A

AQA

**Surname** _____

**Other Names** _____

**Centre Number** _____

**Candidate Number** _____

**Candidate Signature** _____

# GCSE

# PHYSICS

# F

**Foundation Tier Paper 2**

# 8463/2F

**Friday 14 June 2019 Morning**

**Time allowed: 1 hour 45 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 ruler**
- **a scientific calculator**
- **a protractor**
- **the Physics Equations Sheet (enclosed).**

## INSTRUCTIONS

- **Use black ink or black ball-point pen.**
- **Answer ALL questions in the spaces provided.**
- **Do not write on blank pages.**
- **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

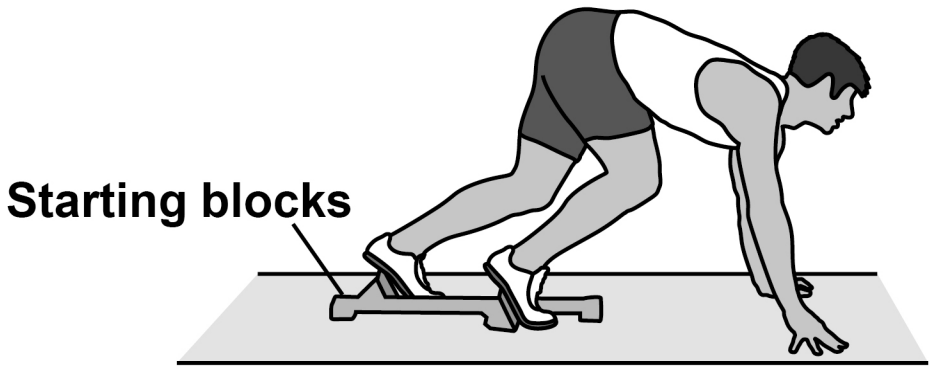
- **The maximum mark for this paper is 100.**
- **The marks for questions are shown in brackets.**
- **You are expected to use a calculator where appropriate.**
- **You are reminded of the need for good English and clear presentation in your answers.**

**DO NOT TURN OVER UNTIL TOLD TO DO SO**

**Answer ALL questions in the spaces provided.**

**0 1** **FIGURE 1 shows an athlete on starting blocks waiting to start a 100 metre race.**

**FIGURE 1**




**0 1 . 1** **Complete the sentence.**

**Choose the answer from the list below.**
**[1 mark]**

- **equal to**
- **greater than**
- **less than**

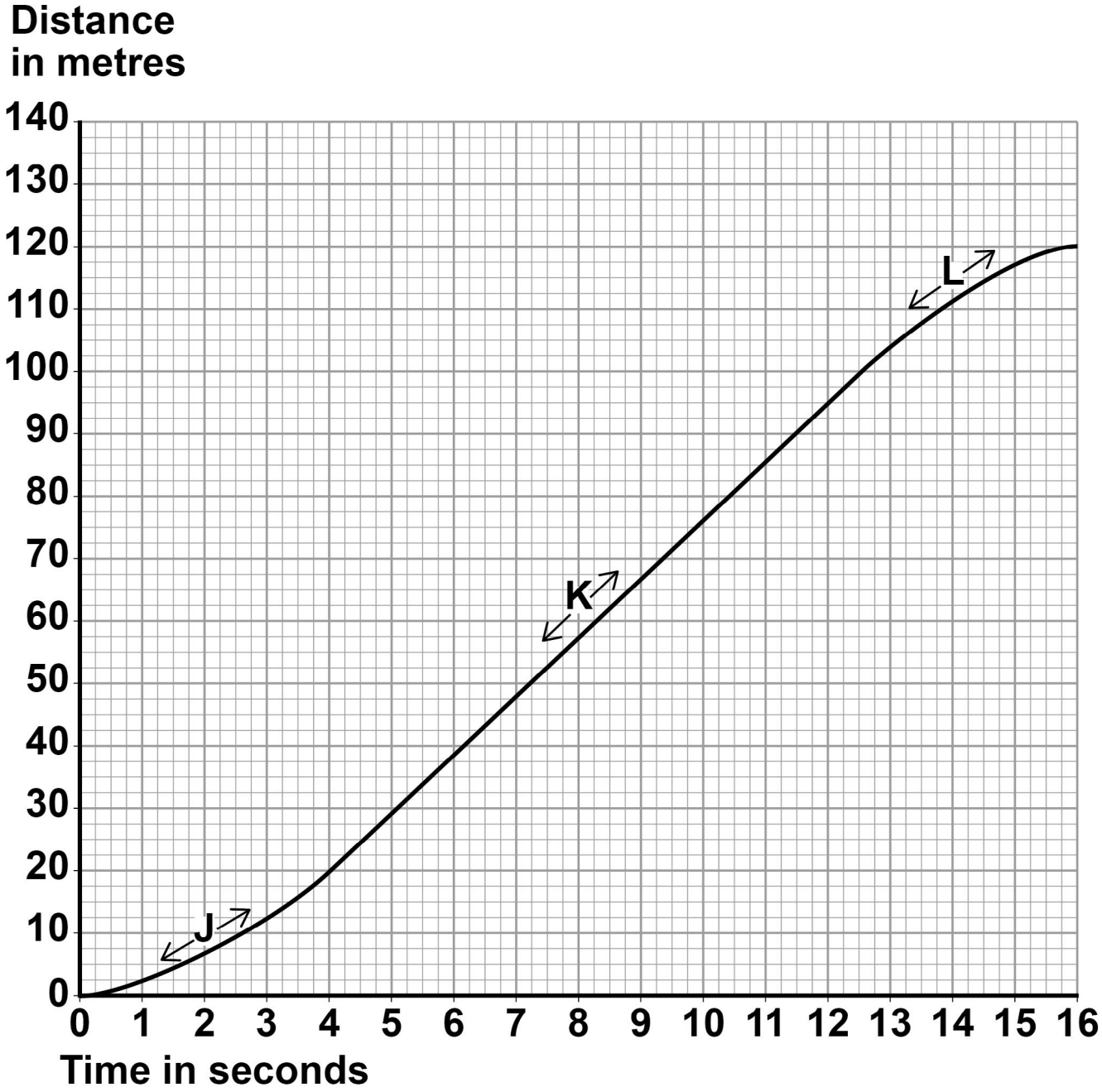
**The force from the athlete pushing backwards on the starting blocks is _____ the force from the starting blocks pushing forwards on the athlete.**

**BLANK PAGE**

**[Turn over]**

**FIGURE 2 shows a distance–time graph for the athlete from the moment the race starts.**

**FIGURE 2**



**0 1 . 2** **Three parts of the distance–time graph are labelled J, K and L.**

**Draw ONE line from EACH of the labels to the correct description of the athlete's motion for that part of the graph. [2 marks]**

| LABELS | DESCRIPTION OF MOTION |
|---|---|
| | not moving |
| J | |
| | constant speed |
| K | |
| | decreasing speed |
| L | |
| | increasing speed |

**0 1 . 3** **What distance does the athlete travel after the end of the race before stopping? [1 mark]**

**Distance = _____ m**

**[Turn over]**

**0 1 . 4** **Calculate the average speed of the athlete between the start and finish of the 100 metre race.**

**Use the equation:**

$$\text{average speed} = \frac{\text{distance travelled}}{\text{time taken}}$$

**[2 marks]**

**Average speed = _____ m/s**

**0 1 . 5 The athlete runs faster than a typical person.**

**What is the average running speed of a typical person in metres per second?**
**[1 mark]**

**Tick (✓) ONE box.**

- ☐ **1.5**
- ☐ **3.0**
- ☐ **4.5**
- ☐ **6.0**

**7**

**0 2** **Most galaxies are moving away from the Earth. Scientists can determine the speed of a galaxy by observing the light from the galaxy.**

**0 2 . 1** **Complete the sentence.**

**Choose the answer from the list below.**
**[1 mark]**

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

**When scientists observe the light from distant galaxies, they observe an increase in the _____ of light from those galaxies.**

