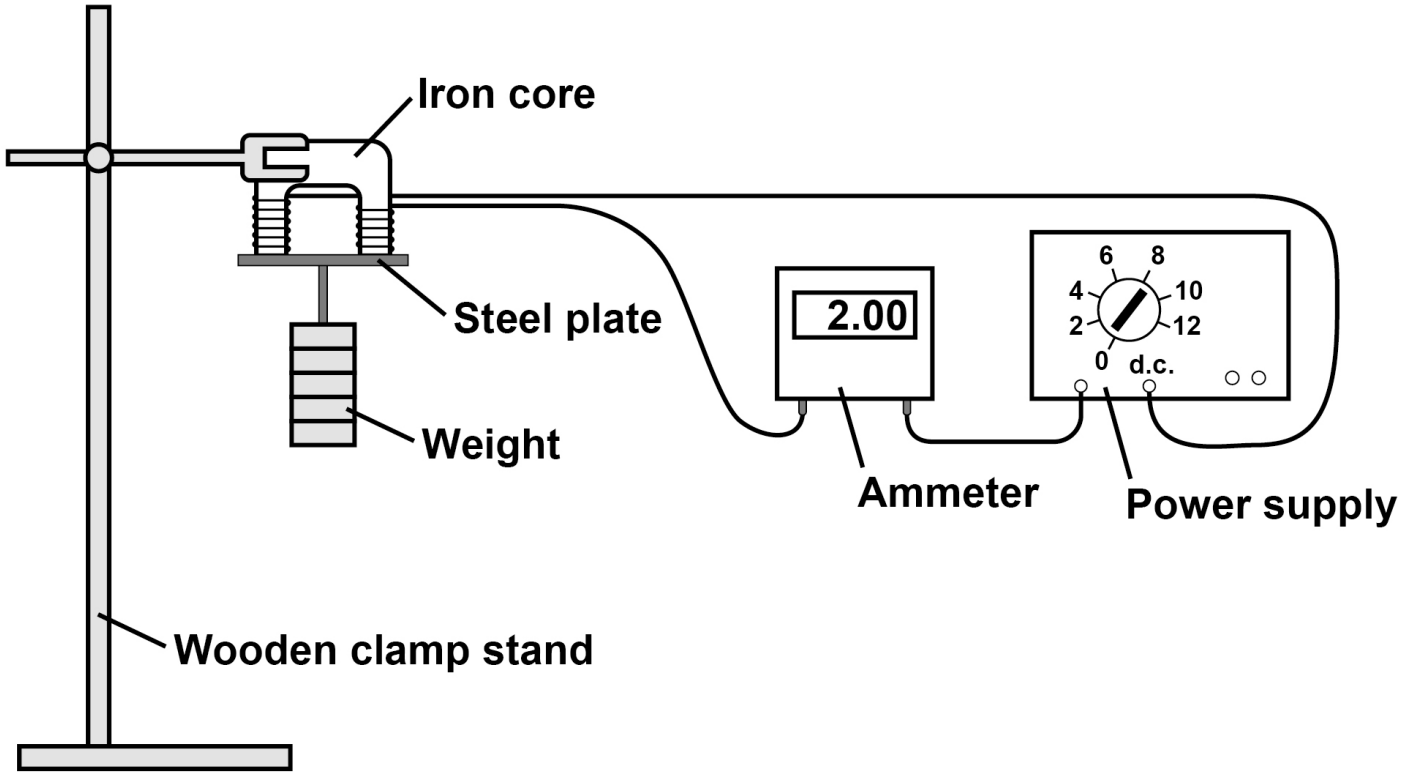
A student investigated the strength of an electromagnet.

The student investigated how the strength depended on:

- **the current in the wire**
- **the number of turns of wire around the iron core.**

FIGURE 7, on the opposite page, shows the equipment used.

FIGURE 7



The student measured the strength of the electromagnet as the maximum weight the electromagnet could hold.

[Turn over]

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0 4 . 3 **TABLE 1 shows the results.**

