AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
COMBINED SCIENCE: TRILOGY

F

Foundation Tier
Physics Paper 2F

Friday 12 June 2020 Morning Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:
- a protractor
- a ruler
- a scientific calculator
- the Physics Equations Sheet (enclosed).

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 all rough work in this book. Cross through any work you do not want to be marked.*
- 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).
- In all calculations, show clearly how you work out your answer.

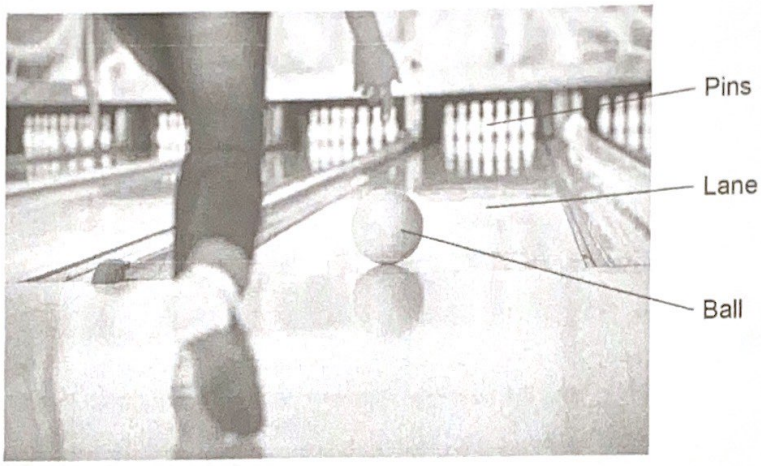
For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

Information
- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

Do not write outside the box

0 1 **Figure 1** shows a girl bowling a ball along a ten-pin bowling lane.

Figure 1



The girl is trying to knock down the ten pins at the end of the bowling lane.

As the ball travels along the lane the velocity of the ball decreases.

0 1 . 1 Velocity is a vector.

Which statement describes a vector?

[1 mark]

Tick (✓) **one** box.

Vectors have direction only. ☐

Vectors have magnitude and direction. ☑

Vectors have magnitude only. ☐

Do not write outside the box

0 1 . 2 Why does the velocity of the ball decrease as the ball travels along the lane?

[1 mark]

Tick (✓) **one** box.

The force of gravity slows the ball down. ☐

There are no forces acting on the ball. ☐

There is a resultant force acting on the ball. ☑

0 1 . 3 The ball travels along the lane at an average speed of 4.5 m/s

It takes the ball 4.0 seconds to travel the length of the lane.

Calculate the length of the lane.

Use the equation:

distance travelled = speed × time

[2 marks]

Length of lane = 4.5 x 4
= 18

Length of the lane = 18 m

Question 1 continues on the next page

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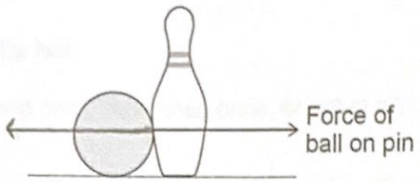
Figure 2 shows the ball hitting one of the pins.

Figure 2



0 1 . 4 Draw an arrow on **Figure 2** to show the force of the pin on the ball.

[2 marks]

0 1 . 5 The velocity of the pin changes from 0 to 12 m/s

It takes 0.15 seconds for the velocity to change.

Calculate the acceleration of the pin.

Use the equation:

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

[2 marks]

acceleration $= \frac{12-0}{0.15}$

$= 80$

Acceleration = 80 m/s^2

Do not write outside the box

0 1 . 6 When the pin is struck it accelerates.

Complete the sentences.

Choose answers from the box.

Each answer can be used once, more than once, or not at all.

[3 marks]

decreases	increases	stays the same

The displacement of the pin from the girl increases.

The mass of the pin stays the same.

The kinetic energy of the pin increases.

11

Turn over for the next question

Do not write outside the box

0 2 **Figure 3** shows a computer keyboard.

There is a spring under each key.

Figure 3

0 2 . 1 Why do the keys have springs under them?

[1 mark]

Tick (✓) **one** box.

Springs make the keys easier to press. ☐

Springs make the keys lighter. ☐

Springs push the keys back to their original position. ☑

0 2 . 2 Why does every spring used in the keyboard have the same spring constant?

