Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

Pearson Edexcel Level 1/Level 2 GCSE (9–1)

Friday 16 June 2023

Morning (Time: 1 hour 10 minutes)

Paper reference **1SC0/2PF**

Combined Science

PAPER 6

Foundation Tier

You must have:
Calculator, ruler, Equation Booklet (enclosed)

Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

Information

- The total mark for this paper is 60.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- In questions marked with an **asterisk** (*), marks will be awarded for your ability to structure your answer logically, showing how the points that you make are related or follow on from each other where appropriate.
- A list of equations is included at the end of this exam paper.

Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.
- Individual links to questions and texts can be found at the bottom of some pages and are shown by a link symbol 🔗.

Turn over ▶

Answer ALL questions. Write your answers in the spaces provided.

Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

1 (a) Figure 1 shows the parts in an electrical circuit.

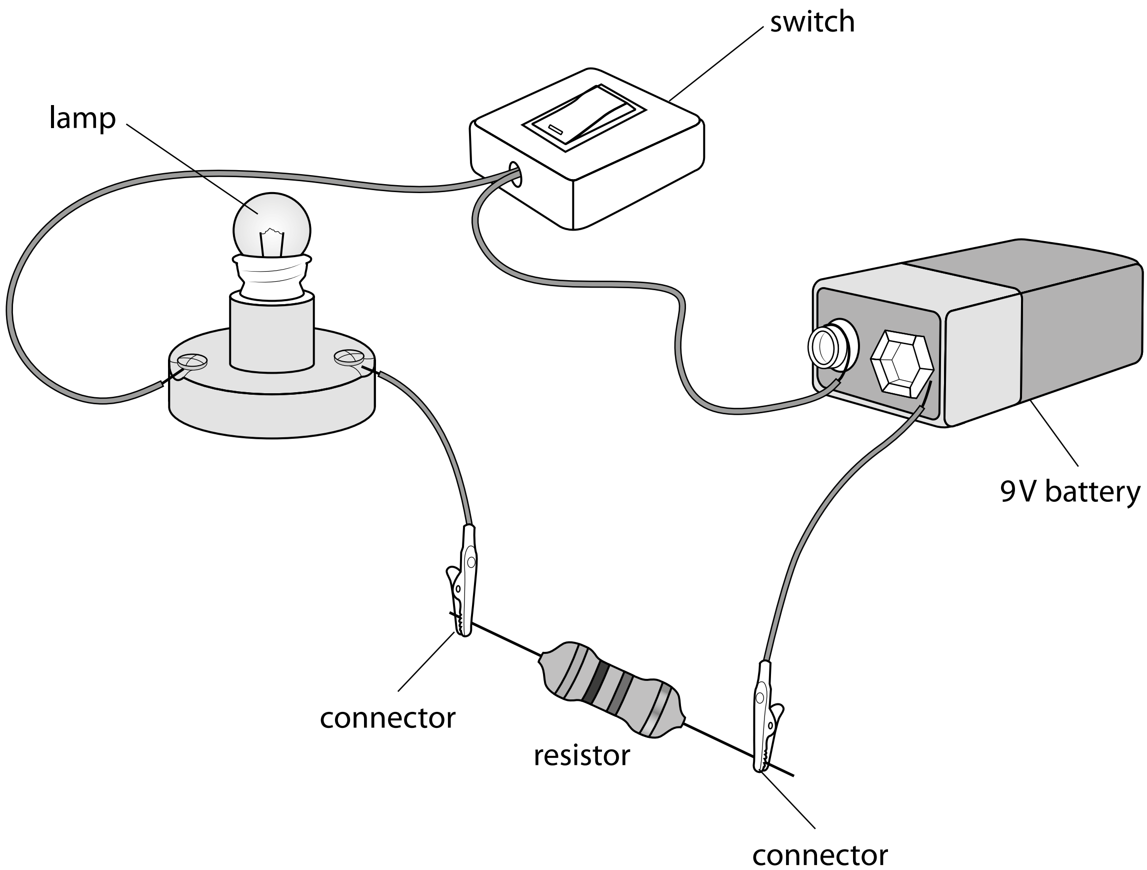


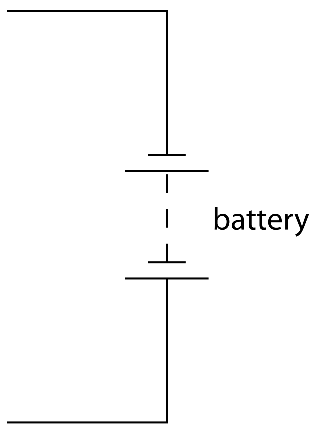
Figure 1

Draw the circuit diagram of this electrical circuit in the space provided.

