OCR
Oxford Cambridge and RSA

Thursday 25 May 2023 – Morning

GCSE (9–1) Combined Science A (Physics) (Gateway Science)

J250/11 Paper 11 (Higher Tier)

Time allowed: 1 hour 10 minutes

H

You must have:
- a ruler (cm/mm)
- the Equation Sheet for GCSE (9–1) Combined Science A (Physics) (inside this document)

You can use:
- a scientific or graphical calculator
- an HB pencil

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*****).
- This document has **24** pages.

ADVICE
- Read each question carefully before you start your answer.

Section A

You should spend a **maximum** of **20 minutes** on this section.

Write your answer to each question in the box provided.

1 Which new feature of the atomic model did Niels Bohr suggest?

A Electrons are in stable shells.

B Electrons orbit a nucleus.

C The atom has a nucleus.

D The nucleus is positive.

Your answer ☐ **[1]**

2 Two rooms have the same fixed volume. They contain identical gases at the same pressure.

Room **H** is at a higher temperature than room **L**.

Which statement is correct?

A The particles are moving at the same speed in both rooms.

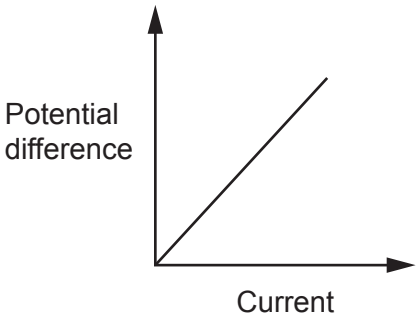
B The particles are moving faster in room **H**.

C The particles are moving faster in room **L**.

D The particles are not moving in either room.

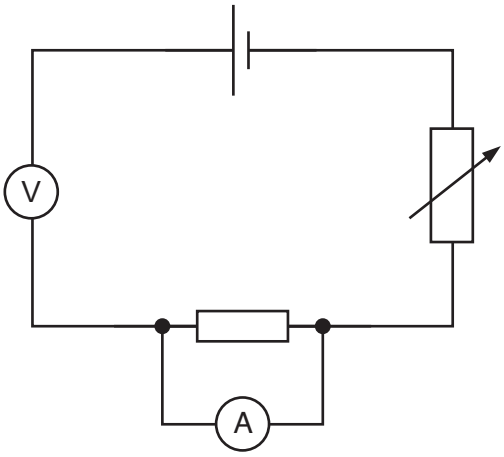
Your answer ☐ **[1]**

3 The graph shows how potential difference varies with current for a fixed resistor.



Which circuit could be used to produce the graph?

A



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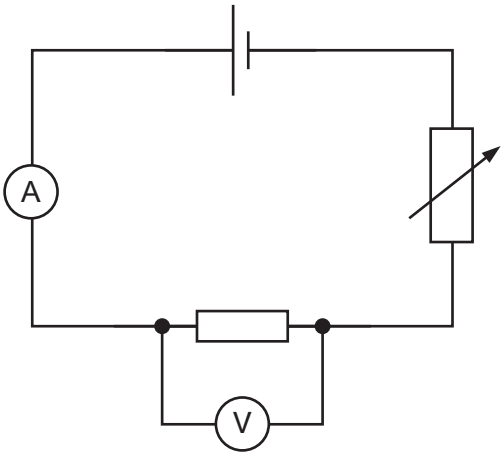

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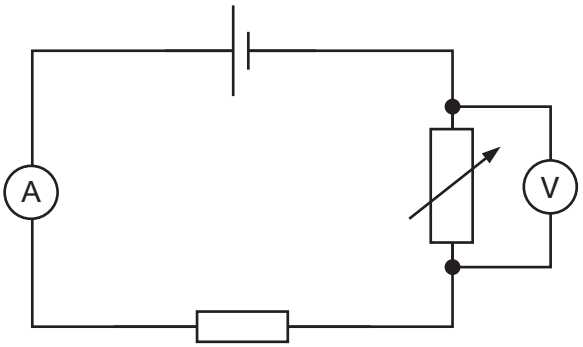