TABLE 1

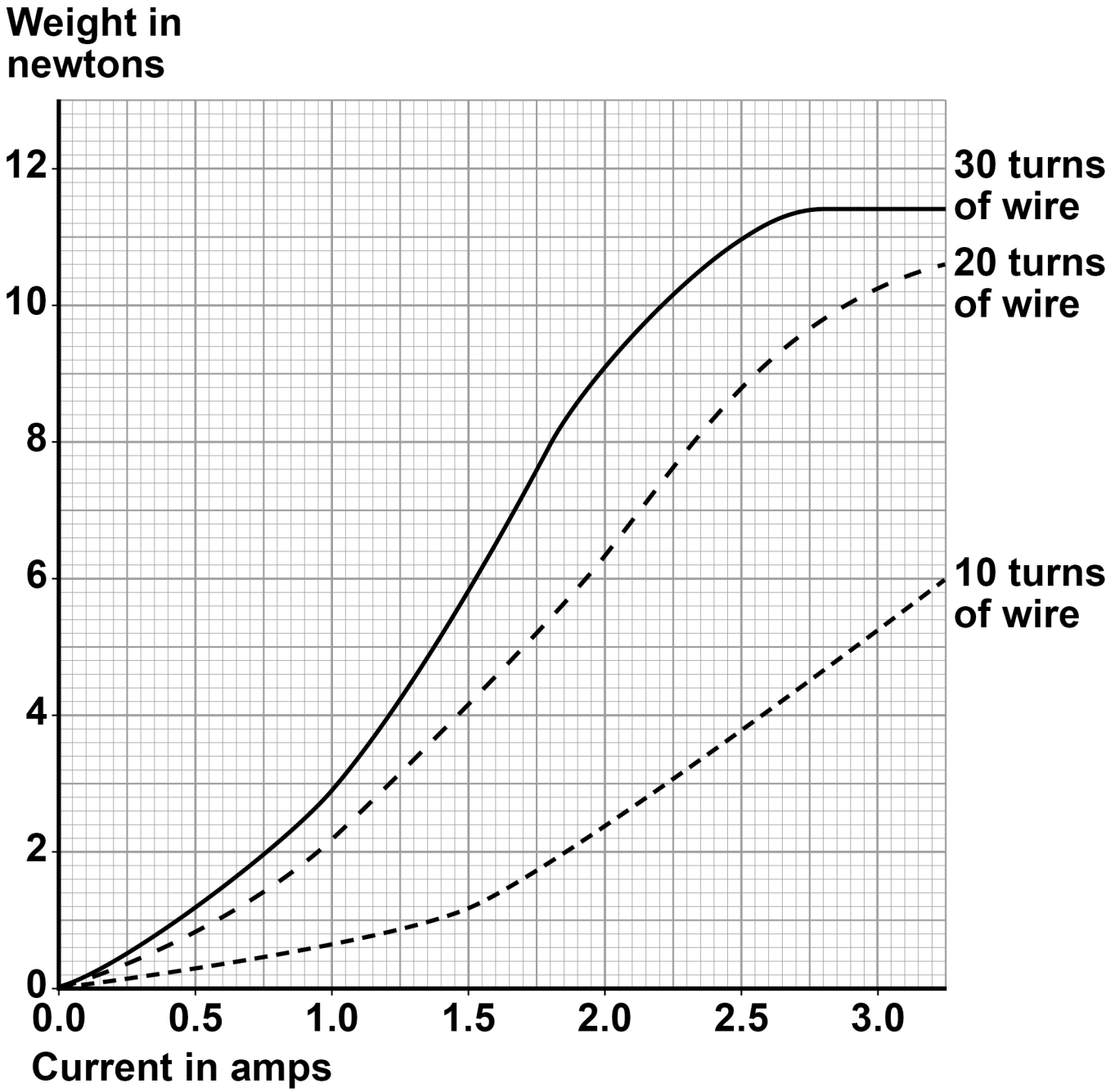
Current in amps	Number of turns of wire	Maximum weight in newtons
1.0	30	6.5
1.5	20	6.4
2.0	10	3.7

Explain why the method used by the student is NOT valid for this investigation. [2 marks]

A second student repeated the investigation using the same equipment.

FIGURE 8 shows the second student's results.

FIGURE 8



0 4 . 4 How does increasing the current in the wire affect the strength of the electromagnet, when the electromagnet has 30 turns of wire? [1 mark]

0 4 . 5 How does increasing the number of turns of wire from 10 to 20 affect the strength of the electromagnet, compared to increasing the number of turns of wire from 20 to 30? [1 mark]

0 5 . 1 **The light from distant galaxies shows red-shift.**

Complete the sentence. [1 mark]

The term red-shift describes the observed

increase in the _____

of the light from a distant galaxy.

0 5 . 2 **The Big Bang theory is one model used to explain the origin of the universe.**

How does the Big Bang theory describe the universe when it began? [1 mark]

_____

_____

_____

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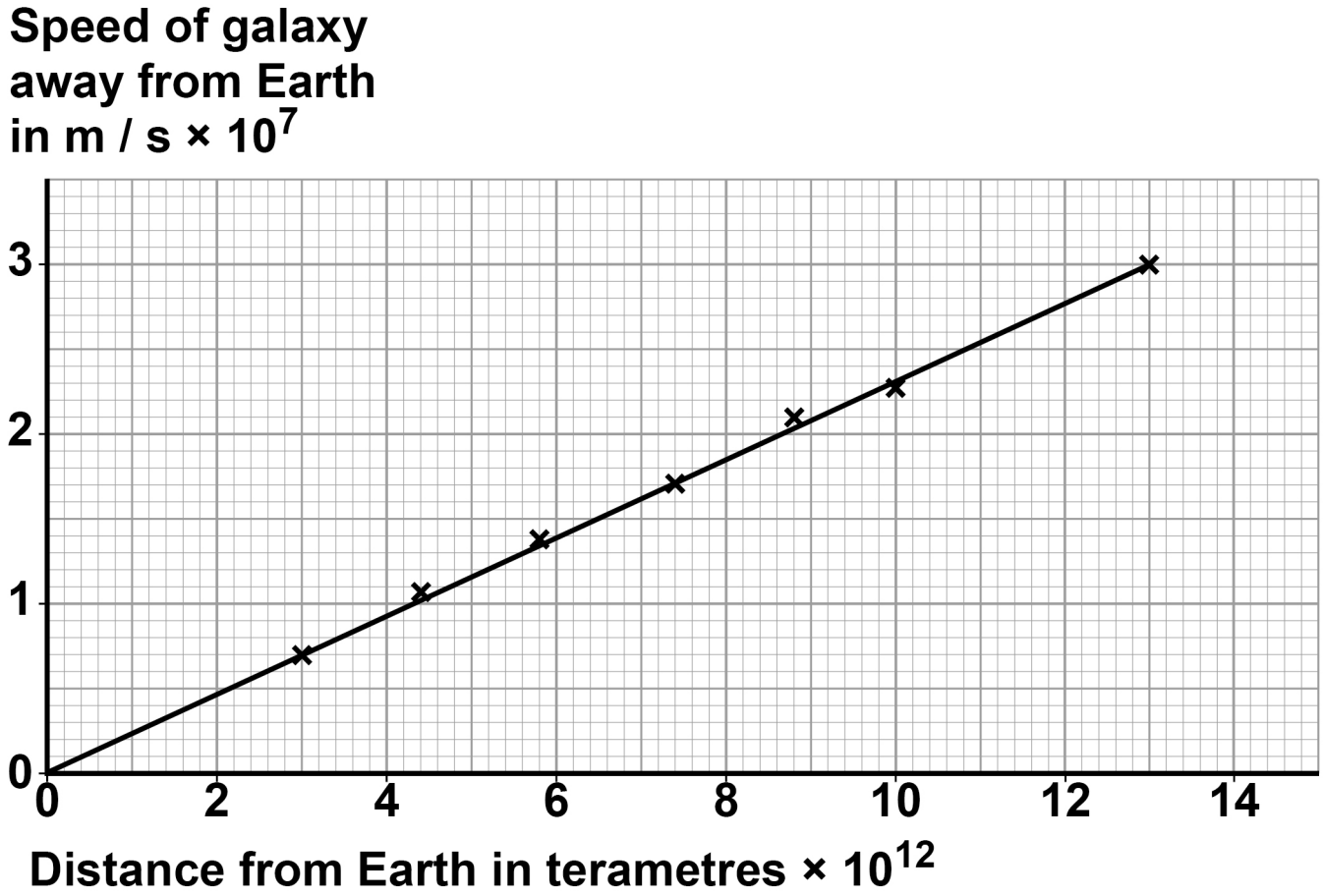
[Turn over]