[1 mark]

Tick (✓) **one** box.

So that more than one key can be pressed at the same time. ☐

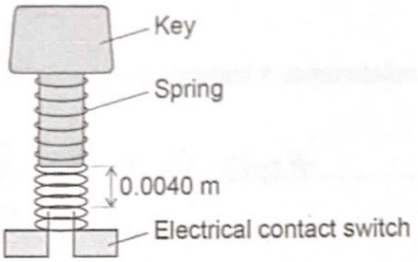
So that the same force is needed to press each key. ☑

So that the springs are all the same length. ☐

Do not write outside the box

Figure 4 shows one of the keys and its spring.

Figure 4



0 2 . 3 What happens to the length of the spring when the key is pressed?

[1 mark]

the length decreases

0 2 . 4 How far must the key move before it touches the switch?

[1 mark]

Tick (✓) **one** box.

4.0 mm ✓ 4.0 cm ☐ 4.0 μm ☐

0 2 . 5 If a key is not pressed with enough force, no signal is sent to the computer.

Explain why.

[2 marks]

The key will not move far enough to press the electrical switch. If the switch is not pressed then no signal will be sent to the computer.

Do not write outside the box

0 2 . 6 The spring in **Figure 4** has a spring constant of 200 N/m

Calculate the force on the spring when the key moves a distance of 0.0040 m

Use the equation:

force = spring constant × compression

[2 marks]

Force = 200 × 0.004

= 0.8

Force = 0.8 N

0 2 . 7 Suggest **two** ways the spring in the key in **Figure 4** could be changed so that the switch can be closed more quickly.

[2 marks]

1 Shorter spring

2 Spring with a lower constant.

10

Turn over for the next question

Do not write outside the box

0 3 X-rays and gamma rays are types of electromagnetic waves.

X-rays are used for medical imaging.

0 3 . 1 Which substance will **not** absorb X-rays?

[1 mark]

Tick (✓) **one** box.

Bone ☐ Metal ☐ Skin ☑

Table 1 shows the effect of exposure to different doses of radiation.

Table 1

Dose in mSv	Effect on the human body
100	slightly increased risk of cancer
1000	5% increased risk of cancer
5000	high risk of death

0 3 . 2 During one X-ray a person receives a dose of 0.100 mSv

Why is this dose unlikely to harm the person?

[1 mark]

The dose is very low, much lower than the dose that slightly increases the cancer risk.

0 3 . 3 A doctor takes an X-ray photograph of a person.

When taking the X-ray photograph, the doctor stands behind a screen.

Suggest why.

[1 mark]

To reduce the dose of radiation that they are exposed to.

Do not write outside the box

0 3 . 4 Which of the following are gamma rays used for?

[1 mark]

Tick (✓) **one** box.

- Cooking food ☐
- Energy-efficient lamps ☐
- Sterilising medical equipment ☑

0 3 . 5 Why are gamma rays and X-rays harmful to humans?

[1 mark]

Tick (✓) **one** box.

- They are ionising ☑
- They are radioactive ☐
- They travel at the speed of light ☐

0 3 . 6 Electromagnetic waves are also used in communications.

Describe how microwaves and visible light are used in communications.

[4 marks]

Microwaves communication with satellites uses microwaves. Data is transmitted and detected by satellite dishes providing satellite TV and satellite phones

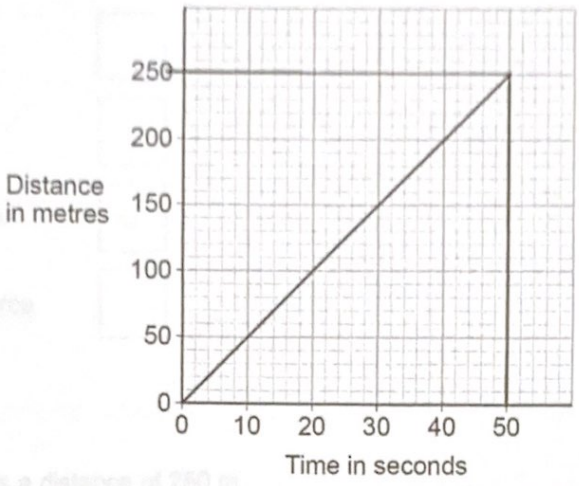
Visible light fibre optics use visible light to carry data to telephones and computers. Light bounces back and forth along the thin glass or plastic tubes to the computer / phone.

