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

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.
- 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.

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 Forces are either contact forces or non-contact forces.

0 1 . 1 Which of the following is a non-contact force?

[1 mark]

Tick (✓) **one** box.

Electrostatic force ☐

Friction force ☐

Tension force ☐

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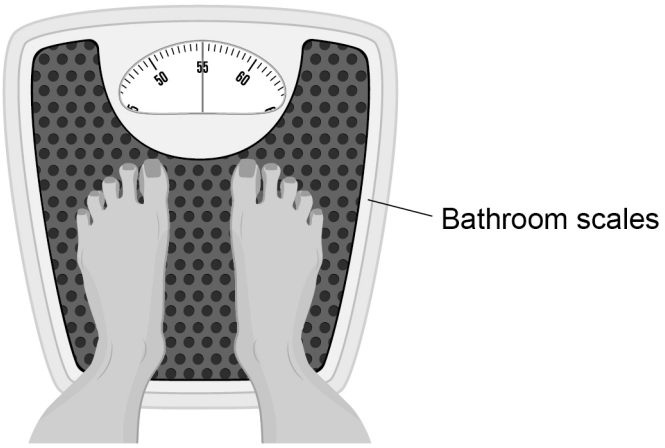
Figure 1 shows a person standing on some bathroom scales.

Figure 1



The person exerts a downward force on the scales and the scales exert an upward force on the person.

0 1 . 2 Which sentence about the forces is true?

[1 mark]

Tick (✓) **one** box.

The downward force is less than the upward force. ☐

The downward force is the same size as the upward force. ☐

The downward force is greater than the upward force. ☐

0 1 . 3 What is the name of the upward force on the person?

[1 mark]

Tick (✓) **one** box.

Air resistance ☐

Normal contact force ☐

Weight ☐

Do not write outside the box

0 1 . 4 The person on the scales has a mass of 55 kg.

gravitational field strength = 9.8 N/kg

Calculate the weight of the person.

Use the equation:

weight = mass × gravitational field strength

[2 marks]

Weight = _____ N

0 1 . 5 The gravitational field strength is **not** the same at all points on the surface of the Earth.

The gravitational field strength is weakest at the equator.

A person travelled from the UK to the equator.

What happened to the weight of the person?

[1 mark]

Tick (✓) **one** box.

The weight decreased. ☐

The weight remained the same. ☐

The weight increased. ☐

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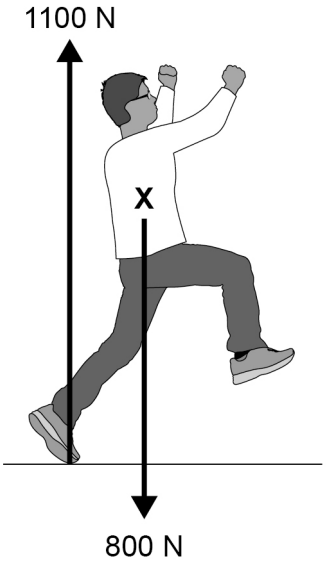
Figure 2 shows the forces acting on a person.

The person is about to jump.

Figure 2



0 1 . 6 The arrow representing the weight of the person is drawn from point **X**.

What is the name given to point **X**?

[1 mark]

Tick (✓) **one** box.

Centre of force ☐

Centre of mass ☐

Centre of weight ☐

0 1 . 7 Determine the size of the resultant force on the person in **Figure 2**.

[1 mark]

Resultant force = _____ N

8

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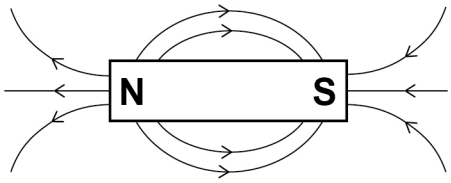
0 2 Magnets attract some metals.

0 2 . 1 Which diagram shows the correct magnetic field pattern for a bar magnet?

[1 mark]

Tick (✓) **one** box.



