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F

Friday 13 November 2020 ± Morning

GCSE (9–1) Combined Science (Physics) A (Gateway Science)

J250/05 Paper 5 (Foundation Tier)

Time allowed: 1 hour 10 minutes

8210503337

You must have:
- a ruler (cm/mm)
- the Data Sheet for GCSE (9–1) Combined Science (Physics) A (inside this document)

You can use:
- a scientific or graphical calculator
- an HB pencil

J250005

Please write clearly in black ink. **Do not write in the barcodes.**

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

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **28** pages.

ADVICE
- Read each question carefully before you start your answer.

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SECTION A

Answer **all** the questions.

You should spend a maximum of 20 minutes on this section.

Write your answer to each question in the box provided.

1 Which action increases the strength of an electromagnet?

A Decreasing the current.

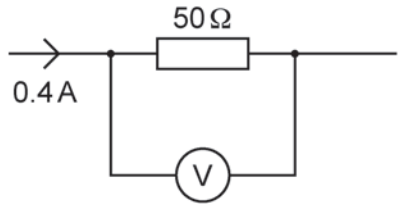
B Decreasing the number of turns of wire.

C Increasing the number of turns of wire.

D Using a copper core.

Your answer ☐ **[1]**

2 Look at the circuit diagram.



What is the potential difference across the 50 Ω resistor?

Use the equation: potential difference = current × resistance

A 0.008 V

B 12.5 V

C 20 V

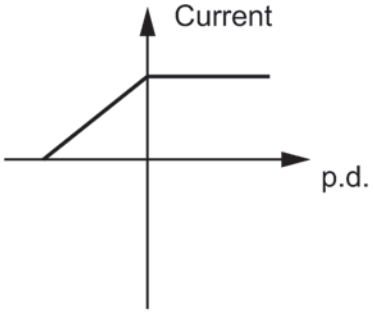
D 125 V

Your answer ☐ **[1]**

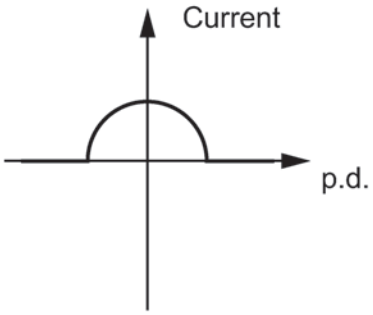
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3 Which is the correct graph for a filament lamp?

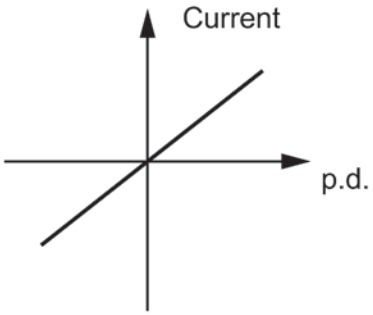
A



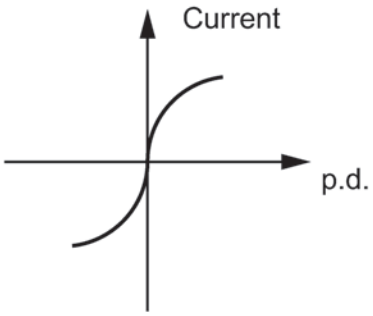
B



C



D



Your answer ☐ **[1]**

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4 A man has a mass of 70 kg.

What is the weight of the man?

Use the equation: gravity force = mass × gravitational field strength

The gravitational field strength on Earth = 10 N / kg.

A 0.7 N

B 7 N

C 700 N

D 700 000 N

Your answer ☐ **[1]**

5 Vectors and scalars are different.

Which statement is correct?

A Speed has a direction. It is a vector.

B Speed only has size. It is a scalar.

C Velocity is a scalar and a vector.

D Velocity only has size. It is a scalar.

Your answer ☐ **[1]**

6 The unit of force is the newton (N). The unit of distance is the metre (m).

Which unit is the same as the newton-metre (Nm)?

Use the equation: work done = force × distance

A Joules (J)

B Kilograms (kg)

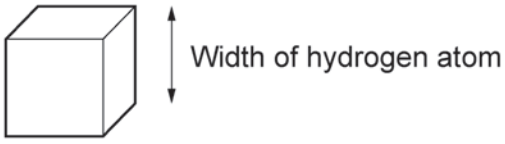
C Newtons per kilogram (N / kg)

D Watts (W)

Your answer ☐ **[1]**

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7 A physics student says a hydrogen atom is like a cube.