FIGURE 9 shows data scientists have calculated from measurements of red-shift.

FIGURE 9



0 5 . 3 **Describe the relationship between the speed of a galaxy and the distance the galaxy is from the Earth. [1 mark]**

_____

_____

[Turn over]

0 5 . 4 Which of the following is the same as 6×10^{12} terametres? [1 mark]

Tick (✓) ONE box.

- ☐ 6×10^{15} m
- ☐ 6×10^{18} m
- ☐ 6×10^{21} m
- ☐ 6×10^{24} m

0 5 . 5 Explain how the data in FIGURE 9, on page 32, supports the suggestion that the universe began from a very small region. [2 marks]

[Turn over]

0 5 . 6 **The Big Bang theory suggested that gravity would slow the rate at which galaxies move away from the Earth.**

New observations suggest that distant galaxies are moving away from the Earth at an increasingly fast rate.

What do the new observations suggest is happening to the universe? [1 mark]

0 5 . 7 **New observations and data that do not fit existing theories should undergo peer review.**

Give ONE reason why peer review is an important process. [1 mark]

0 5 . 8 **The Andromeda galaxy is moving towards the Earth.**

Describe how the wavelength and frequency of the light from Andromeda seem to have changed when viewed from the Earth.
[2 marks]

10

[Turn over]

0 6 . 1 **An adult of mass 80 kg has more inertia than a child of mass 40 kg**

What is inertia? [1 mark]

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[Turn over]

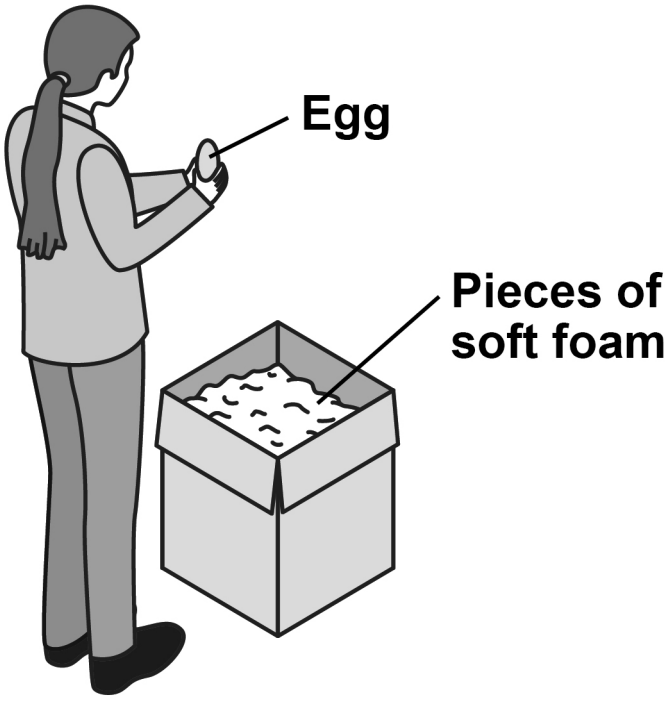
0 6 . 2 **A teacher demonstrated the idea of a safety surface.**

She dropped a raw egg into a box filled with pieces of soft foam.

The egg did not break.

FIGURE 10 shows the demonstration.

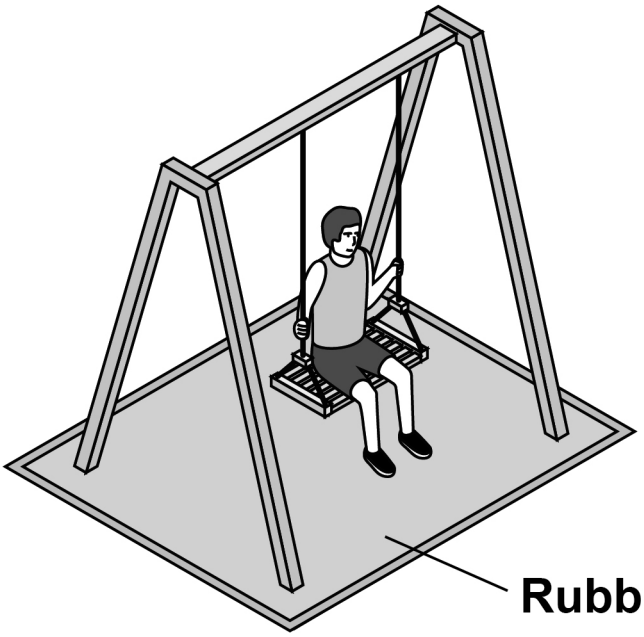
FIGURE 10



Explain why the egg is less likely to break when dropped onto soft foam rather than onto a concrete floor. [3 marks]

0 6 . 3 **FIGURE 11 shows a child on a playground swing. The playground has a rubber safety surface.**

FIGURE 11



A child of mass 32 kg jumped from the swing.