The battery symbol and some of the connecting wires have been drawn for you.

(4)

circuit diagram



(b) Figure 2 shows the current flowing into and out of point P in part of a circuit.

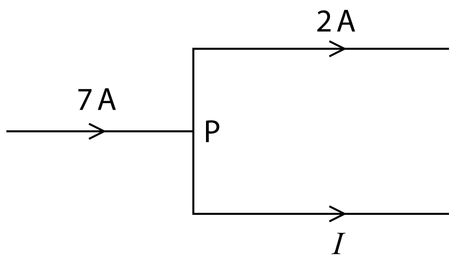


Figure 2

Which of these is the value of current I?

(1)

- ☐ **A** 2 A
- ☐ **B** 5 A
- ☐ **C** 7 A
- ☐ **D** 9 A

(c) (i) There is a current of 0.46 A in a lamp.

Calculate the total charge that flows through the lamp in 30 seconds.

Use the equation

charge = current × time in seconds

(2)

charge = ... C

(ii) The voltage across the lamp is 6.0 V.

The current in the lamp is 0.46 A.

Calculate the energy transferred to the lamp in one minute.

Use the equation

$$\text{energy transferred} = \text{current} \times \text{voltage} \times \text{time in seconds}$$

(2)

energy transferred = ... J

(Total for Question 1 = 9 marks)

2 This question is about magnets and magnetism.

(a) Figure 3 shows a magnet that has picked up three paper clips.

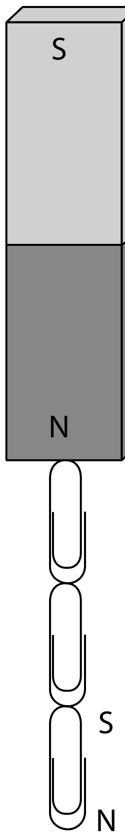


Figure 3

(i) The poles of the lowest paper clip are labelled.

Label the poles of the other two paper clips in Figure 3.

(2)

(ii) Complete the sentence, by choosing a word from the box, to describe the type of magnetism that these paper clips have.

(1)

alternated	earthed	induced	transformed

These paper clips have .... magnetism.

(iii) Suggest a material that these paper clips in Figure 3 could be made from.

(1)

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(iv) When the paper clips were pulled off the magnet they fell separately to the table.

Describe how you could test whether any of the paper clips had kept any magnetism.

(2)

(b) Figure 4 shows the magnetic field around a wire carrying a current.

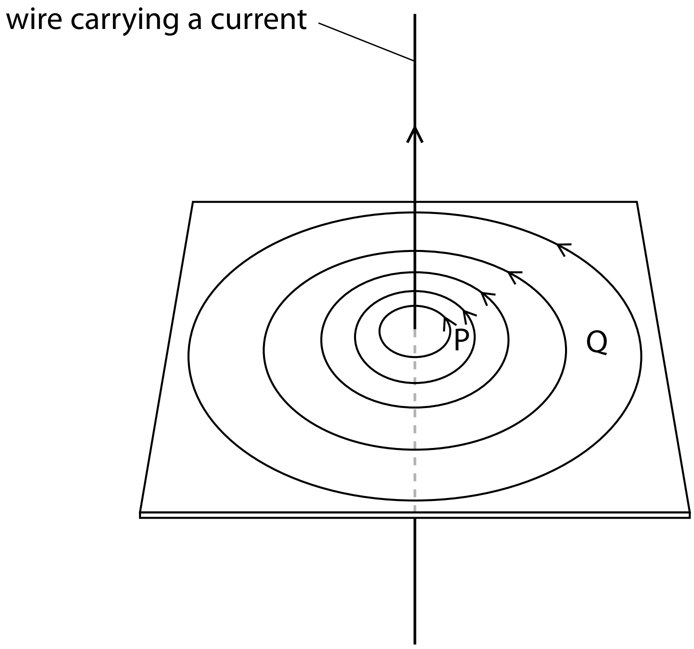

Figure 4

(i) State how you can tell from Figure 4 that the strength of the field is greater at P than at Q.