What is the **approximate** volume of this hydrogen atom?

A $1 \times 10^{-30}\,m^3$

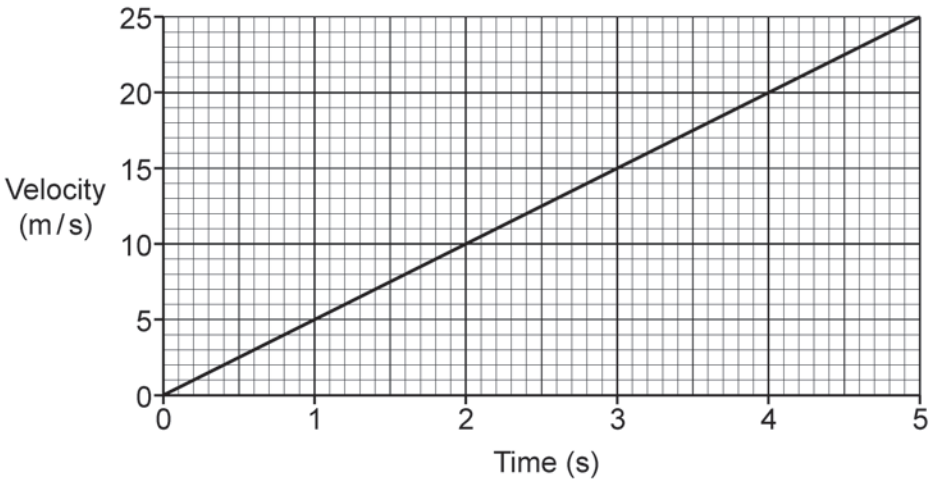
B $1 \times 10^{-27}\,m^3$

C $1 \times 10^{-10}\,m^3$

D $1 \times 10^{-9}\,m^3$

Your answer ☐ **[1]**

8 This is a velocity-time graph for a car.



Calculate the acceleration of the car.

Use the equation: acceleration = change in velocity ÷ time

A $0.2\,m/s^2$

B $5\,m/s^2$

C $6\,m/s^2$

D $25\,m/s^2$

Your answer ☐ **[1]**

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9 Which statement describes an atom?

A The nucleus is smaller than the atom and contains no mass.

B The nucleus is smaller than the atom and contains most of the mass.

C The nucleus orbits the electrons and contains most of the mass.

D The nucleus orbits the protons and contains electrons.

Your answer ☐ **[1]**

10 Which row of the table describes a physical change?

	Process	Material
A	Can be reversed	Keeps new properties when reversed.
B	Can be reversed	Returns to original properties when reversed.
C	Cannot be reversed	Has new properties after the change.
D	Cannot be reversed	Keeps its original properties after the change.

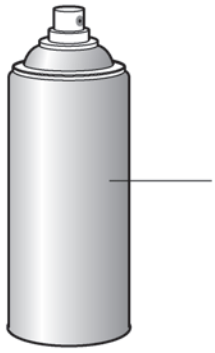
Your answer ☐ **[1]**

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SECTION B

Answer **all** the questions.

11 An aerosol canister contains a non-flammable gas at high pressure. The aerosol canister should **not** be exposed to high temperatures.



Complete the sentences using the words below.

You can use each word once, more than once, or not at all.

accelerate **collide** **faster** **pressure**

slower **temperature** **vibrate** **volume**

When the temperature of the gas in the aerosol canister increases, gas particles move

..... .

The gas particles ..... with the sides of the aerosol canister more often.

The ..... of the gas increases, so the aerosol canister may explode.

[3]

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12 Two students, **P** and **Q**, are each calculating their mean speed when running 200 m.

One lap of a running track is 400 m.

(a) To be able to calculate their mean speed the students must use **two** pieces of apparatus and measure **two** quantities.

Draw lines to join the pictures to the correct name of the apparatus they should use.

Draw lines to join the name of the apparatus selected to the quantities they measure.

Picture of apparatus	Name of apparatus	Quantities
	30 cm ruler	Length of 200 m from the start.
	Trundle wheel	Time to start moving.
	Newton meter	Time to travel 200 m.
	Stopwatch	Length of 1 lap of the track.

[3]

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(b) Student **P** makes three attempts at running 200 m. This is the results table showing the times achieved by student **P**.

