Write your name here

Surname	Other names

13+ Scholarship Examination 2024

Subject: Physics
Paper: Physics
Time: 1 Hour

You must have:
A ruler
A calculator

Total Marks
60

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name.
- Answer **all** questions.
- Answer the questions in the spaces provided
  - *there may be more space than you need.*
- Show all the steps in any calculations and state the units.

Information

- The total mark for this paper is 60
- The marks for **each** question are shown in brackets
  - *use this as a guide as to how much time to spend on each question.*

Advice

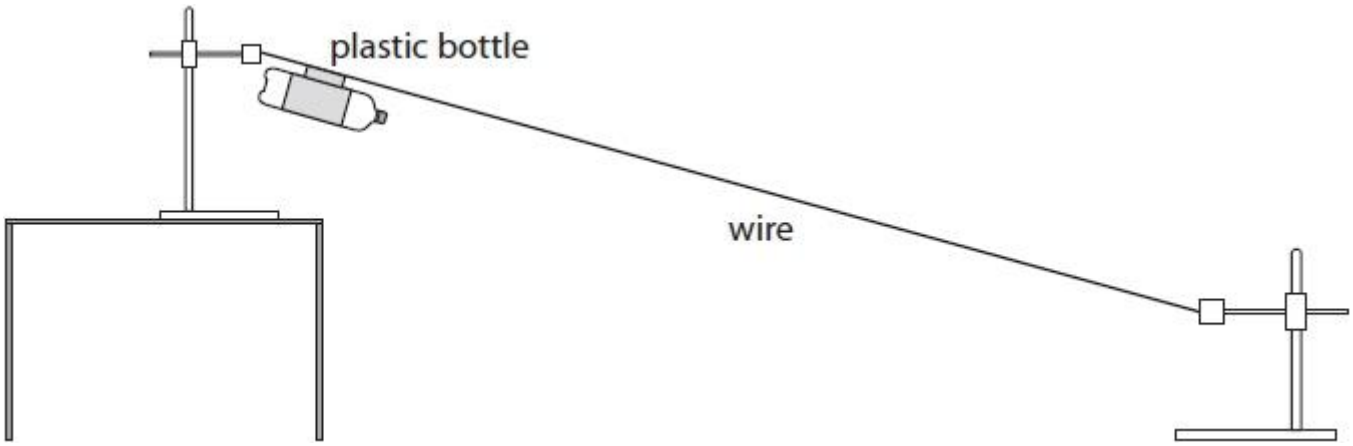
- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Write your answers neatly and in good English (languages please change this).
- Try to answer every question.
- Check your answers if you have time at the end.

Q1.

A class investigates how the mass of an object affects the time it takes to slide down a wire.

They use a plastic bottle and a five metre length of wire.

The diagram shows their apparatus.



This is the method the class uses.

Step 1: measure the mass of the empty plastic bottle

Step 2: attach the plastic bottle to the top end of the wire

Step 3: release the bottle and measure the time taken for it to reach the end of the wire

Step 4: put 40 g of sand in the bottle and repeat the experiment

(a) Name two pieces of measuring equipment needed for this investigation and state their units of measurement.

(3)

Name of piece of equipment	Unit of measurement
.....	.....
.....	.....

(b) Describe what the class must do to make their results more reliable.

(1)

.....

.....

(c) Which other scientific questions would it be sensible to test using the same apparatus?

Tick (✓) the boxes in the table to show your answers.

(2)

Scientific question	Yes	No
Does the thickness of the wire affect the speed the bottle goes down the wire?		
Does the shape of the bottle affect the speed the bottle goes down the wire?		
Does the time of year affect the speed the bottle goes down the wire?		
Does the type of material the wire is made from affect the speed the bottle goes down the wire?		

(Total for question = 6 marks)

Q2.

(a) A day on Jupiter lasts 10 hours.

A day on Earth lasts 24 hours.
Explain why Jupiter has a shorter day than Earth.

(2)

.....

.....

.....

.....

(b) At night, when it is dark on Earth, the Moon can be seen in the sky.

(Source: LeStudio / Shutterstock)

The Moon is not a source of light.
Why can the Moon be seen at night?