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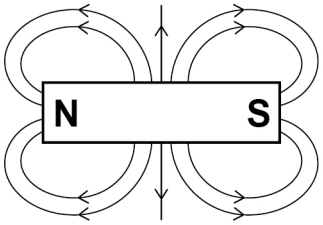

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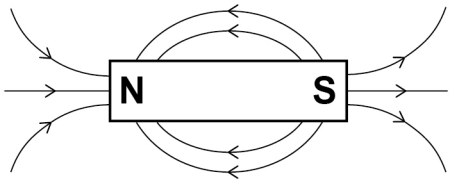

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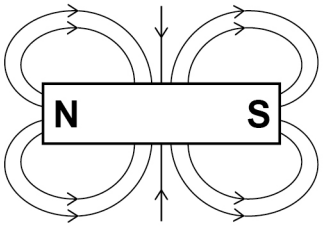

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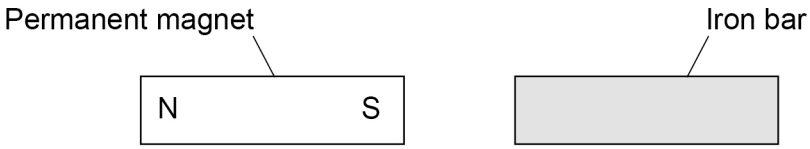
Figure 3 shows an iron bar near a permanent magnet.

Figure 3



The iron bar becomes an induced magnet.

0 2 . 2 Label the poles on the iron bar.

[1 mark]

0 2 . 3 The magnet is turned around so that the north pole is closest to the iron bar.

Which statement about the iron bar is true?

[1 mark]

Tick (✓) **one** box.

The iron bar does not experience a magnetic force. ☐

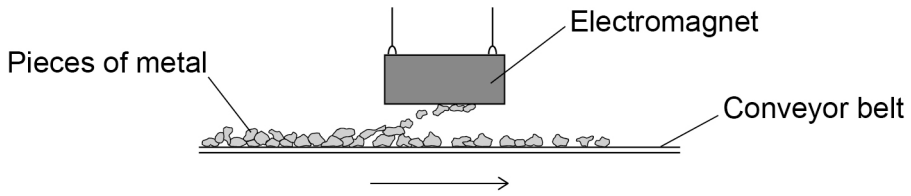
The iron bar experiences a magnetic force of attraction. ☐

The iron bar experiences a magnetic force of repulsion. ☐

Question 2 continues on the next page

Figure 4 shows an electromagnet being used to separate pieces of different types of metal on a conveyor belt.

Figure 4



0 2 . 4 Which **two** of the following types of metal would be attracted to the electromagnet?

[2 marks]

Tick (✓) **two** boxes.

Aluminium ☐

Copper ☐

Magnesium ☐

Nickel ☐

Steel ☐

0 2 . 5 What is an advantage of using an electromagnet instead of a permanent magnet to separate the types of metal?

[1 mark]

Tick (✓) **one** box.

An electromagnet attracts more types of metal than a permanent magnet. ☐

An electromagnet can be switched on and off. ☐

An electromagnet transfers less energy than a permanent magnet. ☐

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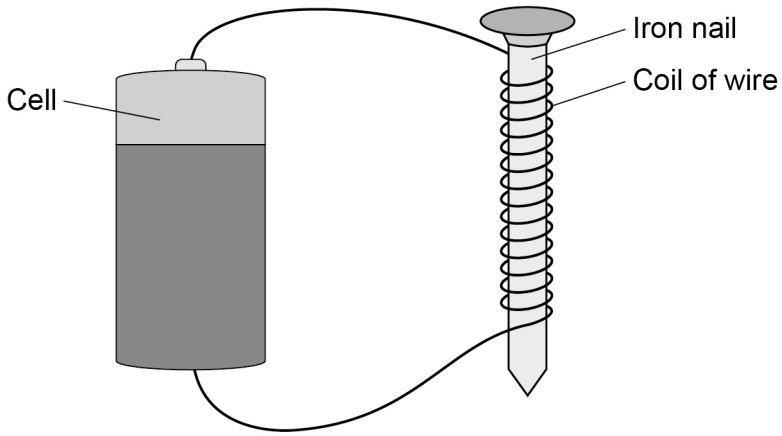
Figure 5 shows a simple electromagnet.

Figure 5



0 2 . 6 What is the purpose of the iron nail inside the coil of wire?

[1 mark]

Tick (✓) **one** box.

The iron nail makes the magnetic field stronger. ☐

The iron nail reduces the magnetic field to zero. ☐

The iron nail reverses the magnetic field. ☐

0 2 . 7 Which of the following would increase the strength of the electromagnet?

[1 mark]

Tick (✓) **one** box.

Use a greater current. ☐

Use a shorter nail. ☐

Use a thinner wire. ☐

8

Do not write outside the box

0 3 The stopping distance of a car is the sum of the thinking distance and the braking distance.