9

Do not write outside the box

0 4 **Figure 5** shows a distance-time graph for 50 seconds of a bicycle ride.

Figure 5



0 4 . 1 The gradient of the distance-time graph gives the speed of the bicycle.

Determine the speed of the bicycle.

[2 marks]

gradient = $\frac{250-0}{50-0}$ = 5

Speed = 5 m/s

Do not write outside the box

0 4 . 2 Which force acting on the moving bicycle is a non-contact force?

[1 mark]

Tick (✓) **one** box.

- Air resistance ☐
- Friction ☐
- Gravitational force ☑
- Normal contact force ☐

0 4 . 3 The bicycle travels a distance of 250 m

The bicycle exerts a constant horizontal force of 30 N on the ground.

Calculate the work done.

Use the equation:

work done = force × distance

Choose the unit from the box.

[3 marks]

J	kg	m

work done = 30 × 250 = 7500

Work done = 7500 Unit J

Do not write outside the box

0 4 . 4 The bicycle travels at a constant speed.

Complete the sentences.

Choose answers from the box.

[3 marks]

chemical	**frictional**	**kinetic**
magnetic		**tension**

As the bicycle moves, work is done against Frictional forces.

There is no change in the cyclist's Kinetic store of energy.

There is a decrease in the cyclist's Chemical store of energy.

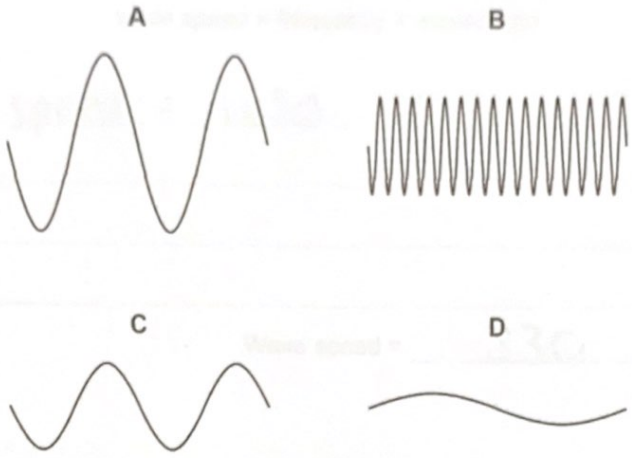
9

Do not write outside the box

0 5 **Figure 6** shows four waves.

The waves are drawn to the same scale.

Figure 6



0 5 . 1 Which wave has the greatest amplitude?

[1 mark]

Tick (✓) **one** box.

A ✓ B ☐ C ☐ D ☐

0 5 . 2 Which wave has the greatest frequency?

[1 mark]

Tick (✓) **one** box.

A ☐ B ✓ C ☐ D ☐

0 5 . 3 Which wave has the greatest wavelength?

[1 mark]

Tick (✓) **one** box.

A ☐ B ☐ C ☐ D ✓

Do not write outside the box

0 5 . 4 A wave has a frequency of 1650 Hz and a wavelength of 0.200 m

Calculate the wave speed.

Use the equation:

wave speed = frequency × wavelength

[2 marks]

wave speed = 1650 × 0·2 = 330

Wave speed = 330 m/s

A student uses a mobile phone app that displays sound waves.

Figure 7 shows the student holding the mobile phone close to a loudspeaker.