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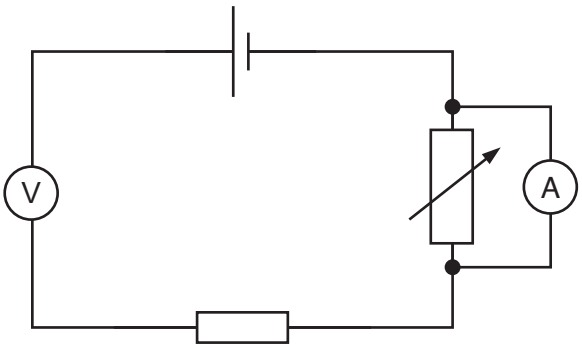


Your answer ☐ **[1]**

4 Which substance listed in the table has the **highest** density?

Substance	Mass (kg)	Volume (cm^3)
A	0.5	1.5
B	0.5	3.0
C	1.0	1.5
D	1.0	3.0

Your answer ☐ **[1]**

5 Two magnets, **X** and **Y**, are placed next to each other.

Magnet **X**

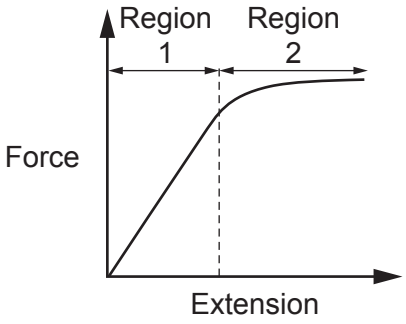
Magnet **Y**

Which row is correct?

	Magnet **X** produces a force on Magnet **Y**	Magnet **Y** produces a force on Magnet **X**
A	no	no
B	yes	no
C	no	yes
D	yes	yes

Your answer ☐ **[1]**

6 The force–extension graph is shown for a copper wire.

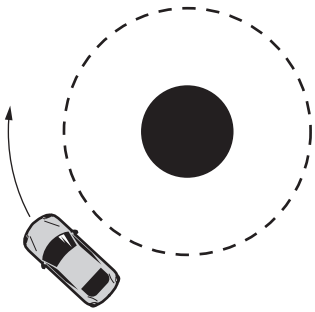


Which row describes the behaviour of copper in region 1 and region 2?

	Region 1	**Region 2**
A	elastic	elastic
B	elastic	plastic
C	plastic	elastic
D	plastic	plastic

Your answer ☐ **[1]**

7 A car travels around a roundabout at 20 mph.



Why is the car accelerating?

A The direction of the car is changing.

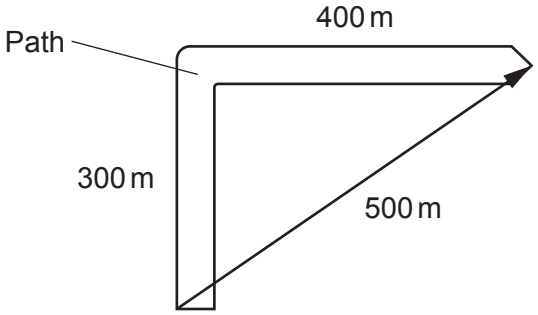
B The forces on the car are balanced.

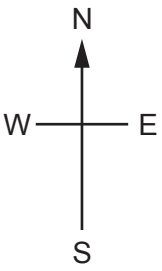
C The mass of the car is decreasing.

D The speed of the car is changing.

Your answer ☐ **[1]**

8 A child walks 300 m north along a path. The path turns through a 90° angle. They then walk another 400 m east.





Which statement is correct?

A The total displacement is 500 m.

B The total displacement is 700 m.

C The total distance travelled is 500 m.

D The total distance travelled is 1200 m.

Your answer ☐ **[1]**

9 The diagram shows some forces acting on an object.

What is the resultant force on the object?