(1)

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(ii) The magnetic field strength is measured at P for different values of current in the wire.

The results of this investigation are shown in Figure 5.

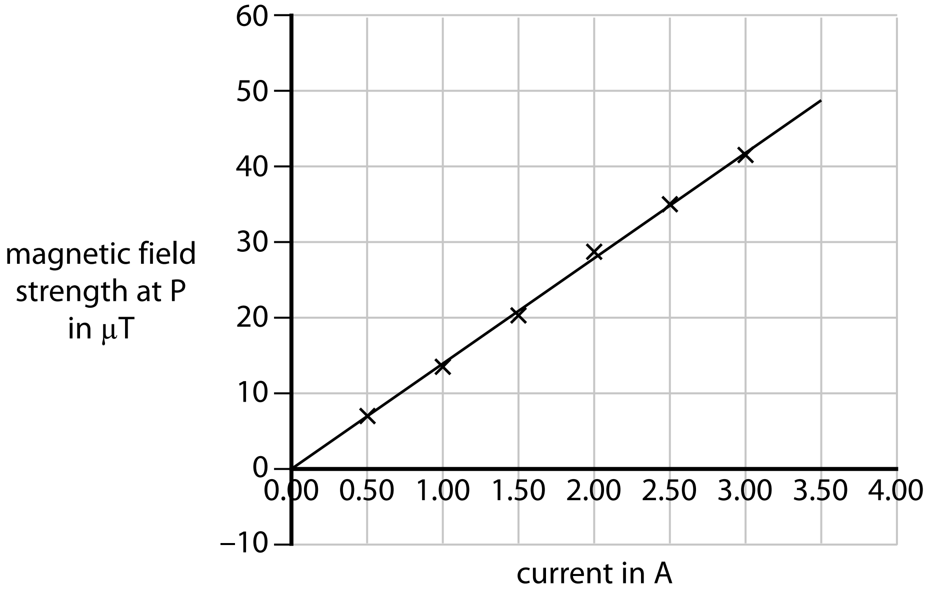

Figure 5

Describe the relationship between magnetic field strength and current.

(2)

(Total for Question 2 = 9 marks)

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3 Figure 6 shows part of the UK National Grid system for the supply of electricity to homes.

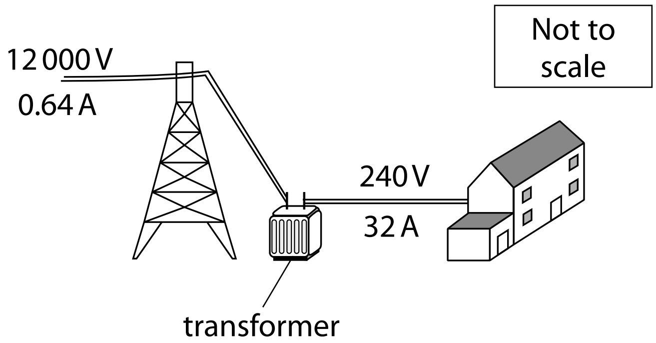

Figure 6

(a) Electricity supplied to homes has a frequency of

(1)

- ☐ **A** 0.02 Hz
- ☐ **B** 20 Hz
- ☐ **C** 50 Hz
- ☐ **D** 500 Hz

(b) Explain why the National Grid uses high voltages with small currents to transfer electricity from power stations.

(2)

(c) Figure 7 shows details of a transformer.