**BLANK PAGE**

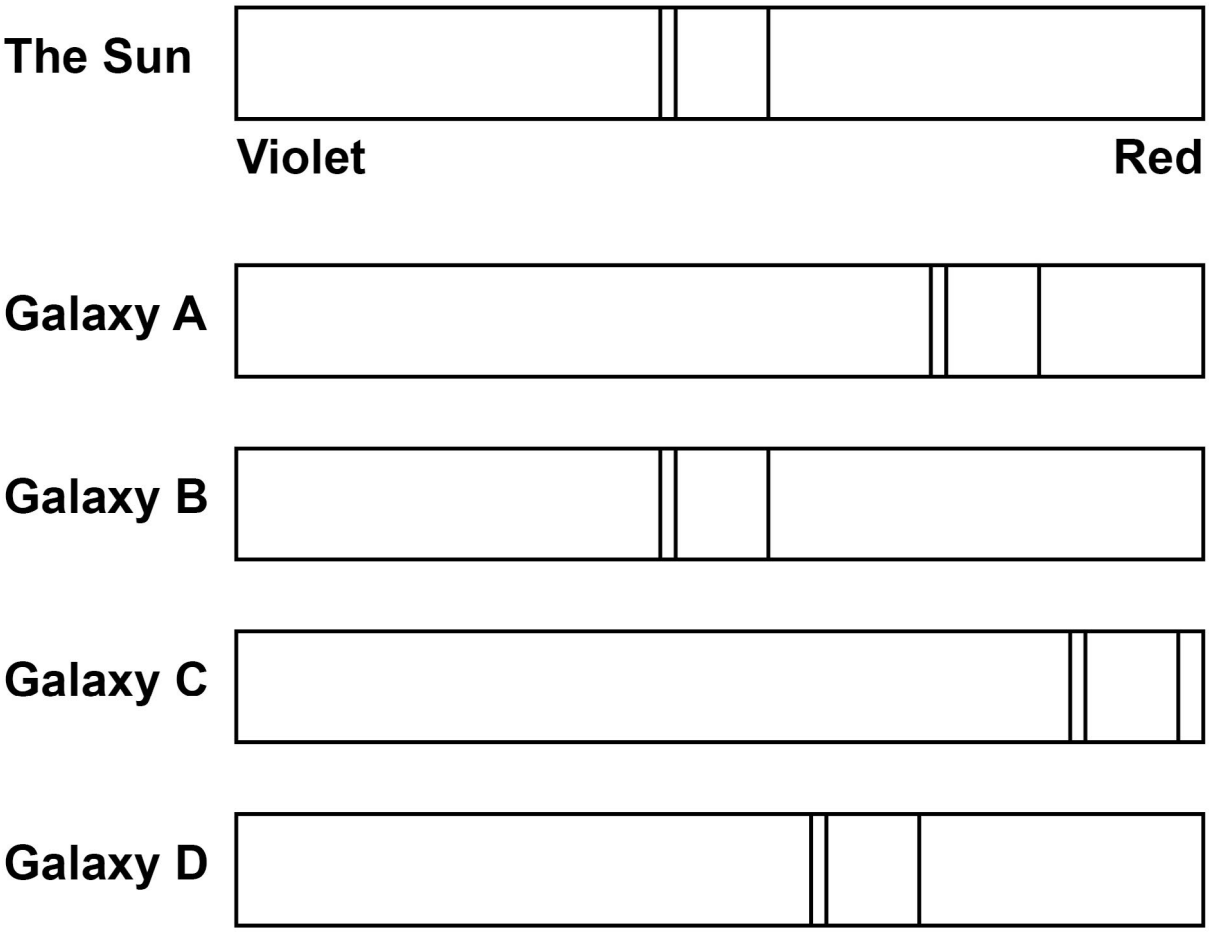
**[Turn over]**

**The light spectra from stars and galaxies include dark lines.**

**The lines have the same pattern.**

**FIGURE 3 shows the light spectrum from the Sun and from four galaxies.**

**FIGURE 3**



**0 2 . 2** **Which galaxy is moving the fastest away from the Earth? [1 mark]**

**Tick (✓) ONE box.**

- ☐ **A**
- ☐ **B**
- ☐ **C**
- ☐ **D**

**0 2 . 3** **Which galaxy is the furthest away from the Earth? [1 mark]**

**Tick (✓) ONE box.**

- ☐ **A**
- ☐ **B**
- ☐ **C**
- ☐ **D**

**0 2 . 4** **The Big Bang theory is one way to explain the origin of the universe.**

**How does the Big Bang theory describe the universe when it began? [1 mark]**

**Tick (✓) ONE box.**

- ☐ **Very big and very dense**
- ☐ **Very big and extremely hot**
- ☐ **Very dense and extremely hot**
- ☐ **Very small and extremely cold**

**0 2 . 5** **Which statement about the Big Bang theory is correct? [1 mark]**

**Tick (✓) ONE box.**

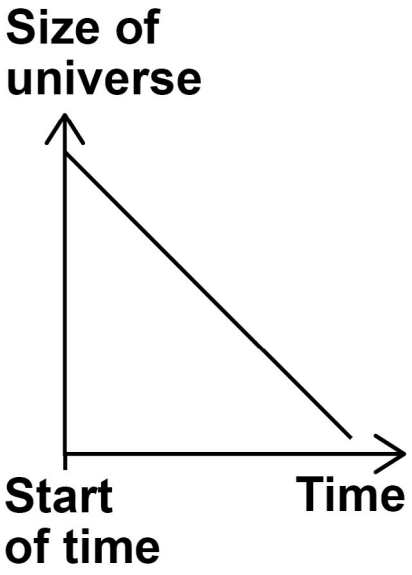
- ☐ **Scientists have proved that the theory is correct.**
- ☐ **Scientific evidence supports the theory.**
- ☐ **There is no other way to explain the origin of the universe.**

**[Turn over]**

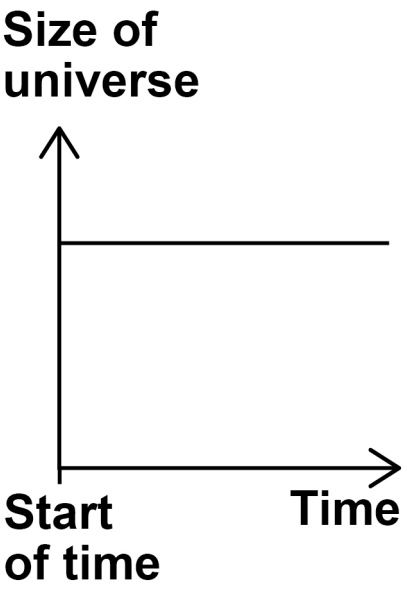
**0 2 . 6** **FIGURE 4 shows three ways that the size of the universe may have changed with time.**

**FIGURE 4**

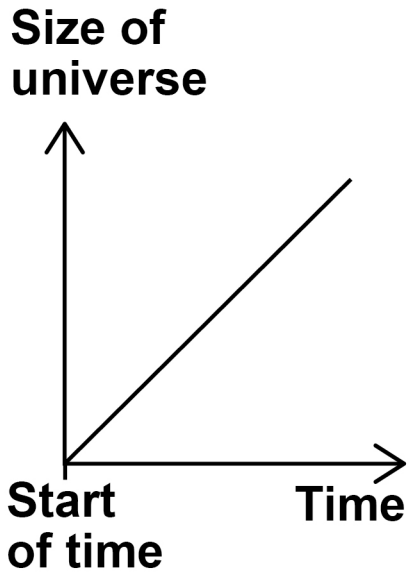
**X**




**Y**




**Z**



**Which graph would the Big Bang theory suggest is correct? [2 marks]**

**Tick (✓) ONE box.**

☐ **X**

☐ **Y**

☐ **Z**

**Give a reason for your answer.**

_____

_____

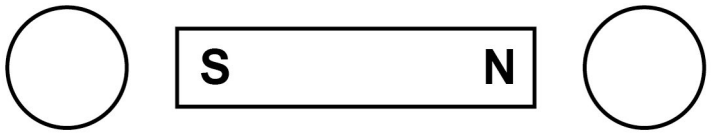
_____

**7**

**0 3 . 1** **FIGURE 5 shows a bar magnet.**

**Each circle represents a compass.**

**FIGURE 5**




**Draw an arrow inside each circle to show the direction that each compass would point.**
**[1 mark]**

**0 3 . 2** **FIGURE 6, below, shows part of a coat.**

**The coat has two magnets hidden inside the material.**

**FIGURE 7, on the opposite page, shows how the magnets are used to fasten the coat.**

**FIGURE 6**

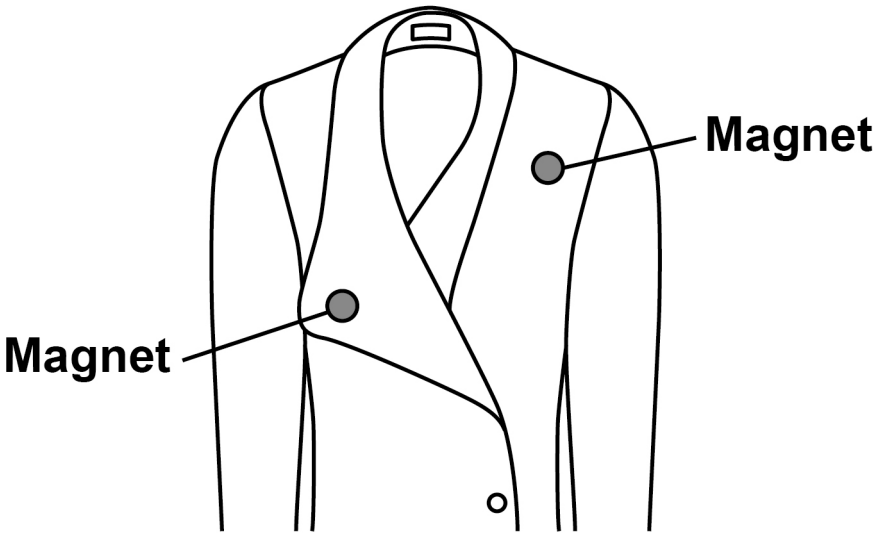
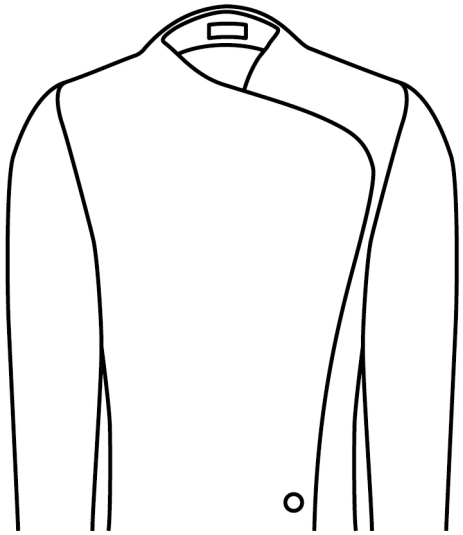