A 5.4 N

B 12 N

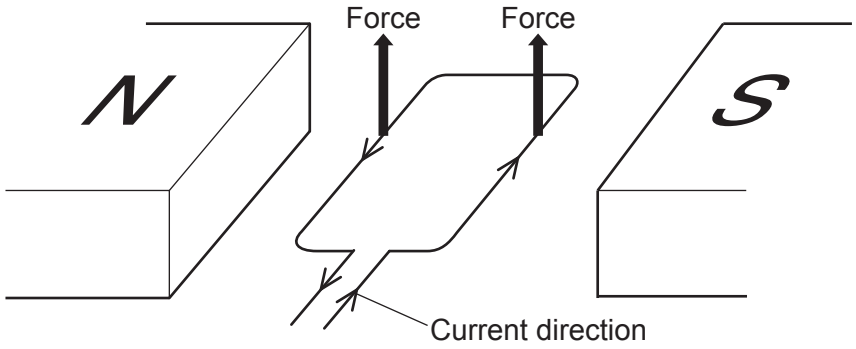
C 13 N

D 14.9 N

Your answer ☐ **[1]**

10 Which diagram explains how a simple d.c. electric motor spins?

A



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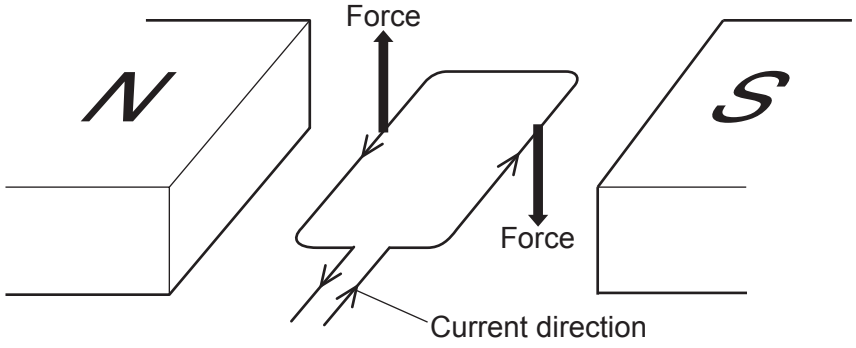

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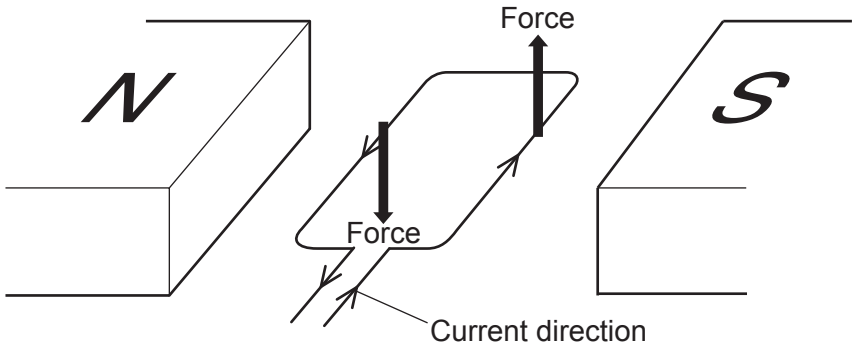

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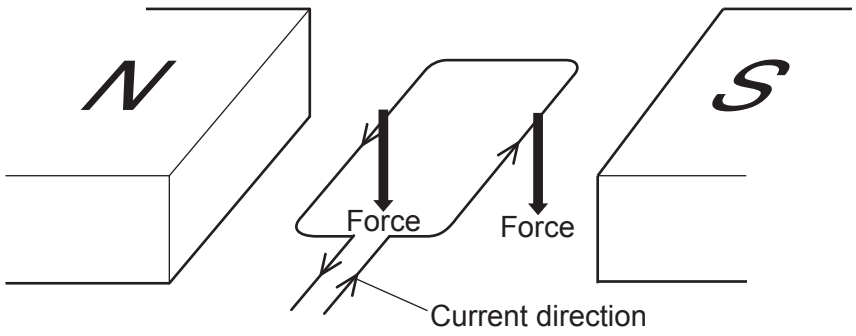
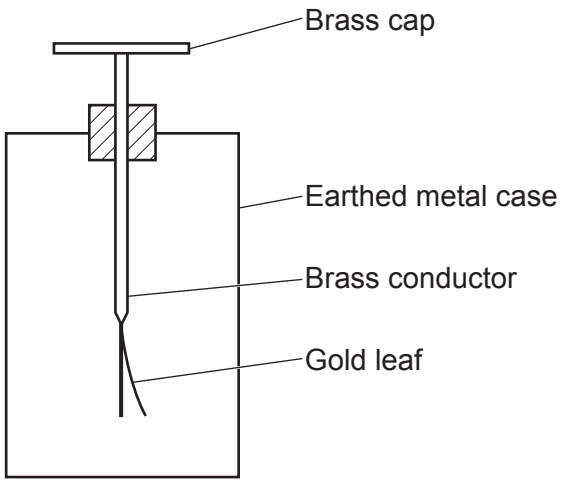