	Time 1 (s)	Time 2 (s)	Time 3	Mean (s)
First row				
Second row	31	31.2	10.1	

(i) Look at the **first row** of the table.

What mistake has the student made?

..... **[1]**

(ii) Look at the **second row** of the table.

How many decimal places should the student have for **Time 1**?

..... **[1]**

(iii) Calculate the mean of the data in the table.

Mean = ... s **[1]**

(iv) Suggest what the student could do to improve their experiment.

.....

.....

..... **[1]**

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(c) This is part of the results table for student **Q** who runs 200 m.

Mean (s)
40

Calculate the mean speed of student **Q** running 200 m.

Use the equation: distance travelled = speed × time

Mean speed = ... m/s **[3]**

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13 Salol is a solid at room temperature. A student heats some salol in a boiling tube, as shown in **Fig. 13.1**.

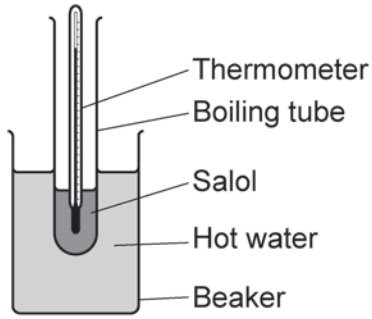


Fig. 13.1

She measures the temperature of the salol at different times. **Fig. 13.2** is a graph of her results.

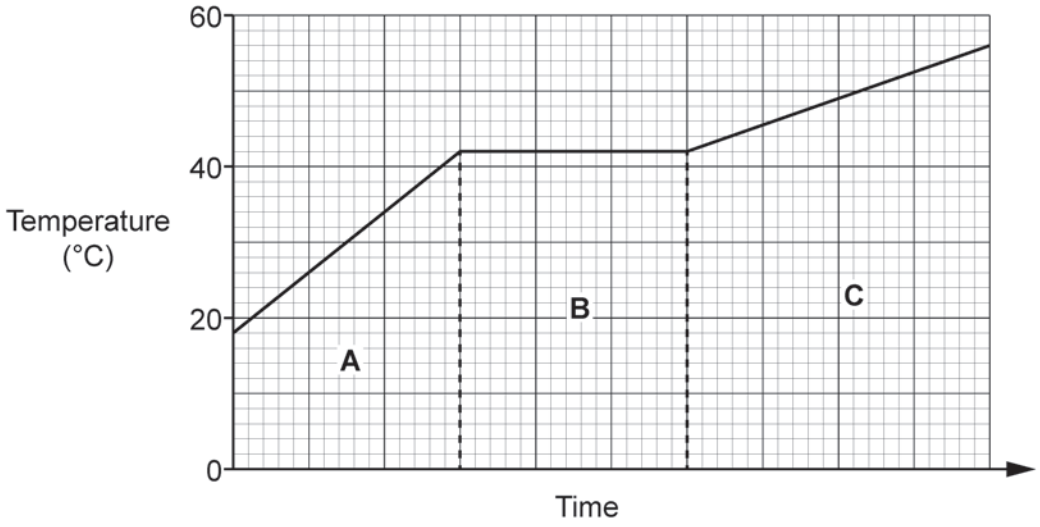


Fig. 13.2

(a) **Fig. 13.3** is a model of particles in salol.

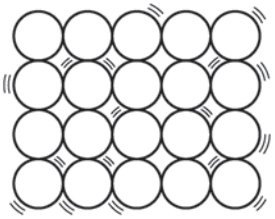


Fig. 13.3

In which part of the graph, **A**, **B** or **C**, would the particles look like those in **Fig. 13.3**?

Tick (✓) **one** box.

A ☐

B ☐

C ☐

[1]

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(b) What is the melting point of salol?

Melting point = ... °C **[1]**

(c) In which part of the graph, **A**, **B** or **C**, is salol a solid **and** a liquid?

Tick (✓) **one** box.

A ☐

B ☐

C ☐

[1]

(d) Complete the sentences using the words or phrases below.

You can use each word or phrase once, more than once, or not at all.

break **decreases** **form** **increases** **stays the same**

In part **B** of the graph, bonds between salol particles ..... .

In part **B** of the graph, the temperature ..... .

In part **B** of the graph, the kinetic energy store of the salol ..... .

In part **B** of the graph, the mass of the salol ..... .

[4]

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(e) (i) The student is given 20 grams (g) of salol.