When the child reached the ground she took 180 milliseconds to slow down and stop.

During this time an average force of 800 N was exerted on her by the ground.

Calculate the velocity of the child when she first touched the ground.

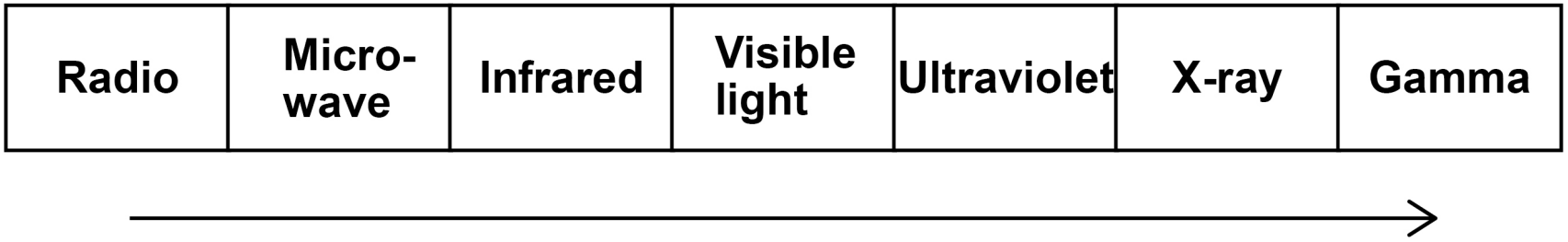
Use the Physics Equations Sheet. [4 marks]

Velocity = _____ m/s

8

0 7 . 1 FIGURE 12 shows the electromagnetic spectrum.

FIGURE 12



Which statement is correct for the direction of the arrow in FIGURE 12? [1 mark]

Tick (✓) ONE box on the opposite page.

☐ The wavelength decreases and the wave speed in air increases.

☐ The frequency increases and the wavelength increases.

☐ The frequency increases and the wave speed in air stays the same.

☐ The wavelength increases and the wave speed in air increases.

[Turn over]

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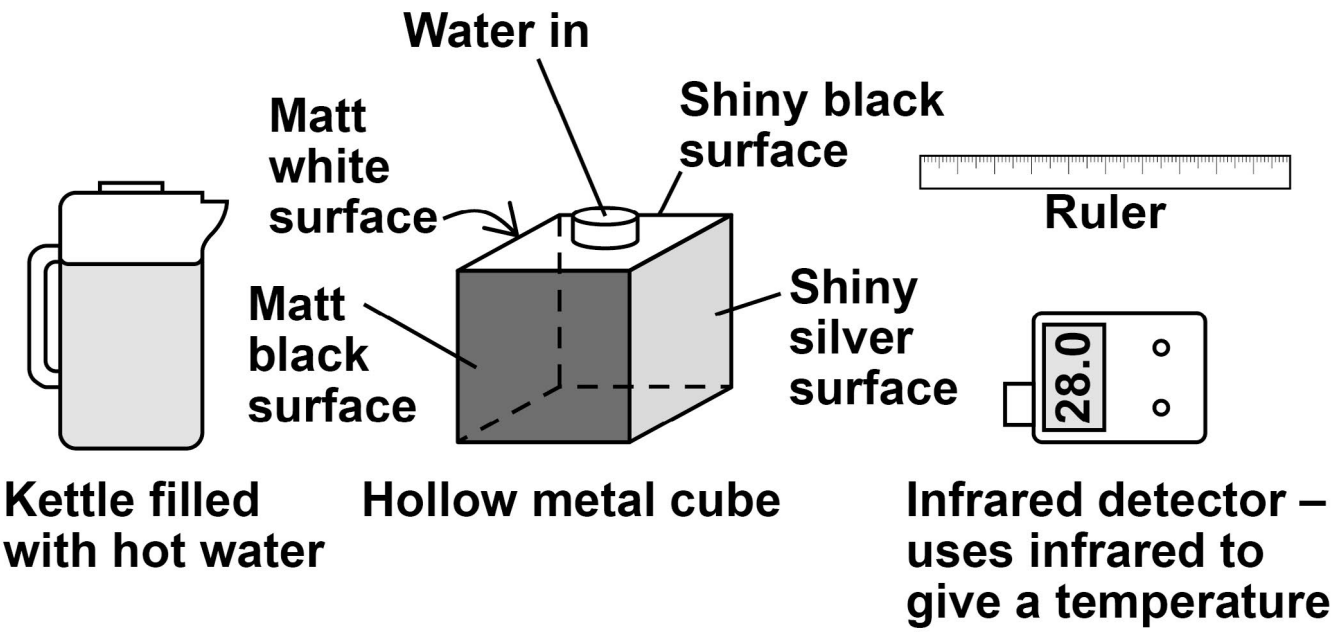
0 7 . 2 **Explain how the properties of X-rays make them suitable for the medical imaging of bones. [2 marks]**

A student investigated the infrared radiation emitted from the sides of a hollow metal cube.

The sides of the cube are different colours or textures.

FIGURE 13 shows the equipment used.

FIGURE 13



Boiling water was poured into the cube. The amount of infrared radiation emitted from each vertical surface was then measured.

0 7 . 3 **Boiling water is a hazard in this investigation.**

Suggest how the risk of harm could be reduced in this investigation. [1 mark]

0 7 . 4 **What is the control variable in this investigation? [1 mark]**

[Turn over]

TABLE 2 shows the results.

