Please write clearly in block capitals.

F

Centre number ☐☐☐☐☐ Candidate number ☐☐☐☐

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE

COMBINED SCIENCE: TRILOGY

Foundation Tier Physics Paper 1

Practice Paper Series – Set 2

Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:

- a ruler
- a scientific calculator
- the Physics Equations Sheet (printed at the back of this booklet).

Instructions

- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do not write outside the box around each page or 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 marks for questions are shown in brackets.
- The maximum mark for this paper is 70.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- When answering question 07.1 you need to make sure that your answer:
  - is clear, logical, sensibly structured
  - fully developed
  - shows how the points that you make are related or follow on from each other where appropriate.

For Examiner's Use

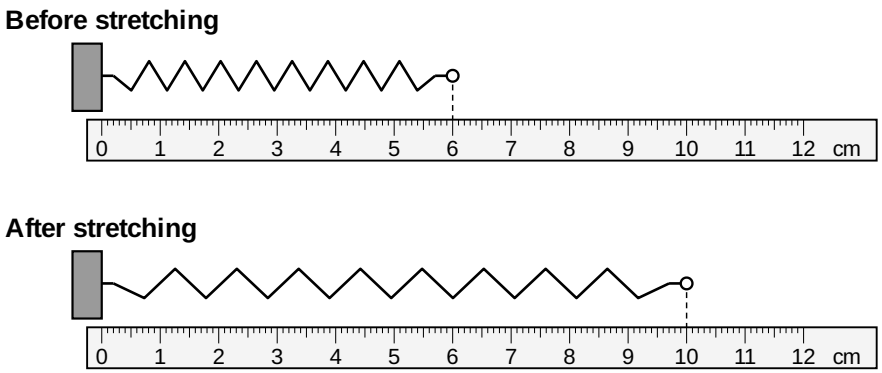
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	

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0 1 A toy launcher uses a spring to launch a toy car.

Figure 1 shows the spring before and after it is stretched.

Figure 1



0 1 . 1 Which energy store of the spring increases when the spring is stretched? [1 mark]

Tick (✓) **one** box.

- Chemical ☐
- Elastic potential ☐
- Gravitational potential ☐
- Kinetic ☐

0 1 . 2 Determine the extension of the spring. [2 marks]

Give your answer in metres.

Extension = ... m

0 1 . 3 The spring constant of the spring is 250 N/m [2 marks]

Calculate the energy stored in the spring when it is stretched.

Use your answer to question 01.2

Assume that the limit of proportionality of the spring has not been exceeded.

Use the Physics Equations Sheet.

Energy stored = ... J

Question 1 continues on the next page

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0 1 . 4 When the spring is released, 0.15 J of energy is transferred to the kinetic energy store of the car. [1 mark]

Calculate the energy transferred to other stores.

Use your answer to question 01.3

Energy = ... J

0 1 . 5 The car moves along a horizontal floor and slows down until it stops. [2 marks]

Explain what happens to the kinetic energy of the car.

.....

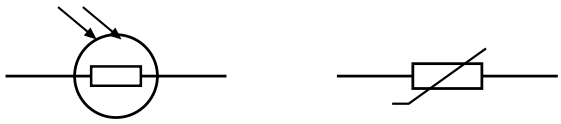
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0 2 **Figure 2** shows the circuit symbols for two components, **A** and **B**.

Figure 2



A **B**

0 2 . 1 Draw **one** line from each circuit symbol to its name. [2 marks]

Component	Name
A	Diode
B	Light-dependent resistor (LDR)
	Thermistor
	Variable resistor

Question 2 continues on the next page

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0 2 . 2 Complete the sentences. [2 marks]

Choose answers from the box. Each answer may be used once, more than once or not at all.

decreases	increases	stays the same

When the light intensity on an LDR increases, the resistance of the LDR

..... .

The potential difference across a thermistor is kept constant. When the temperature of the thermistor increases, the current in the thermistor ..... .

0 2 . 3 In a brightly lit room, an LDR has a resistance of 500 Ω [2 marks]

The potential difference across the LDR is 2.0 V

Calculate the current in the LDR.

Current = ... A

Table 1 shows how the resistance of a thermistor changes with temperature.

Table 1

Temperature in °C	0	10	20	30	40
Resistance of the thermistor in Ω	5800	4200	3100	2300	1700

0 2 . 4 The thermistor is used to control a heater. [1 mark]

The heater switches off when the resistance of the thermistor falls below 2500 Ω

Between which two temperatures in **Table 1** does the heater switch off?

Between ..... °C and ..... °C

Turn over for the next question

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0 3 This question is about the particle model of matter.

0 3 . 1 Compare the arrangement and the movement of the particles in a liquid with those in a gas. [2 marks]

0 3 . 2 A sealed glass jar contains air. The jar is put in a fridge. The volume of the jar does not change. [2 marks]

The pressure of the air in the jar decreases from 104 kPa to 98 kPa

Calculate the percentage decrease in the pressure of the air.