What is the mass of salol in kilograms (kg)?

Mass = ... kg **[1]**

(ii) The specific latent heat of fusion of salol is 89 700 J / kg.

How much thermal energy is needed to completely melt 0.01 kg of salol?

Use an equation from the Data Sheet to help you.

Thermal energy = ... J **[2]**

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14 Plastic rods are used in static electricity experiments.

(a) Describe how a student could charge a plastic rod.

.....

..... **[1]**

(b) **Fig. 14.1** is a diagram of a plastic rod before being charged.

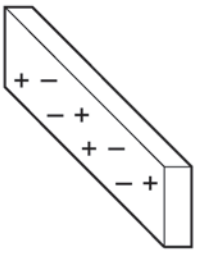


Fig. 14.1

Explain why the plastic rod becomes positively charged.

You may add to the diagram to explain your answer.

.....

..... **[2]**

(c) A teacher has two charged rods. One rod is positively charged.

She holds the positively charged rod near the other charged rod.

The rods move towards each other, as shown in **Fig. 14.2**.

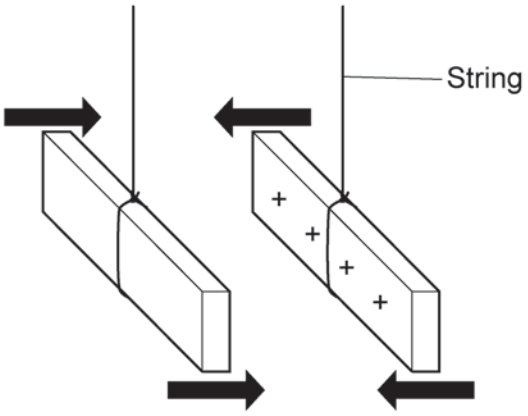


Fig. 14.2

Explain why the rods move towards each other.

.....

.....

..... **[2]**

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15 Look at the circuit in **Fig. 15.3**. The lamps in the circuit are identical.

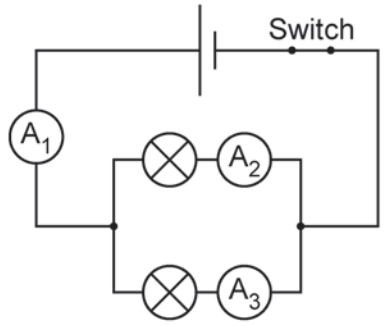


Fig. 15.3

(a) Ammeter A_2 reads 500 mA.

What is the reading on ammeter A_1 and ammeter A_3 in **amps (A)**?

Ammeter A_1 = ... A

Ammeter A_3 = ... A **[2]**

(b) Ammeter A_2 still reads 0.5A.

How much charge flows through ammeter A_2 in 20 seconds?

Use the equation: charge flow = current × time

Charge flow = ... C **[2]**

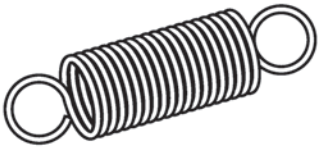
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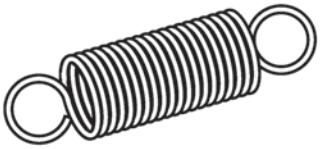
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16* A student is conducting an experiment by hanging some masses on two springs, **A** and **B**, and recording the extension.

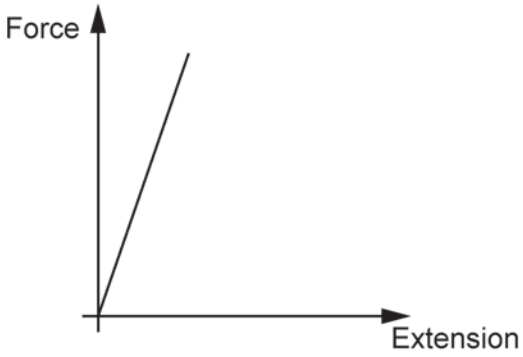


Spring **A** before the experiment

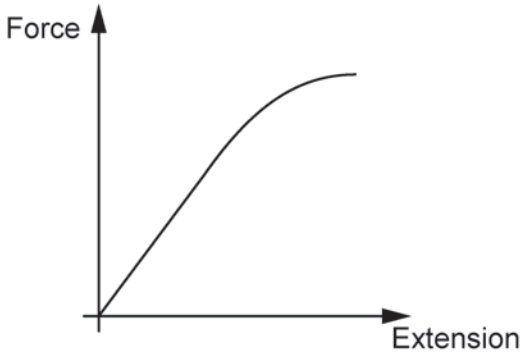


Spring **B** before the experiment

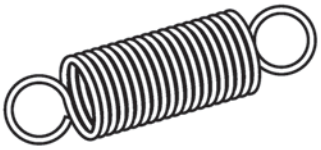
Here are graphs of his results:



