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.

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.

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

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.

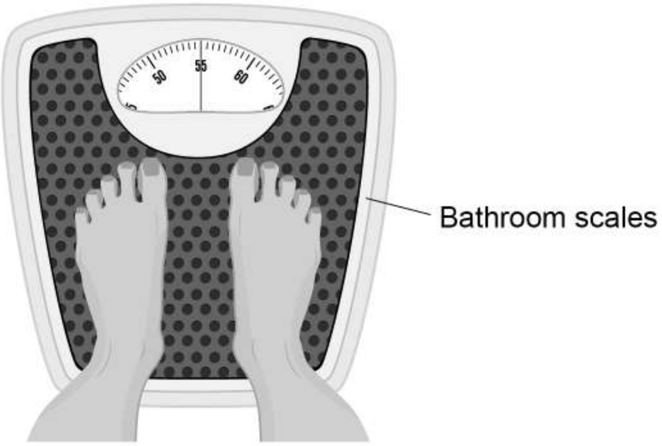
Electrostatic force ☐

Friction force ☐

Tension force ☐

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 ☐

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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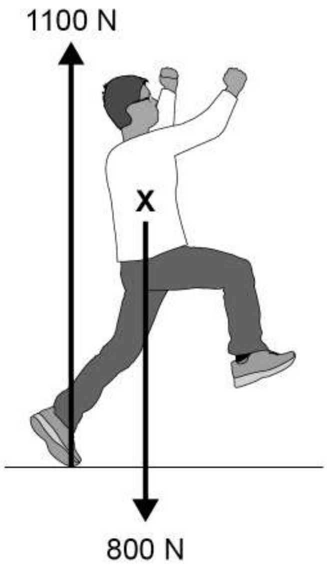
Figure 2 shows the forces acting on a person.

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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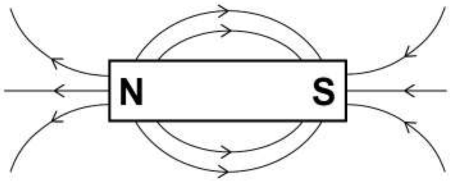
0 2 Magnets attract some metals.

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

[1 mark]

Tick (✓) **one** box.



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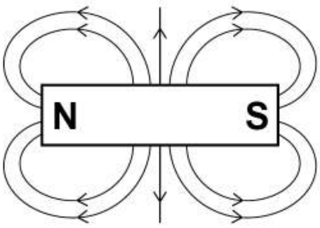

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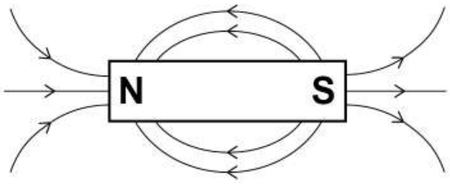

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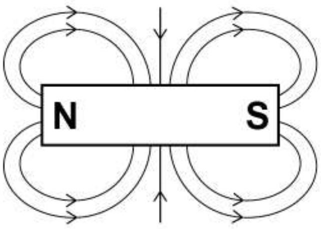
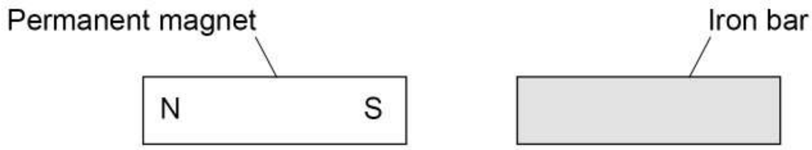


☐

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. ☐

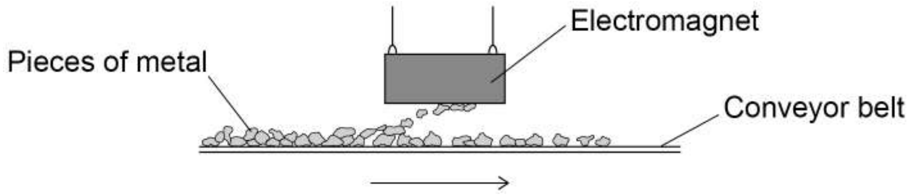
The iron bar experiences a magnetic force of attraction. ☐

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.