**FIGURE 7**



**Explain why the magnets inside the coat must NOT have two south poles facing each other. [2 marks]**

**A coil of wire is connected to a battery.**

**The current in the coil produces a magnetic field.**

**0 3 . 3** **Which diagram in FIGURE 8, below and on the opposite page, shows the magnetic field produced by the current in the coil? [1 mark]**

**FIGURE 8**

**Tick (✓) ONE box.**

☐ **A**

**A**

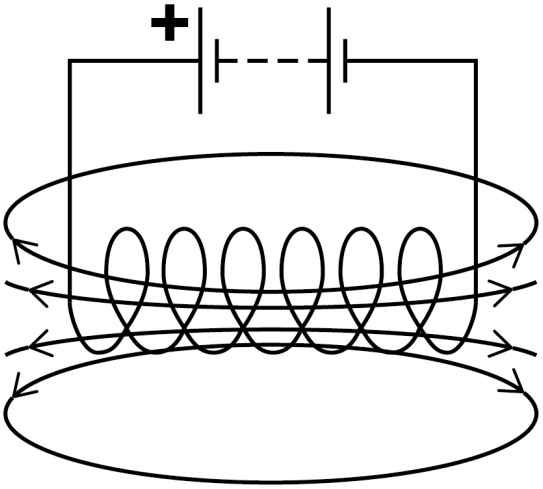
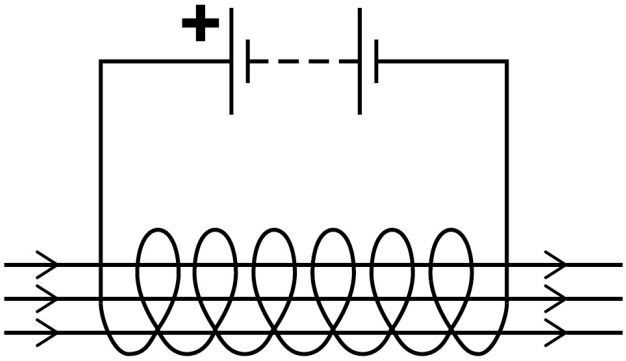


**FIGURE 8 continued**

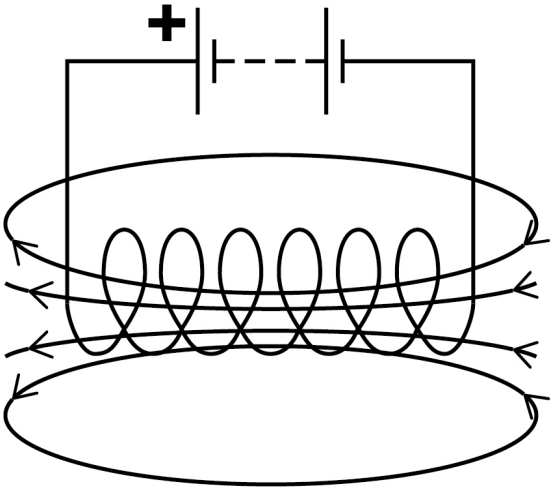
☐ **B**

**B**



☐ **C**

**C**



**[Turn over]**

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**0 3 . 4 A solid rod is placed inside the coil.**

**Which type of rod would make the magnetic field of the coil stronger? [1 mark]**

**Tick (✓) ONE box.**

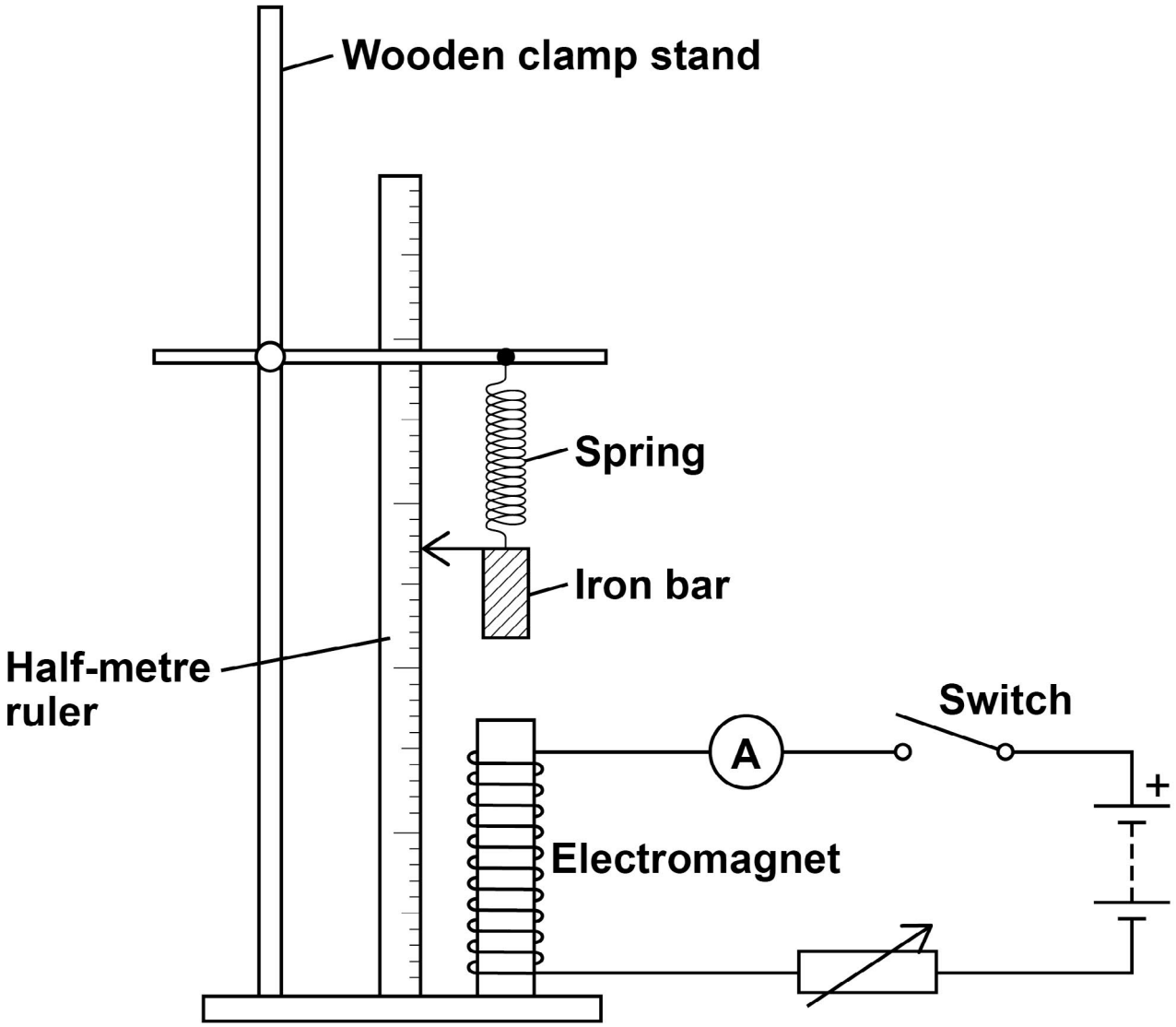
- ☐ **Glass rod**
- ☐ **Plastic rod**
- ☐ **Steel rod**
- ☐ **Wooden rod**

**[Turn over]**

**A student investigated how the strength of an electromagnet varies with the current in the coil of the electromagnet.**

**FIGURE 9 shows the equipment the student used.**

**FIGURE 9**



**0 3 . 5** **Why does the spring get longer when the electromagnet is switched on? [1 mark]**

_____

_____

_____

_____

_____

**[Turn over]**

**The student measured how much further the spring extended with different values of current in the coil.**

**FIGURE 10 shows the results.**

**FIGURE 10**

**0 3 . 6** **The current in the coil is increased from 0.6 A to 1.2 A**

**Determine the increase in the extension of the spring. [1 mark]**

_____

_____

**Increase in the extension = _____ cm**

**0 3 . 7** **Calculate the increase in the force on the spring when the current in the coil increased from 0.6 A to 1.2 A**

