Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE

COMBINED SCIENCE: TRILOGY

Higher Tier Physics Paper 2

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 02.1 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	

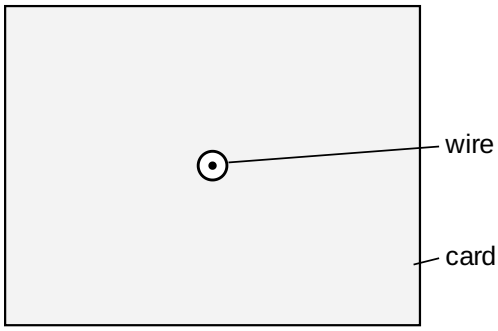
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0 1 A current in a wire produces a magnetic field around the wire.

Figure 1 shows a vertical wire passing through a horizontal piece of card. The view is from above.

The current in the wire is upwards, out of the page.

Figure 1

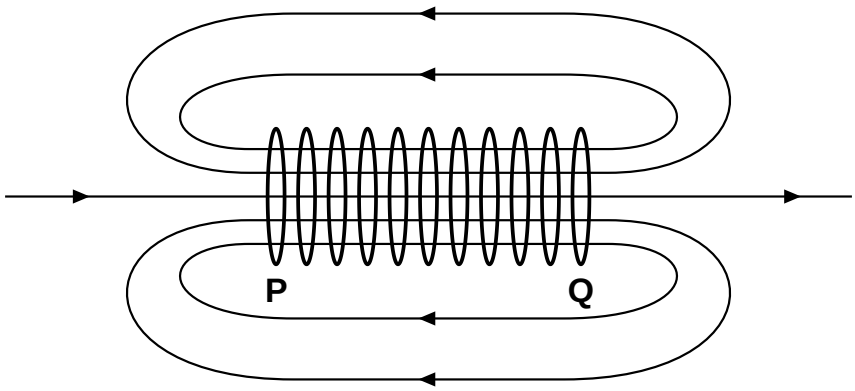


0 1 . 1 Draw the magnetic field pattern around the wire on **Figure 1**. [2 marks]

Show the direction of the magnetic field.

Figure 2 shows the magnetic field of a solenoid. **P** and **Q** are the two ends of the solenoid.

Figure 2



0 1 . 2 Which end of the solenoid, **P** or **Q**, is the north pole? [2 marks]

Give a reason for your answer.

End .....

Reason

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0 1 . 3 The magnetic field inside the solenoid is uniform. [2 marks]

How do the field lines in **Figure 2** show that the field inside the solenoid is uniform?

0 1 . 4 State the effect on the magnetic field of the solenoid of: [2 marks]

- putting an iron core inside the solenoid
- reversing the direction of the current.

Iron core

Reversing the current

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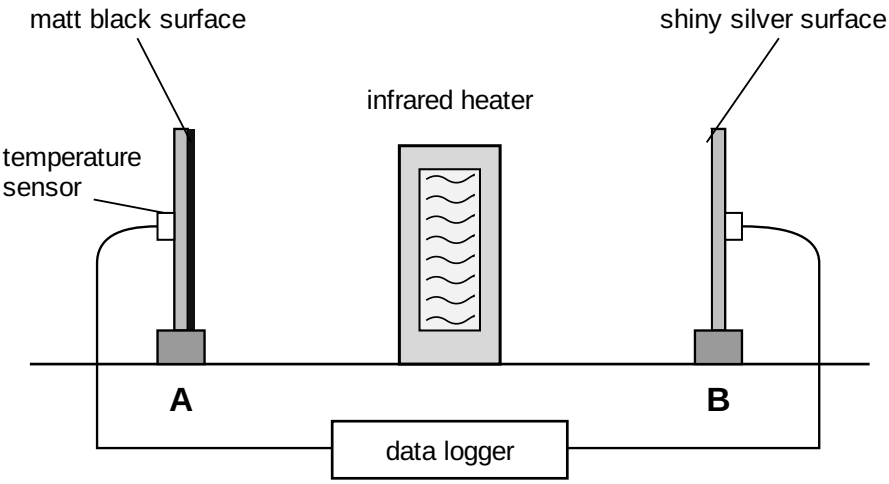
Turn over for the next question

0 2 A student investigated how the type of surface affects how much infrared radiation the surface absorbs.

Figure 3 shows the equipment.

Plates **A** and **B** are identical metal plates. The surface of plate **A** facing the heater is matt black. The surface of plate **B** facing the heater is shiny silver.

Figure 3



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Question 2 continues on the next page

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0 2 . 1 Describe a method the student could use to compare how well the two surfaces absorb infrared radiation. [6 marks]

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Table 1 shows the student's results.