Percentage decrease = ... %

0 3 . 3 Explain why cooling the air decreases its pressure. [3 marks]

Use ideas about particles.

0 3 . 4 What happens to the density of the air in the jar when the air is cooled? [2 marks]

Give a reason for your answer.

Question 3 continues on the next page

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A block of wax has a mass of 50 g

The block of wax is heated until it has all melted.

0 3 . 5 What is the mass of the liquid wax? [1 mark]

Mass = ... g

0 3 . 6 The liquid wax has a volume of 62.5 cm^3 [2 marks]

Calculate the density of the liquid wax.

Density = ... g/cm^3

0 4 An electric toaster has a metal case.

The toaster is connected to the mains electricity supply with a three-core cable.

0 4 . 1 Draw **one** line from each wire to the colour of its insulation. [2 marks]

Wire	Colour of insulation
Earth wire	Blue
Live wire	Brown
Neutral wire	Green and yellow stripes
	Red

0 4 . 2 When the toaster is switched on, 240 C of charge flows through it in one minute. [2 marks]

The potential difference of the mains supply is 230 V

Calculate the energy transferred by the toaster in one minute.

Energy = ... J

Question 4 continues on the next page

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0 4 . 3 The toaster is switched off but it is still connected to the mains supply. [2 marks]

Explain why touching the live wire in the cable could still be dangerous.

.....

.....

.....

.....

0 5 Energy is transferred from a warm house to the surroundings through the walls and the roof.

0 5 . 1 Give **one** way of reducing the energy transferred through the roof of the house. [1 mark]

.....

Table 2 gives the relative thermal conductivity of some materials.

Table 2

Material	Relative thermal conductivity
Brick	0.72
Glass	0.96
Mineral wool	0.040
Polystyrene	0.033
Wood	0.13

0 5 . 2 Which material in **Table 2** would be the best thermal insulator? [2 marks]

Give a reason for your answer.

Material .....

Reason

.....

.....

Question 5 continues on the next page

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A student investigated how the thickness of a layer of polystyrene affects the energy transferred from a can of hot water.

The student wrapped identical cans of hot water in different thicknesses of polystyrene.

The student measured the decrease in the temperature of the water in 10 minutes

Table 3 shows the results.

Table 3

Thickness of polystyrene in mm	0	5	10	15	20	25
Temperature decrease in °C	24	15	11	9	8	7

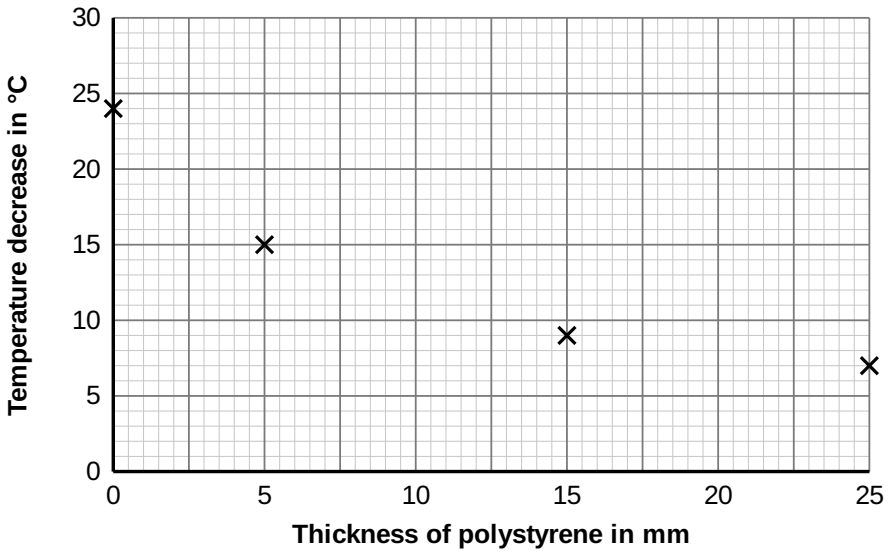
0 5 . 3 **Figure 3** shows some of the results. [3 marks]

Complete **Figure 3**.

You should:

- plot the results for 10 mm and 20 mm
- draw a line of best fit.

Figure 3



0 5 . 4 Use **Figure 3** to estimate the thickness of polystyrene needed for a temperature decrease of 10 °C [1 mark]

Thickness = ... mm

Question 5 continues on the next page

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0 5 . 5 A student said: [2 marks]

'Doubling the thickness of the polystyrene halves the temperature decrease.'