Your answer ☐ **[1]**

Section B

11 **Fig. 11.1** shows a gold leaf electroscope that can be used to measure electric charge.

Fig. 11.1



(a) A positively charged rod is rubbed across the brass cap of the gold leaf electroscope.

Complete the sentence to explain how the gold leaf electroscope becomes **positively** charged.

Use words from the list.

Electrons	**Gold leaf electroscope**	**Neutrons**	**Protons**
Positively charged rod			

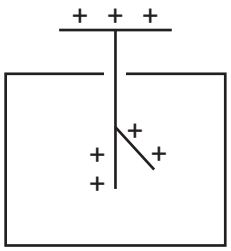
..... move from the ..... to the ..... .

[2]

(b) When the gold leaf electroscope is positively charged, the gold leaf rises.

Fig. 11.2 shows the positively charged gold leaf electroscope.

Fig. 11.2



Explain why the gold leaf rises.

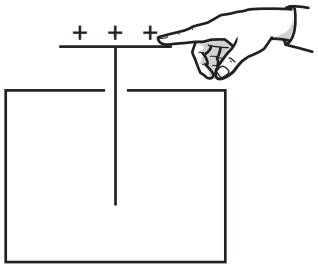
.....

..... **[1]**

(c) A scientist earths the cap of the positively charged gold leaf electroscope by touching it with their finger.

Complete **Fig. 11.3** to show what happens to the gold leaf.
Explain your answer.

Fig. 11.3



Explanation .....

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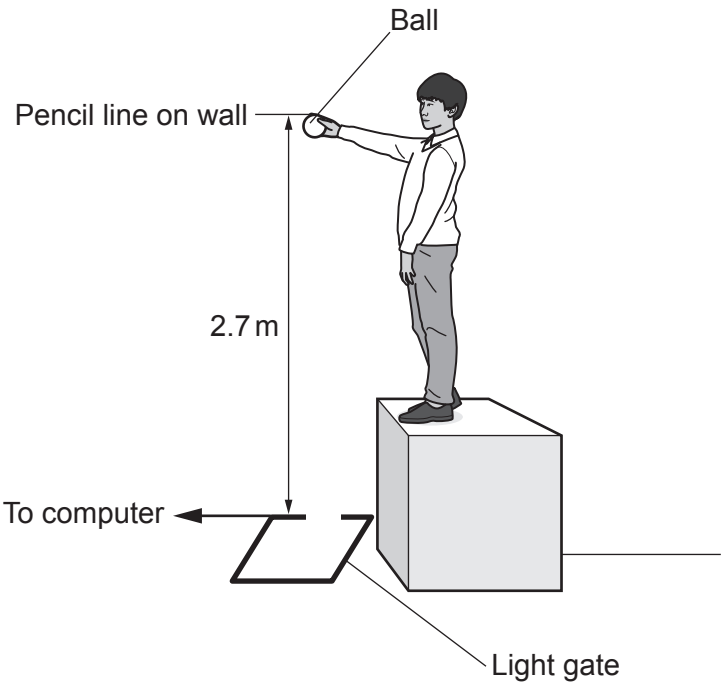
..... **[2]**

12 A student measures the acceleration due to gravity by dropping a ball through a light gate.

The diagram shows the experiment.



(a) Put the steps in the correct order to describe a method for the experiment.

Write numbers **1–4** in the boxes below. Step **5** has been filled in for you.