Figure 7

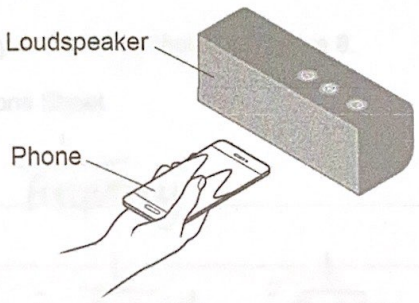


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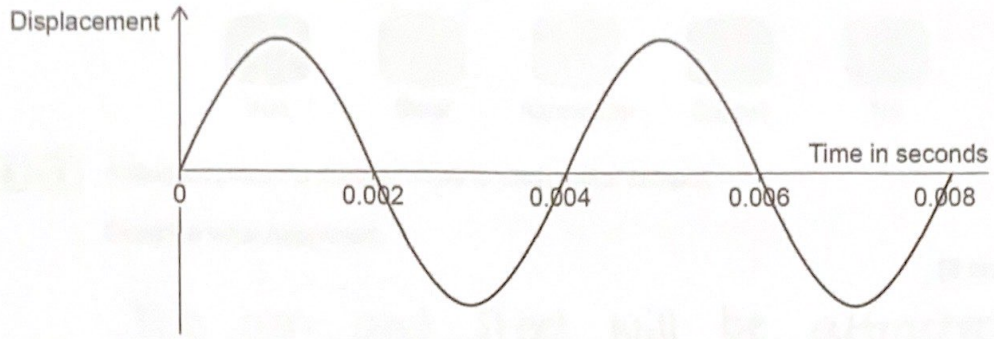
Figure 8 shows the wave pattern seen on the phone screen.

Figure 8



0 5 . 5 What is the period of the wave shown in **Figure 8**?

[1 mark]

Tick (✓) **one** box.

0.002 s ☐ 0.004 s ☑ 0.006 s ☐ 0.008 s ☐

0 5 . 6 Determine the frequency of the wave shown in **Figure 8**.

Use the Physics Equations Sheet.

[3 marks]

$\text{period} = \frac{1}{\text{frequency}}$

$\text{frequency} = \frac{1}{\text{period}} = \frac{1}{0.004} = 250$

Frequency = 250 Hz

9

Do not write outside the box

0 6 **Figure 9** shows five different metal samples.

Figure 9

0 6 . 1 A student placed a magnet close to each metal sample.

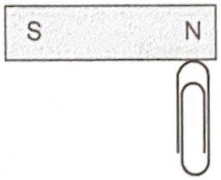
Describe what happened.

[2 marks]

The iron and steel will be attracted to the magnet but aluminium, copper and tin will not be attracted to the magnet.

Figure 10 shows a paper clip being attracted to a permanent magnet.

Figure 10



0 6 . 2 The paper clip in **Figure 10** is not a permanent magnet.

Explain what would happen if the paper clip was removed and brought close to the south pole of the permanent magnet.

[2 marks]

The paper clip would still be attracted to the magnet due to induced magnetism

Do not write outside the box

0 6 . 3 Write down the equation that links gravitational field strength (g), mass (m) and weight (W).

[1 mark]

weight = mass x gravitational field strength

0 6 . 4 The student added more paperclips to one end of the magnet.

The maximum number of paperclips the magnet could hold was 20

Each paper clip had a mass of 1.0 g

gravitational field strength = 9.8 N/kg

Calculate the maximum force the magnet can exert.

[3 marks]

1 g = 0.001 kg

weight of 1 paper clip = 0.0098

force = 0.0098 x 20 = 0.196

Force = 0.196 N

8

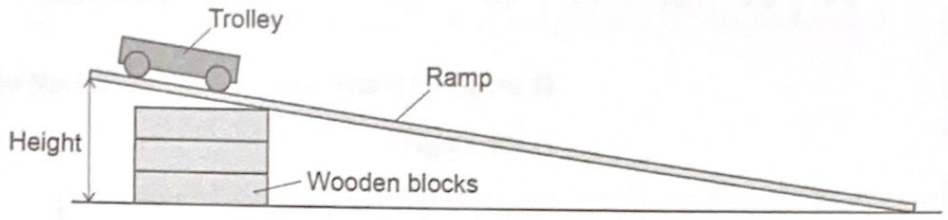
Turn over for the next question

Do not write outside the box

0 7 A student investigated how the height of a ramp affects the acceleration of a trolley down the ramp.

Figure 11 shows some of the equipment used.

Figure 11



0 7 . 1 Plan an investigation to determine how the height of the ramp affects the acceleration of the trolley.

[6 marks]

Begin by placing one block under the ramp and measure the height of the ramp using a ruler or meter ruler. Use the same method to measure the distance that the trolley travels down the ramp. Place the trolley at the top of the ramp and release without pushing / applying force. Use a stop watch to ~~time~~ measure the time taken for the trolley to reach the bottom of the ramp. Repeat the experiment, adding a block under the ramp each time to vary the height, and releasing the trolley from the same position on the ramp. Repeat at least 3 times per height and calculate a mean for each. Calculate acceleration of the trolley for each height using $a = \frac{v-u}{t}$.