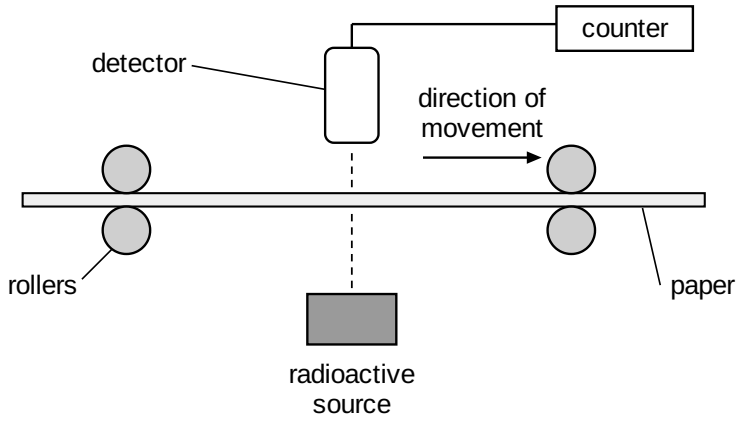
Use **Table 3** to explain why the student is **not** correct.

0 6 A factory makes paper.

A radioactive source is used to check the thickness of the paper.

Figure 4 shows the equipment.

Figure 4



0 6 . 1 The source emits beta radiation. [2 marks]

Explain why a source of beta radiation is used, rather than a source of alpha radiation or a source of gamma radiation.

0 6 . 2 The count rate at the detector decreases. [1 mark]

What does this show about the paper?

Question 6 continues on the next page

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0 6 . 3 The source contains strontium-90. Strontium-90 decays to yttrium (Y) by emitting a beta particle. [2 marks]

Complete the nuclear equation for this decay.

$$^{90}_{38}\text{Sr} \longrightarrow \square\!\!\square\ \text{Y} + {}^{0}_{-1}\text{e}$$

0 6 . 4 Strontium-90 has a half-life of 29 years [1 mark]

Suggest why a source with a long half-life is used.

.....

.....

0 6 . 5 When the source is not being used it is kept in a box lined with lead. [2 marks]

Explain why.

.....

.....

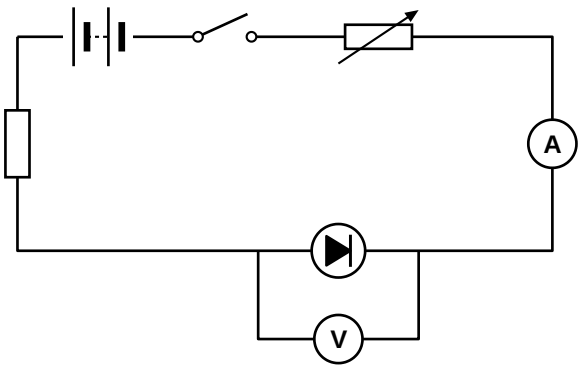
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0 7 A student investigated how the current in a diode depends on the potential difference across the diode.

Figure 5 shows the circuit used.

Figure 5



Question 7 continues on the next page

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0 7 . 1 Describe a method the student could use to obtain the current–potential difference characteristic of the diode. [6 marks]

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Table 4 shows some of the student's results.

Table 4

Potential difference in V	0.00	0.20	0.40	0.50	0.60	0.70	0.80
Current in mA	0.0	0.0	0.1	1.2	6.0	20.0	52.0

0 7 . 2 Describe how the current changes as the potential difference increases from 0 V to 0.80 V [2 marks]

.....

.....

.....

.....

0 7 . 3 Calculate the resistance of the diode when the potential difference across it is 0.70 V [2 marks]

Use **Table 4**.

Resistance = ... Ω

0 7 . 4 Which statement describes a diode? [1 mark]

Tick (✓) **one** box.

- Its resistance is the same in both directions. ☐
- The current in it is directly proportional to the potential difference. ☐
- It has a very high resistance in the reverse direction. ☐
- Its resistance increases as the current increases. ☐

0 7 . 5 The student then reversed the diode in the circuit. [1 mark]

The ammeter reading was 0.0 mA

The resolution of the ammeter was 0.1 mA

The student concluded:

'There is no current at all in the reverse direction.'

Suggest why the student's conclusion may not be correct.

.....

.....

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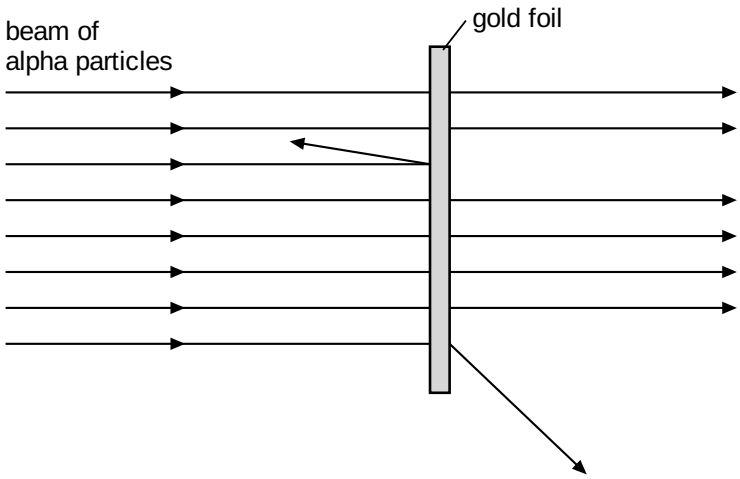
0 8 Scientists have used evidence from experiments to develop models of the atom.