**Spring constant = 0.18 N/cm**

**Use the equation:**
**force = spring constant × extension**
**[2 marks]**

_____

_____

_____

**Increase in the force = _____ N**

**[Turn over]**

**0 3 . 8** **Describe what happened to the strength of the electromagnet as the current in the coil increased from 1.2 A to 1.6 A**
**[2 marks]**

11

**BLANK PAGE**

**[Turn over]**

**0 4 . 1** **FIGURE 11 shows the position of three types of wave in the electromagnetic spectrum.**

**FIGURE 11**

| | | | | | | |
|---|---|---|---|---|---|---|
| **A** | **Microwaves** | **B** | **Visible light** | **C** | **D** | **Gamma rays** |

**Which letter represents infrared in the electromagnetic spectrum? [1 mark]**

**Tick (✓) ONE box.**

☐ **A**

☐ **B**

☐ **C**

☐ **D**

**0 4 . 2 What is infrared used for? [1 mark]**

**Tick (✓) ONE box.**

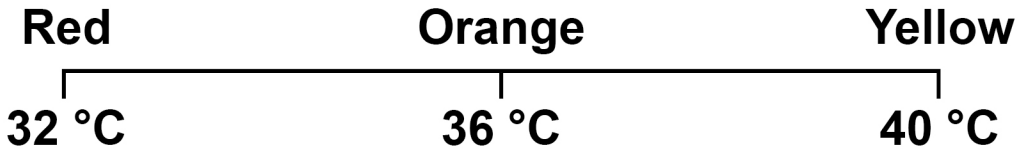
- ☐ **Electrical heating**
- ☐ **Energy efficient lamps**
- ☐ **Satellite communications**
- ☐ **Sun tanning**

**[Turn over]**

An infrared camera produces a colour image. Different colours show different temperatures.

People emit infrared radiation. FIGURE 12 shows how the colour of the image of a person on an infrared camera depends on the person's body temperature.

FIGURE 12




**0 4 . 3** Complete the sentence.

Choose the answer from the list below.
[1 mark]

- orange
- red
- yellow

The image produced by an infrared camera

of a person with a body temperature of 37 °C

is mainly _____ .

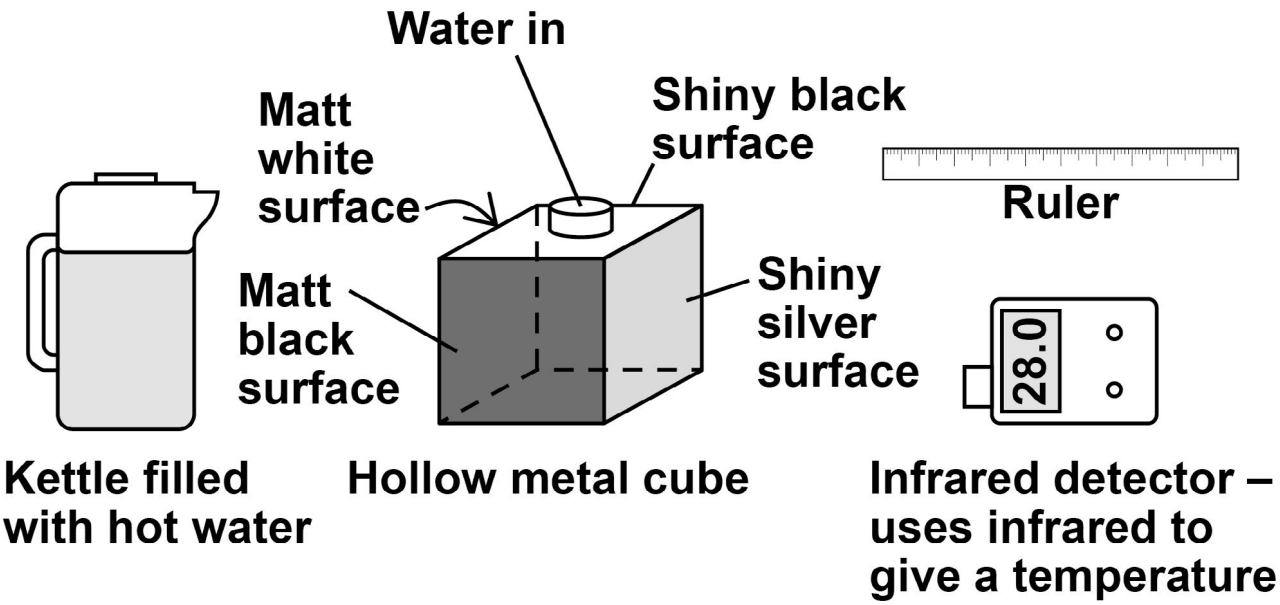
**0 4 . 4** **Rescue workers use infrared cameras to search for people trapped under rubble after an earthquake.**

**How does the image of a trapped person change if the person's body temperature drops from 37 °C to 33 °C? [1 mark]**

**A student investigated how the type of surface affects the amount of infrared the surface radiates.**

**FIGURE 13 shows the equipment used.**

**FIGURE 13**



**0 4 . 5** **Complete the sentence.**

**Choose the answer from the list below.**
**[1 mark]**

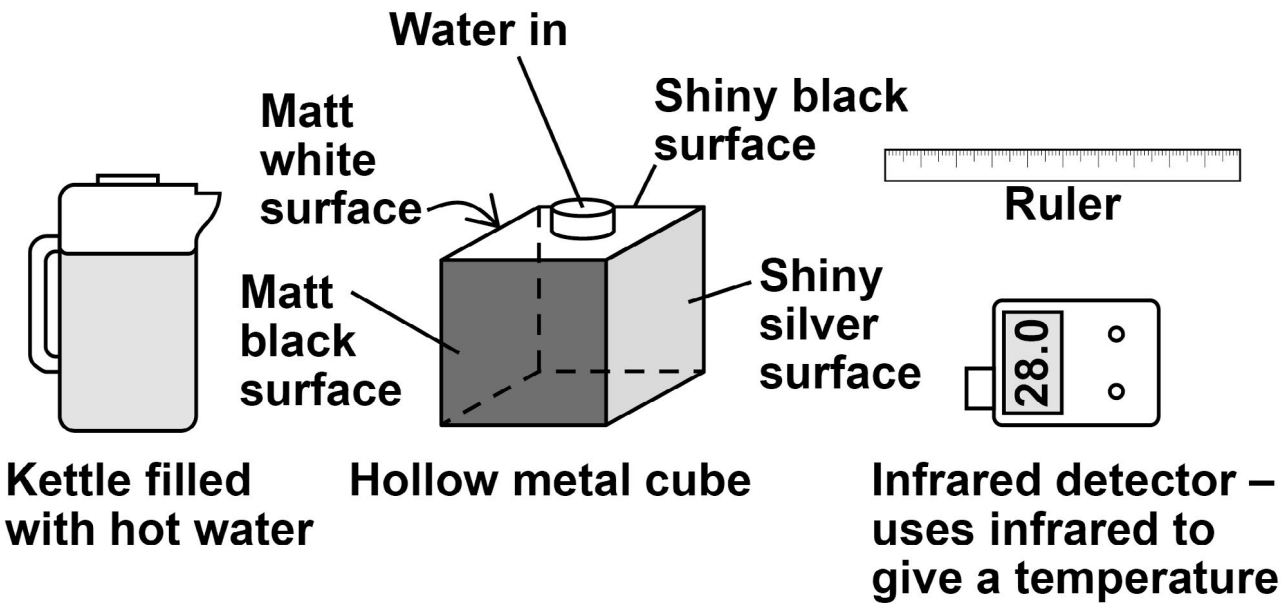
- **a control**
- **the dependent**
- **the independent**

**In this investigation the type of surface is**

**_____ variable .**

**[Turn over]**

## Repeat of FIGURE 13



**0 4 . 6** **Describe how the equipment shown in FIGURE 13 would be used to compare the infrared radiation emitted from the vertical surfaces of the cube. [3 marks]**

**TABLE 1 shows the results.**

**TABLE 1**

| Type of surface | Temperature in °C |
|---|---|
| Matt black | 68.0 |
| Matt white | 65.5 |
| Shiny black | 66.3 |
| Shiny silver | 28.0 |