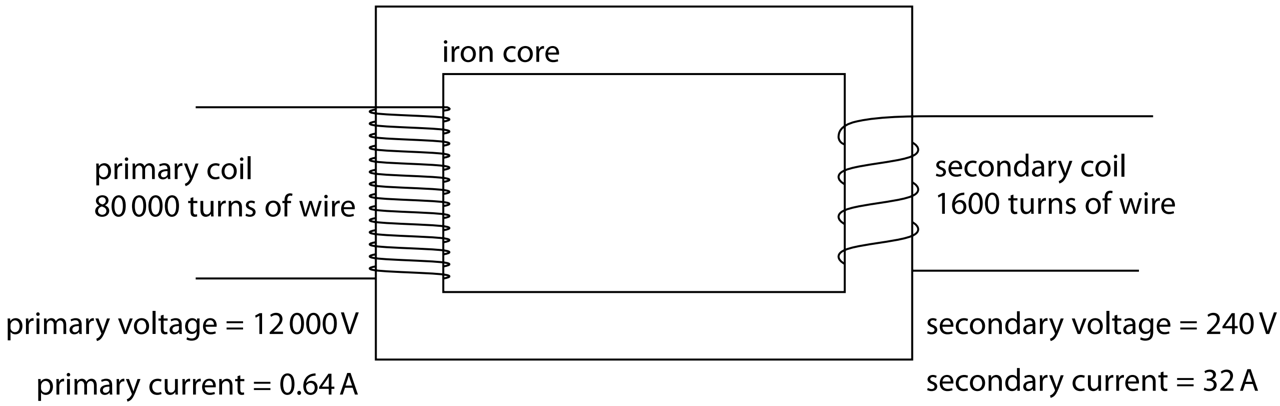

Figure 7

(i) Calculate the power in the primary coil.

Use the equation

$$P = V \times I$$

(2)

power in the primary coil = ... W

(ii) Calculate the following for the transformer in Figure 7.

$$\frac{\text{number of turns in secondary coil}}{\text{number of turns in primary coil}}$$

(2)

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(iii) For the transformer in Figure 7, evaluate, in its simplest form, the ratio

secondary voltage : primary voltage

(2)

:

(Total for Question 3 = 9 marks)

4 This question is about energy transfers.

Figure 8 shows the apparatus used for investigating the transfer between gravitational potential energy and kinetic energy.

A metal ball is attached to a thread.

The ball is released from a starting position and swings on the thread.

The ball cuts a light beam at the bottom of its swing.

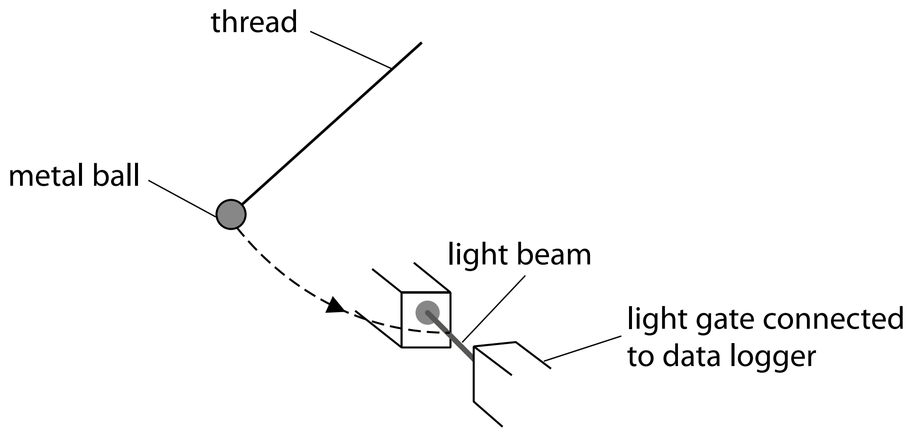

Figure 8

When the ball cuts the light beam, the speed of the ball is recorded by the data logger.

The ball was released 3 times from the same height and the speed measured each time.

The measurements of speed are given in Figure 9.

speed in m/s	1.31	1.27	1.16

Figure 9

(a) Calculate the mean speed.

(2)

mean speed = ... m/s

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(b) Suggest **one** reason why the measurements of speed were repeated.

(1)

(c) The mass of the ball is 0.052 kg.

The ball falls through a vertical height (Δh) of 5.0 cm as it swings.

The gravitational field strength, g, is 10 N/kg.

Calculate the change in the gravitational potential energy of the ball.

Use the equation

$$\Delta GPE = m \times g \times \Delta h$$

(3)

change in gravitational potential energy = J

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(d) Figure 10 shows an end-on view of the ball's swing from its starting position.

