A

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

I declare this is my own work.

GCSE

COMBINED SCIENCE: TRILOGY

Higher Tier

Physics Paper 2H

H

8464/P/2H

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

FIGURE 1 shows a longitudinal wave.

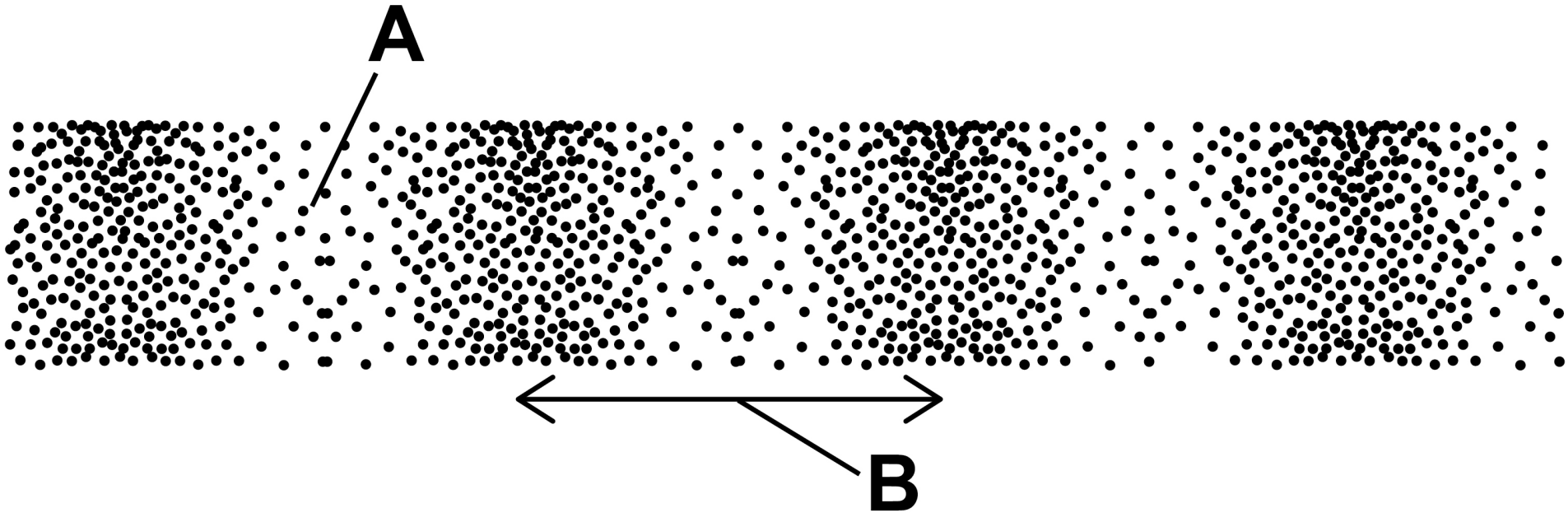


FIGURE 1

0 1 . 1

What do the labels A and B on FIGURE 1, on the opposite page, represent?

Choose answers from the list. [2 marks]

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

A _____

B _____

[Turn over]

0 1 . 2

The wave shown in FIGURE 1, on page 4, has a frequency of 4.0 kHz

Calculate the period of the wave.

Use the Physics Equations Sheet.

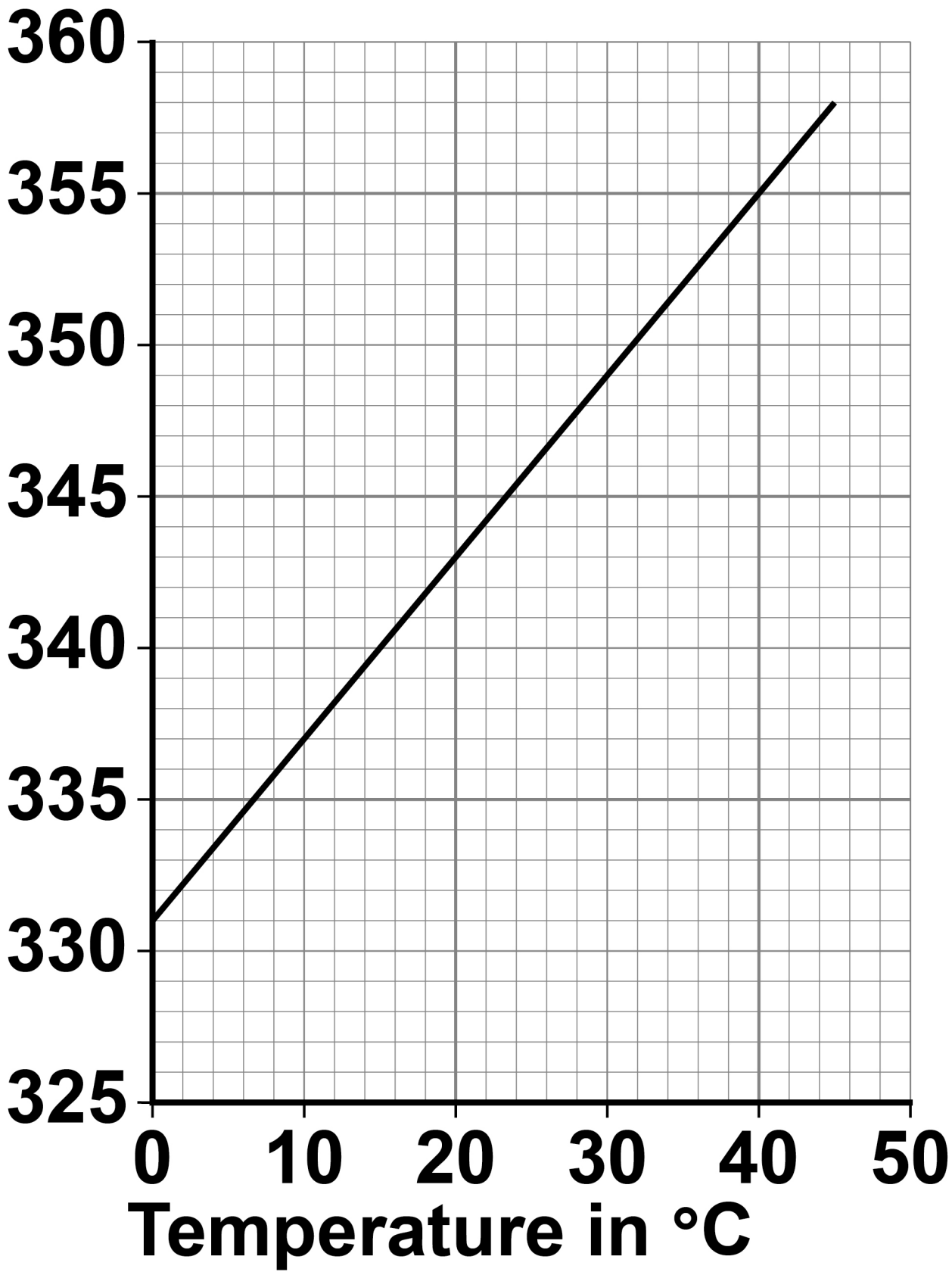
Give the unit. [4 marks]