TABLE 2

Type of surface	Temperature in °C
Matt black	68.0
Matt white	65.5
Shiny black	66.3
Shiny silver	28.0

0 7 . 5 **The four temperature values in TABLE 2 cannot be used to show that the infrared detector gives precise readings.**

Give the reason why. [1 mark]

0 7 . 6 **The student looked at the data in TABLE 2 and concluded:**

‘A black surface always emits more infrared radiation than a white surface.’

Explain how using an infrared detector with a resolution of 1 °C would have affected the student’s conclusion. [2 marks]

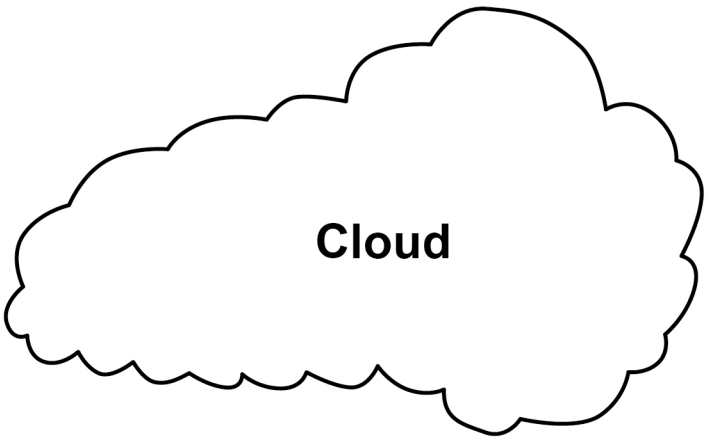
Albedo is a measure of the amount of solar radiation reflected by an object compared to the total solar radiation incident on the object.

A perfect reflector has an Albedo value of 1.0
A perfect absorber has an Albedo value of 0.0

0 7 . 7 **What is the Albedo value of a perfect black body? [1 mark]**

0 7 . 8 **FIGURE 14 shows two points, A and B, just above the Earth's surface.**

FIGURE 14



The average Albedo value of the Earth's surface is 0.3

The Albedo value of thick cloud varies between 0.6 and 0.9

At night the air at point A cools faster than the air at point B.

Explain why. [3 marks]

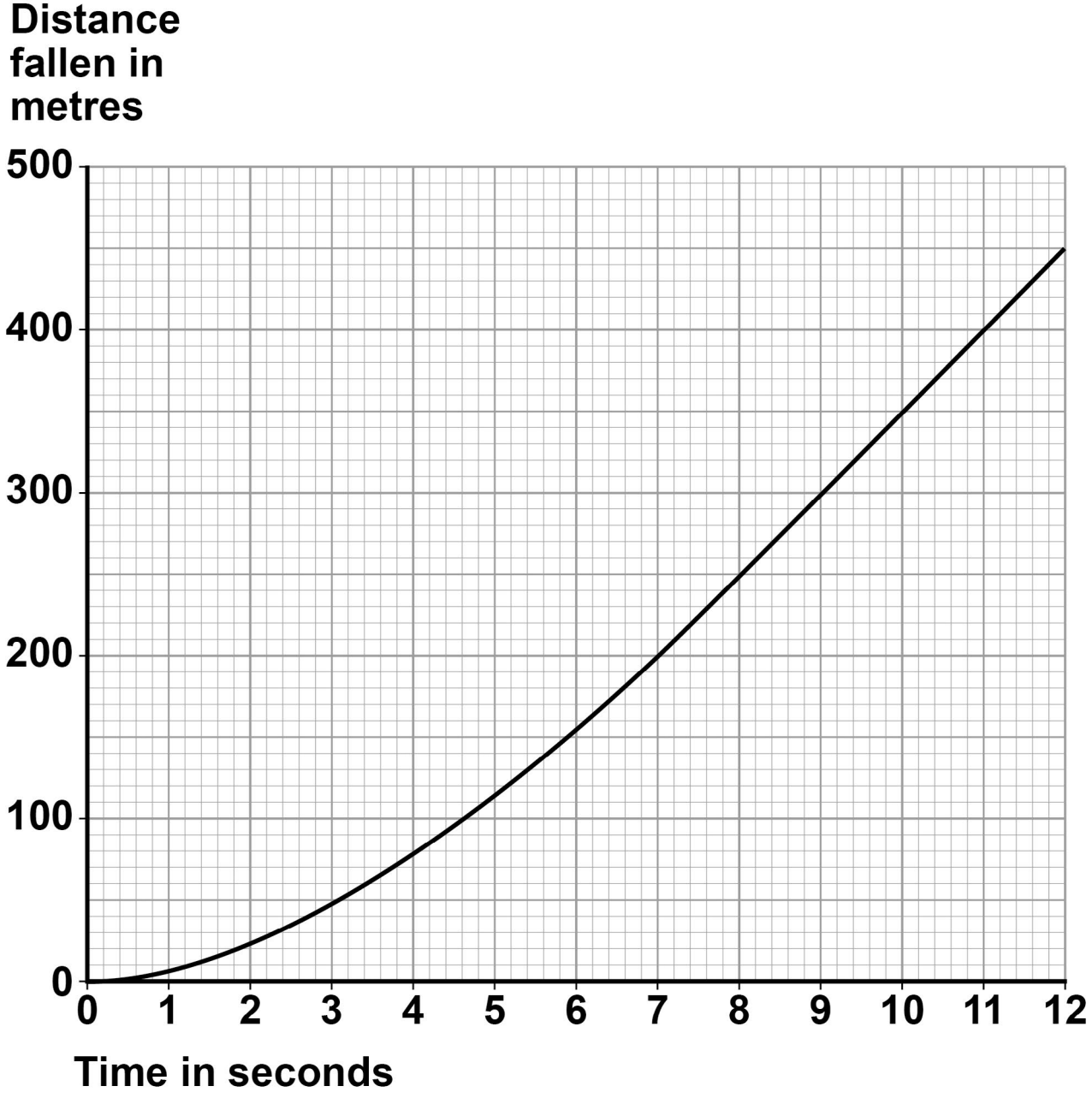
12

0 8 **An aeroplane is 4000 m above the Earth's surface.**

A skydiver jumps from the aeroplane and falls vertically.