(1)

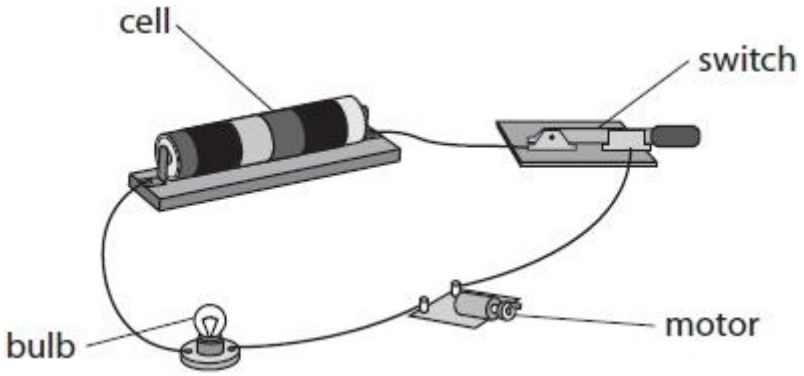
.....

.....

(Total for question = 3 marks)

Q3.

A student makes this circuit.



(a) State two ways she could increase the speed of the motor.

(2)

1 .....

2 .....

(b) The circuit contains a switch.

Explain what a switch does in a circuit.

(2)

.....

.....

.....

(Total for question = 4 marks)

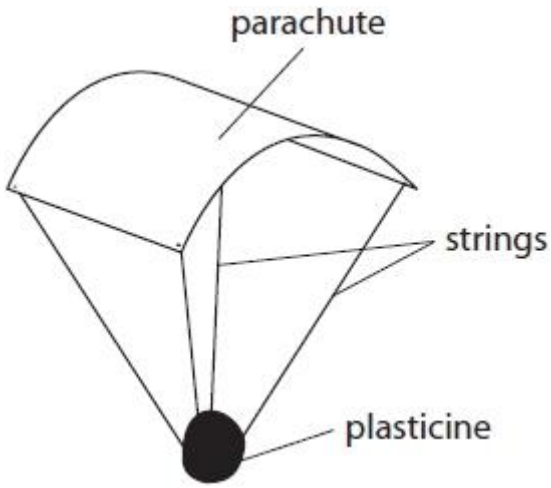
Q4.

A student investigates to see if the size of a parachute affects the time taken for it to fall to the floor.

The student makes six different sized parachutes.

Each parachute is dropped once from a height of 2 m.

The student measures the time taken for the parachute to fall to the floor.



(a) Give the name of **one** piece of equipment the student will need to take their measurements.

(1)

.....

(b) The investigation needs to be a fair test.

Tick **two** boxes to show what should be kept the same throughout the experiment to make it a fair test.

(2)

colour of parachute	☐
height dropped from	☐
size of parachute	☐
time taken to fall	☐
weight of plasticine	☐

(c) Give **one** thing the student could do to improve the reliability of the results.

(1)

.....

(Total for question = 4 marks)

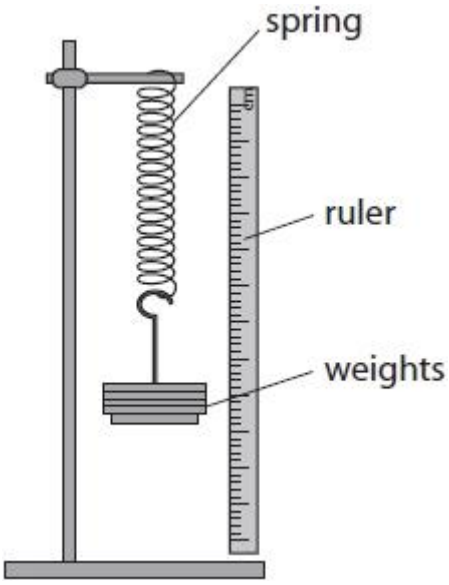
Q5.