Do not writ outside the box

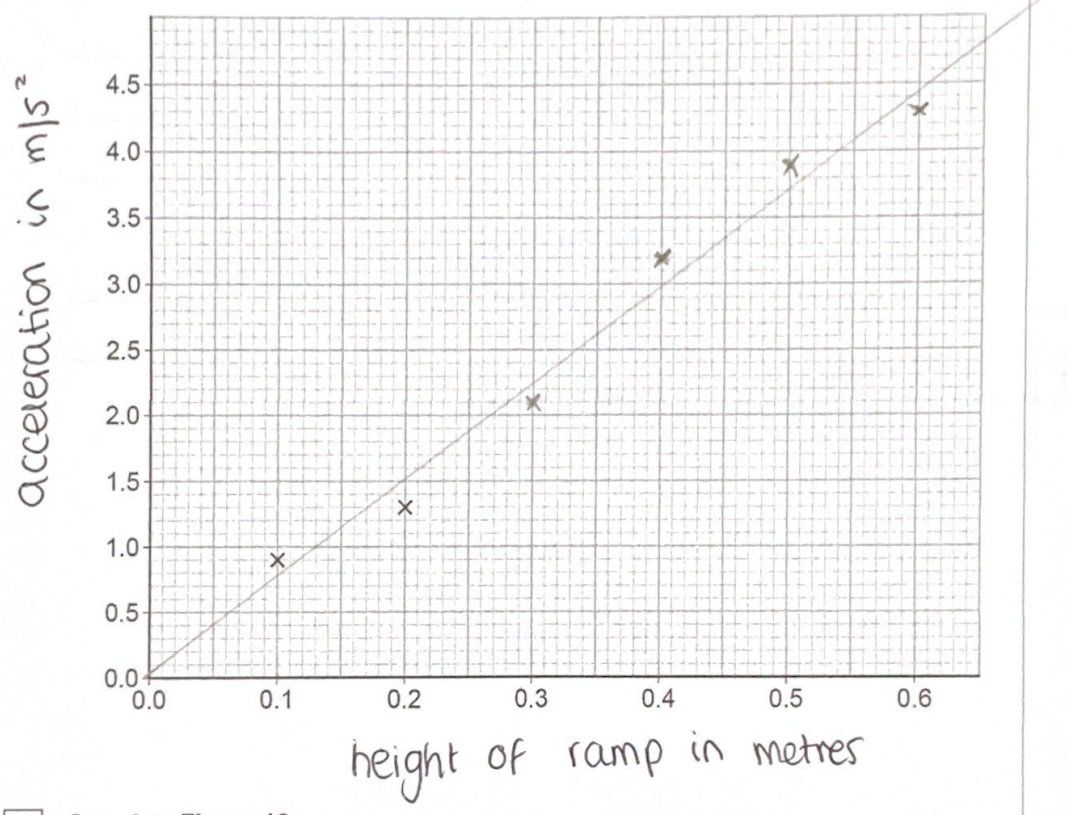
Table 2 shows the results.

Table 2

Height of ramp in metres	0.1	0.2	0.3	0.4	0.5	0.6
Acceleration in m/s²	0.9	1.3	2.1	3.2	3.9	4.3

The first two results have been plotted on **Figure 12**.

Figure 12



0 7 . 2 Complete **Figure 12**.

You should:

- label the axes
- plot the remaining results from **Table 2**
- draw a line of best fit.

[4 marks]

Question 7 continues on the next page

Do not write outside the box

0 7 . 3 Write down the equation that links acceleration (a), mass (m) and resultant force (F).

[1 mark]

resultant force = mass x acceleration

0 7 . 4 When the resultant force on the trolley was 0.63 N the acceleration of the trolley was 2.1 m/s^2

Calculate the mass of the trolley.

[3 marks]

$0.63 = m \times 2.1$

$m = \frac{0.63}{2.1} = 0.3$

Mass of trolley = 0.3 kg

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END OF QUESTIONS