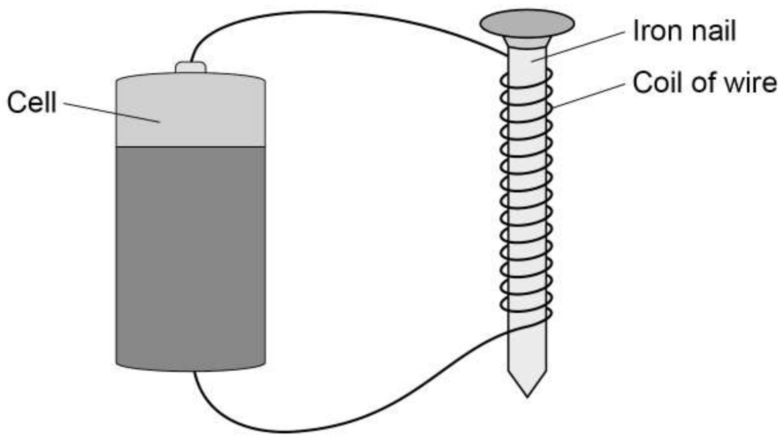
An electromagnet attracts more types of metal than a permanent magnet. ☐

An electromagnet can be switched on and off. ☐

An electromagnet transfers less energy than a permanent magnet. ☐

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

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

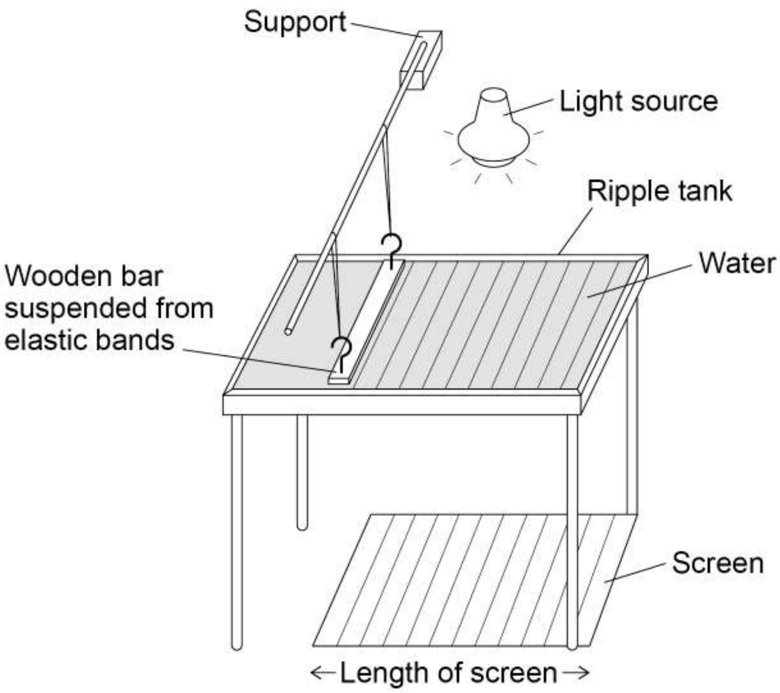
Do not write outside the box

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

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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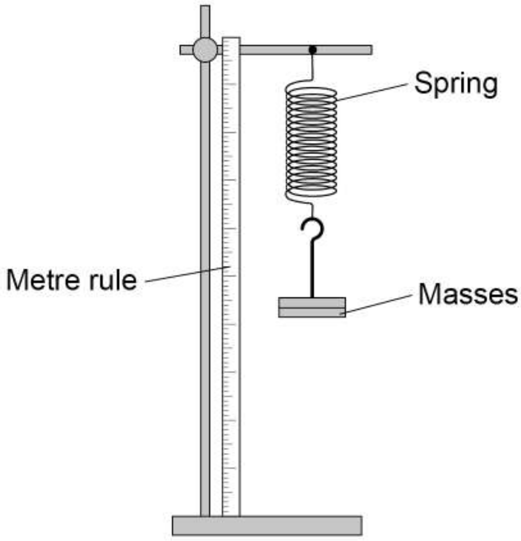
0 6 **Figure 8** shows a stretched spring.