Period = _____ Unit _____

BLANK PAGE

[Turn over]

FIGURE 2


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 2, 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 01.3 and 01.4.

0 1 . 3

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

0 1 . 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 2 on page 8. [4 marks]

Wavelength = _____ m

[Turn over]

0 2

FIGURE 3 shows competitors in the wheelchair race at the London Marathon.

The distance of the London Marathon is 42 000 m

FIGURE 3

Use the Physics Equations Sheet to answer questions 02.1 and 02.2.

0 2 . 1

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

[Turn over]

0 2 . 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 02.3 and 02.4.

0 2 . 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 2 . 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 2 . 5

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

0 3

FIGURE 4 shows a child playing with a toy train.

The train is on a bridge.

FIGURE 4

When the child lets go of the train, the train rolls down the bridge.

BLANK PAGE

[Turn over]

0 3 . 1

The momentum of the train at the bottom of the bridge is 0.216 kg m/s

mass of the train = 180 g

Calculate the velocity of the train at the bottom of the bridge.

Use the Physics Equations Sheet.
[4 marks]

Velocity = _____ m/s

[Turn over]

0 3 . 2

The train collides with a stationary carriage on the track.

Explain why the velocity of the train after the collision is less than it was before the collision.

Use ideas about momentum in your answer. [4 marks]

[Turn over]