Table 1

Time in minutes	0	1	2	3	4	5
Temperature of plate A in °C	20.0	23.4	26.5	29.2	31.8	34.0
Temperature of plate B in °C	20.0	21.0	21.9	22.8	23.6	24.4

0 2 . 2 Which surface is the better absorber of infrared radiation? [2 marks]

Give a reason for your answer.

Use data from **Table 1**.

Surface .....

Reason

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0 2 . 3 The mass of plate **A** is 0.080 kg [3 marks]

The specific heat capacity of the metal is 900 J/kg °C

Calculate the mean rate at which energy was transferred to the thermal energy store of plate **A** during the 5 minutes

Use the Physics Equations Sheet.

Mean rate = ... W

0 2 . 4 The rate of temperature increase of plate **A** decreased during the investigation. [1 mark]

Suggest why.

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Turn over for the next question

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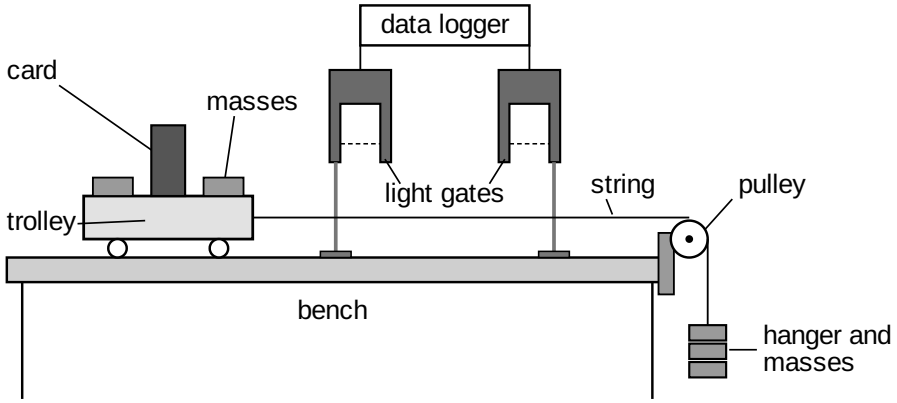
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0 3 A student investigated how the acceleration of a trolley depends on the force pulling it.

Figure 4 shows the equipment.

The pulling force is the weight of the hanger and the masses on it.

Figure 4



0 3 . 1 To increase the pulling force, the student moved masses from the trolley to the hanger. [2 marks]

Explain why the student did not add extra masses to the hanger instead.

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0 3 . 2 In one test, the speed of the card was 0.40 m/s at the first light gate and 0.70 m/s at the second light gate. [2 marks]

The card took 0.60 s to travel from the first light gate to the second light gate.

Calculate the acceleration of the trolley.

Acceleration = ... m/s^2

Question 3 continues on the next page

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Table 2 shows the student's results.

Table 2

Pulling force in N	0.10	0.20	0.30	0.40	0.50
Acceleration in m/s^2	0.10	0.30	0.50	0.70	0.90

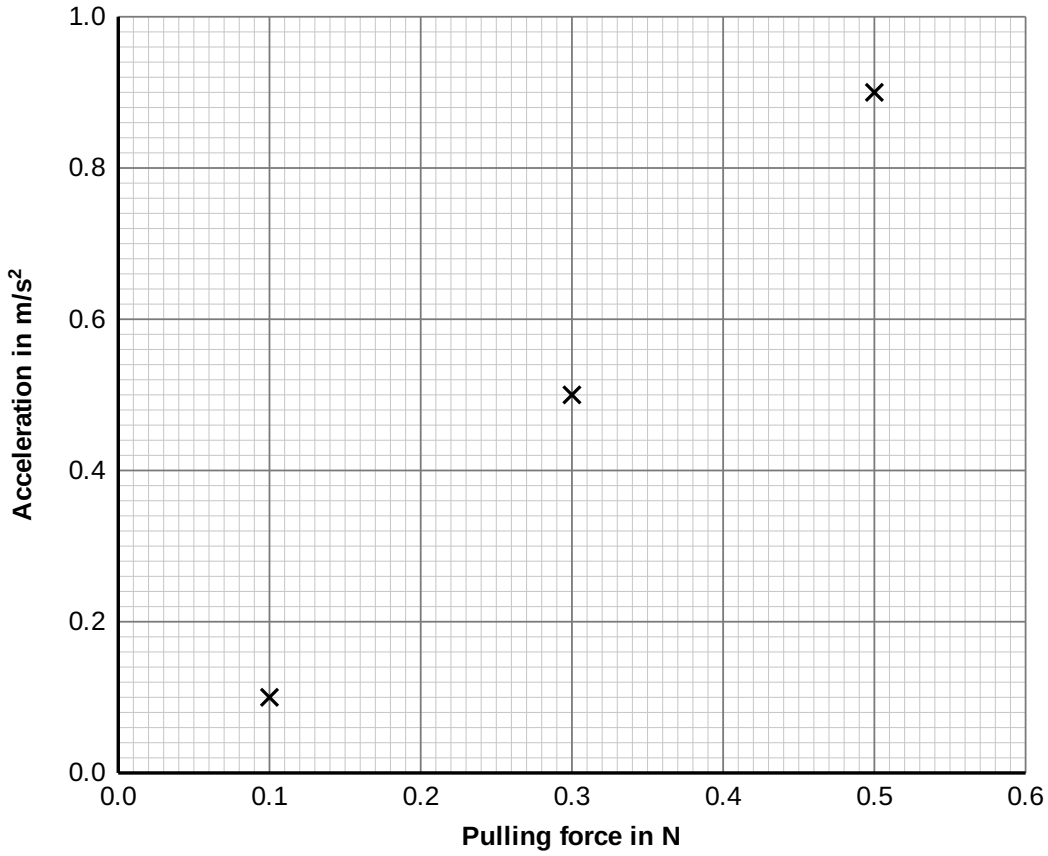
0 3 . 3 **Figure 5** shows some of the results. [2 marks]

