

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

INTERNATIONAL GCSE COMBINED SCIENCE

C

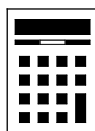
Paper 3 Physics Core

Tuesday 8 November 2022 07:00 GMT Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:

- a pencil and a ruler
- a protractor
- a scientific calculator
- the Physics Equations Sheet (enclosed).



Instructions

- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- All working must be shown.
- 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.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 100.
- You are expected to use a scientific calculator where appropriate.
- The Physics Equations Sheet is provided as a loose insert.

For Examiner's Use

Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	



N 0 V 2 2 9 2 0 4 P C 0 1

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

0 1

Force is a vector quantity.

0 1 . 1

Complete **Table 1** to show which of the quantities are scalars and which of the quantities are vectors.

Tick (✓) **one** box in **each** row of **Table 1**.

The first one has been done for you.

[2 marks]

Table 1

Quantity	Scalar	Vector
Force		✓
Displacement		
Distance		
Speed		
Velocity		

0 1 . 2

Figure 1 shows a force represented by an arrow.

Figure 1



What **two** properties of the force does the arrow show?

[2 marks]

1 _____

2 _____



0 1 . 3

The weight of a person is the force of gravity acting on them.

The mass of a person is 70 kg.

gravitational field strength = 9.8 N/kg

Calculate the weight of the person.

Use the Physics Equations Sheet.

[2 marks]

Weight = _____ N

0 1 . 4

The weight of a person depends on the gravitational field strength at the place the person is standing.

How does the weight of a person change as they climb a high mountain?

[1 mark]

Tick (✓) **one** box.

Decreases

☐

Stays the same

☐

Increases

☐

0 1 . 5

Weight is a non-contact force.

Which of the following is also a non-contact force?

[1 mark]

Tick (✓) **one** box.

Friction

☐

Magnetic force

☐

Tension

☐

8

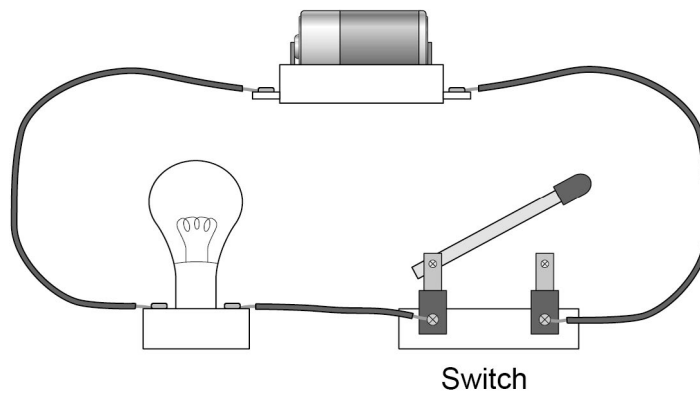
Turn over ►



0 2

Figure 2 shows a simple circuit.

Figure 2



0 2 . 1

Draw a circuit diagram for the circuit shown in **Figure 2**.

Use the correct circuit symbols.

[3 marks]

0 2 . 2

What device is used to measure electrical current?

[1 mark]

0 2 . 3

A charge of 15 C flows past a point in a circuit in a time of 25 s.

Calculate the current in the circuit.

Use the Physics Equations Sheet.

[2 marks]

Current = _____ A

0 2 . 4

What device is used to measure potential difference?

[1 mark]

0 2 . 5There is a current of 0.85 A in a 22 Ω resistor.

Calculate the potential difference across the resistor.

Use the Physics Equations Sheet.

[2 marks]

Potential difference = _____ V

Question 2 continues on the next page**Turn over ►**

0 2 . 6

Complete the sentence.

Choose the answer from the box.

[1 mark]

atoms

electrons

neutrons

protons

Metal wires in a circuit have a low resistance because metals contain free

0 2 . 7

Complete the sentence.

Choose the answer from the box.

[1 mark]

atoms

acceleration

energy

resistance

When charges flow through metal wires, the charges transfer



Electrical appliances in the home use mains electricity.

0 2 . 8

Mains electricity is an alternating current supply.

What is meant by 'alternating current'?

[1 mark]

Tick (✓) **one** box.

The current always passes in the same direction.

☐

The current can pass in any direction.