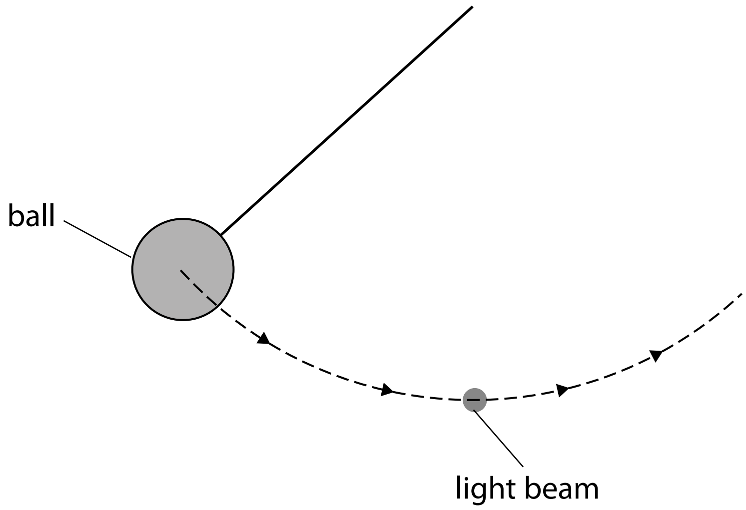

Figure 10

(i) To measure the change in vertical height, Δh, through which the ball moves, a ruler could be used.

Draw a ruler on Figure 10, placed in a position to measure the change in vertical height Δh.

(1)

(ii) Figure 11 shows a set square.

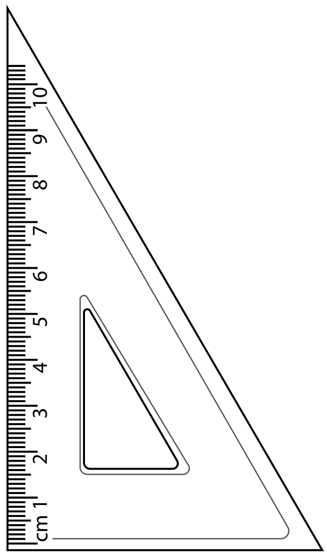

Figure 11

Describe how the measurement of the change in vertical height, Δh, could be improved using the set square.

You may add to Figure 10 or Figure 11 to help your description.

(2)

(Total for Question 4 = 9 marks)

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5 (a) The voltage (potential difference) across a length of wire is 1.5 V.

A charge of 0.042 C flows through the wire.

Calculate the energy transferred.

Use the equation

$$E = Q \times V$$

(2)

E = ... J

(b) Figure 12 shows some of the apparatus that students use to determine the resistance of a piece of iron wire.

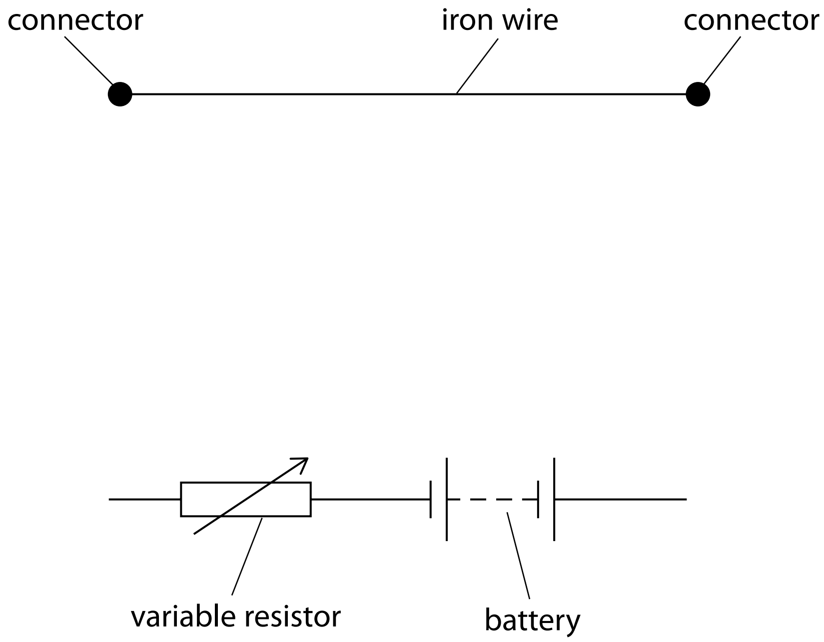

Figure 12

Add connecting wires, a voltmeter and an ammeter to complete the circuit in Figure 12 so that the students can determine the resistance of the piece of iron wire.

(2)

(c) The students extend the investigation to determine how the resistance of the iron wire changes with its length.

(i) Give the name of **one** additional piece of apparatus the students would need.

(1)

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(ii) Figure 13 shows a graph of the results.