Complete **Figure 5**.

You should:

- plot the results for 0.20 N and 0.40 N
- draw a line of best fit.

Figure 5



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Question 3 continues on the next page

0 3 . 4 Determine the gradient of the line. [3 marks]

Use the gradient to determine the total mass of the trolley, the hanger and the masses.

Gradient = ...

Total mass = ... kg

0 3 . 5 The line of best fit does not pass through the origin. [1 mark]

Suggest why.

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0 4 Electromagnetic waves have many uses.

0 4 . 1 X-rays are used to produce images of broken bones. [2 marks]

Explain why X-rays are suitable for this use.

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0 4 . 2 Explain why X-rays can increase the risk of cancer, whereas absorbed microwaves mainly heat body tissue. [3 marks]

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Question 4 continues on the next page

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0 4 . 3 Infrared radiation has a higher frequency than microwaves. [3 marks]

Compare the speed and the wavelength of infrared radiation and microwaves in a vacuum.

Explain your answer about wavelength.

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0 5 A model parachute and its load have a total mass of 50 g

The parachute is dropped from rest. It falls vertically.

0 5 . 1 Calculate the weight of the parachute and load. [2 marks]

gravitational field strength = 9.8 N/kg

Weight = ... N

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Question 5 continues on the next page

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Table 3 shows how the speed of the parachute changes after it is dropped.

Table 3

Time in s	0	0.25	0.50	0.75	1.00	1.25	1.50	1.75
Speed in m/s	0	2.3	3.9	4.7	5.0	5.2	5.3	5.3

0 5 . 2 Calculate the mean air resistance on the parachute between 0.50 s and 1.00 s [5 marks]

Use **Table 3**.

Mean air resistance = ... N

0 5 . 3 After 1.50 s the parachute falls at a constant speed. [3 marks]

Explain why.

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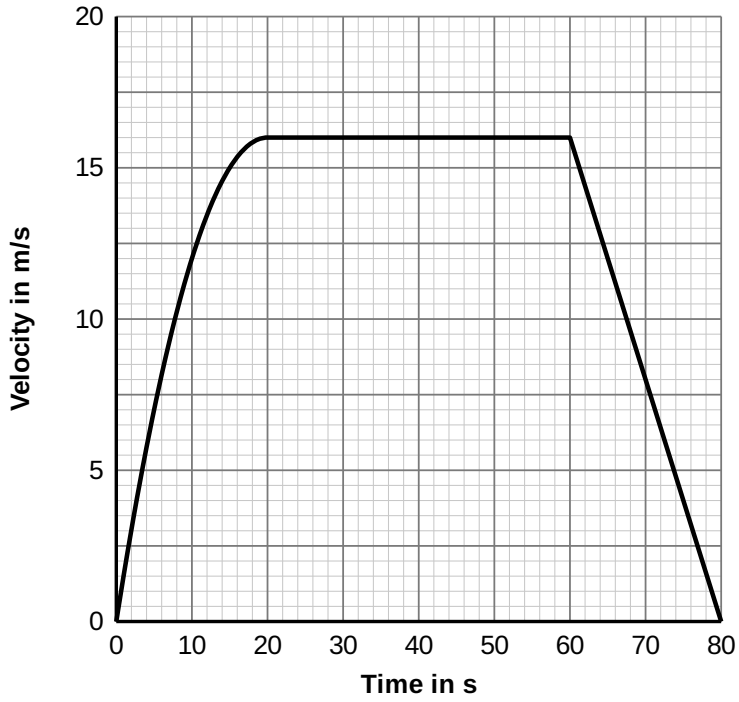
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Turn over for the next question

0 6 **Figure 6** shows the velocity–time graph for a train travelling between two stations.