☐

The current repeatedly changes direction.

☐

0 2 . 9

Appliances that use mains electricity are usually protected by a fuse.

How does a fuse protect an appliance?

[1 mark]

Tick (✓) **one** box.

The fuse powers the appliance if the mains electricity is disconnected.

☐

The fuse provides a low resistance path to earth.

☐

The wire inside the fuse melts and breaks the circuit.

☐

0 2 . 1 0

Circuit breakers also protect appliances that use mains electricity.

Why is a circuit breaker better than a fuse?

[1 mark]

Tick (✓) **one** box.

Circuit breakers are closer to the appliances.

☐

Circuit breakers are double insulated.

☐

Circuit breakers work much more quickly.

☐

14

Turn over ►

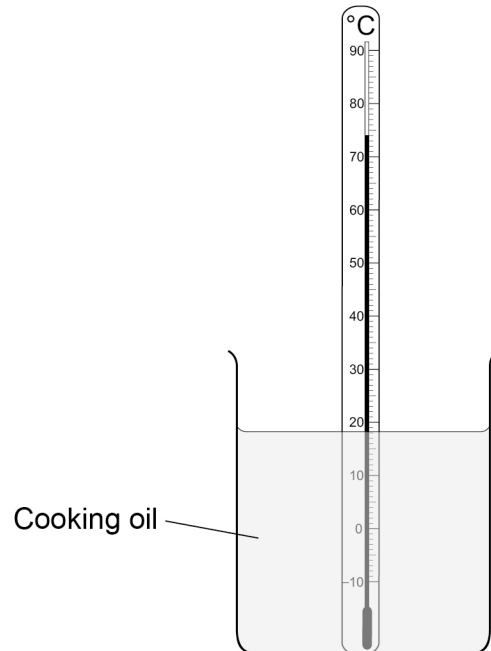


0 3

A student investigated how the temperature of hot cooking oil changed as it cooled.

Figure 3 shows the temperature of the cooking oil being measured.

Figure 3



0 3

1

Name the instrument used to measure the temperature of the oil.

[1 mark]

0 3

2

During part of the investigation, the temperature of the oil decreased from 74 °C to 39 °C.

Calculate the change in temperature of the oil.

[1 mark]

Change in temperature = _____ °C



0 3 . 3

The mass of the oil was 0.15 kg.

specific heat capacity of the oil = 1800 J/(kg °C)

Determine the energy decrease of the oil during this part of the investigation.

Use your answer to **Question 03.2** and the Physics Equations Sheet.

[2 marks]

