A

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE

COMBINED SCIENCE: TRILOGY

Foundation Tier

Physics Paper 2F

F

8464/P/2F

Time allowed: 1 hour 15 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

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.**
- **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.**

DO NOT TURN OVER UNTIL TOLD TO DO SO

0 1

There are different types of electromagnetic waves.

0 1 . 1

What do all electromagnetic waves transfer? [1 mark]

Tick (✓) ONE box.

☐ **Charge**

☐ **Energy**

☐ **Matter**

☐ **Sound**

0 1 . 2

Complete the sentence.

Choose answers from the list. [2 marks]

- **charge**
- **frequency**
- **speed**
- **wavelength**

Different types of electromagnetic waves have a different _____ and a different _____.

0 1 . 3

FIGURE 1 shows the electromagnetic spectrum.

FIGURE 1

Radio waves	**Microwaves**	**Infrared**	**A**	**Ultraviolet**	**X-rays**	**B**

Give the names of parts A and B of the electromagnetic spectrum. [2 marks]

A _____

B _____

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[Turn over]

0 1 . 4

Different types of electromagnetic waves have different uses.

On the opposite page, draw ONE line from each type of electromagnetic wave to its use. [3 marks]

Type of electromagnetic wave	Use
	Electrical heaters
Microwaves	Energy efficient lamps
Ultraviolet	Imaging bones
X-rays	Satellite communications

[Turn over]

0 2

A student investigated how the colour of a surface affects the power of the infrared radiation emitted by the surface.

FIGURE 2, on the opposite page, shows the equipment used.

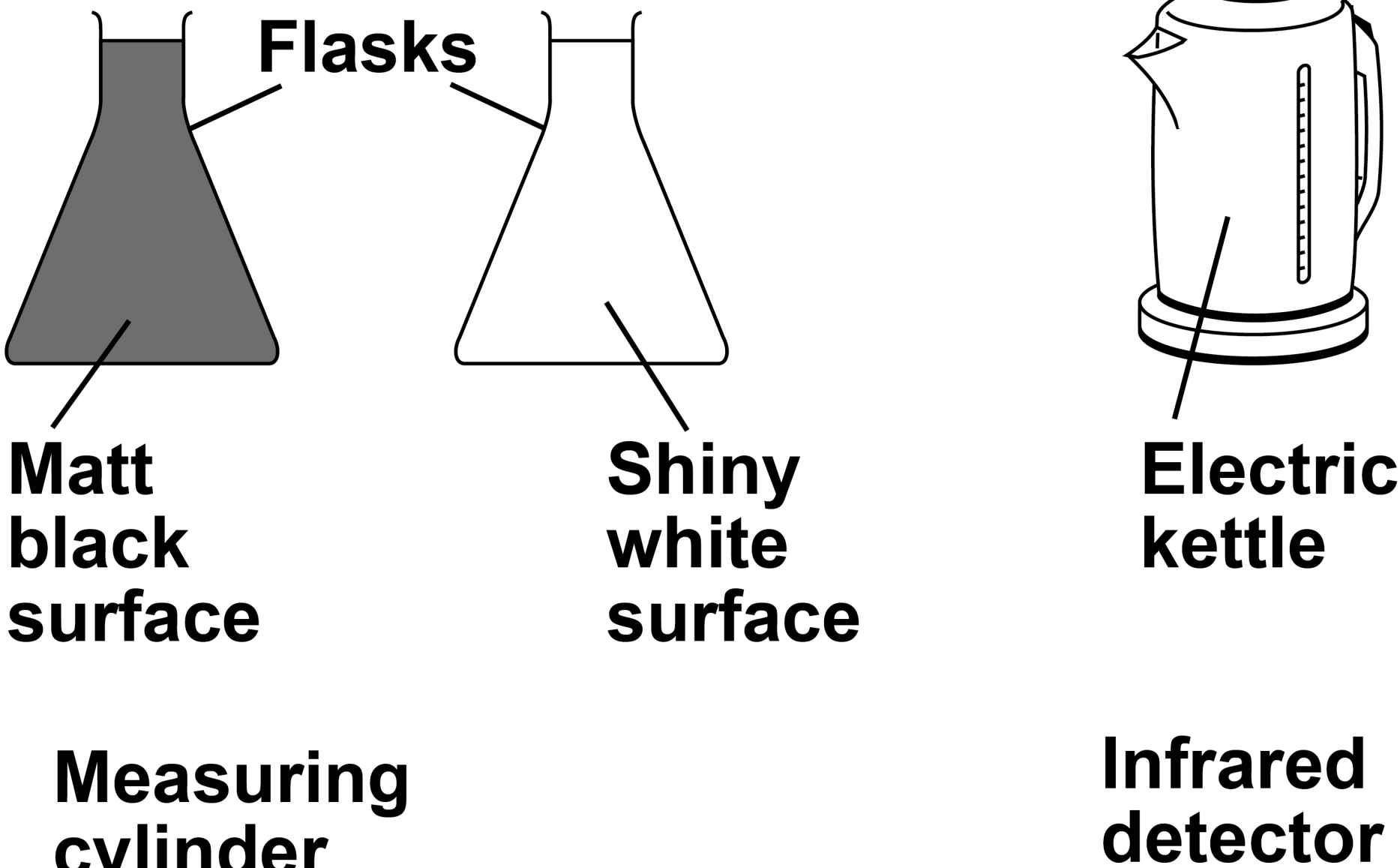
The infrared detector measures the power of the infrared radiation emitted by the flasks.

0 2 . 1

The student poured hot water into each flask.

What should the student do to reduce the risk of burning herself with the hot water? [1 mark]

FIGURE 2



[Turn over]

0 2 . 2

Describe how the student should use the equipment in FIGURE 2, on page 11, to compare the power of the infrared radiation emitted by each surface.
[4 marks]

[Turn over]

A student investigated how the power of the infrared radiation emitted from a flask changed with time.

TABLE 1 shows the results.