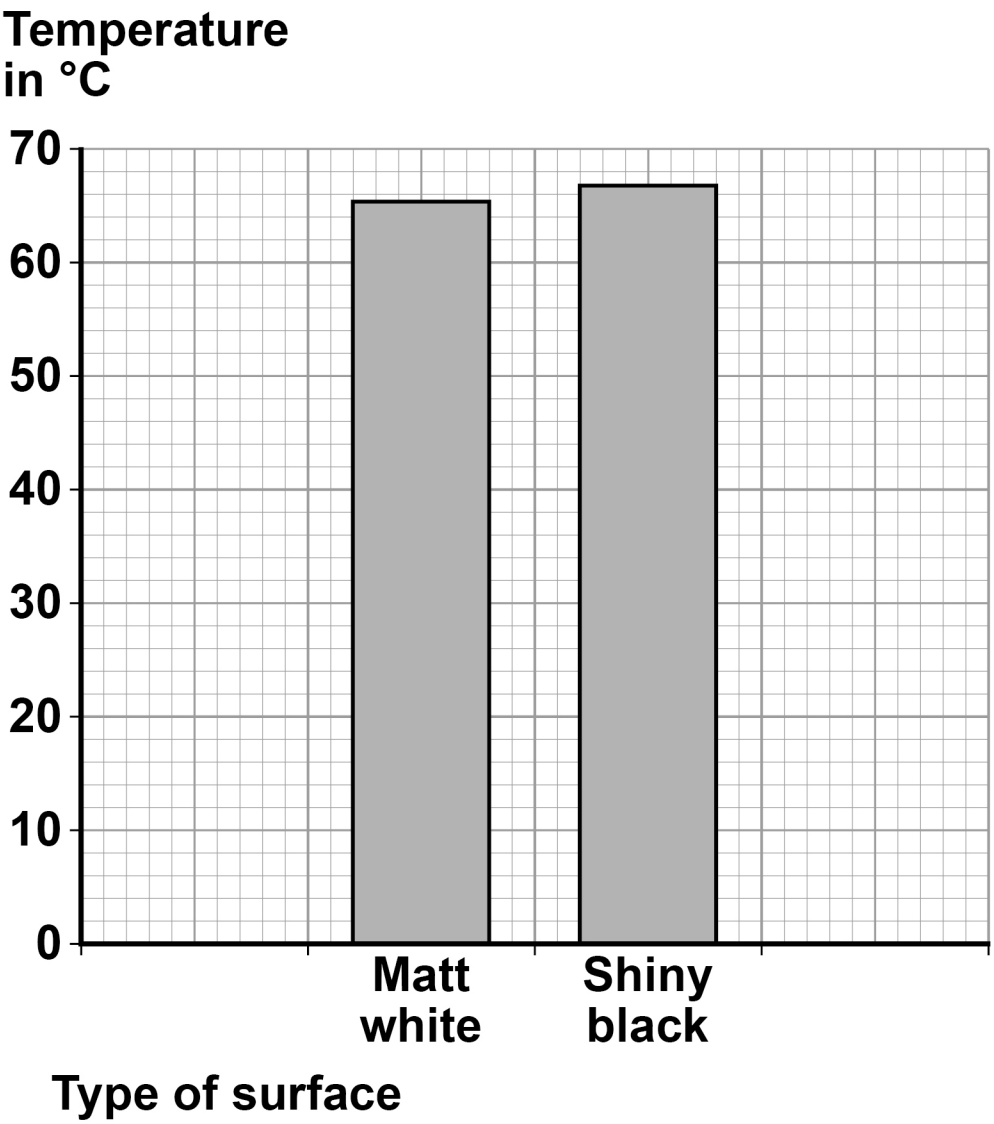
**0 4 . 7 What is the resolution of the infrared detector? [1 mark]**

**Tick (✓) ONE box.**

- ☐ **0.1 °C**
- ☐ **1.0 °C**
- ☐ **1.7 °C**
- ☐ **68.0 °C**

The bar chart in FIGURE 14 shows two of the results.

FIGURE 14




**0 4 . 8** Complete the bar chart to show all of the results. [3 marks]

[Turn over]

**0 4 . 9** **Give ONE conclusion that can be made from the results. [1 mark]**

_____

_____

_____

_____

_____

**13**

**[Turn over]**

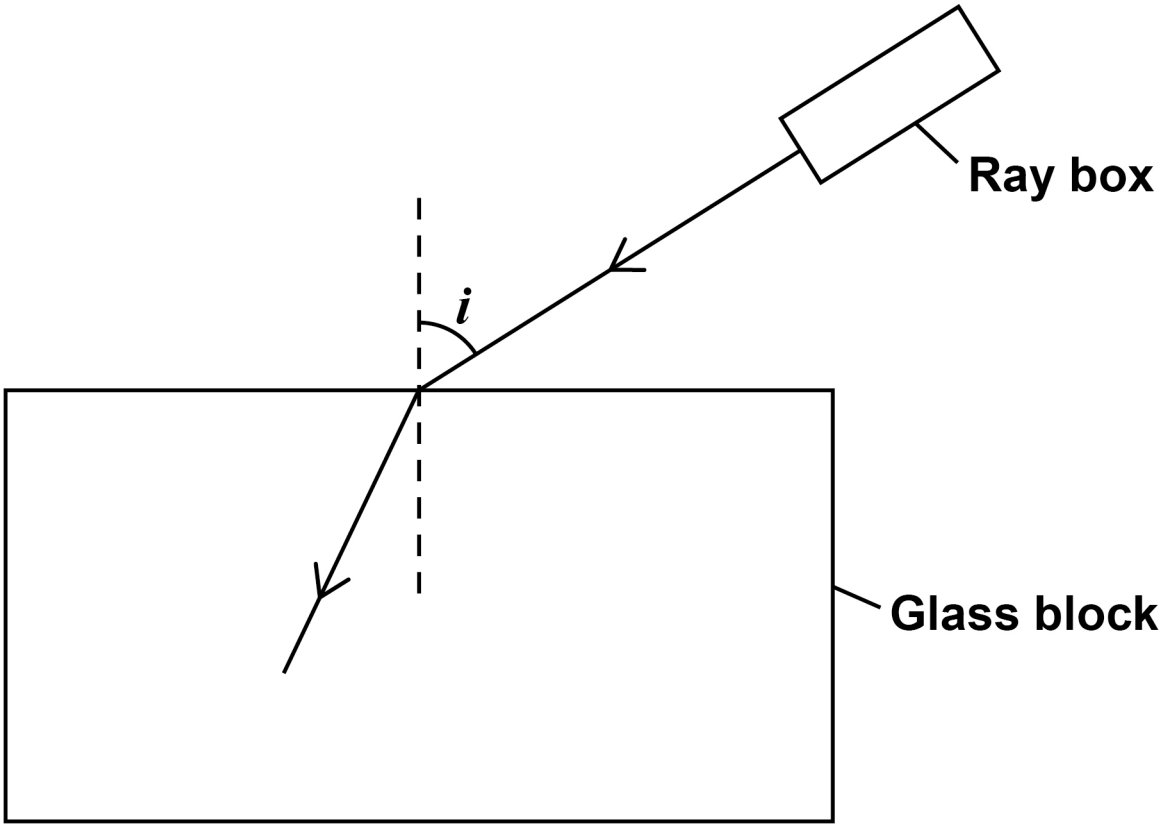
**BLANK PAGE**

**[Turn over]**

**0 5** **A student used a ray box and glass block to investigate refraction of light.**

**FIGURE 15 shows a ray of light entering the glass block.**

**FIGURE 15**



**0 5 . 1** **In FIGURE 15, the angle of incidence is labelled with the letter *i*.**

**Label the angle of refraction in FIGURE 15 with the letter *r*. [1 mark]**

**0 5 . 2** **Measure the angle of incidence in FIGURE 15. [1 mark]**

**Angle of incidence = _____ °**

**0 5 . 3** **Complete FIGURE 15 to show the path taken by the ray of light through the glass block and out into the air. [3 marks]**

**[Turn over]**

**0 5 . 4** **Complete the sentence.**

**Choose an answer from the list below.**
**[1 mark]**

- **random**
- **systematic**
- **zero**

**The student repeated the measurement three times and calculated the mean to reduce the effect of _____ errors.**

**TABLE 2 shows the student's values for the angles of incidence and the mean angles of refraction.**

**TABLE 2**

| Angle of incidence in degrees | Mean angle of refraction in degrees |
|---|---|
| 20 | 13 |
| 30 | 19 |
| 40 | X |
| 50 | 31 |

**0 5 . 5** **For an angle of incidence of 40° the three measurements for the angle of refraction were:**

**23°  27°  25°**

**Calculate the value of X in TABLE 2.**
**[1 mark]**

_____

_____

_____

**X =** _____ **°**

**0 5 . 6** **Complete the sentence.**

**Choose the answer from the list below.**
**[1 mark]**

- **equal to**
- **greater than**
- **less than**

**The student used the data in TABLE 2, on page 45, and correctly concluded that the angle of refraction is _____ the angle of incidence used.**

**0 5 . 7** **Why is the student's conclusion only valid for angles of incidence between 20° and 50°?**
**[1 mark]**

_____

_____

_____

_____

**0 5 . 8** **The student repeated the investigation using a transparent plastic block.**

**Why did the student use a transparent block and not an opaque block? [1 mark]**

_____

_____

_____

_____

**[Turn over]**

**0 5 . 9** **The student wanted to compare the refraction caused by the plastic with the refraction caused by the glass.**