In one experiment, a beam of alpha particles was directed at a very thin sheet of gold foil.

Alpha particles are positively charged.

Figure 6 shows what happened to some of the alpha particles.

Figure 6



0 8 . 1 Most of the alpha particles passed straight through the foil. A few were deflected through large angles. [3 marks]

Explain what these results show about the structure of an atom.

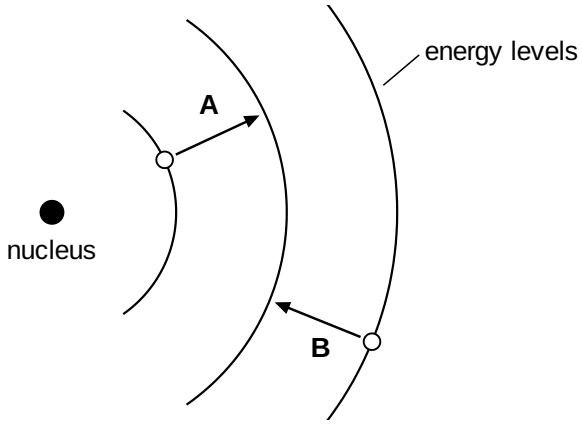
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Question 8 continues on the next page

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Figure 7 shows three energy levels in an atom. Arrows **A** and **B** show electrons changing energy level.

Figure 7



0 8 . 2 State whether energy is absorbed or emitted in change **A** and in change **B**. [2 marks]

A .....

B .....

0 8 . 3 A neutral atom becomes a positive ion. [1 mark]

What happens to the electrons of the atom?

.....

.....

0 8 . 4 The radius of an atom is 1.2×10^{-10} m [2 marks]

The radius of its nucleus is 6.0×10^{-15} m

Calculate how many times as large the radius of the atom is as the radius of its nucleus.

..... times

END OF QUESTIONS

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Write the question numbers in the left-hand margin.

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Physics Equations Sheet

GCSE Combined Science: Trilogy – Practice Paper Series, Set 2

You may use these equations in your answers. HT = Higher Tier only equations. The equations are those listed in the AQA specification; this sheet is provided by sciencegcse.co.uk and is not an AQA document.

		Word equation	Symbol equation
1		kinetic energy = 0.5 × mass × (speed)^2	$E_k = ½ m v^2$
2		elastic potential energy = 0.5 × spring constant × (extension)^2	$E_e = ½ k e^2$
3		gravitational potential energy = mass × gravitational field strength × height	$E_p = m g h$
4		change in thermal energy = mass × specific heat capacity × temperature change	$\Delta E = m c \Delta\theta$
5		power = energy transferred ÷ time	$P = E / t$
6		power = work done ÷ time	$P = W / t$
7		efficiency = useful output energy transfer ÷ total input energy transfer	
		efficiency = useful power output ÷ total power input	
8		charge flow = current × time	$Q = I t$
9		potential difference = current × resistance	$V = I R$
10		power = potential difference × current	$P = V I$
11		power = (current)^2 × resistance	$P = I^2 R$
12		energy transferred = power × time	$E = P t$
13		energy transferred = charge flow × potential difference	$E = Q V$
14	**HT**	potential difference across primary coil × current in primary coil = potential difference across secondary coil × current in secondary coil	$V_p I_p = V_s I_s$
15		density = mass ÷ volume	$\rho = m / V$
16		thermal energy for a change of state = mass × specific latent heat	$E = m L$
17		weight = mass × gravitational field strength	$W = m g$
18		work done = force × distance (along the line of action of the force)	$W = F s$
19		force applied to a spring = spring constant × extension	$F = k e$
20		distance travelled = speed × time	$s = v t$
21		acceleration = change in velocity ÷ time taken	$a = \Delta v / t$
22		(final velocity)^2 − (initial velocity)^2 = 2 × acceleration × distance	$v^2 - u^2 = 2 a s$
23		resultant force = mass × acceleration	$F = m a$
24	**HT**	momentum = mass × velocity	$p = m v$
25		period = 1 ÷ frequency	$T = 1 / f$
26		wave speed = frequency × wavelength	$v = f \lambda$
27	**HT**	force on a conductor (at right angles to a magnetic field) carrying a current = magnetic flux density × current × length	$F = B I l$