TABLE 1

Time in seconds	Power in watts
0	8.0
60	7.2
120	6.5
180	5.9
240	5.4
300	5.0
360	4.7
420	4.5

0 2 . 3

Describe the pattern shown by the data in TABLE 1, on the opposite page.
[2 marks]

REPEAT OF TABLE 1

Time in seconds	Power in watts
0	8.0
60	7.2
120	6.5
180	5.9
240	5.4
300	5.0
360	4.7
420	4.5

0 2 . 4

What is the most likely value for the power of the infrared radiation emitted after 480 seconds?

Use TABLE 1, on the opposite page.

[1 mark]

Tick (✓) ONE box.

☐ **4.0 W**

☐ **4.2 W**

☐ **4.4 W**

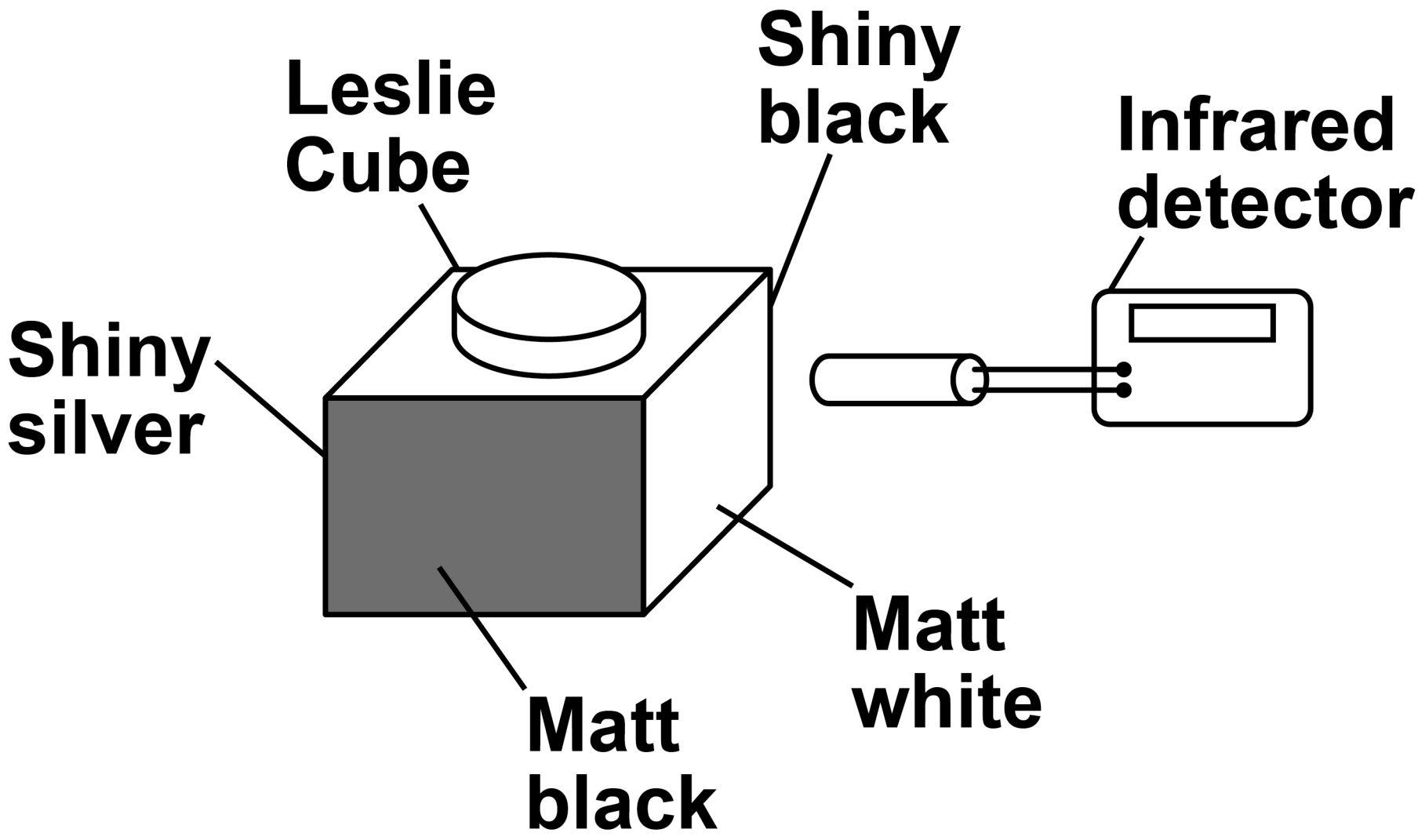
☐ **4.6 W**

[Turn over]

A Leslie Cube is used to demonstrate that different surfaces emit different amounts of infrared radiation.

FIGURE 3 shows an infrared detector and a Leslie Cube filled with hot water.

FIGURE 3



0 2 . 5

Give ONE advantage of using a Leslie Cube rather than the equipment in FIGURE 2 on page 11. [1 mark]

[Turn over]

0 2 . 6

The teacher improved the demonstration by using four infrared detectors connected to a data logger and computer. Each detector was pointed at a different surface of the Leslie Cube.

The distance between the surface and the detector was the same in each case.