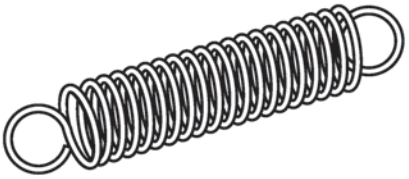
Spring **A**



Spring **B**



Spring **A** after the experiment



Spring **B** after the experiment

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Use the graphs to describe the properties of spring **A** and spring **B**.

Write about Hooke's law in your answer.

.....

.....

.....

.....

.....

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..... **[6]**

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17 This question is about magnetic fields.

(a) **Fig. 17.1** is a diagram of the magnetic field around a bar magnet.

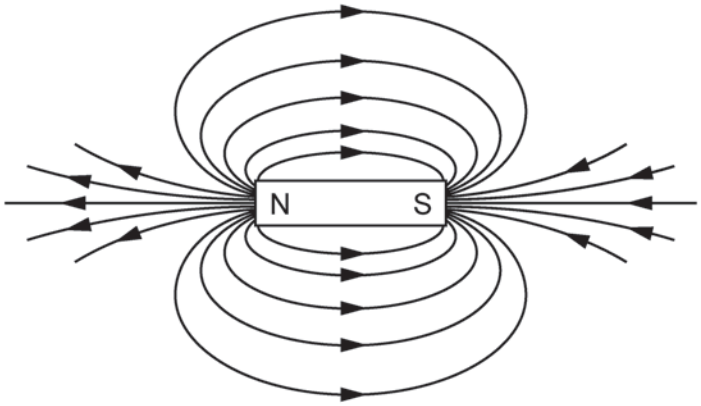


Fig. 17.1

The field lines give information about magnetic forces.

State **two** pieces of information **Fig. 17.1** gives you.

1.....

.....

2.....

.....

[2]

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(b) A student has a permanent magnet and three metal blocks marked **A**, **B** and **C**, as shown in **Fig. 17.2**.

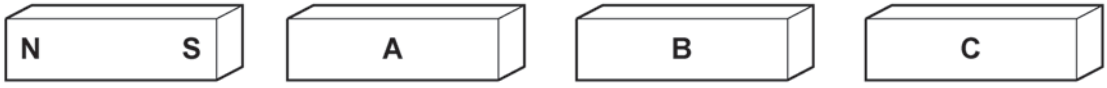


Fig. 17.2

- One block is a permanent magnet.
- One block is a piece of copper.
- One block is a piece of iron.

Explain how the student can use the permanent magnet to identify block **A**, **B** and **C**.

.....

.....

.....

.....

..... **[3]**

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(c) **Fig. 17.3** is a picture of a dipping compass.

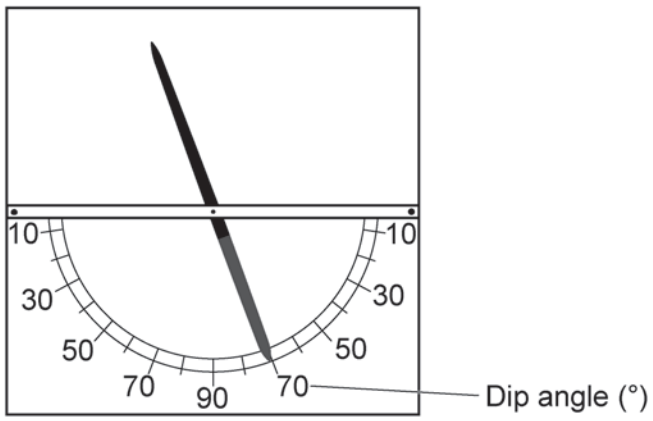


Fig. 17.3

The dip angle can be measured at different distances from the Earth's North pole.

The graph in **Fig. 17.4** shows how the dip angle varies with distance from the Earth's North pole.