The spring is elastically deformed.

Figure 8



0 6 . 1 What is meant by 'elastically deformed'?

[1 mark]

Tick (✓) **one** box.

As the force on the spring increases the length of the spring increases. ☐

Only a very small force is needed to stretch the spring. ☐

The force on the spring causes it to change shape. ☐

The spring will return to its original length when the force is removed. ☐

Do not write outside the box

0 6 . 2 Describe a method to determine the extension of the spring.

[2 marks]

0 6 . 3 The extension of the spring is 80 mm.

spring constant = 40 N/m

Calculate the elastic potential energy of the spring.

Use the Physics Equations Sheet.

[3 marks]

Elastic potential energy = ____________ J

Question 6 continues on the next page

Do not write outside the box

0 6 . 4 Write down the equation which links extension (e), force (F) and spring constant (k).

[1 mark]

____

0 6 . 5 A force of 300 N acts on a different spring.

The force causes the spring to extend by 0.40 m.

Calculate the spring constant of the spring.

[3 marks]

____

____

____

____

____

Spring constant = ____________________ N/m

10

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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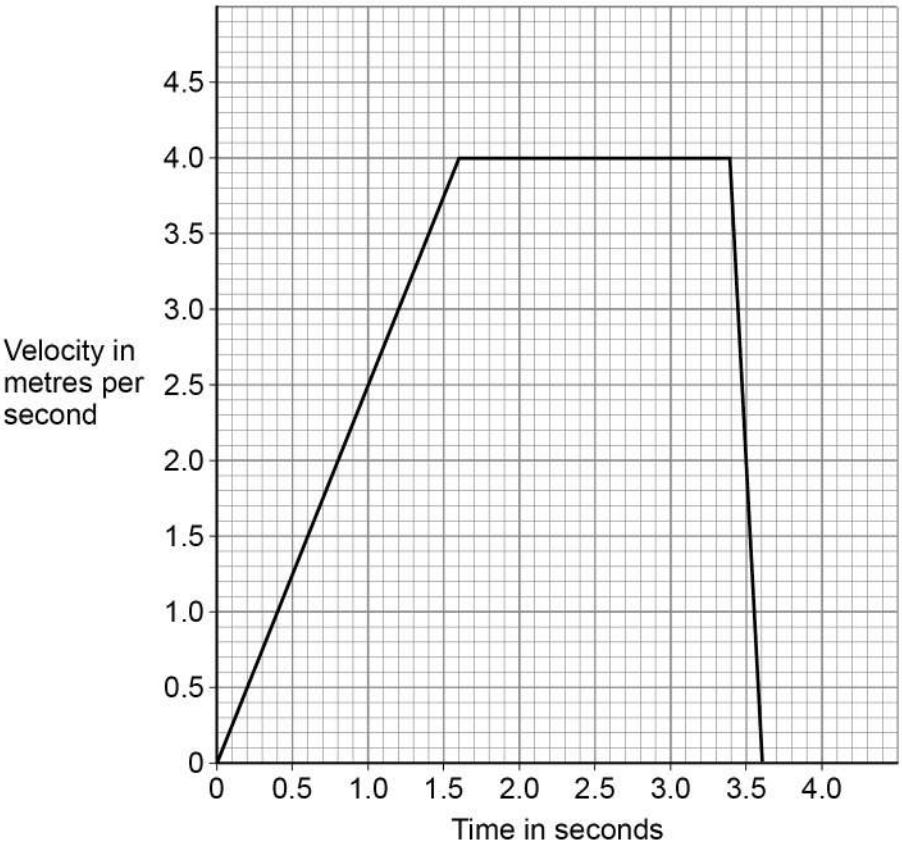
Figure 10 shows a velocity–time graph for the player running with the ball.

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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