Give TWO reasons why this improved the demonstration. [2 marks]

1

2

11

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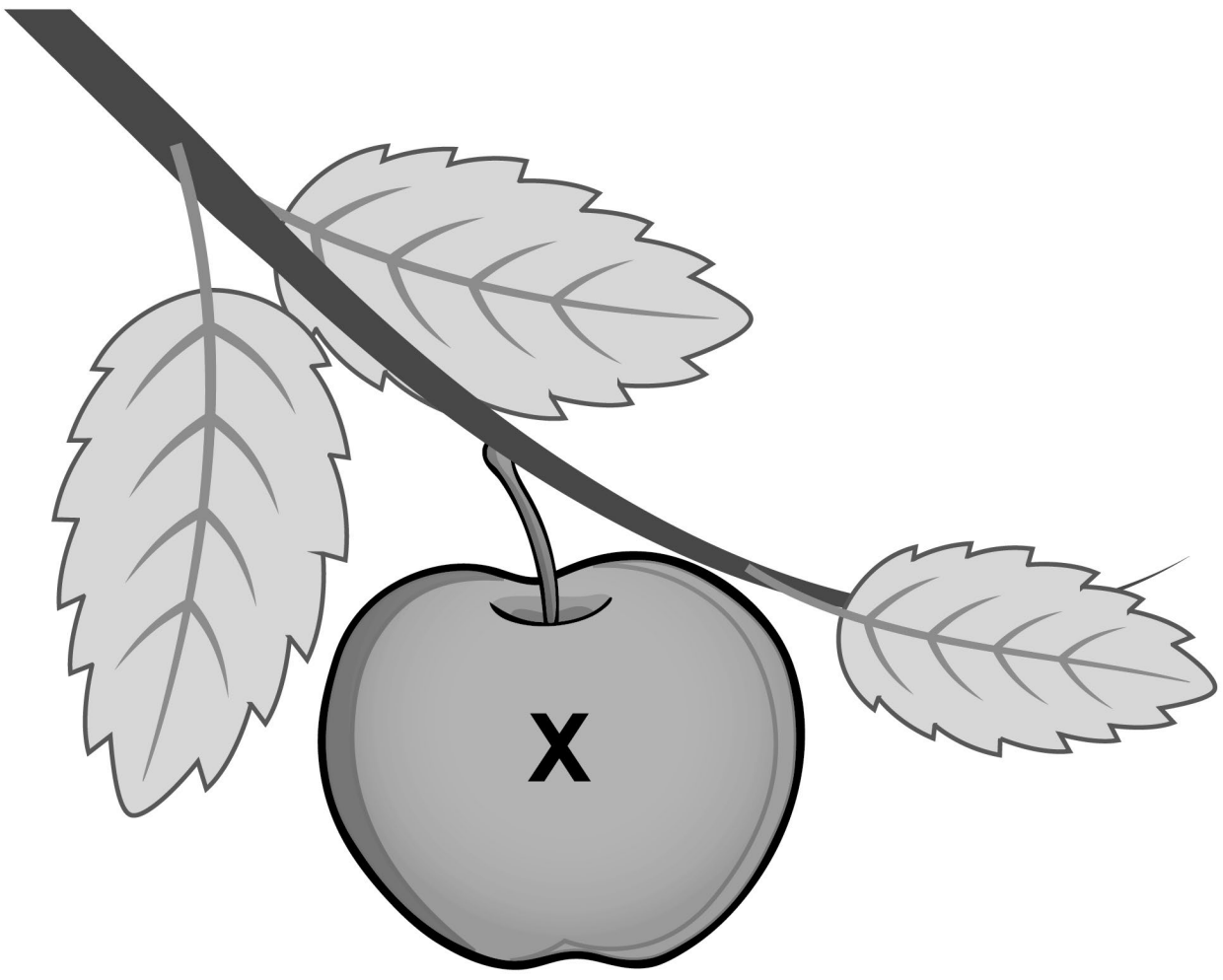
[Turn over]

0 3

FIGURE 4 shows an apple hanging from a tree.

The X marks the centre of mass of the apple.

FIGURE 4



0 3 . 1

Draw an arrow on FIGURE 4 to represent the weight of the apple. [1 mark]

0 3 . 2

The apple has a mass of 0.150 kg

gravitational field strength = 9.8 N/kg

Calculate the weight of the apple.

Use the equation:

weight = mass × gravitational field strength

[2 marks]

Weight = _____ N

0 3 . 3

The apple in FIGURE 4, on page 22, is stationary.

Why is the apple stationary? [1 mark]

Tick (✓) ONE box.

- ☐ **The resultant force on the apple is downwards.**
- ☐ **The resultant force on the apple is upwards.**
- ☐ **The resultant force on the apple is zero.**

[Turn over]

When the apple is ripe it falls from the tree and accelerates towards the ground.

0 3 . 4

Why does the apple accelerate?

[1 mark]

Tick (✓) ONE box.

☐ The resultant force on the apple is downwards.

☐ The resultant force on the apple is upwards.

☐ The resultant force on the apple is zero.

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[Turn over]

0 3 . 5

The acceleration of the apple is 9.8 m/s^2

The velocity of the apple changes from 0 to 4.9 m/s

Calculate the time taken for the apple to fall to the ground.

Use the equation:

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

[2 marks]

Time taken = _____ s

[Turn over]

7

0 4

FIGURE 5 shows a compass.