	Write down the computer's value for the final velocity.
	Make a pencil line on the wall.
	Measure a height of 2.7 m with a tape measure.
5	Use (final velocity)^2 – (initial velocity)^2 = 2 × acceleration × distance to calculate the acceleration due to gravity.
	Drop the ball through the light gate.

[1]

(b) Draw lines to match each **source of error** in the experiment to the correct **way to remove the error**.

Source of error	Way to remove the error
The ball is thrown downwards.	Hold the ball in a clamp stand and loosen the clamp to release.
The ball is dropped from the wrong height.	Repeat the same measurement 3 times.
The computer calculates the wrong velocity.	Make sure the ball is dropped through the centre of the light gate.
	Make sure the ball is at the same level as the pencil line.

[2]

(c) The light gate and computer are used to calculate the final velocity of the ball.

(i) What information does the student have to enter into the computer?

..... **[1]**

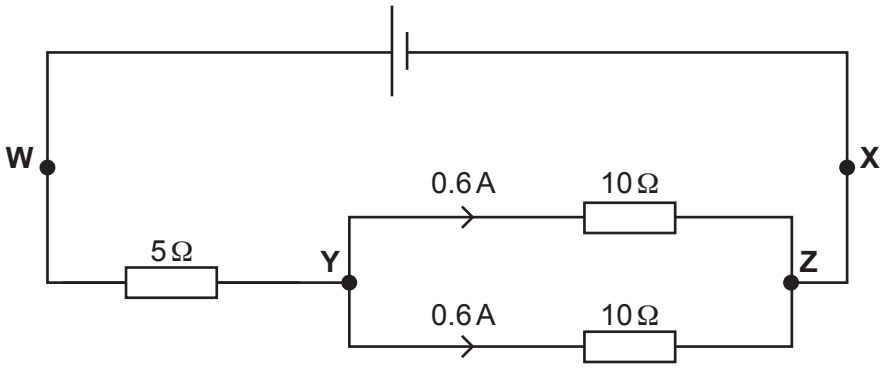
(ii) The computer displays a final velocity of 7.2 m / s when the student drops the ball from 2.7 m.

Calculate a value for the acceleration due to gravity.

Use the equation: $(\text{final velocity})^2 - (\text{initial velocity})^2 = 2 \times \text{acceleration} \times \text{distance}$

Acceleration due to gravity = ... m/s^2 **[3]**

13 A student builds the circuit shown in the diagram.
W, **X**, **Y** and **Z** are points in the circuit.



(a) Calculate the potential difference between **Y** and **Z**.

Use the Equation Sheet.

Potential difference between **Y** and **Z** = ... V **[3]**

(b) The resistance of the circuit between **Y** and **Z** must be less than 10 Ω.

Explain why.

.....

.....

.....

..... **[2]**

(c) Calculate the current at **W**.

Current at **W** = ... A **[1]**

(d) Which statement describes the values of the current at **W** and **X**?

Tick (✓) **one** box.

The current at **W** is equal to the current at **X**. ☐

The current at **W** is more than the current at **X** as the current at **X** equals 0A. ☐

The current at **X** is more than the current at **W**. ☐

The current at **X** is more than 0A but less than the current at **W**. ☐

[1]

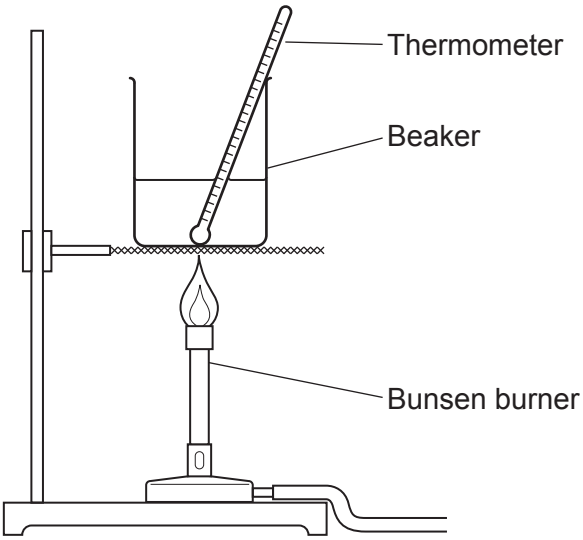
(e) Calculate the power dissipated by one of the 10Ω resistors.