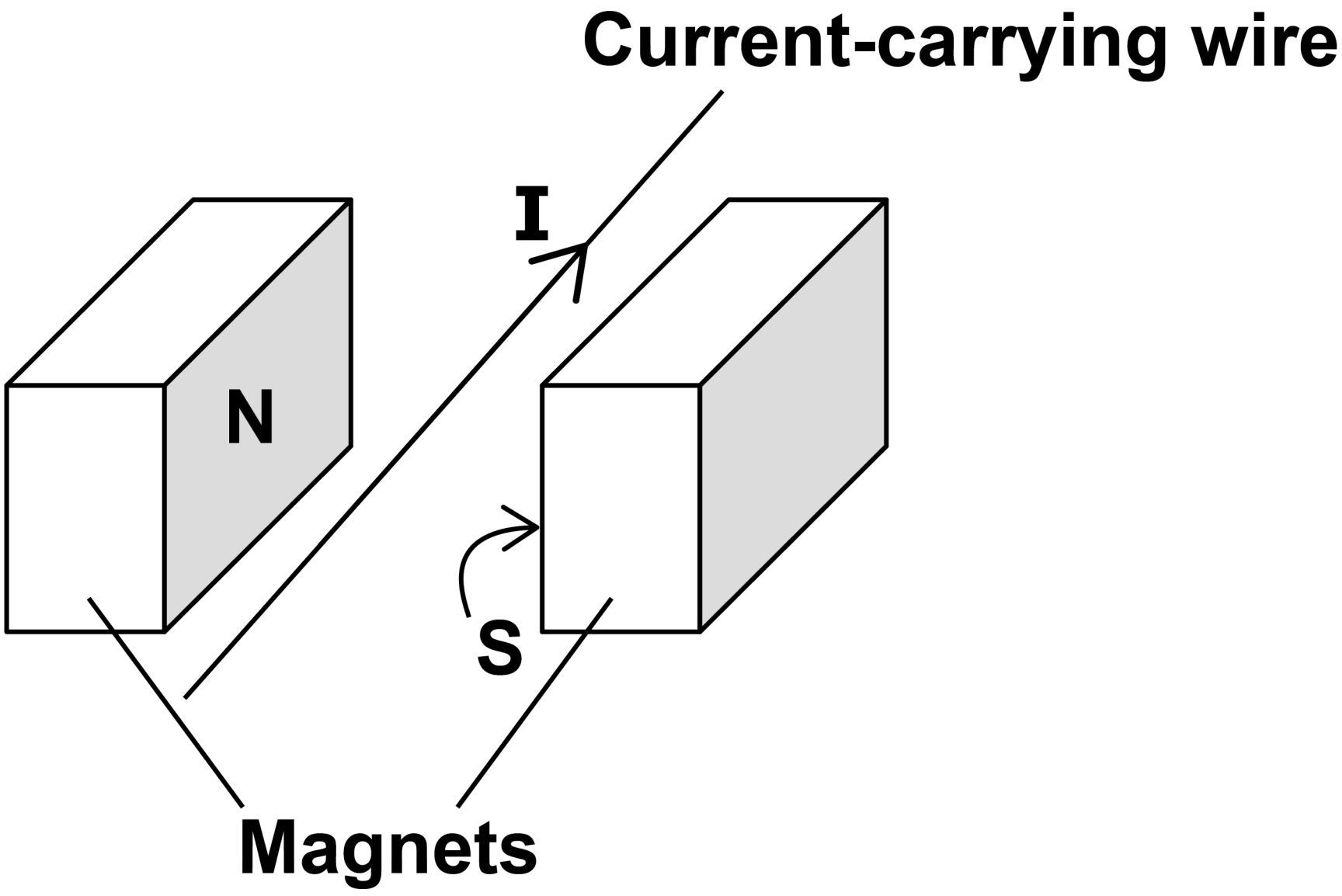
8

0 4

A teacher demonstrated the motor effect.

FIGURE 5 shows the equipment used.

FIGURE 5



0 4 . 1

Explain why there is a force on the wire when there is a current in the wire.
[2 marks]

0 4 . 2

Explain how the direction of the force on the wire can be predicted. [3 marks]

BLANK PAGE

[Turn over]

0 4 . 3

FIGURE 6 shows a simple electric motor.