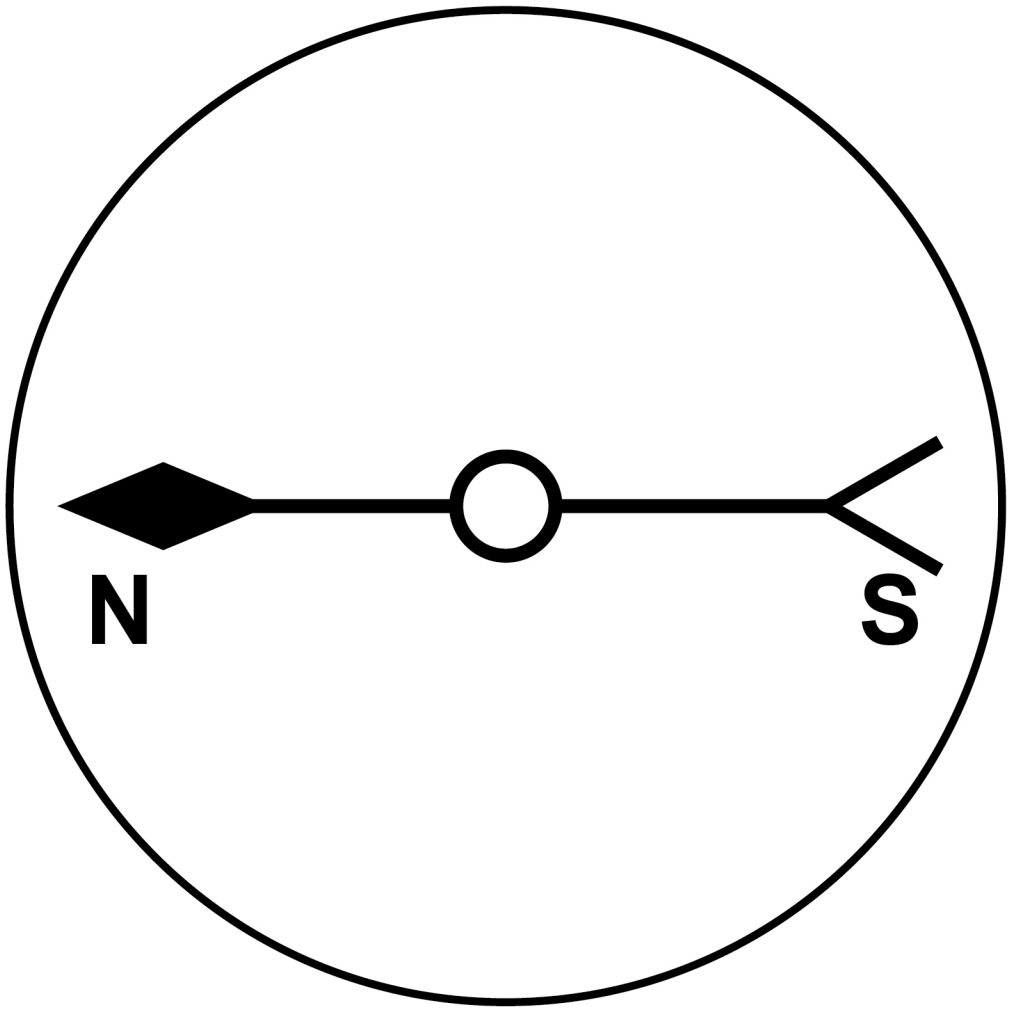

FIGURE 5

0 4 . 1

Why does the compass always point in the same direction when it is NOT near a magnet? [1 mark]

Tick (✓) ONE box.

☐ **The compass is not magnetic.**

☐ **The Earth has a magnetic field.**

☐ **There is no force acting on the compass.**

[Turn over]

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0 4 . 2

What material could the needle of the compass be made from? [1 mark]

Tick (✓) ONE box.

- ☐ **Aluminium**
- ☐ **Copper**
- ☐ **Plastic**
- ☐ **Steel**

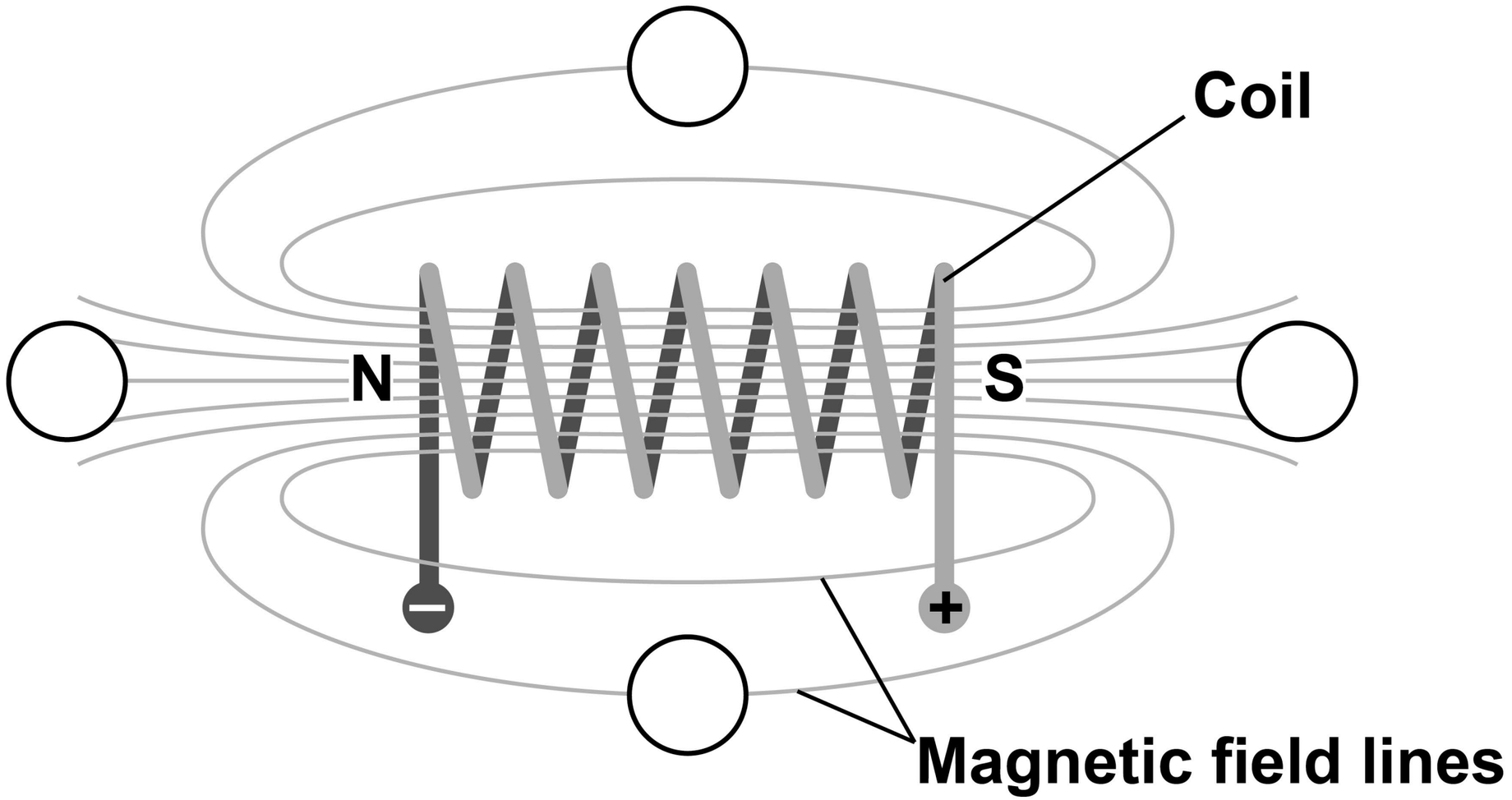
[Turn over]

FIGURE 6 shows a coil of wire.