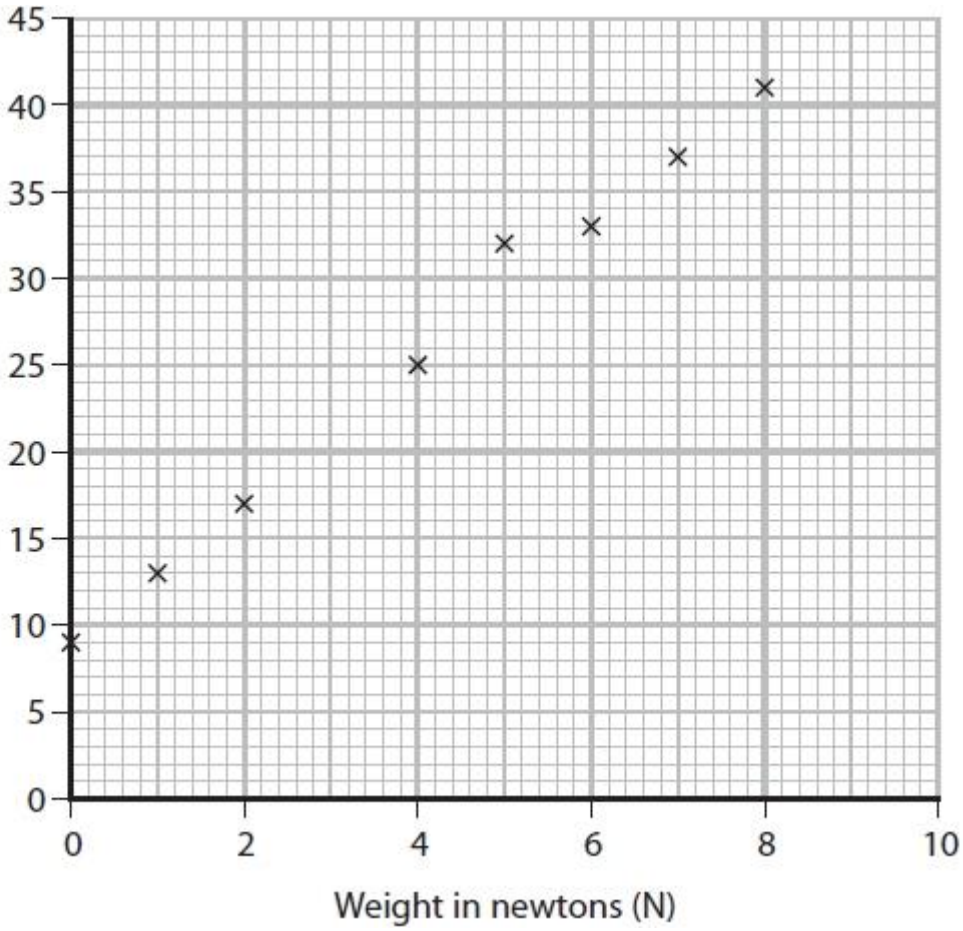
Some students investigate what happens to the length of a spring when different weights are hung from it.

The students start by measuring the length of the spring with no weights on it.

They then add weights, one at a time, and measure the length of the spring each time.

Their results are shown on the graph.





.....

.....

The students forgot to label one of the axes on their graph.

(a) Add the missing label to the axis on the graph.

(1)

(b) (i) Circle the result that looks odd compared to the other results.

(1)

(ii) Complete the graph by drawing a straight line through the points.
You should ignore the result that looks odd.

(1)

(c) (i) What conclusion can the students make about the effect of adding weights to the length of the spring? **(2)**

.....

.....

.....

.....

(ii) Predict, using the graph, what the length of the spring will be when a weight of 3 N is hung from it.

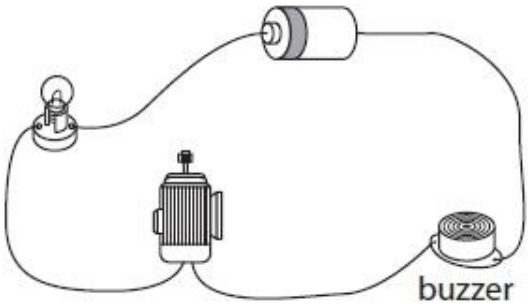
(1)

length = ... cm

(Total for question = 6 marks)

Q6.