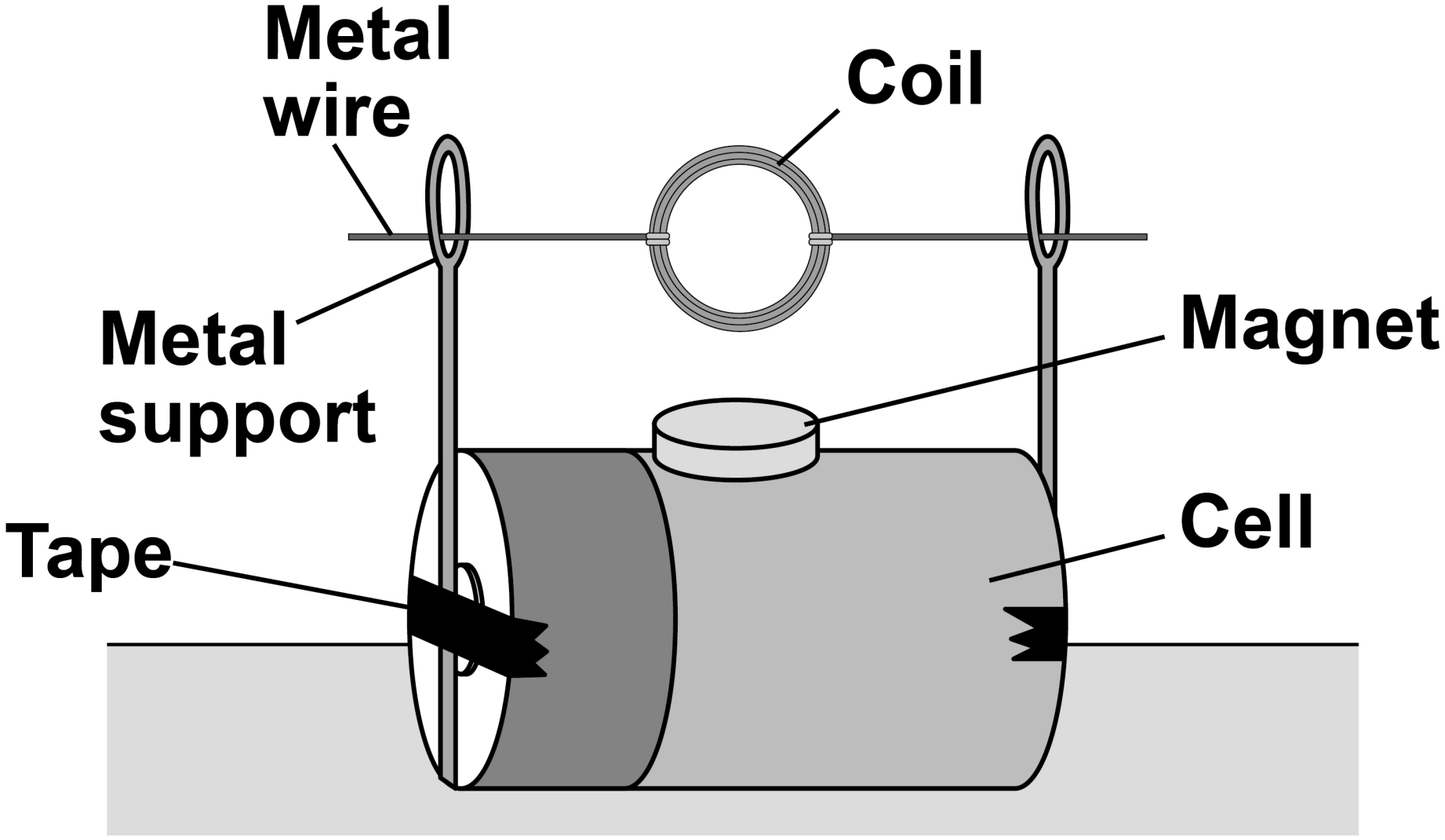


FIGURE 6

Explain ONE way that the motor could be changed to increase the rate at which the coil rotates. [2 marks]

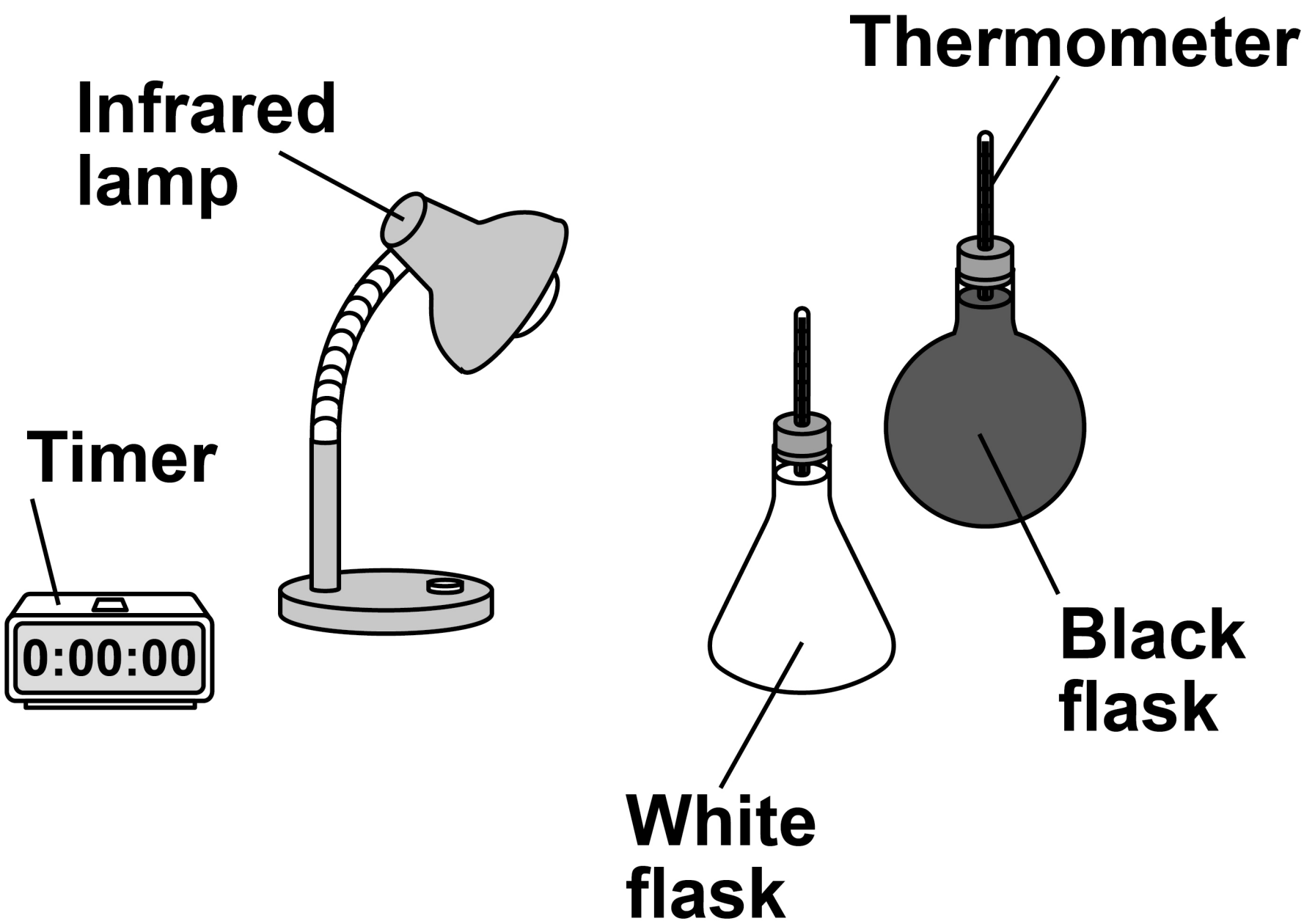
0 5

A student investigated how the colour of a surface affects the amount of infrared radiation the surface absorbs.

FIGURE 7 shows the equipment used.

The two flasks are painted different colours.

FIGURE 7



This is the method used.