There is a current in the coil.

The circles show the position of four compasses.

FIGURE 6



0 4 . 3

Which statement describes the magnetic field around the coil? [1 mark]

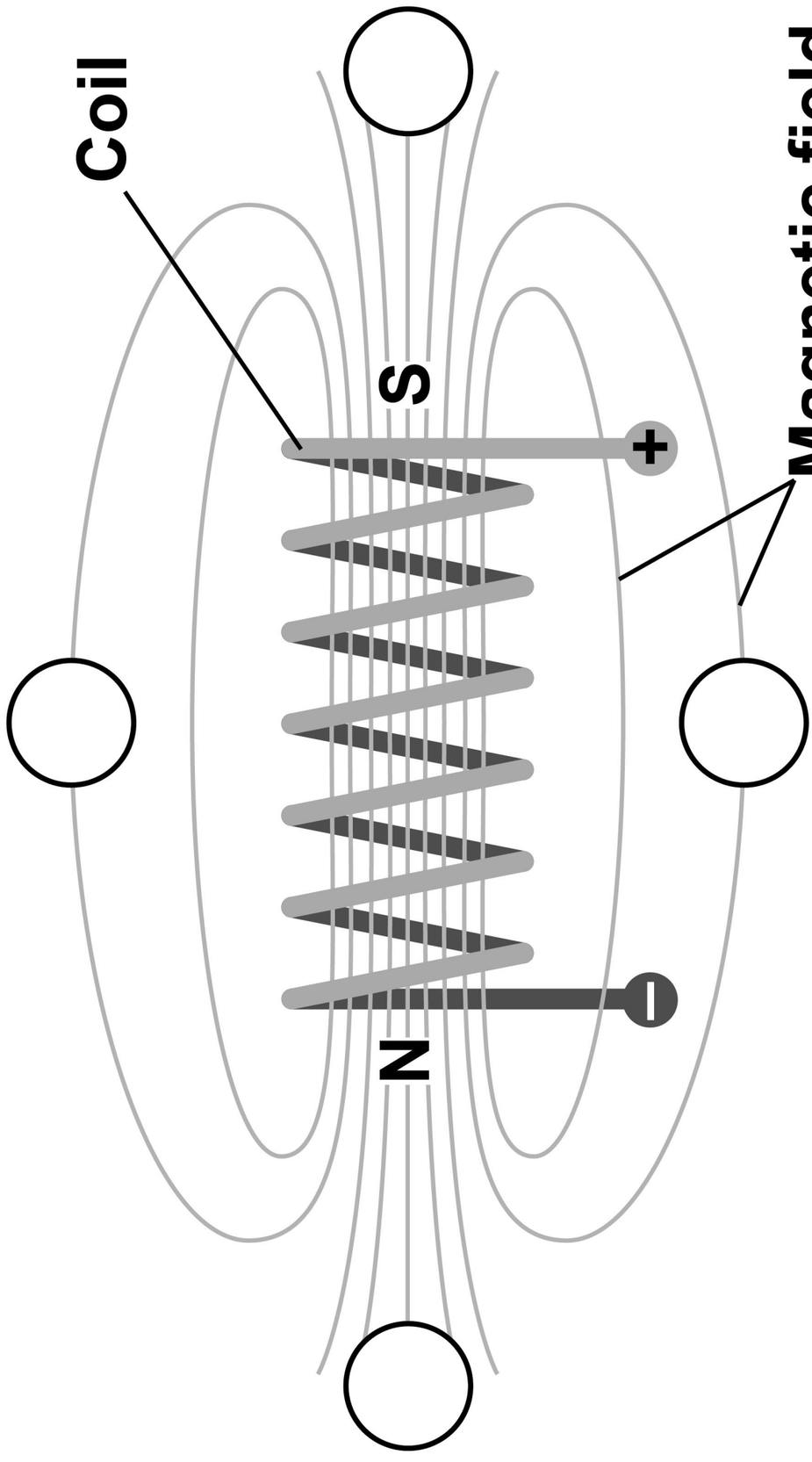
Tick (✓) ONE box.

☐ **The field has the same strength at all points.**

☐ **The field is stronger further away from the coil.**

☐ **The field is strongest at the ends of the coil.**

REPEAT OF FIGURE 6



0 4 . 4

Draw ONE arrow in EACH circle on FIGURE 6, on the opposite page, to show the direction of the magnetic field at that point. [2 marks]

0 4 . 5

Give TWO ways the magnetic field around the coil could be made stronger. [2 marks]

1 _____

_____

2 _____

_____

[Turn over]

7

0 5

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

0 5 . 1

Which factors affect the thinking distance? [2 marks]

Tick (✓) TWO boxes.