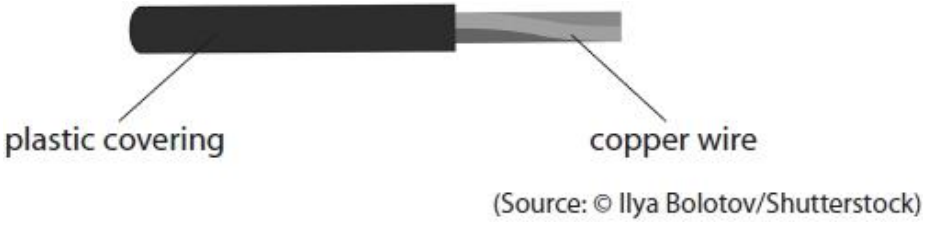
The drawing shows an electrical circuit.



(a) Complete the circuit diagram for this circuit. Use the correct scientific symbols for each component.

(2)

(b) Explain why electrical cables are made from a copper wire inside a plastic covering.



(Source: © Ilya Bolotov/Shutterstock)

(2)

.....

.....

.....

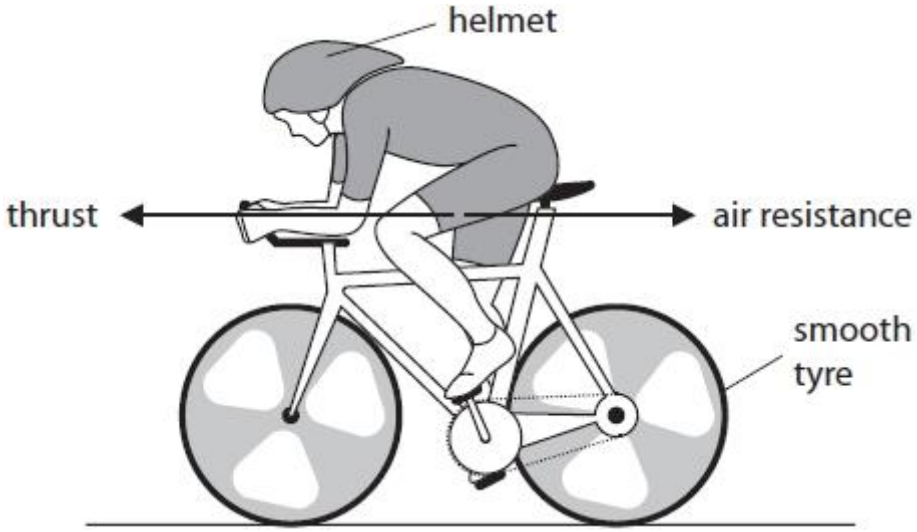
.....

(Total for question = 4 marks)

Q7.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

The diagram shows two forces acting on a cyclist moving along a racing track. The arrows in the diagram show the size and direction of the two forces.



(a) Which of the following statements about these two forces is correct?

(1)

- ☒ **A** the forces are the same size and act in the opposite direction
- ☒ **B** the forces are the same size and act in the same direction
- ☒ **C** the forces are a different size and act in the opposite direction
- ☒ **D** the forces are a different size and act in the same direction

(b) Explain how the shape of the helmet helps the cyclist to go faster.

(2)

.....

.....

.....

.....

(c) During wet conditions the racing track becomes very slippery.

State a change the cyclist could make to the bicycle to overcome the wet conditions.

(1)

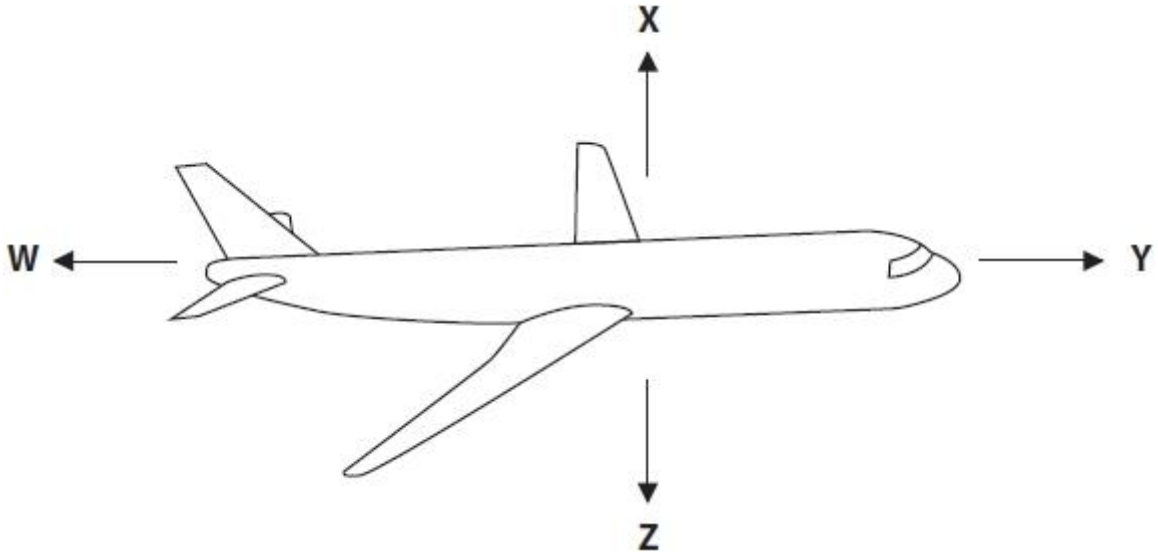
.....