Use the Equation Sheet.

Power dissipated = ... W **[3]**

14 Three students **A**, **B** and **C** do an experiment to measure the power rating of a Bunsen burner.

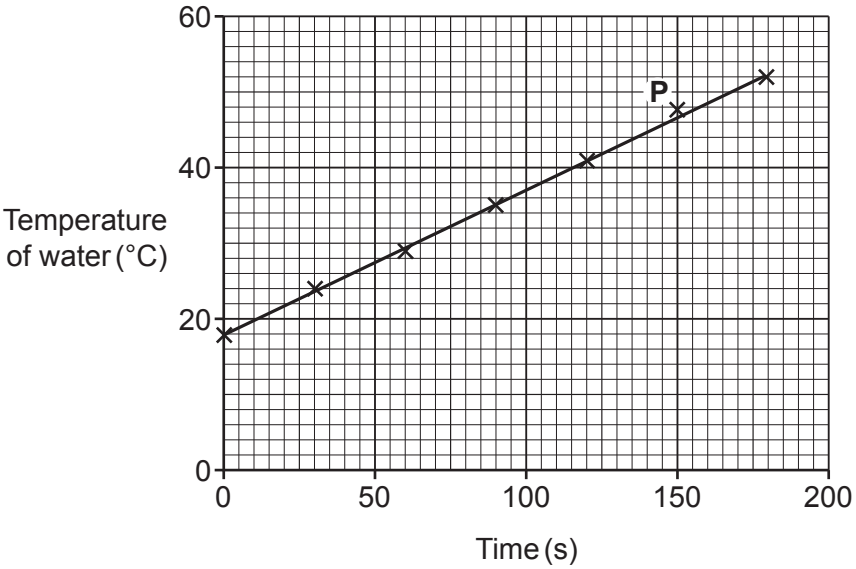
The diagram shows their apparatus.



This is the method they follow:

- Pour 0.2 kg of water into a beaker.
- Increase the temperature of the water using the Bunsen burner.
- Measure the temperature of the water every 30 seconds.

The graph shows student **A**'s results.



(a) Student **A** uses point **P** on the graph to calculate the gradient of the line of best fit.

Explain why student **A**'s calculation is **incorrect**.

.....

..... **[1]**

(b) Calculate the gradient of the line of best fit on the graph.
Give your answer to **2** significant figures.

Gradient = ... °C / s **[3]**

(c) **(i)** What is the significance of the *y* intercept of the line on the graph?

..... **[1]**

(ii) What is the significance of the gradient of the line on the graph?

..... **[1]**

(d) Student **B** repeats the experiment. The gradient of their line of best fit is 0.25 °C / s.
The specific heat capacity of water is 4200 J / kg °C.

Use student **B**'s value to calculate the thermal energy transferred to 0.2 kg of water after 200 s.

Use the Equation Sheet.

Thermal energy transferred = ... J **[3]**

(e) Student **C** also repeats the experiment.

They say the thermal energy transferred is 32 000 J after 200 s.

Use student **C**'s value to calculate the power of the Bunsen burner.

Use the Equation Sheet.

Power = ... W **[3]**

15* **Fig. 15.1** shows the distance–time graph for a skydiver after jumping out of a plane.

The graph describes the distance the skydiver falls through until the parachute opens.

Fig. 15.2 shows the free-body force diagram for the skydiver in the air.