- ☐ **Condition of the tyres**
- ☐ **Driving on wet roads**
- ☐ **Mass of the car**
- ☐ **Tiredness of the driver**
- ☐ **Using a mobile phone**

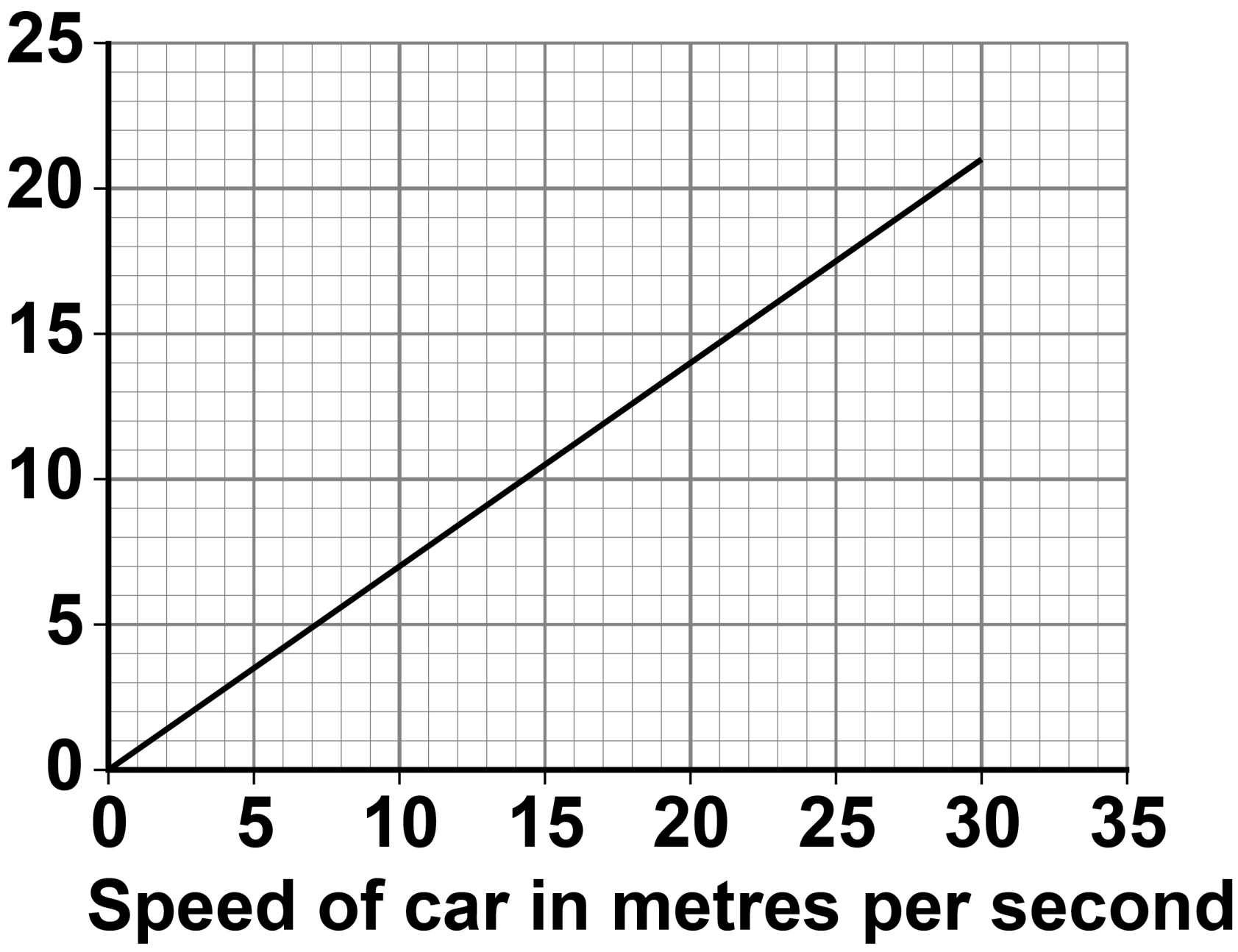
0 5 . 2

Explain why a person should NOT drink alcohol and then drive. [3 marks]

The Highway Code gives information on how thinking distance depends on the speed of a car.

FIGURE 7 shows the information as a graph.

FIGURE 7



0 5 . 3

What is the speed of a car if the thinking distance is 16 m? [1 mark]

Speed of car = _____ m/s

0 5 . 4

Describe the relationship between speed and thinking distance. [2 marks]