1. **Pour water at 20 °C into each flask.**
2. **Place a bung and thermometer into each flask.**
3. **Place each flask in front of the infrared lamp.**
4. **Measure the temperature of the water every 30 seconds for 10 minutes.**

0 5 . 1

Explain TWO improvements to the method the student used. [4 marks]

1

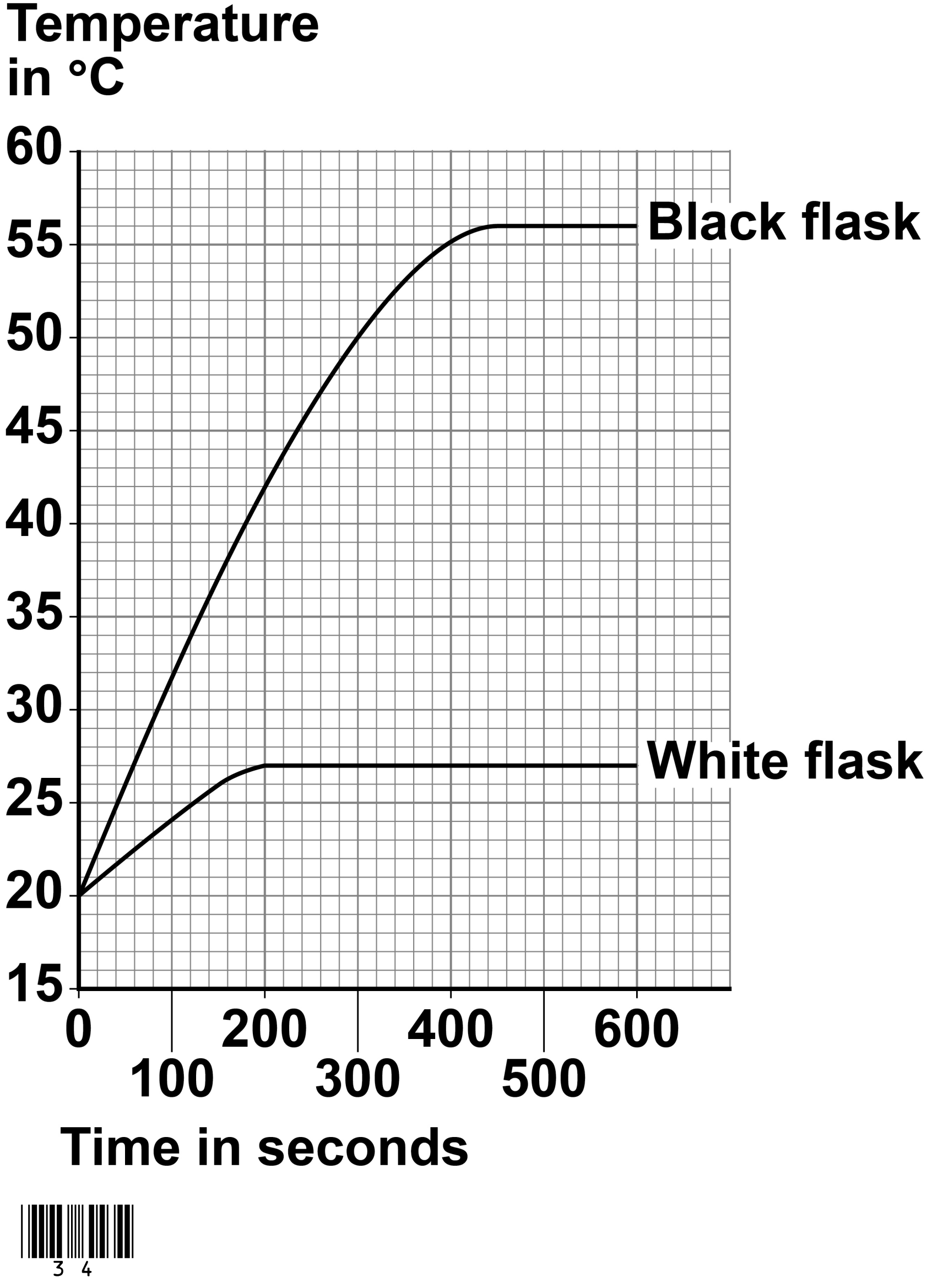
2

BLANK PAGE

[Turn over]

FIGURE 8 shows the results for each flask.

FIGURE 8



0 5 . 2

Complete the sentences. [2 marks]

After 100 seconds the temperature difference between the black flask and the white flask was _____ °C

The temperature of the white flask stopped increasing. The temperature inside the black flask continued to increase for a further _____ seconds.

[Turn over]

0 5 . 3

The initial rate of absorption of infrared radiation by the black flask was greater than the initial rate of absorption by the white flask.

How does FIGURE 8, on page 34, show this? [1 mark]

0 5 . 4

Explain why the temperature of the water in the flasks increased and then became constant. [4 marks]

0 6

The distance a car travels during the driver's reaction time is called the thinking distance.