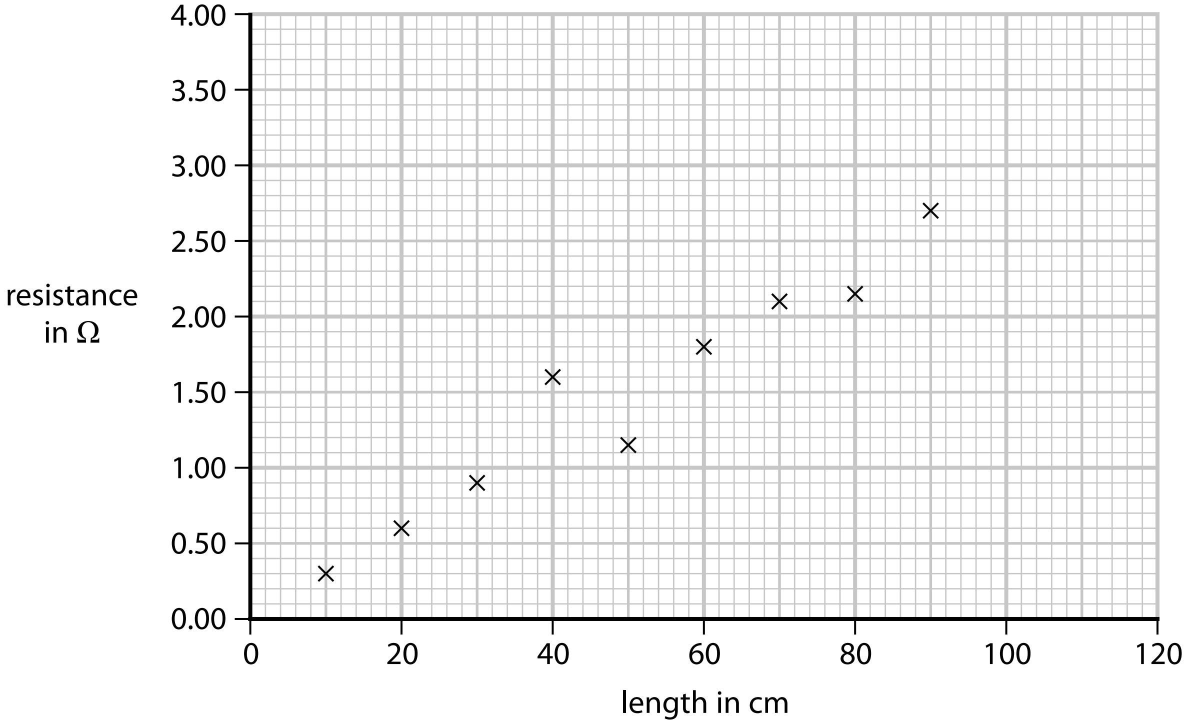

Figure 13

Draw a straight line of best fit on Figure 13.

(1)

(iii) Use Figure 13 to estimate the resistance of a 100 cm length of the iron wire.

(1)

resistance = ... Ω

(iv) The variable resistor shown in Figure 12 is used to prevent the iron wire from becoming too hot.

Explain how the variable resistor is used to prevent the iron wire from becoming too hot.

(2)

(d) The potential difference (voltage) across another piece of wire is 1.56 V.

The current in the wire is 0.45 A.

Calculate the resistance of this piece of wire.

Use the equation

$$V = I \times R$$

(2)

resistance = ... Ω

(Total for Question 5 = 11 marks)

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6 (a) Which of these means changing state from solid directly to gas?

(1)

☐ **A** condensing

☐ **B** freezing

☐ **C** melting

☐ **D** sublimating

(b) An object has a mass of 7.22×10^{-2} kg and a volume of 2.69×10^{-5} m^3.

Calculate the density, ρ, of the object.

Use the equation

$$\rho = \frac{m}{V}$$

(3)

State the unit.

density = ... unit ....

(c) Aluminium has a melting point of 660 °C.

The absolute zero of temperature is –273 °C.

(i) Calculate the melting point of aluminium in kelvin.

(1)

melting point of aluminium = ... K

(ii) Describe the motion of particles in liquid aluminium (above 660 °C).

(2)

*(d) The table shows some properties of two materials used as thermal insulation.

The higher the R-value, the better the thermal insulating properties of the material.

material	R-value	fire resistance
fibreglass, made from sand	R-3.3	non-flammable
polystyrene, made from petroleum oil	R-4.0	melts at 270 °C and spreads fire very quickly

Assess which of these materials may be the more suitable to use as thermal insulation in a building.