_____

_____

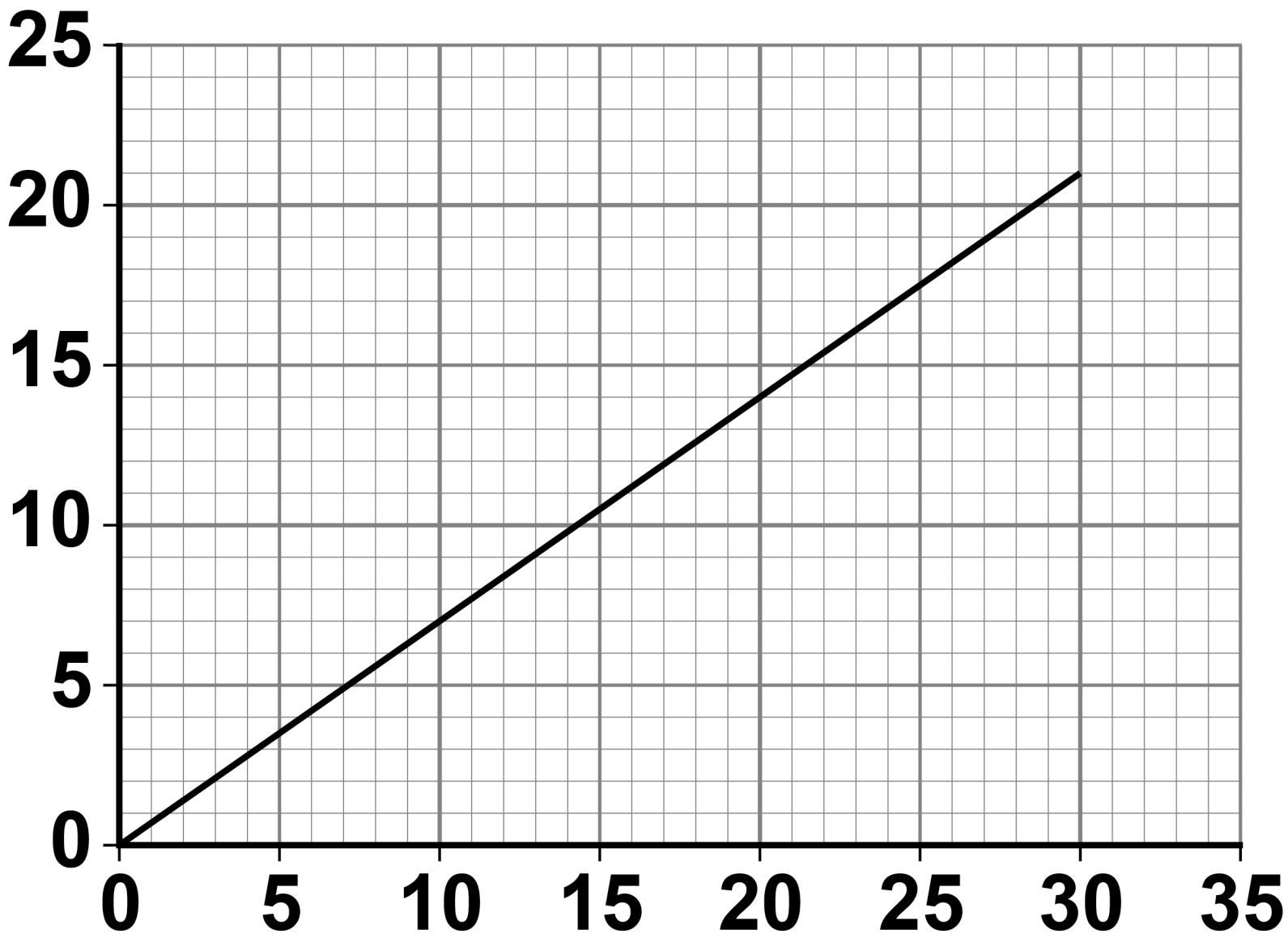
_____

_____

_____

[Turn over]

REPEAT OF FIGURE 7



0 5 . 5

The Highway Code assumes the driver's reaction time is 0.70 seconds.

Draw a line on FIGURE 7, on the opposite page, to show the relationship for a driver with a reaction time of 1.4 seconds. [2 marks]

[Turn over]

0 5 . 6

A car accelerates at 5.0 m/s^2 over a distance of 45 m

initial velocity of the car = 0 m/s

Calculate the final velocity of the car.

Use the Physics Equations Sheet.

Give your answer to 2 significant figures.
[4 marks]

Final velocity (2 significant figures) =

_____ m/s

[Turn over]

14

0	6

FIGURE 8 shows a longitudinal wave.

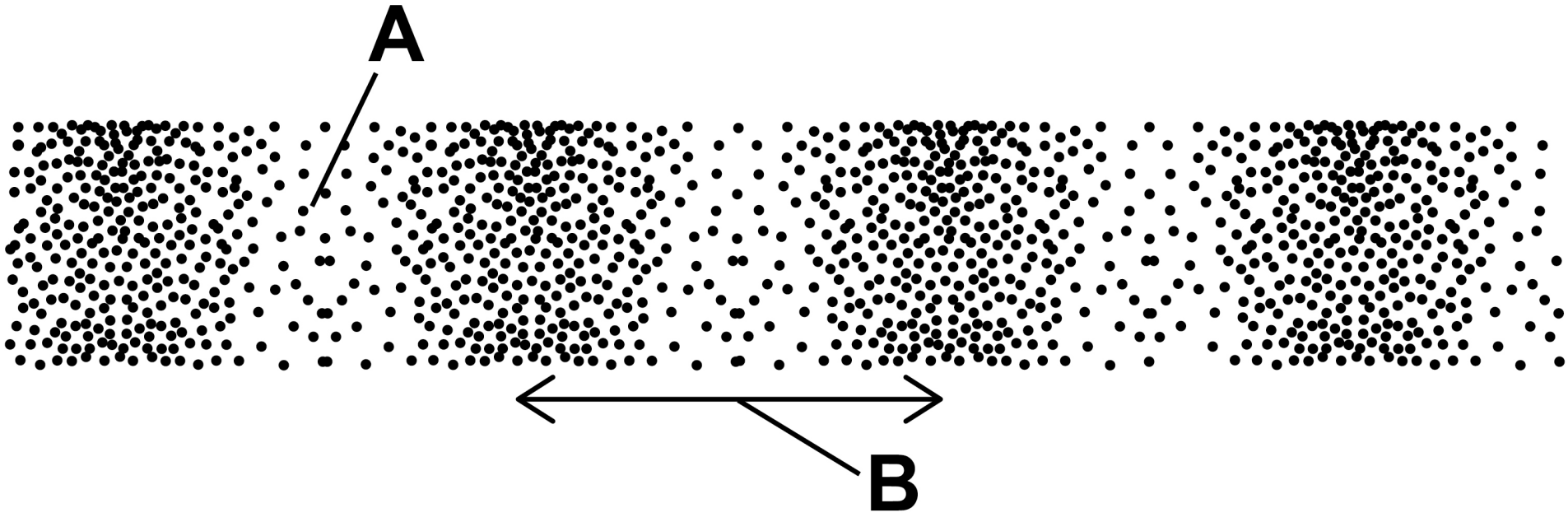


FIGURE 8

0 6 . 1

What do the labels A and B on FIGURE 8, on the opposite page, represent?

Choose answers from the list. [2 marks]

- **amplitude**
- **frequency**
- **rarefaction**
- **reflection**
- **wavelength**

A _____

B _____

[Turn over]

0 6 . 2

The wave shown in FIGURE 8, on page 46, has a frequency of 4.0 kHz

Calculate the period of the wave.

Use the Physics Equations Sheet.