.....

(Total for question = 4 marks)

Q8.

The drawing shows an aeroplane flying. There are four forces acting on it.



(a) Which arrow, **W**, **X**, **Y** or **Z**, represents the force of gravity acting on the aeroplane?

(1)

.....

(b) Name **one** of the other forces acting on this aeroplane as it moves through the air.

(1)

.....

(c) What scientific unit are forces measured in?

(1)

.....

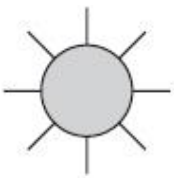
(Total for question = 3 marks)

Q9.

The picture shows a tiger watching a gazelle.

On the picture draw a ray diagram to show how the Sun helps the tiger to see the gazelle.

(2)



(Total for question = 2 marks)

Q10.

A girl is riding her skateboard downhill. Her speed is increasing. Then she gently touches one foot on the ground.

Explain what will happen to her speed when she puts her foot on the ground.

(2)

.....

.....

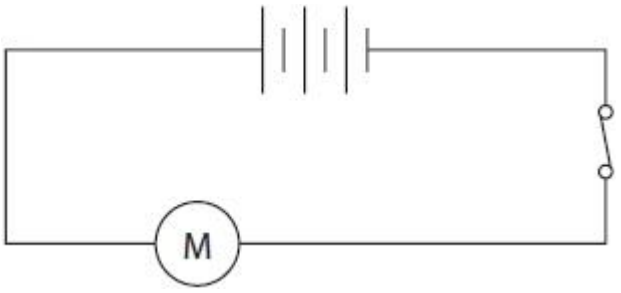
.....

(Total for question = 2 marks)

Q11.

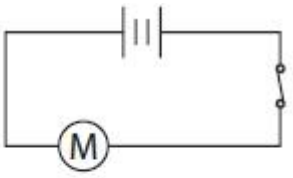
Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross☒ .

The motor in this circuit turns in a clockwise direction.

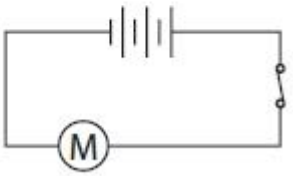


In which of the following circuits will the motor turn in the opposite direction?

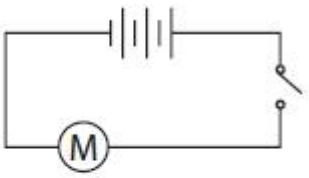
☐ **A**



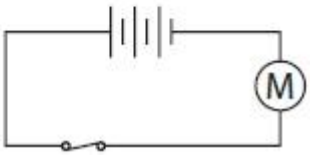
☐ **B**



☐ **C**



☐ **D**

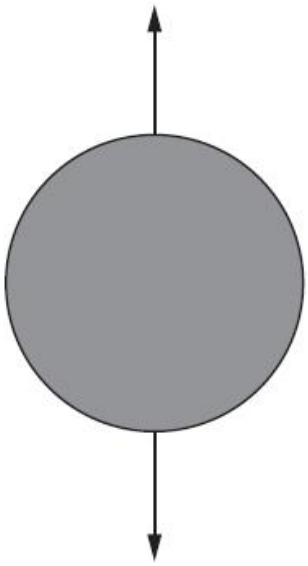


(Total for question = 1 mark)

Q12.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

The diagram shows two forces acting on a ball.