FIGURE 15, on the opposite page, shows the distance the skydiver falls during the first 12 seconds after jumping.

FIGURE 15

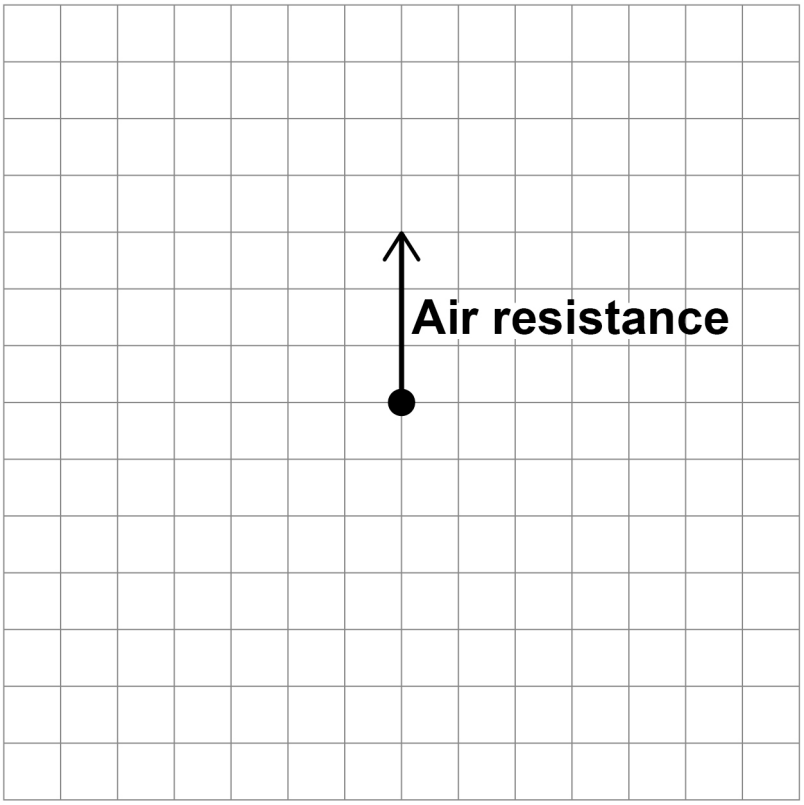


[Turn over]

0 8 . 1 **FIGURE 16 shows part of the free body diagram for the skydiver three seconds after jumping.**

Complete the free body diagram for the skydiver. [2 marks]

FIGURE 16



0 8 . 2 **Explain the changing motion of the skydiver in terms of the forces acting on the skydiver. [4 marks]**

0 8 . 3 **Use FIGURE 15, on page 55, to determine the speed of the skydiver between 7 seconds and 12 seconds. [3 marks]**

Speed = _____ m/s

0 8 . 4 **In 2012 a skydiver jumped from a helium balloon 39 000 metres above the Earth's surface. The skydiver reached a maximum speed of 377 m/s**

Jumping from 39 000 metres allowed the skydiver to reach a much higher speed than a skydiver jumping from 4000 metres.

Explain why. [3 marks]

0 9 . 1 **TABLE 3 gives the frequencies in the hearing ranges of five different animals.**

TABLE 3

Animal	Frequencies of hearing range
Cat	55 Hz to 77 kHz
Chicken	125 Hz to 2 kHz
Dog	20 Hz to 30 kHz
Gerbil	56 Hz to 60 kHz
Horse	55 Hz to 33 kHz

Which ONE of the animals from TABLE 3 would not be able to hear ultrasound?
[1 mark]

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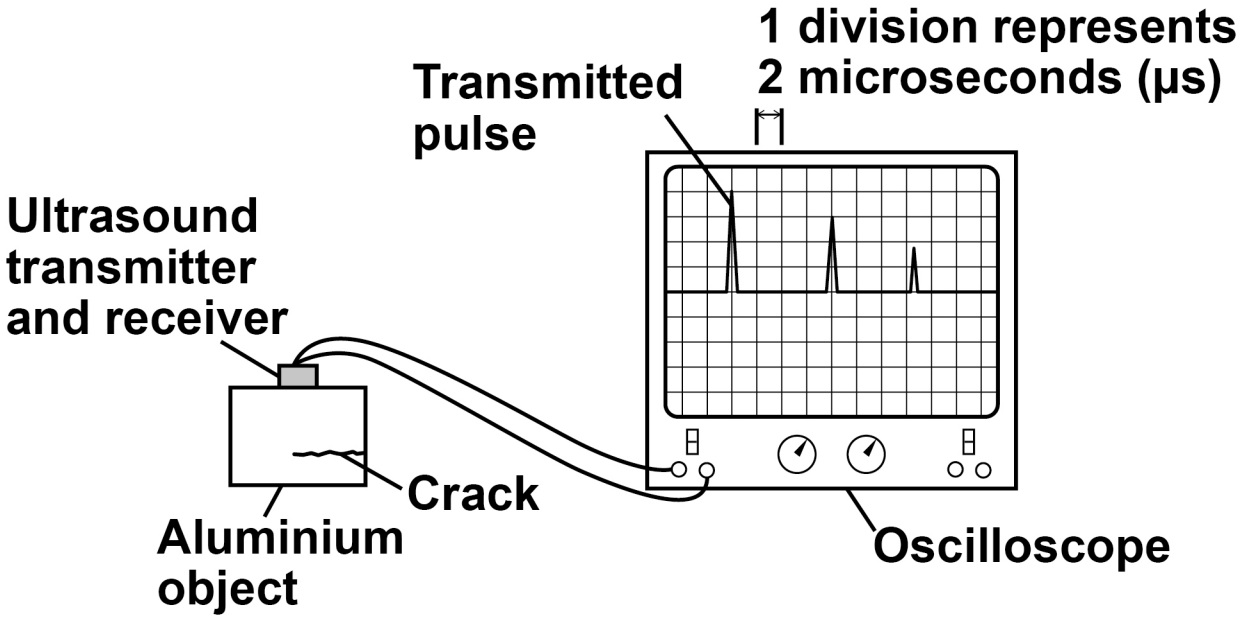
FIGURE 17 shows ultrasound being used to detect a hidden crack in a solid aluminium object. The transmitted and reflected pulses of ultrasound are shown on the screen.