0 3 . 1 The thinking distance is affected by the reaction time of the driver.

Which **two** of the following can affect the reaction time of the driver?

[2 marks]

Tick (✓) **two** boxes.

Damaged brakes ☐

Taking drugs ☐

Tiredness ☐

Wet roads ☐

Worn tyres ☐

Scientists measured the reaction time for drivers of different ages.

Figure 6 shows the results.

Figure 6

0 3 . 2 At what age did the drivers have the lowest mean reaction time?

[1 mark]

Age = _____ years

0 3 . 3 What was the lowest mean reaction time?

[1 mark]

Time = _____ seconds

Question 3 continues on the next page

Do not write outside the box

The braking distance of a car is the distance travelled between the driver applying the brakes and the car stopping.

0 3 . 4 Complete the sentences.

Choose answers from the box.

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

[2 marks]

decreases	**stays the same**	**increases**

When the brakes are applied, the kinetic energy of the

car _____ .

The temperature of the brakes _____ .

Do not write outside the box

0 3 . 5 A car is travelling at a speed of 12 m/s.

The driver applies the brakes and the car decelerates at a constant 3.0 m/s^2.

Calculate the braking distance of the car.

Use the equation:

$$\text{braking distance} = \frac{(\text{speed})^2}{2 \times \text{deceleration}}$$

Choose the unit from the box.

[3 marks]

m	**kg**	**s**

Braking distance = _____ Unit _____

0 3 . 6 To pass the UK driving test, people must know the typical stopping distance of a car at certain speeds.

Suggest **one** reason why.

[1 mark]

10

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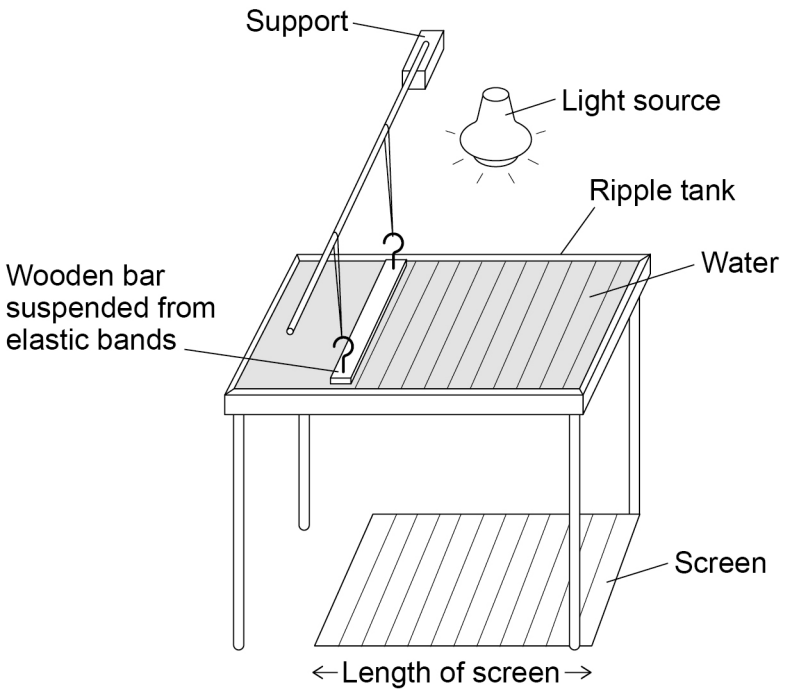
0 4 **Figure 7** shows a ripple tank.

The wooden bar vibrates up and down producing waves on the water.

The light source produces shadows of the water waves on the screen.

Figure 7



0 4 . 1 Describe how the student can measure the frequency and wavelength of the waves.

You should refer to any equipment the student needs in your answer.

[4 marks]

Do not write outside the box

A student measured the frequency and wavelength of the waves produced.

Table 1 shows some of the results.

Table 1

Reading	**1**	**2**	**3**	**Mean**
Frequency in hertz	12.8	12.4	12.3	**X**

0 4 . 2 Calculate value **X** in **Table 1**.

[1 mark]

X = _____ Hz

0 4 . 3 Why is it a good idea to take repeat readings and then calculate a mean?

[1 mark]

Tick (✓) **one** box.

To reduce the effect of random errors. ☐

To reduce the effect of systematic errors. ☐

To reduce the effect of zero errors. ☐

Question 4 continues on the next page

Do not write outside the box

0 4 . 4 The student changed the frequency of the waves in the ripple tank to 20 Hz.