**What must the student keep the same for both the plastic block and the glass block? [1 mark]**

**Tick (✓) ONE box.**

- ☐ **The angles of incidence tested**
- ☐ **The angles of refraction tested**
- ☐ **The number of results recorded**
- ☐ **The size of the two blocks**

**11**

**0 6** **The following statements describe parts of a short train journey between two railway stations.**

**PART A:** **The train accelerates at a constant rate from 0 m/s to 20 m/s in 40 s**

**PART B:** **The train travels at a constant velocity for 260 s**

**PART C:** **The train decelerates at a constant rate coming to a stop in 60 s**

**0 6 . 1** **During which part of the journey is the resultant force on the train zero? [1 mark]**

**Tick (✓) ONE box.**

☐ **A**

☐ **B**

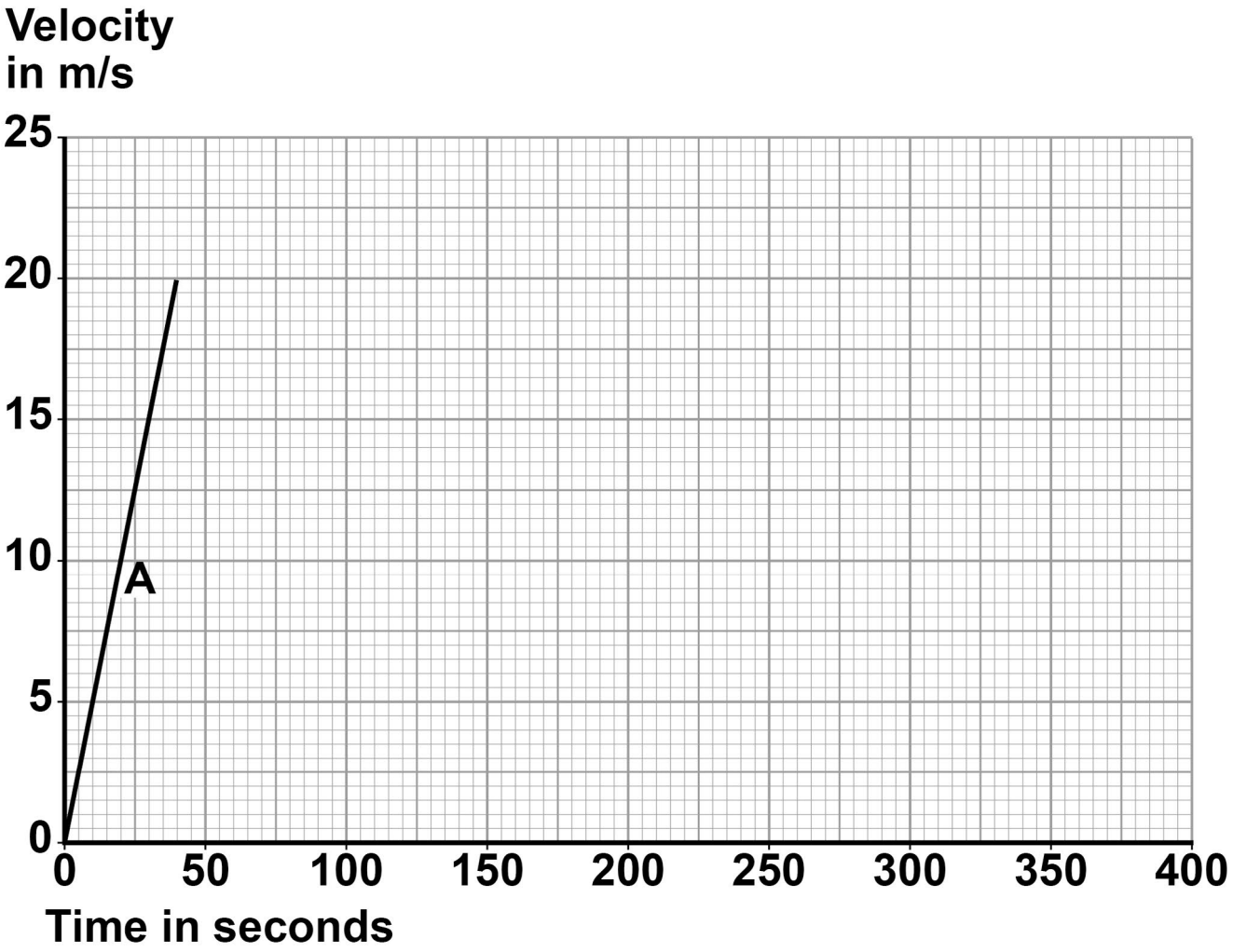
☐ **C**

**[Turn over]**

**0 6 . 2** **FIGURE 16 shows part of the velocity–time graph for the train journey.**

**Complete FIGURE 16 showing part B and part C of the train journey. [3 marks]**

**FIGURE 16**



**0 6 . 3** **Write down the equation which links acceleration, change in velocity and time taken. [1 mark]**

**0 6 . 4** **Another train accelerated at 1.15 m/s$^2$ for 22.0 s**

**Calculate the increase in velocity of the train. [3 marks]**

**Increase in velocity =**

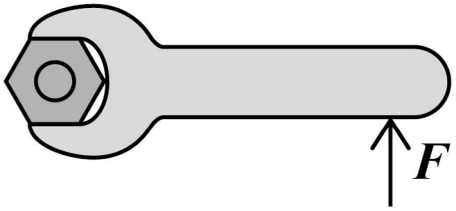
_____ **m/s**

8

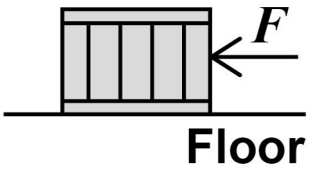
**0 7 . 1** **FIGURE 17 shows four examples of a force causing an object to move.**