Energy decrease = _____ J

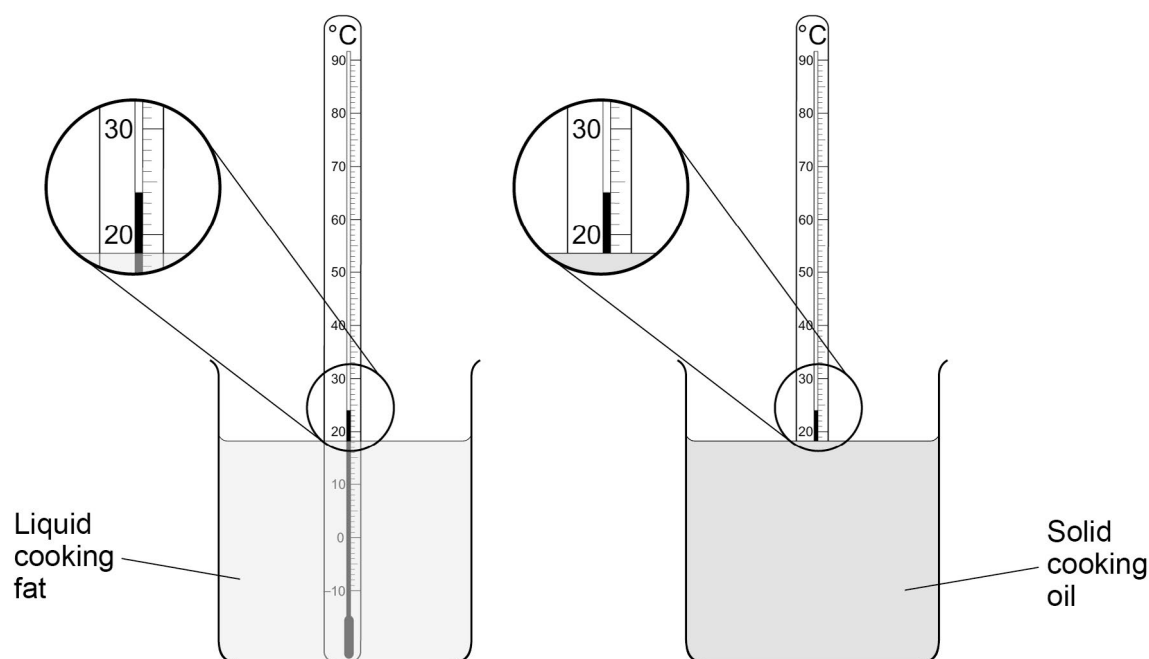
Question 3 continues on the next page

Turn over ►



Figure 4 shows the temperature of the oil being measured as it changed from a liquid to a solid.

Figure 4



0 3 . 4 At what temperature does the oil change from a liquid to a solid?

[1 mark]

_____ °C

0 3 . 5 What happens to the energy of the particles in the oil as the oil changes from a liquid to a solid?

[1 mark]

Tick (✓) **one** box.

The energy decreases.

☐

The energy stays the same.

☐

The energy increases.

☐


03.6

Food can be cooked by placing the food in hot liquid oil.

After the oil has been used to cook food, the oil changes from a liquid to a solid at a different temperature.

Why does the oil change from a liquid to a solid at a different temperature?

[1 mark]

Tick (✓) **one** box.

Impurities in the oil change the melting point.

☐

Heating the oil changes the melting point.

☐

The volume of the oil changes the melting point.

☐

7

Turn over for the next question

Turn over ►



0 4

Nuclear power stations use fuel rods.

0 4 . 1

The fuel rods contain two isotopes of uranium (U).

Figure 5 shows how the two isotopes can be represented.**Figure 5**

Complete the table to give the number of protons and the number of neutrons in a nucleus of each isotope.

[2 marks]

	Uranium-235	Uranium-238
Number of protons		
Number of neutrons	143	

The fuel rods emit alpha, beta and gamma radiation.

0 4 . 2

Which type of radiation has the greatest range in air?

[1 mark]

Tick (✓) **one** box.

Alpha

☐

Beta

☐

Gamma

☐

0 4 . 3

Which type of radiation travels at the greatest speed?

[1 mark]

Tick (✓) **one** box.

Alpha

☐

Beta

☐

Gamma

☐

Figure 6 shows an engineer using handles to move a nuclear fuel rod without touching the fuel rod.

Figure 6



Handle

Glass screen

The glass screen protects the engineer from the radiation emitted by the fuel rod.

0 4 . 4

Explain why it is important to protect the engineer from the radiation.

[2 marks]

0 4 . 5

The glass screen is made from a type of glass that contains lead.

Suggest why the glass contains lead.

[1 mark]

Question 4 continues on the next page

Turn over ►



During nuclear fission, a uranium-235 nucleus splits into two smaller nuclei.

0 4 . 6 What is released during nuclear fission?

[2 marks]

Tick (✓) **two** boxes.

Alpha particles

☐

Beta particles

☐

Energy

☐

Neutrons

☐

Protons

☐

0 4 . 7 The waste fuel rods contain large amounts of the isotopes strontium-90 and caesium-137.

Both the isotopes are radioactive.

Table 2 shows the half-lives of the two isotopes.

Table 2

Isotope	Half-life in years
strontium-90	29
caesium-137	30

Explain why the waste fuel rods need to be disposed of carefully.

[2 marks]



0 5

The Sun is the star at the centre of the solar system.

0 5 . 1

Which gases make up most of the mass of stars?

[2 marks]Tick (✓) **two** boxes.

Carbon dioxide

☐

Carbon monoxide

☐

Helium

☐

Hydrogen

☐

Nitrogen

☐

Oxygen

☐**0 5 . 2**

Energy is released by nuclear fusion in the centre of a star.

What name is given to the centre of a star?

[1 mark]Tick (✓) **one** box.