Figure 6



0 6 . 1 Describe how the acceleration of the train changes during the first 20 s [2 marks]

Give a reason for your answer.

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0 6 . 2 Determine the distance travelled by the train during the first 20 s [3 marks]

Distance = ... m

Question 6 continues on the next page

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0 6 . 3 The mass of the train is 2.0×10^5 kg [3 marks]

Calculate the braking force on the train between 60 s and 80 s

Assume that the braking force is the only horizontal force on the train.

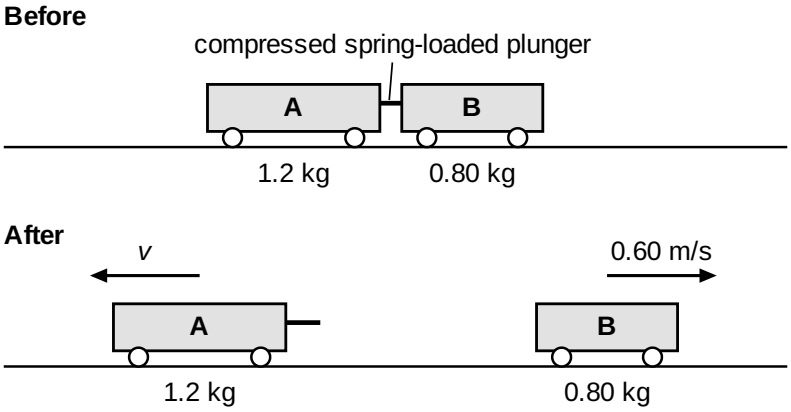
Braking force = ... N

0 7 **Figure 7** shows two trolleys, **A** and **B**, on a horizontal track.

A spring-loaded plunger on trolley **A** is pushed in against trolley **B**. Both trolleys are stationary.

When the plunger is released, the trolleys move apart.

Figure 7



0 7 . 1 What is the total momentum of the two trolleys before the plunger is released? [1 mark]

Total momentum = ... kg m/s

0 7 . 2 After the plunger is released, trolley **B** moves to the right at 0.60 m/s [3 marks]

Calculate the speed *v* of trolley **A**.

Speed = ... m/s

Question 7 continues on the next page

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0 7 . 3 Explain why the trolleys move in opposite directions. [2 marks]

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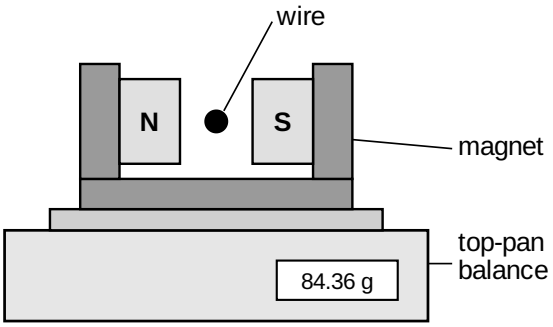
0 8 A student investigated the force on a wire in a magnetic field.

Figure 8 shows the equipment. A magnet is on a top-pan balance. A straight wire is held between the poles of the magnet, at right angles to the page. The wire does not touch the magnet.

The wire is held in place by a clamp, which is not on the balance. The wire is connected to a power supply and an ammeter, which are not shown.

With no current in the wire, the reading on the balance is 84.36 g

Figure 8



0 8 . 1 When there is a current in the wire, there is a force on the wire. [1 mark]

What is the name of this effect?

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Question 8 continues on the next page

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The student used the change in the balance reading to find the force on the wire.

Table 4 shows the results.

Table 4

Current in A	0.0	1.0	2.0	3.0	4.0	5.0
Force on the wire in mN	0.0	10.1	19.8	30.2	40.0	49.9

0 8 . 2 Describe the relationship between the force on the wire and the current. [2 marks]

Use data from **Table 4**.

0 8 . 3 The magnetic flux density between the poles of the magnet is 0.50 T [3 marks]

Calculate the length of the wire in the magnetic field.

Use the result for a current of 4.0 A

Use the Physics Equations Sheet.

Length = ... m

0 8 . 4 When the current was switched on, the reading on the balance increased. [2 marks]

The student then reversed the direction of the current.

Explain what happened to the reading on the balance.

END OF QUESTIONS

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There are no more questions in this paper. Original practice paper © sciencegcse.co.uk – free to use for non-commercial education. Not an AQA paper.

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	$F = B I l$