**FIGURE 17**

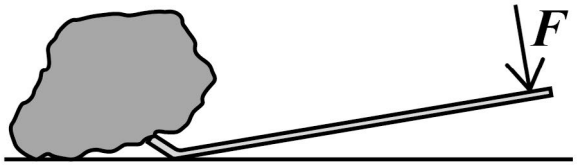
**Spanner**



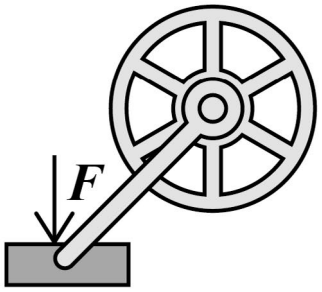

**Crate**




**Crowbar**




**Bicycle pedal system**



**Which object is NOT likely to rotate?**
**[1 mark]**

**Tick (✓) ONE box.**

- ☐ **Bicycle pedal system**
- ☐ **Crate**
- ☐ **Crowbar**
- ☐ **Spanner**

**[Turn over]**

**FIGURE 18 shows a simple device that can be used as a weighing scale.**

**FIGURE 19, on the opposite page, shows the device being used to measure a quantity of rice.**

**The weight of the device is balanced by the weight of the rice and basket.**

**FIGURE 18**

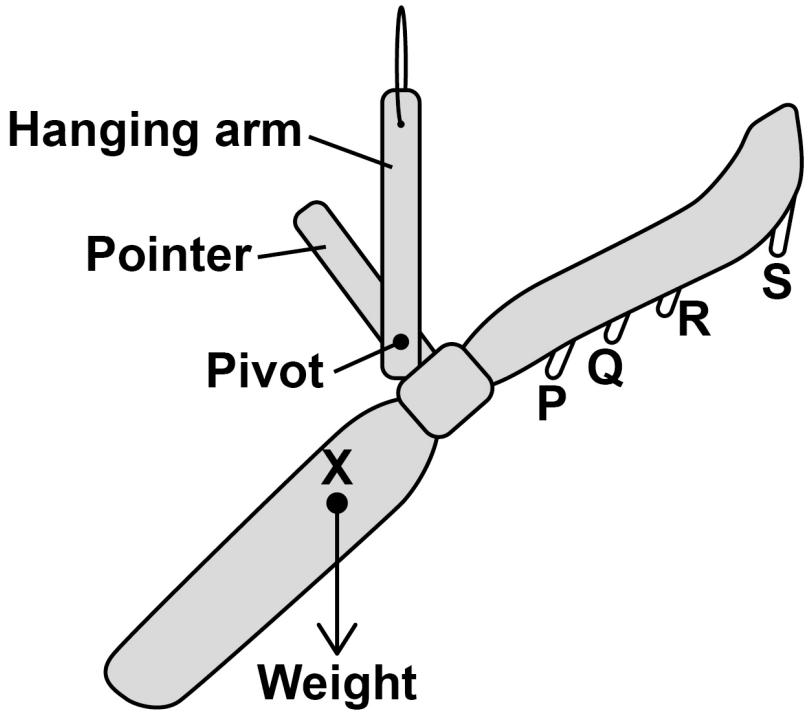
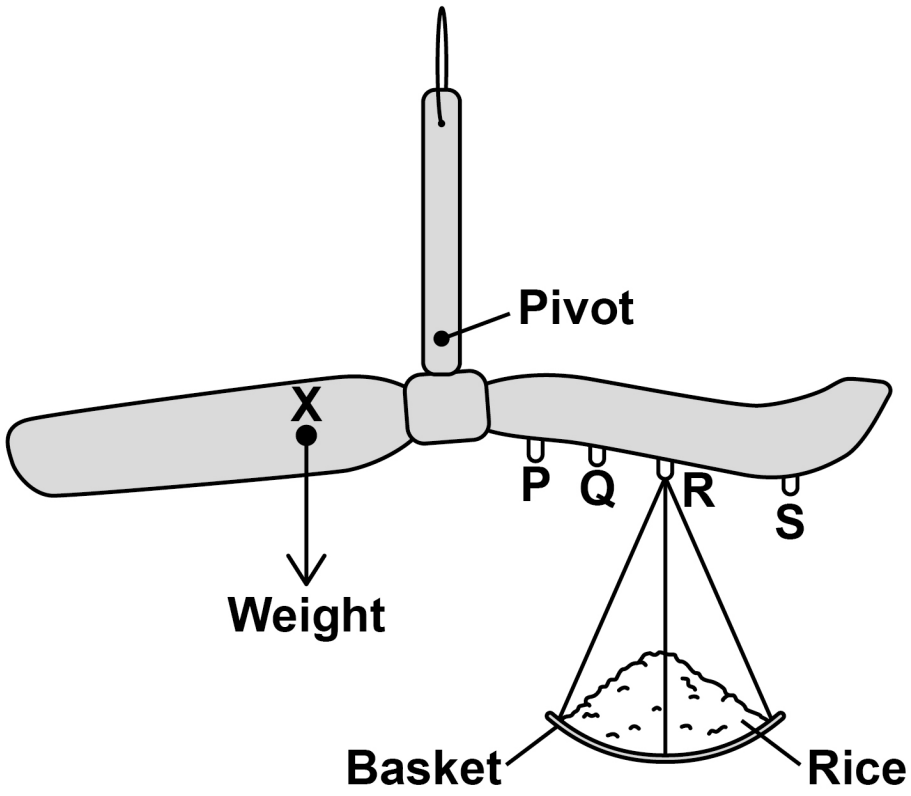


**FIGURE 19**




**0 7 . 2** **The weight of the device acts through the point labelled X.**

**What is point X called? [1 mark]**

**Tick (✓) ONE box.**

☐ **Centre of balance**

☐ **Centre of mass**

☐ **Centre of weight**

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**0 7 . 3** **How does FIGURE 19, on page 55, show that the weight of the device is balanced by the weight of the rice and basket? [1 mark]**

**0 7 . 4** **The basket can hang from different points on the device.**

**Where should the basket hang to measure the largest quantity of rice? [1 mark]**

**Tick (✓) ONE box.**

- ☐ **P**
- ☐ **Q**
- ☐ **R**
- ☐ **S**

**0 7 . 5** **Write down the equation which links distance, force and moment of a force.**
**[1 mark]**

**0 7 . 6** **In FIGURE 19, on page 55, the weight of the device causes an anticlockwise moment of 0.15 Nm about the pivot.**

**The weight of the rice and basket acts 0.06 m from the pivot.**

**Calculate the weight of the rice and basket.**
**[3 marks]**

**Weight of rice and basket = _____ N**

**0 7 . 7** **Write down the equation which links gravitational field strength, mass and weight. [1 mark]**

**0 7 . 8** **The basket has a mass of 0.04 kg**

**gravitational field strength = 9.8 N/kg**

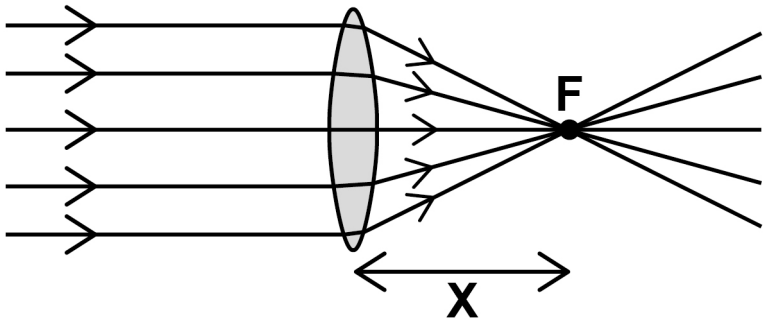
**Calculate the mass of rice in the basket. [3 marks]**