Core

☐

Nucleus

☐

Protostar

☐**Question 5 continues on the next page****Turn over ►**

0 5 . 3

Which of the following statements about a main sequence star with a greater mass than the Sun is correct?

[1 mark]

Tick (✓) **one** box.

The centre of the star is cooler than the centre of the Sun.

☐

The centre of the star is at the same temperature as the centre of the Sun.

☐

The centre of the star is hotter than the centre of the Sun.

☐

Antares is a star that is much bigger than the Sun.

0 5 . 4

The mass of Antares is 2.4×10^{31} kg. The mass of the Sun is 2.0×10^{30} kg.

Calculate how many times greater the mass of Antares is than the mass of the Sun.

[2 marks]

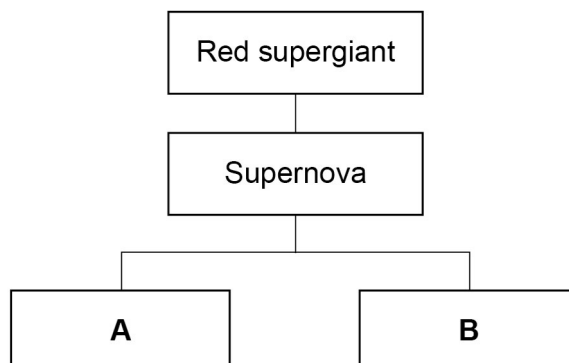
Number of times greater = _____



Figure 7 shows stages in the life cycle of stars much bigger than the Sun.

Antares is a red supergiant.

Figure 7



0 5 . 5 What is a supernova?

[1 mark]

0 5 . 6 Give the names of the stages **A** and **B** in **Figure 7**.

[2 marks]

A _____

B _____

0 5 . 7 Which of the following could be the age of Antares at the end of its life?

[1 mark]

Tick (✓) **one** box.

15 years

☐

15 000 years

☐

15 000 000 years

☐

Question 5 continues on the next page

Turn over ►



The Sun and Antares are in the same galaxy.

Figure 8 shows the galaxy.

Figure 8



0 5 . 8 Give the name of the galaxy.

[1 mark]

0 5 . 9 The galaxy is a spiral shape that rotates.

Suggest which force keeps the stars in orbit around the centre of the galaxy.

[1 mark]

12



Turn over for the next question

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0	6
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Figure 9 shows a rhinoceros.

Figure 9



The rhinoceros is running at a constant velocity of 12 m/s.

0	6	.	1
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Calculate the distance the rhinoceros travels in 15 seconds.

Use the equation:

$$\text{distance} = \text{speed} \times \text{time}$$

[2 marks]

Distance = _____ m



0 6 . 2

The rhinoceros has a mass of 4.0 tonnes.

1 tonne = 1000 kg

Determine the kinetic energy of the rhinoceros.

Give the unit.

Use the Physics Equations Sheet.

[4 marks]

Kinetic energy = _____ Unit _____

0 6 . 3

There are two horizontal forces acting on the rhinoceros as it runs.

A force from the ground pushes the rhinoceros forwards. There is also a drag force acting on the rhinoceros.

Explain why these two horizontal forces keep the rhinoceros at a constant velocity.

[3 marks]

9

Turn over ►



07

Astronomers use telescopes to detect electromagnetic radiation emitted by objects in space.

Figure 10 shows a telescope on the Earth. The telescope detects radio waves.

Figure 10



The telescope detects a radio wave with a wavelength of 12.5 cm.

07.1

What is 12.5 cm in metres?

[1 mark]

_____ m

07.2

Calculate the frequency of the radio wave.

speed of radio waves = 3.0×10^8 m/s

Use your answer from **Question 07.1** and the Physics Equations Sheet.

Give your answer in standard form.

[3 marks]

Frequency (standard form) = _____ Hz



0 7 . 3 How do radio waves compare with the other parts of the electromagnetic spectrum?

[1 mark]

Tick (✓) **one** box.

Radio waves have the highest energy.

☐

Radio waves have the highest frequency.