Which of the following statements about these two forces is correct?

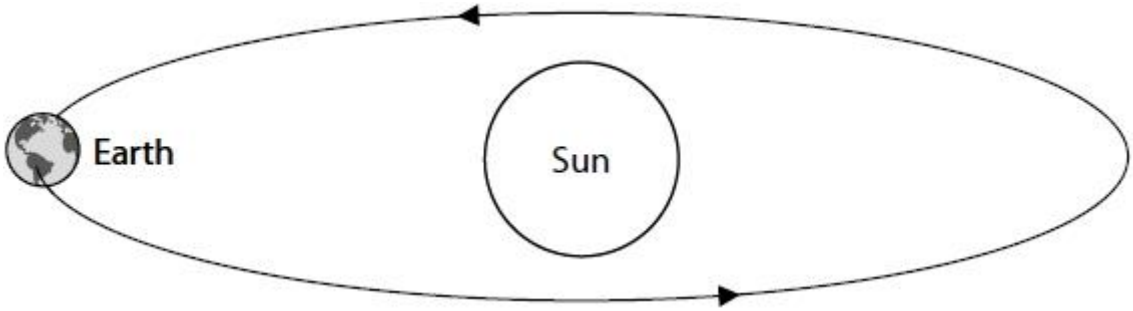
- ☐ **A** the forces are different in size and act in opposite directions
- ☐ **B** the forces are different in size and act in the same direction
- ☐ **C** the forces are the same size and act in opposite directions
- ☐ **D** the forces are the same size and act in the same direction

(Total for question = 1 mark)

Q13.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

The diagram shows the orbit of the Earth around the Sun.



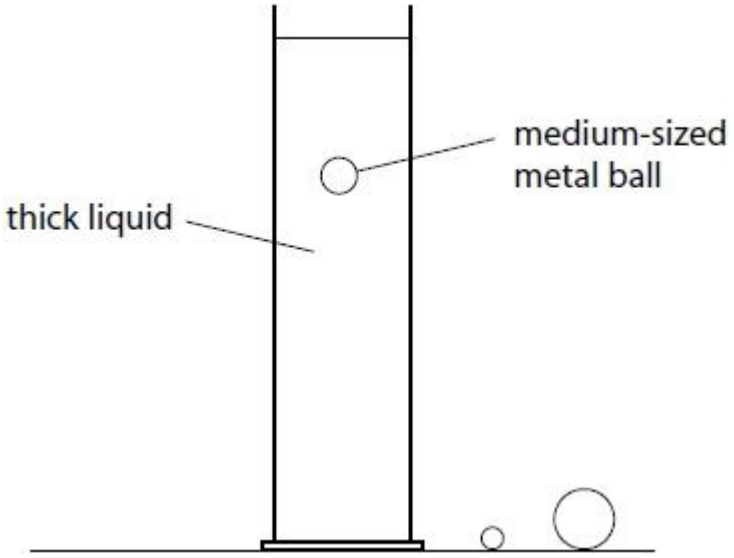
How long does it take for the Earth to make one full orbit around the Sun?

- ☐ **A** one day
- ☐ **B** one week
- ☐ **C** one month
- ☐ **D** one year

(Total for question = 1 mark)

Q14.

The diagram shows the equipment a student used to investigate how long it takes three different-sized metal balls to travel through a thick liquid.



(a) They use the following method.

Step 1: pour the thick liquid into a tall container.
Step 2: hold the metal ball just above the surface of the liquid.
Step 3: release the metal ball and time how long it takes to reach the bottom of the container.
Step 4: repeat the experiment with the other two metal balls.

(i) Name the force that causes the metal ball to fall to the bottom of the container.

(1)

.....

(ii) Name the piece of equipment needed in Step 3.

(1)

.....

The table shows the student's results.

Size of metal ball	Time to travel to the bottom of the container in seconds (s)
medium	12
small	24
large	6

Before the student started the experiment they were given four predictions.

Prediction 1: the smallest metal ball will take the least time.
Prediction 2: the smallest metal ball will take three-times longer than the largest metal ball.
Prediction 3: the medium-sized metal ball will travel slowest.
Prediction 4: the largest metal ball will travel the fastest.

(b) Which prediction was correct?