Fig. 15.1

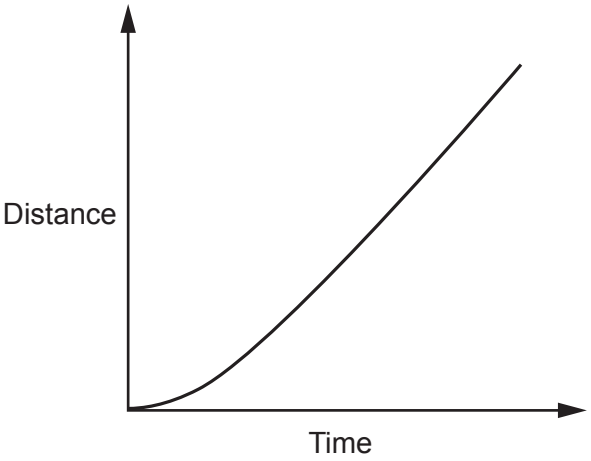
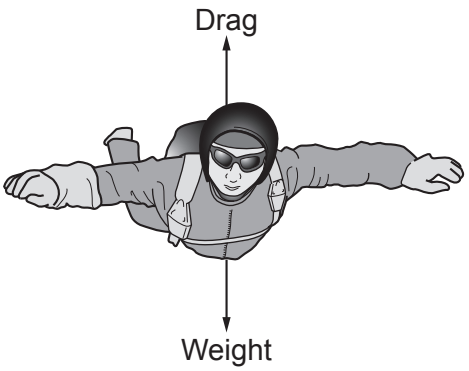


Fig. 15.2



Explain the shape of **Fig. 15.1**. Use information from **Fig. 15.2** in your answer.

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..... **[6]**

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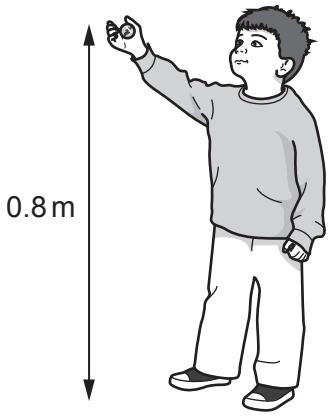
16 (a) A child is holding a marble at a height of 0.8 m.



The mass of the marble is 0.015 kg.

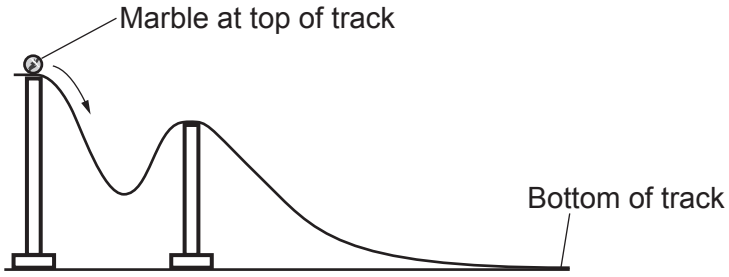
Calculate the gravitational potential energy of the marble.

Gravitational field strength = 10 N / kg.

Use the equation:
gravitational potential energy = mass × gravitational field strength × height

Gravitational potential energy = ... J **[2]**

(b) The child rolls the marble along a track. The diagram shows the marble and track.



(i) The kinetic energy of the marble at the bottom of the track is less than the potential energy of the marble calculated at the top of the track.

Suggest and explain why.

.....

.....

.....

..... **[2]**

(ii) The mass of the marble is 0.015 kg.

The kinetic energy of the marble at the bottom of the track is 0.03 J.

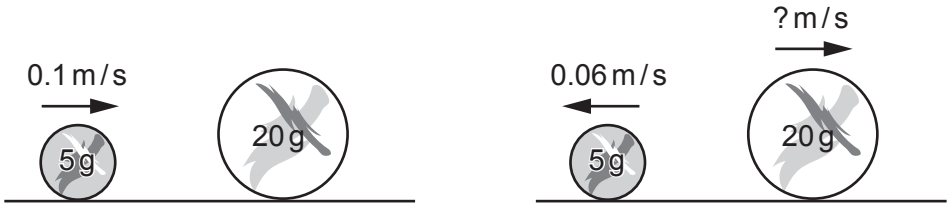
Calculate the speed of the marble at the bottom of the track.

Use the equation: kinetic energy = $\frac{1}{2}$ × mass × (speed)^2

Speed of marble = ... m/s **[3]**

(c) The child now has a small marble and a large marble.
The child rolls the small marble across the floor.
The small marble collides with the stationary large marble.

The diagram shows the marbles before and after the collision.



Before the collision **After the collision**

The mass of the small marble is 5 grams. The mass of the large marble is 20 grams.

Use the information in the diagram to calculate the speed of the large marble after the collision.

Use the Equation Sheet.

Speed of large marble = ... m / s **[3]**

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).