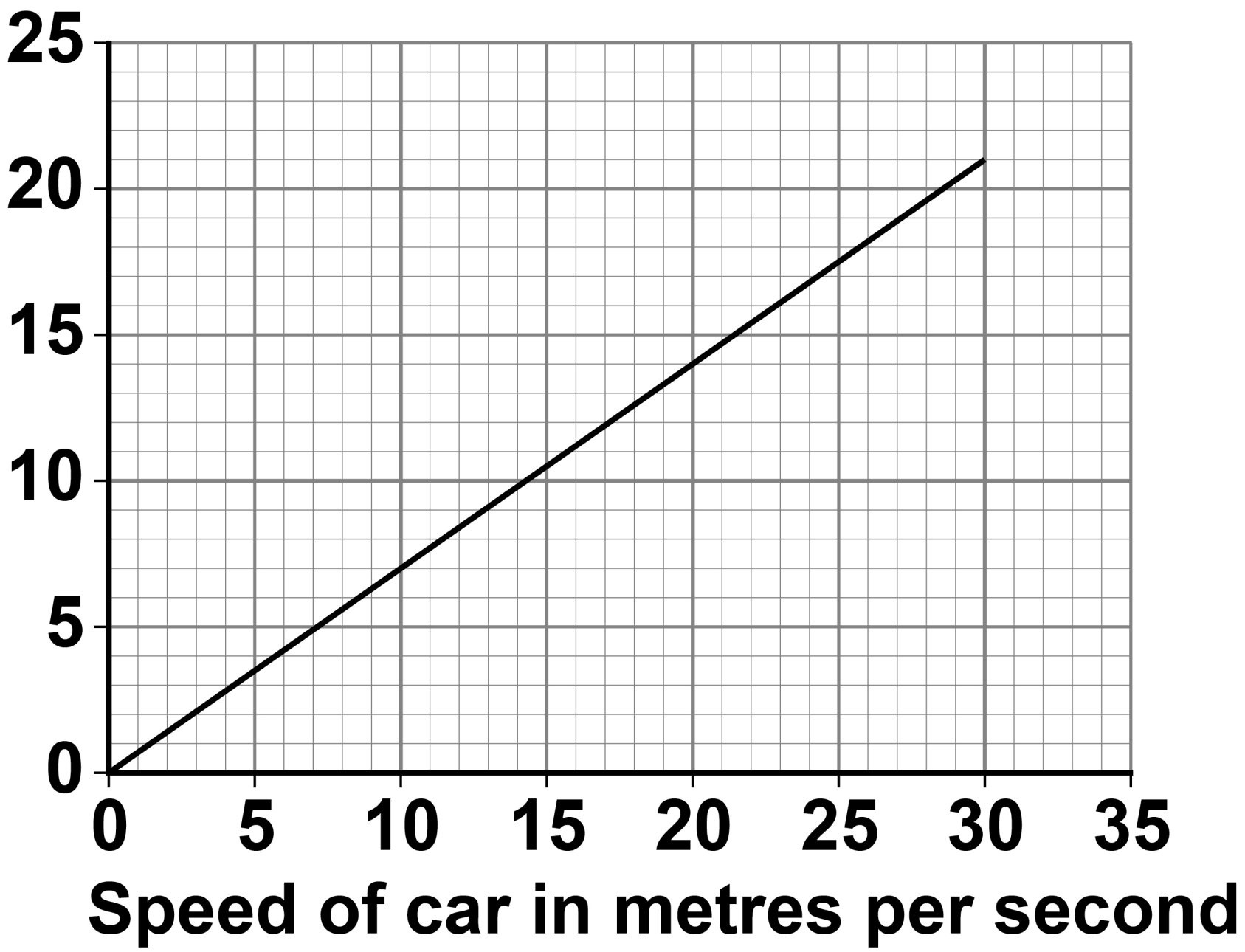
0 6 . 1

FIGURE 9, on page 40, shows how thinking distance depends on speed for a car.

BLANK PAGE

[Turn over]

FIGURE 9


Thinking distance in metres
25
20
15
10
5
0
0
5
10
15
20
25
30
35
Speed of car in metres per second

Determine the driver's reaction time.

Use the Physics Equations Sheet.
[3 marks]