Your answer should compare the properties of fibreglass and polystyrene given in the table.

(6)

(Total for Question 6 = 13 marks)

TOTAL FOR PAPER = 60 MARKS

Equations

(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance $v^2 - u^2 = 2 \times a \times x$
energy transferred = current × potential difference × time $E = I \times V \times t$
potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil $V_p \times I_p = V_s \times I_s$
change in thermal energy = mass × specific heat capacity × change in temperature $\Delta Q = m \times c \times \Delta\theta$
thermal energy for a change of state = mass × specific latent heat $Q = m \times L$
to calculate pressure or volume for gases of fixed mass at constant temperature $P_1 V_1 = P_2 V_2$
energy transferred in stretching = 0.5 × spring constant × (extension)^2 $E = \frac{1}{2} \times k \times x^2$

Pearson Edexcel Level 1/Level 2 GCSE (9–1)

May–June 2023 Assessment Window

Paper reference **1SC0/2PF**

Combined Science

PAPER 6

Foundation Tier

Equation Booklet

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Pearson

If you're taking **GCSE (9–1) Combined Science** or **GCSE (9–1) Physics**, you will need these equations:

HT = higher tier

	distance travelled = average speed × time	
	acceleration = change in velocity ÷ time taken	$a = \frac{(v-u)}{t}$
	force = mass × acceleration	$F = m \times a$
	weight = mass × gravitational field strength	$W = m \times g$
HT	**momentum = mass × velocity**	$\boldsymbol{p = m \times v}$
	change in gravitational potential energy = mass × gravitational field strength × change in vertical height	$\Delta GPE = m \times g \times \Delta h$
	kinetic energy = 1/2 × mass × $(\text{speed})^2$	$KE = \frac{1}{2} \times m \times v^2$
	efficiency = $\frac{(\text{useful energy transferred by the device})}{(\text{total energy supplied to the device})}$	
	wave speed = frequency × wavelength	$v = f \times \lambda$
	wave speed = distance ÷ time	$v = \frac{x}{t}$
	work done = force × distance moved in the direction of the force	$E = F \times d$
	power = work done ÷ time taken	$P = \frac{E}{t}$
	energy transferred = charge moved × potential difference	$E = Q \times V$
	charge = current × time	$Q = I \times t$
	potential difference = current × resistance	$V = I \times R$
	power = energy transferred ÷ time taken	$P = \frac{E}{t}$
	electrical power = current × potential difference	$P = I \times V$
	electrical power = $(\text{current})^2$ × resistance	$P = I^2 \times R$
	density = mass ÷ volume	$\rho = \frac{m}{V}$

	force exerted on a spring = spring constant × extension	$F = k \times x$
	(final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance	$v^2 - u^2 = 2 \times a \times x$
HT	**force = change in momentum ÷ time**	$\boldsymbol{F = \frac{(mv - mu)}{t}}$
	energy transferred = current × potential difference × time	$E = I \times V \times t$
HT	**force on a conductor at right angles to a magnetic field carrying a current = magnetic flux density × current × length**	$\boldsymbol{F = B \times I \times l}$
	For transformers with 100% efficiency, potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil	$V_P \times I_P = V_S \times I_S$
	change in thermal energy = mass × specific heat capacity × change in temperature	$\Delta Q = m \times c \times \Delta\theta$
	thermal energy for a change of state = mass × specific latent heat	$Q = m \times L$
	energy transferred in stretching = 0.5 × spring constant × (extension)^2	$E = \frac{1}{2} \times k \times x^2$

If you're taking **GCSE (9–1) Physics**, you also need these extra equations:

	moment of a force = force × distance normal to the direction of the force	
	pressure = force normal to surface ÷ area of surface	$P = \frac{F}{A}$
HT	$\boldsymbol{\frac{\text{potential difference across primary coil}}{\text{potential difference across secondary coil}} = \frac{\text{number of turns in primary coil}}{\text{number of turns in secondary coil}}}$	$\boldsymbol{\frac{V_p}{V_S} = \frac{N_p}{N_S}}$
	to calculate pressure or volume for gases of fixed mass at constant temperature	$P_1 \times V_1 = P_2 \times V_2$
HT	**pressure due to a column of liquid = height of column × density of liquid × gravitational field strength**	$\boldsymbol{P = h \times \rho \times g}$

END OF EQUATION LIST

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