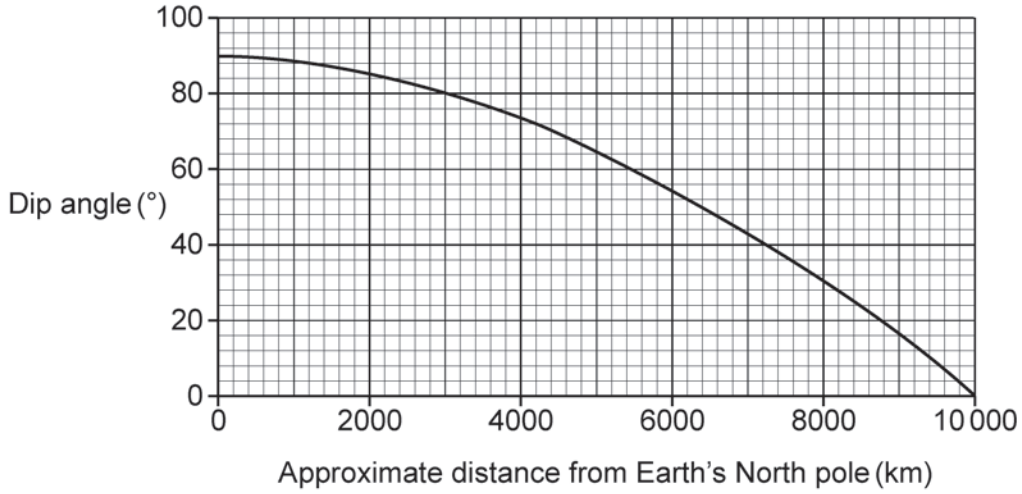


Fig. 17.4

(i) Describe the relationship shown in the graph in **Fig. 17.4**.

.....

.....

..... **[2]**

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(ii) London is approximately 4200 km from the North pole.

Use the graph in **Fig. 17.4** to estimate the dip angle in London.

Dip angle = ...° **[1]**

(iii) The actual value of the dip angle in London is 66°, with an uncertainty of +/– 3°.

Is the value you obtained in part **(c)(ii)** accurate? Explain your answer.

.....

..... **[1]**

(iv) The dipping compass gives important information about the Earth.

Describe what the dipping compass tells us about the Earth.

.....

..... **[1]**

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(d) The graph in **Fig. 17.5** shows how the magnetic field strength around a straight wire decreases with distance from the wire.

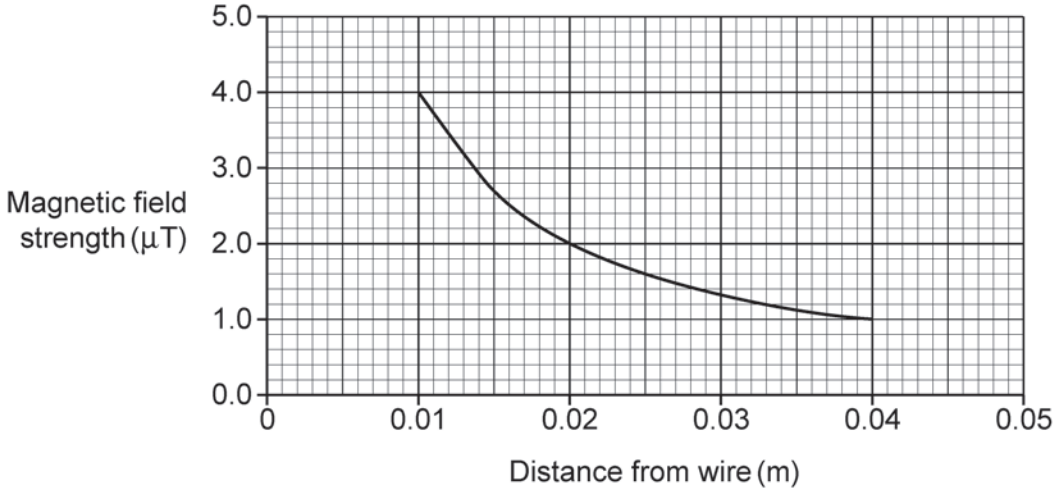


Fig. 17.5

Two students are discussing the graph in **Fig. 17.5**. This is what they say:

Student **X**: 'As distance doubles, field strength is multiplied by 0.25.'

Student **Y**: 'As distance doubles, field strength is multiplied by 0.75.'

Use the graph in **Fig. 17.5** to evaluate each statement.

.....

.....

.....

..... **[2]**

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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