(1)

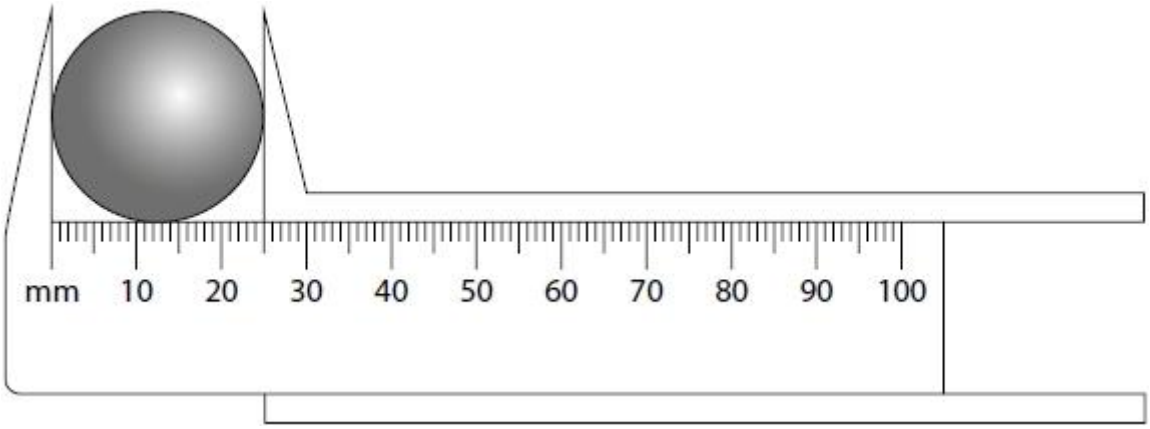
.....

To improve the experiment, the student measured the diameter of the metal balls.

(c) What is the diameter of the metal ball shown in the diagram below?

(1)

..... mm

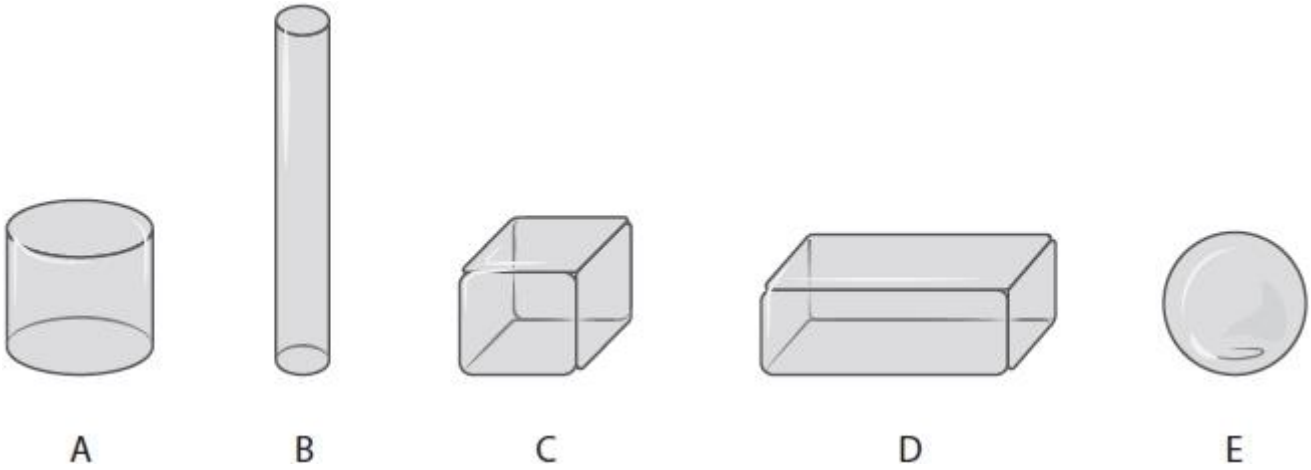


(Total for question = 4 marks)

Q15.

A student investigates how the shape of a piece of ice affects the time it takes to melt.

The diagram shows the shapes of five pieces of ice, A, B, C, D, and E, the student investigates.



The student takes all the pieces of ice out of the freezer at the same time.

The student places each of the pieces of ice on a plate and starts timing.

They record the time it takes each piece of ice to change into water.