FIGURE 17



0 9 . 2 **Which of the following is the same as 2 microseconds? [1 mark]**

Tick (✓) ONE box.

☐ **2×10^{3} s**

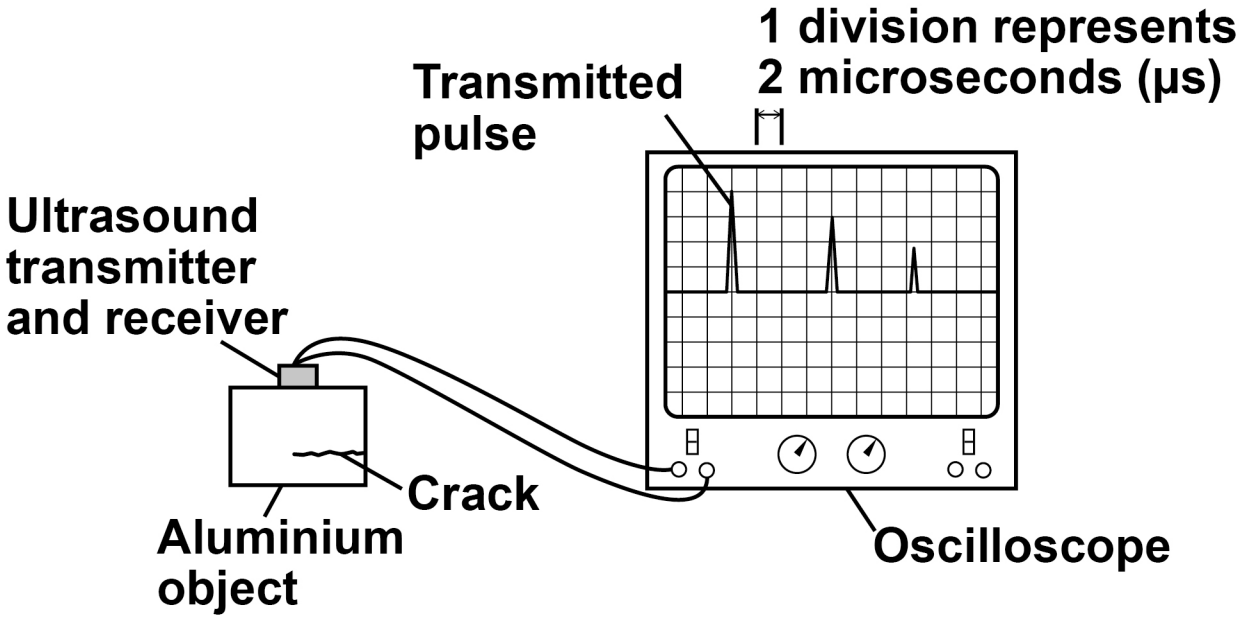
☐ **2×10^{-3} s**

☐ **2×10^{-6} s**

☐ **2×10^{-9} s**

[Turn over]

Repeat of FIGURE 17



0 9 . 3 **Ultrasound travels at 6300 m/s in aluminium.**

Determine the depth of the crack below the top surface of the aluminium.

Use information from FIGURE 17.

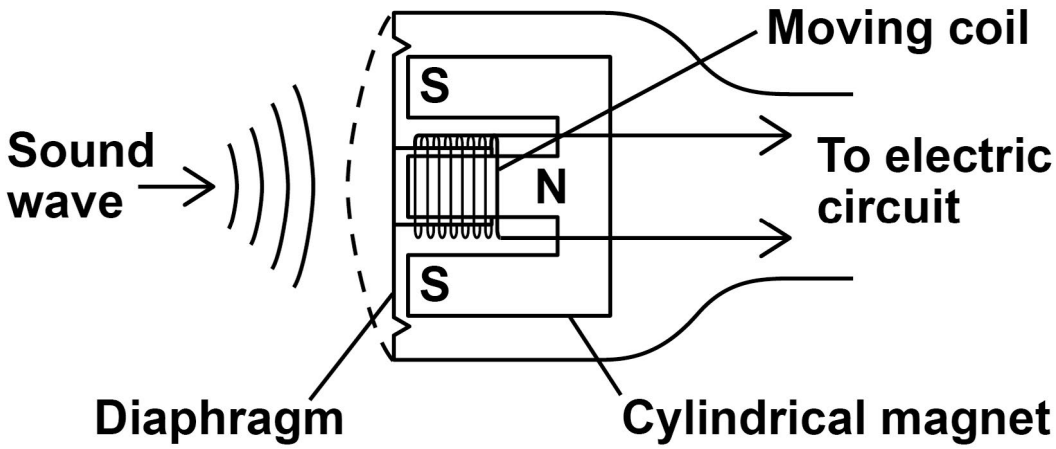
Give your answer to TWO significant figures.
[4 marks]

Depth = _____ m

[Turn over]

FIGURE 18 shows the parts of a moving-coil microphone.