Calculate the period of the waves.

Use the equation:

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

[2 marks]

Period = _____ s

0 4 . 5 At a frequency of 20 Hz the wavelength of the waves was 0.012 m.

Calculate the wave speed.

Use the equation:

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

[2 marks]

Wave speed = _____ m/s

10

Do not write outside the box

0 5 Scientists are developing a rocket aeroplane designed to travel much faster than jet aeroplanes.

0 5 . 1 The rocket aeroplane must accelerate along a runway to take off.

What would happen to the air resistance acting on the rocket aeroplane as it accelerates?

[1 mark]

0 5 . 2 An upward force called lift will act on the wings of the rocket aeroplane when it moves.

Complete the sentence.

Choose the answer from the box.

[1 mark]

less than	**the same as**	**greater than**

As the rocket aeroplane starts to accelerate along the runway, the lift force on the wings will be _____ the weight of the rocket aeroplane.

Question 5 continues on the next page

Do not write outside the box

0 5 . 3 During the first 14 seconds the average speed of the rocket aeroplane on the runway will be 35 m/s.

Calculate the distance that the rocket aeroplane will travel during the first 14 seconds.

Use the equation:

distance travelled = average speed × time

[2 marks]

Distance travelled = _____ m

0 5 . 4 Write down the equation which links distance (*s*), force (*F*) and work done (*W*).

[1 mark]

0 5 . 5 When the rocket aeroplane travels a distance of 270 m on the runway the engines will do 54 000 000 J of work.

Calculate the average force exerted by the engines.

[3 marks]

Average force = _____ N

Do not write outside the box

0 5 . 6 The rocket aeroplane will fly at a greater height than a jet aeroplane.

The height that an aeroplane flies at affects the radiation dose a passenger will receive each hour.

Table 2 shows the speed of each aeroplane and the radiation dose a passenger will receive each hour.

Table 2

Aeroplane	Speed in metres per second	Radiation dose each hour in millisieverts
Rocket aeroplane	8000	0.006
Jet aeroplane	250	0.003

Exposure to ionising radiation has risks and possible consequences.

Evaluate the risks and possible consequences of flying in a rocket aeroplane and in a jet aeroplane.

Assume the same journey is made in each aeroplane.

Use values from **Table 2**.

[6 marks]

14

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Q6. The electromagnetic spectrum is made up of waves with different wavelengths and frequencies.

(a) Draw **one** line from each type of electromagnetic wave to a use of that type of wave.

Electromagnetic wave	**Use**
Radio waves	Cooking food
Visible light	Detecting broken bones
X-rays	Fibre optic communications
	Transmitting TV programmes

(3)

(b) The diagram below shows equipment that is used to investigate the emission of infrared radiation from different colours of surface.

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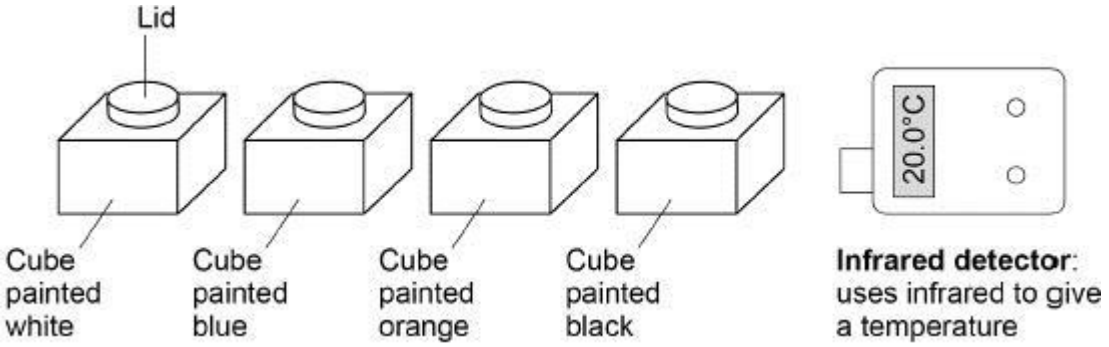
The four hollow metal cubes are each painted a different colour.

The cubes can be filled with hot water before the lid is put on.



Describe a method to investigate which colour of surface emits infrared radiation at the greatest rate.

(4)

Table 2 shows the results.

Do not write outside the box

Table 2

Type of surface	Temperature in °C
Blue	66.5
White	61.0
Black	69.0
Orange	26.0

(c) What was the resolution of the infrared detector?