☐

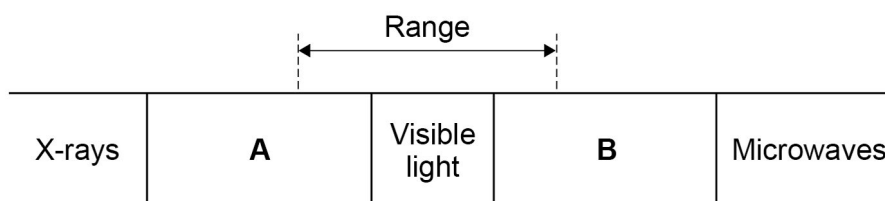
Radio waves have the longest wavelength.

☐

0 7 . 4 There are also telescopes orbiting the Earth in space.

The dashed lines on **Figure 11** show the range of electromagnetic waves that the Hubble Space Telescope can detect.

Figure 11



Give the names of the types of electromagnetic radiation, **A** and **B**.

[2 marks]

A _____

B _____

Question 7 continues on the next page

Turn over ►



0 7 . 5

Thousands of satellites have been launched and are orbiting the Earth.

Many of the satellites are no longer working but remain in orbit.

Astronomers refer to these satellites as space junk.

Figure 12 shows some space junk orbiting the Earth.

Figure 12



Space junk

Explain why the astronomers that operate the Hubble Space Telescope are worried about space junk.

[2 marks]

0 8

Figure 13 shows a car fitted with solar panels.

A person is cleaning the solar panels.

Figure 13



Solar panels

The car can be powered in two ways:

- by an engine that runs on fuel
- by an electric motor that is connected to a battery.

The battery is charged by the solar panels.

0 8 . 1

Solar power is a renewable energy source.

What is meant by 'renewable energy source'?

[1 mark]

0 8 . 2

Dirt on the car roof decreases the useful power output of the solar panels.

Suggest the reason why.

[1 mark]

Question 8 continues on the next page

Turn over ►



0 8 . 3 When the roof is clean, the useful power output from the solar panels is not constant.

Explain why.

[2 marks]

0 8 . 4 On one day, the solar panels received sunlight for 5 hours.

The average power received by the solar panels was 1200 W.

Calculate the total energy received by the solar panels.

Use the Physics Equations Sheet.

[4 marks]

Total energy = _____ J



0 8 . 5 The efficiency of the solar panels is 0.20

Calculate the useful power out when the total power in is 1200 W.

Use the Physics Equations Sheet.

[3 marks]

Useful power out = _____ W

0 8 . 6 **Table 3** gives information about two different types of solar panel.

Table 3

Solar Panel	Efficiency	Cost
Type A	0.20	\$1500
Type B	0.30	\$12 000

Explain why Type **A** solar panels rather than Type **B** solar panels are used on the roof of a car.

You **must** include calculations from the data in **Table 3** in your answer.

[3 marks]



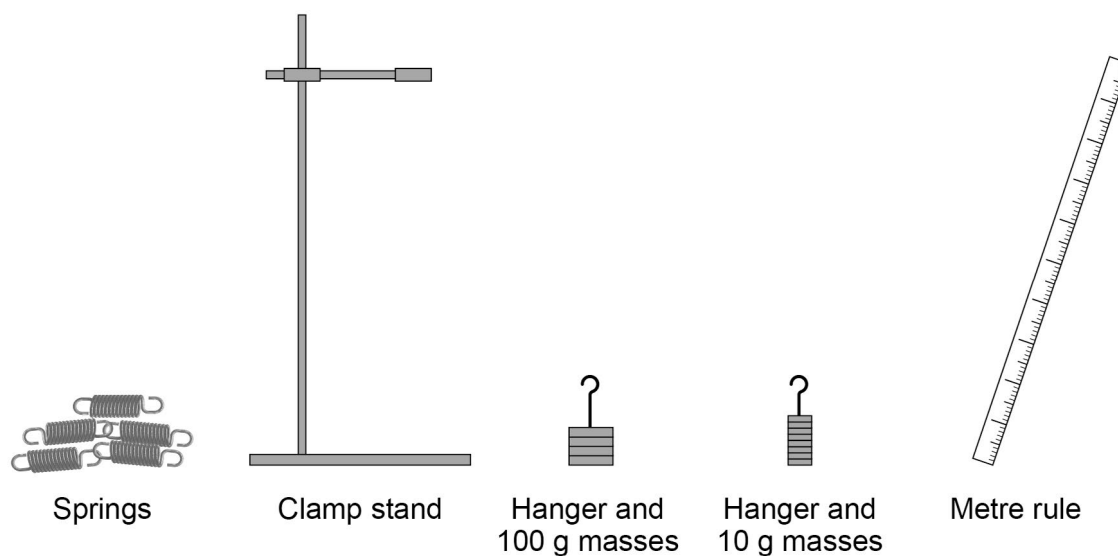
0 9

A student tested some springs to find the limit of proportionality of the springs.