**Mass = _____ kg**

12

**0 8 . 1** **FIGURE 20 shows parallel rays of light being refracted by a convex lens.**

**FIGURE 20**



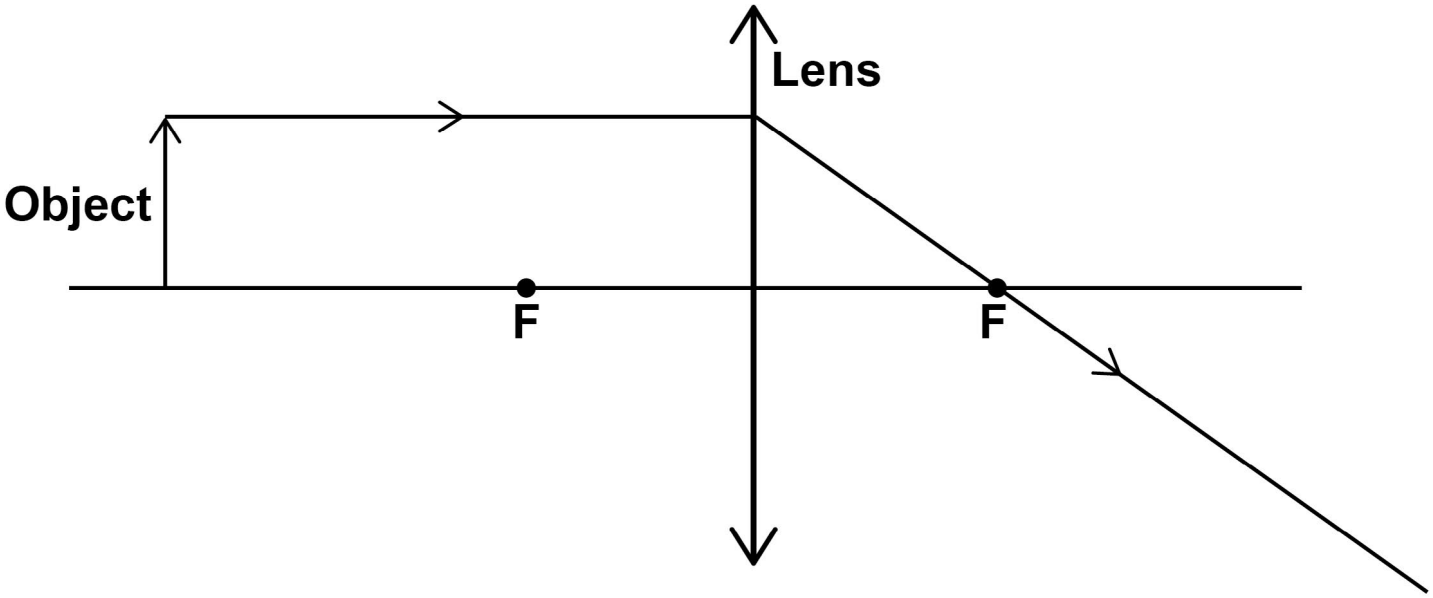

**What is distance 'X' called? [1 mark]**

**0 8 . 2** **Lenses can be used to form the image of an object.**

**Complete the ray diagram in FIGURE 21 to show how a CONVEX lens forms the image of the object.**

**Use an arrow to represent the image.**
**[2 marks]**

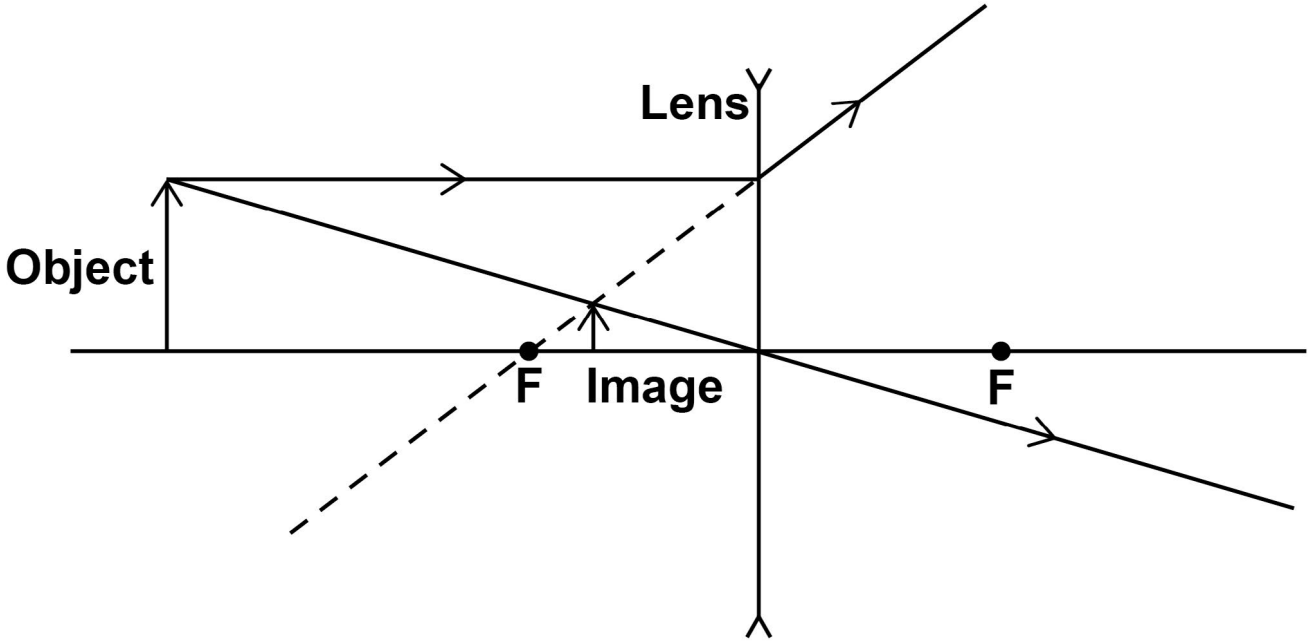
**FIGURE 21**




**[Turn over]**

**FIGURE 22 shows how a CONCAVE lens forms the image of an object.**

**FIGURE 22**



**0 8 . 3** **Give ONE similarity and ONE difference between the image formed by the convex lens and the image formed by the concave lens. [2 marks]**

**Similarity** _____

_____

_____

**Difference** _____

_____

_____

**[Turn over]**

**0 8 . 4** **A person uses a lens to read the letters on the back of a coin.**

**The image height of the letters on the coin is 9.0 mm**

**The magnification produced by the lens is 6.0**

**Calculate the height of the letters on the coin.**

**Use the Physics Equations sheet. [3 marks]**

**Height = _____ mm**

**8**

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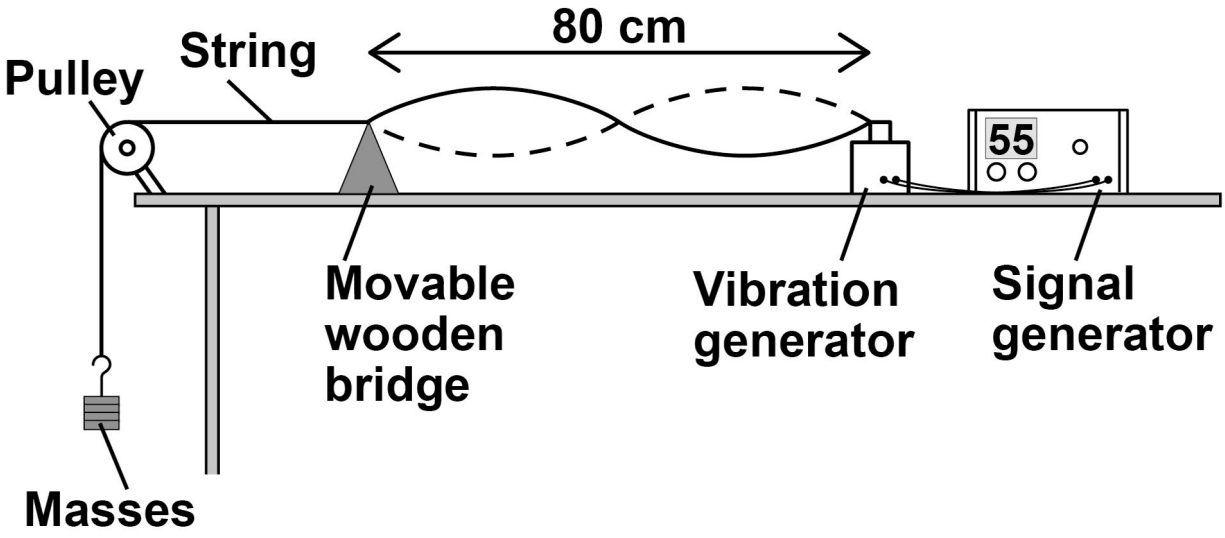
**[Turn over]**

**0 9** **FIGURE 23 shows the apparatus used to investigate the waves in a stretched string.**

**FIGURE 23**




**The frequency of the signal generator is adjusted so that the wave shown in FIGURE 23 is seen.**

**At this frequency the string vibrates between the two positions shown in FIGURE 23.**

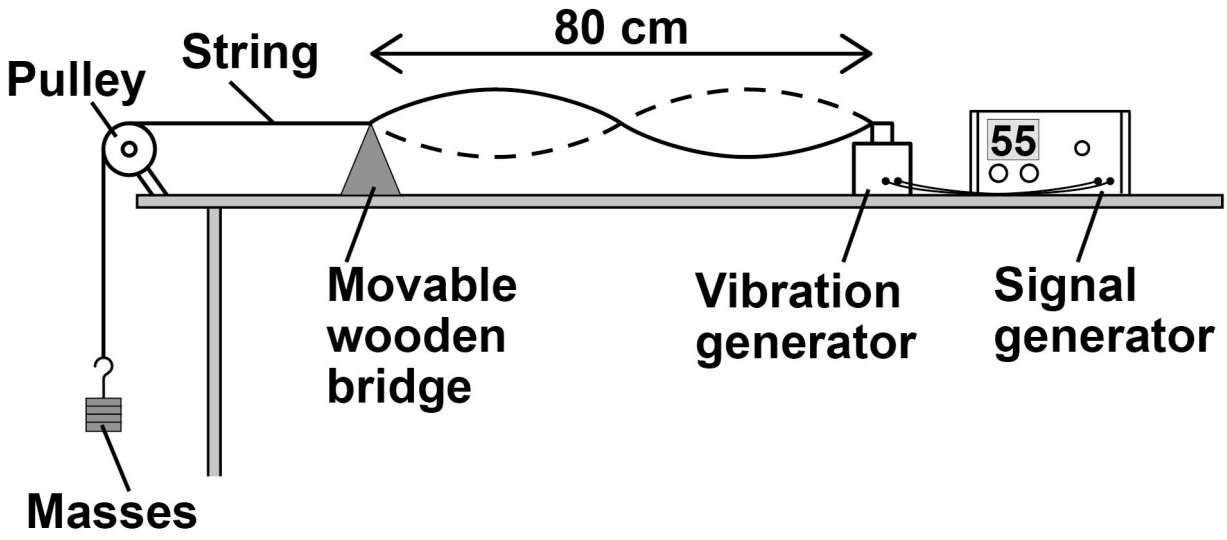
**0 9 . 1** **The wavelength of the wave shown in FIGURE 23 was measured as 80 cm**

**What piece of apparatus would have been suitable for measuring this wavelength? [1 mark]**

**0 9 . 2** **Write down the equation which links frequency, wavelength and wave speed. [1 mark]**

**[Turn over]**

**Repeat of FIGURE 23**



**0 9 . 3** **The string in FIGURE 23 vibrates at 55 Hz**

**Calculate the wave speed of the wave shown in FIGURE 23.**

**Use data given in FIGURE 23. [3 marks]**

_____

_____

_____

_____

**Wave speed =** _____ **m/s**

**[Turn over]**

**0 9 . 4** **The frequency of the signal generator is increased.**

**This makes the wavelength of the wave change.**

**The wave speed stays the same.**

**Describe how the apparatus could be adjusted to show one complete wave without reducing the frequency. [2 marks]**

**0 9 . 5** **A student wants to investigate how the speed of a wave on a stretched string depends on the tension in the string.**

**The student uses the apparatus in FIGURE 23 on page 68.**

**Describe a method the student could use for this investigation. [4 marks]**

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**1 0 . 1** **The driver of a vehicle sees a hazard on the road.**

**The driver uses the brakes to stop the vehicle.**

**Explain the factors that affect the distance needed to stop a vehicle in an emergency. [6 marks]**

[Turn over]

**1 0 . 2** **Write down the equation which links distance, force and work done. [1 mark]**

_____

_____

**1 0 . 3** **The work done by the braking force to stop a vehicle was 900 000 J**

**The braking force was 60 000 N**

**Calculate the braking distance of the vehicle. [3 marks]**

_____

_____

_____

_____

_____

_____

**Braking distance = _____ m**

**1 0 . 4** **The greater the braking force, the greater the deceleration of a vehicle.**

**Explain the possible dangers caused by a vehicle having a large deceleration when it is braking. [2 marks]**

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**END OF QUESTIONS**

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| For Examiner's Use | |
|---|---|
| Question | Mark |
| 1 | |
| 2 | |
| 3 | |
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| 8 | |
| 9 | |
| 10 | |
| **TOTAL** | |