Tick (✓) **one** box.

0.5 °C ☐

1.0 °C ☐

26.0 °C ☐

66.5 °C ☐

(1)

(d) What was the range of temperatures recorded?

Range = _____ °C to _____ °C

(1)

(e) Give **one** conclusion that can be made from the results in **Table 2**.

_____

_____

(1)

10

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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0 7 Professional rugby players wear a tracking device that measures their velocity and acceleration.

Figure 9 shows a player wearing a tracking device.

The player is tackling another player who is running with the ball.

Figure 9

0 7 . 1 Velocity and acceleration are both vector quantities.

What is a vector quantity?

[1 mark]

Tick (✓) **one** box.

A quantity with both magnitude and direction ☐

A quantity with direction only ☐

A quantity with magnitude only ☐

Do not write outside the box

0 7 . 2 Which of the following is a vector quantity?

[1 mark]

Tick (✓) **one** box.

Displacement ☐

Distance ☐

Time ☐

Work done ☐

Question 7 continues on the next page

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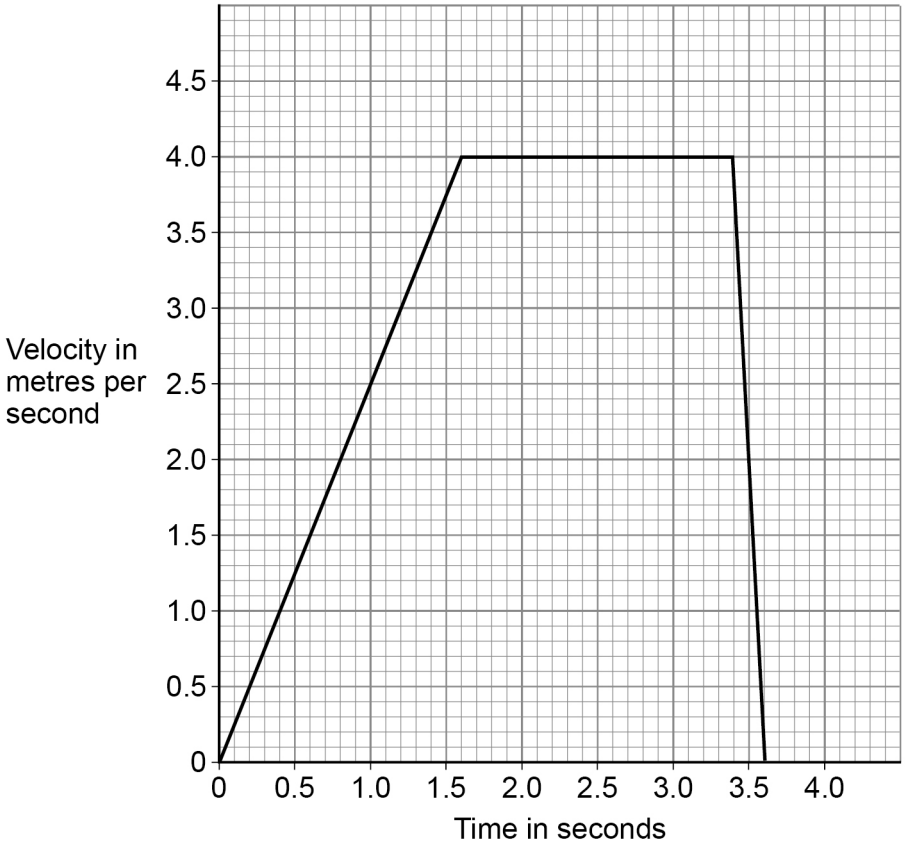
Figure 10 shows a velocity–time graph for the player running with the ball.

Figure 10



0 7 . 3 Determine the acceleration of the player between 0 and 1.6 s.

[2 marks]

Acceleration = _____ m/s^2

0 7 . 4 Describe the motion of the player between 3.4 s and 3.6 s.

[1 mark]

Do not write outside the box

The force exerted on the player when she is tackled causes her to accelerate.

0 7 . 5 Write down the equation which links acceleration (*a*), mass (*m*) and resultant force (*F*).

[1 mark]

0 7 . 6 The player accelerates at 25 m/s^2 when a resultant force of 1800 N acts on her.

Calculate the mass of the player.

[3 marks]

Mass = _____ kg

0 7 . 7 The tracking device sends data to a computer during the game.

Suggest **one** advantage of the data being sent during the game.

[1 mark]

10

END OF QUESTIONS

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