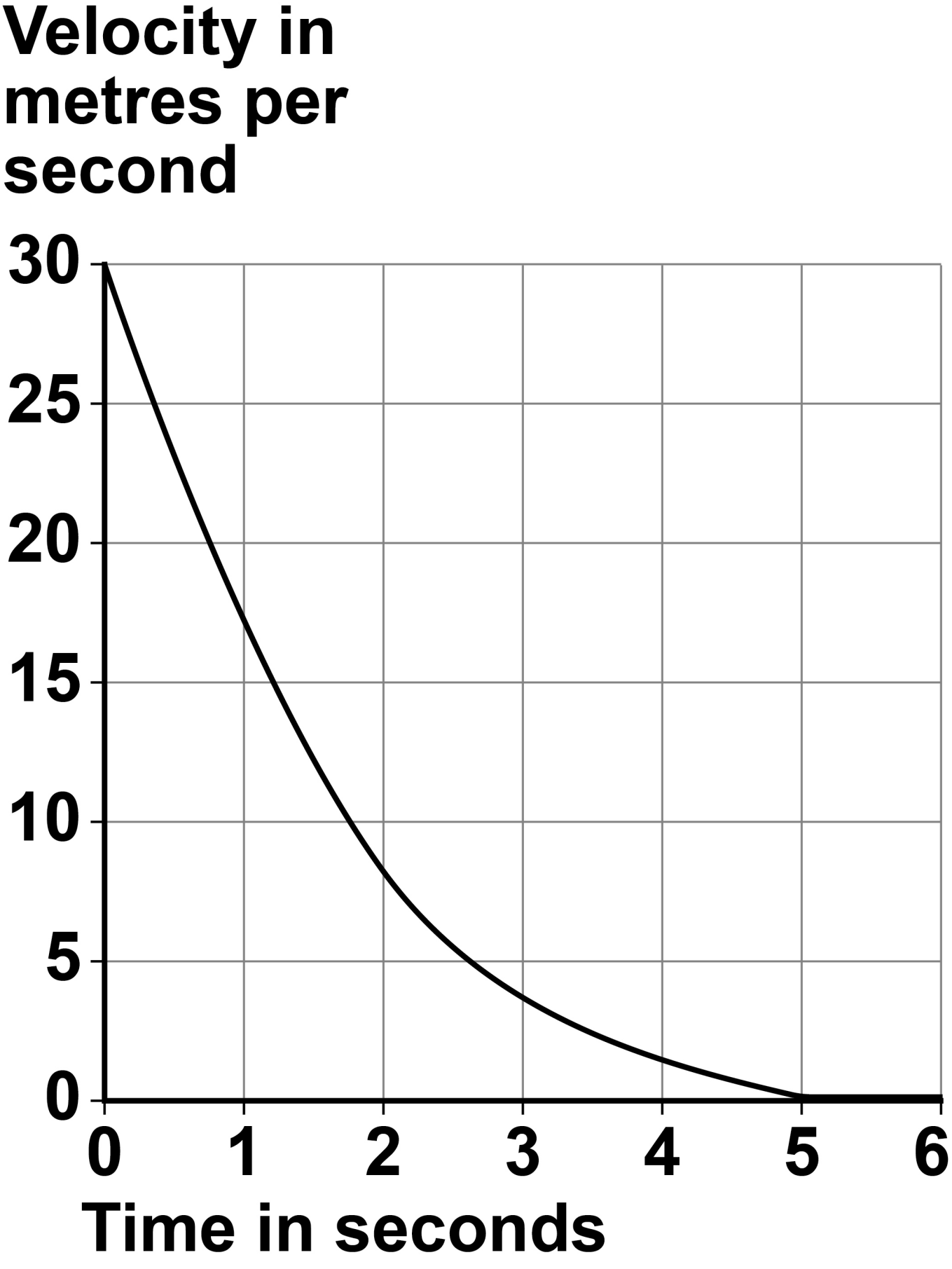
Reaction time = _____ s

[Turn over]

0 6 . 2

FIGURE 10 shows how the velocity of a car changes during braking.