Give the unit. [4 marks]

Period = _____ Unit _____

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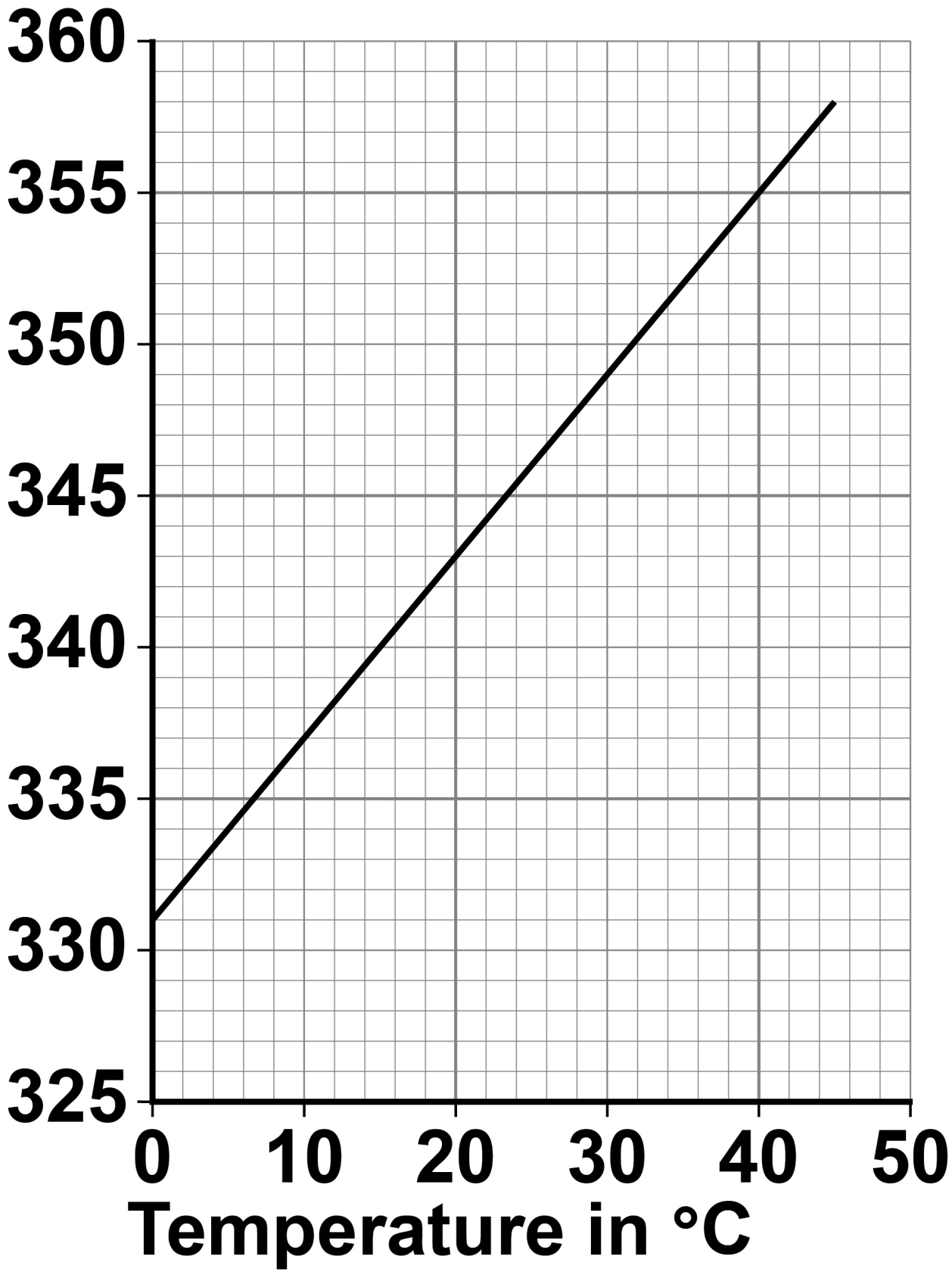
[Turn over]

FIGURE 9


Speed in metres per second
360
355
350
345
340
335
330
325
0
10
20
30
40
50
Temperature in °C

Sound waves are longitudinal.

FIGURE 9, on the opposite page, shows how the speed of sound varies with the temperature of the air.

Use the Physics Equations Sheet to answer questions 06.3 and 06.4.

0 6 . 3

Write down the equation that links frequency (*f*), wavelength (*λ*) and wave speed (*v*). [1 mark]

0 6 . 4

A sound wave with a frequency of 300 Hz travels through the air.

The air has a temperature of 28.0 °C

Determine the wavelength of the sound wave.

Use FIGURE 9 on page 50. [4 marks]

_____

_____

_____

_____

Wavelength = _____ m

[Turn over]

11

0 7

FIGURE 10 shows competitors in the wheelchair race at the London Marathon.

The distance of the London Marathon is 42 000 m

FIGURE 10

Use the Physics Equations Sheet to answer questions 07.1 and 07.2.

0 7 . 1

Write down the equation that links distance (*s*), force (*F*) and work done (*W*). [1 mark]

[Turn over]

0 7 . 2

During the race competitors work against air resistance.

The work done against air resistance by the winner of the race was 3 360 000 J

Calculate the average air resistance acting on the winner of the race.
[3 marks]

Average air resistance = _____ N

Use the Physics Equations Sheet to answer questions 07.3 and 07.4.

0 7 . 3

Which equation links distance travelled, speed and time? [1 mark]

Tick (✓) ONE box.

- ☐ **distance travelled = speed × time**
- ☐ **time = distance travelled × speed**
- ☐ **speed = distance travelled × time**

0 7 . 4

The distance of the London Marathon is 42 000 m

The winning time for the race was 5600 seconds.

Calculate the average speed of the winner of the race. [3 marks]

Average speed = _____ m/s

0 7 . 5

Explain why the speed of a competitor changes during the race. [4 marks]

END OF QUESTIONS

12

Additional page, if required.

Write the question numbers in the left-hand margin.

Additional page, if required.

Write the question numbers in the left-hand margin.

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For Examiner's Use	
Question	Mark
1	
2	
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TOTAL	