The student had several identical springs.

Figure 14 shows the equipment used.

Figure 14



0 9 . 1

Plan an investigation to determine an accurate value for the limit of proportionality of the springs.

[6 marks]



Question 9 continues on the next page

Turn over ►



The student then investigated the spring constant of a spring.

Table 4 shows the results.

Table 4

Force in newtons	Extension in millimetres			
	Test 1	Test 2	Test 3	Mean
1.0	21	20	22	21
2.0	48	50	52	50
3.0	78	78	81	79
4.0	110	115	X	113
5.0	135	134	139	136
6.0	176	175	171	174

0 9 . 2 Determine value **X** in **Table 4**.

[2 marks]

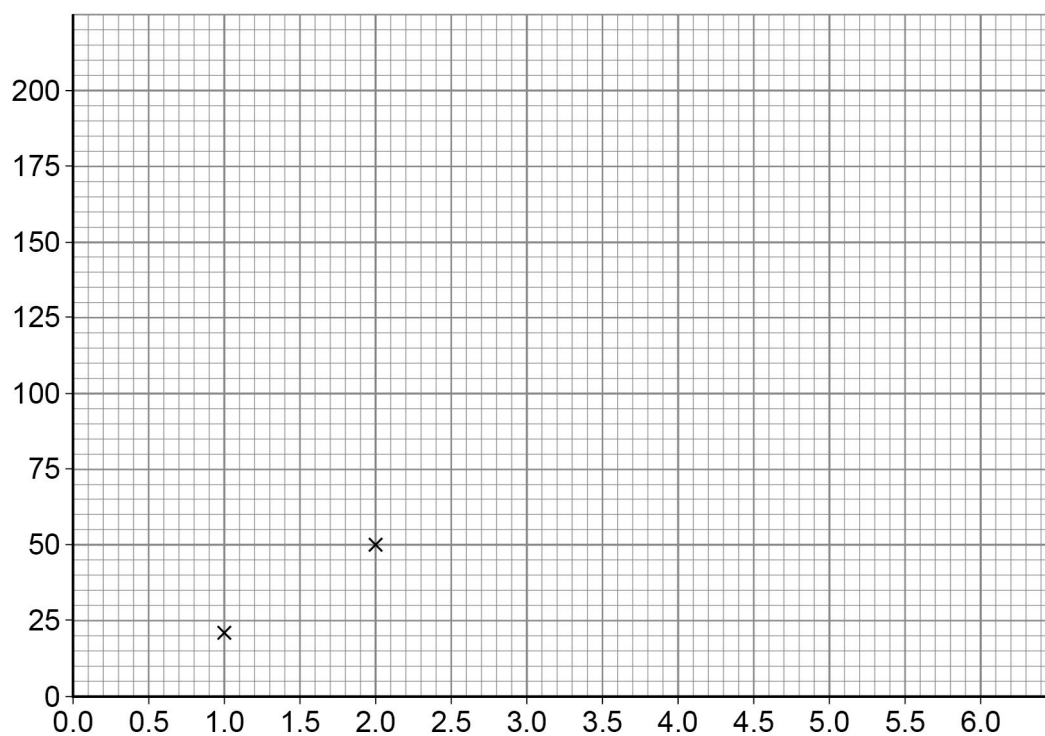
Value **X** = _____ mm



0 9 . 3

Figure 15 is an incomplete graph for the data in Table 4.

Figure 15



Complete Figure 15.

You should:

- label both axes
- plot the data from Table 4
- draw the line of best fit for this data.

[5 marks]

Question 9 continues on the next page

Turn over ►



0	9	.	4
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A different spring has an extension of 0.15 m when a force of 120 N is applied to the spring.

Calculate the spring constant of this spring.

Use the Physics Equations Sheet.

[3 marks]

Spring constant = _____ N/m

16

END OF QUESTIONS



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