FIGURE 10

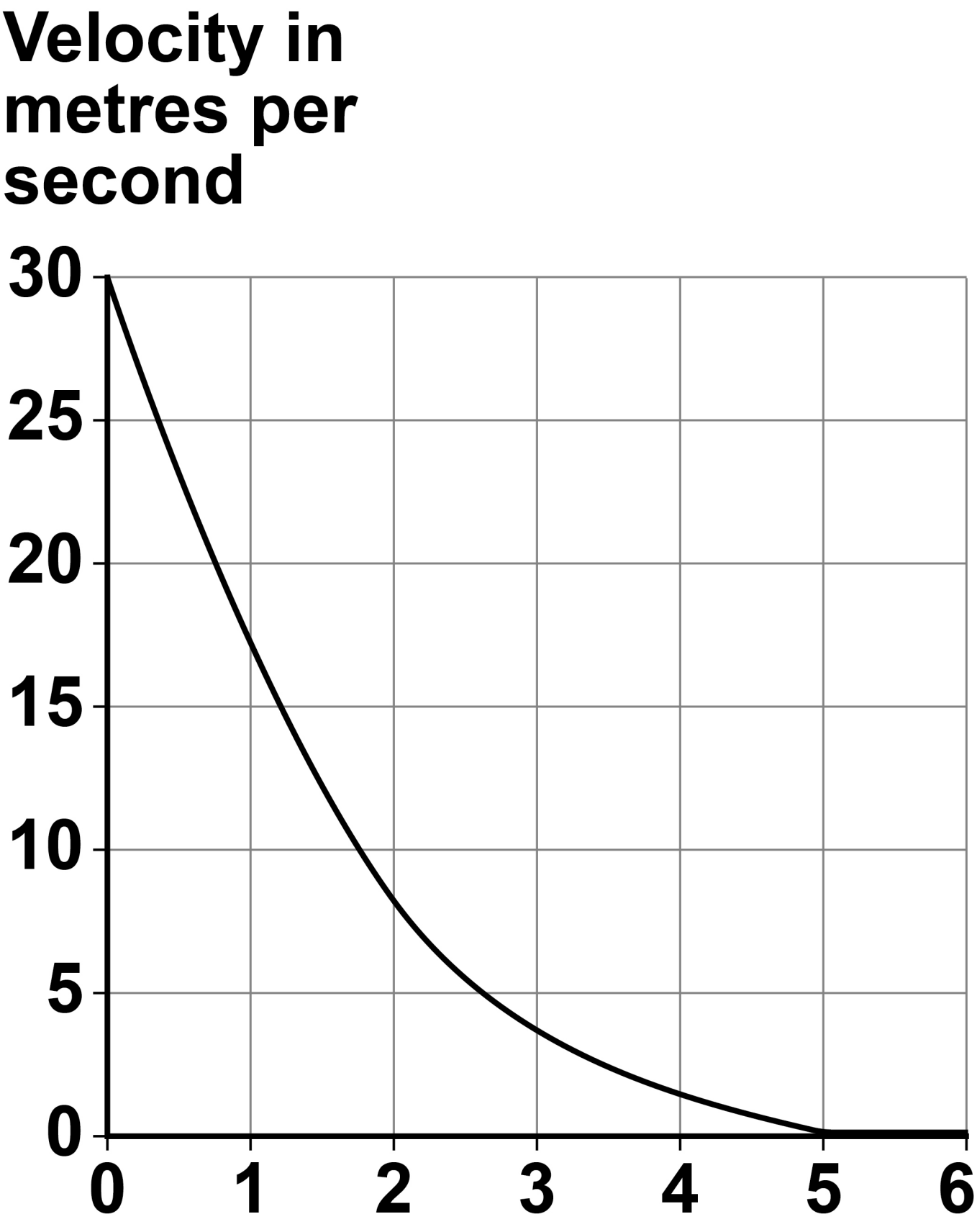


Determine the braking distance of the car. [3 marks]

Braking distance = _____ m

[Turn over]

REPEAT OF FIGURE 10



0 6 . 3

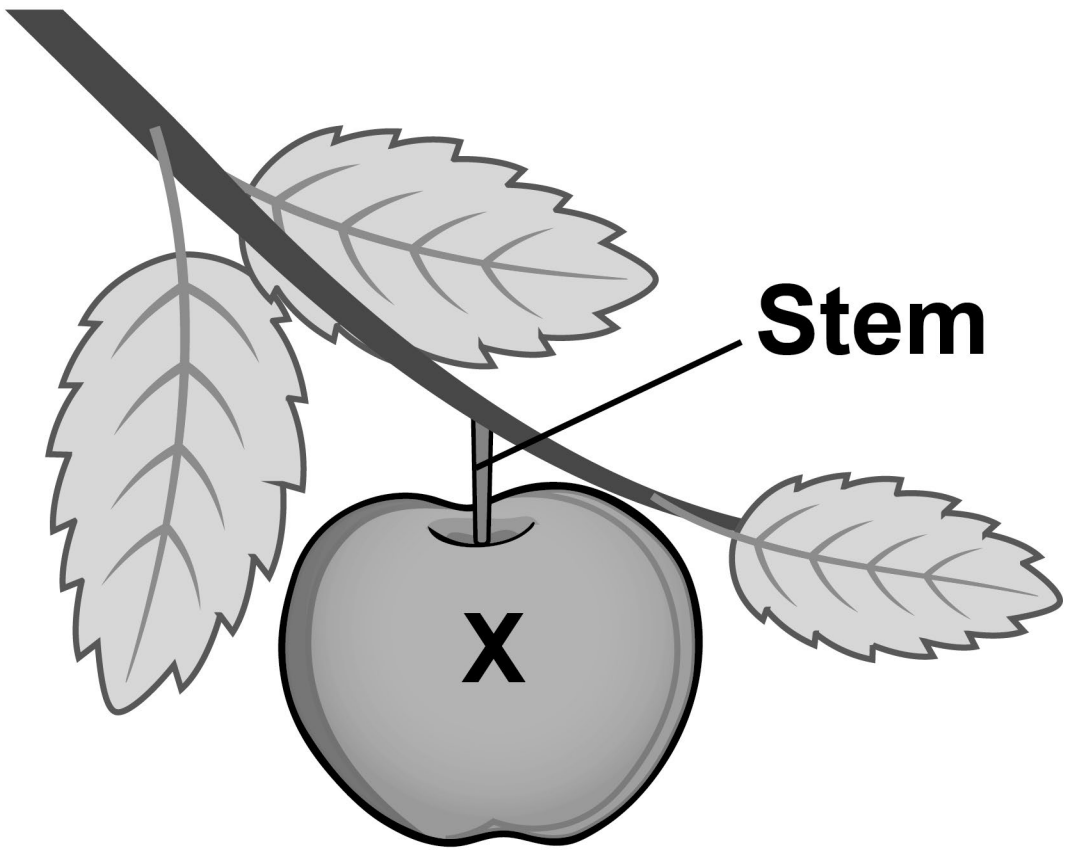
Explain how the gradient of the line on FIGURE 10 shows that the resultant force on the car was NOT constant. [3 marks]

0 7

FIGURE 11 shows a stationary apple hanging from a tree.

The X marks the centre of mass of the apple.

FIGURE 11



0 7 . 1

Draw TWO arrows on FIGURE 11 to show the forces acting on the apple. [2 marks]

0 7 . 2

It takes 0.50 s for the apple to fall to the ground.

The initial velocity of the apple is 0 m/s

acceleration due to gravity = 9.8 m/s^2

Calculate the distance fallen by the apple.

Use the Physics Equations Sheet.
[6 marks]

Distance = _____ m

[Turn over]

0 7 . 3

In Question 07.2 it was assumed that the acceleration was a constant 9.8 m/s^2

Evaluate this assumption. [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.

BLANK PAGE

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