FIGURE 18



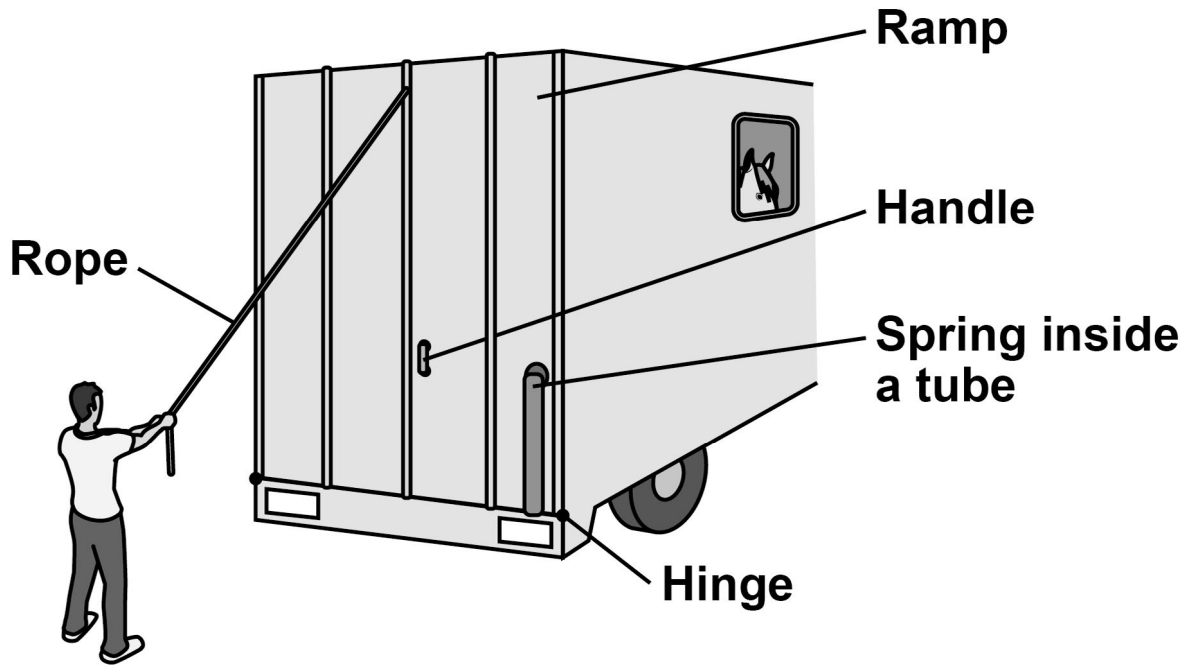
0 9 . 4 What is the function of a microphone? [1 mark]

0 9 . 5 Explain how a moving-coil microphone works. [4 marks]

11

1 0 **FIGURE 19 shows the back of a lorry. The lorry is used to carry horses.**

FIGURE 19



The ramp is lowered by pulling on the rope or by pulling on the handle.

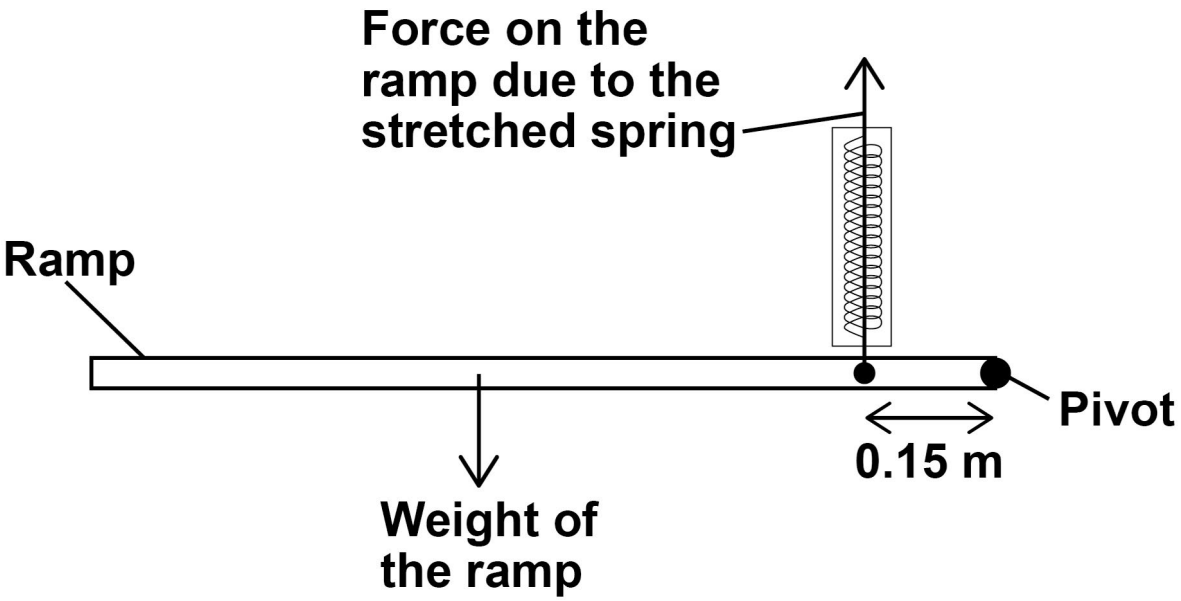
The hinge acts as a pivot.

1 0 . 1 **Explain why it is easier to lower the ramp by pulling on the rope rather than pulling on the handle. [2 marks]**

When the ramp is lowered, work is done to stretch a spring on the side of the ramp.
Elastic potential energy is stored in the stretched spring.

FIGURE 20 shows the ramp part way down in a balanced horizontal position.

FIGURE 20



1 0 . 2 With the ramp horizontal:

the moment caused by the weight of the ramp = 924 Nm

the spring is stretched by 0.250 m

Calculate the elastic potential energy stored in the stretched spring.

Use data from FIGURE 20. [6 marks]

Elastic potential energy = _____ J

END OF QUESTIONS

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For Examiner's Use	
Question	Mark
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