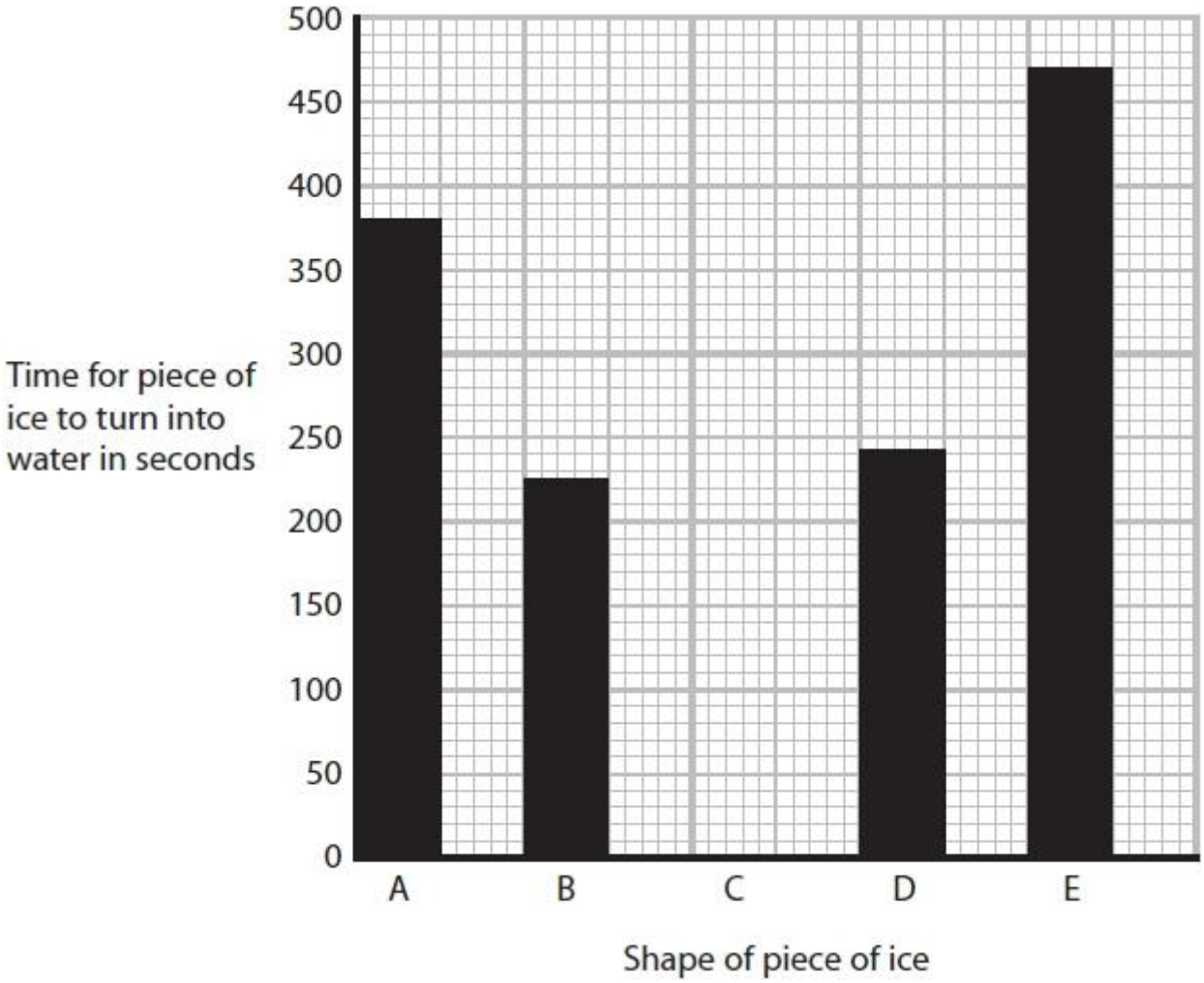
(a) Name **two** variables that must be kept the same to make the investigation a fair test.

(2)

1 .....

2 .....

(b) The student draws a bar chart to show the results of the investigation.



(i) The shape C takes 330 seconds to turn into water.
Add the bar for shape C to the bar chart.

(1)

(ii) How long did it take for shape D to turn into water?

(1)

.....

(iii) Which shape, A, B, C, D, or E, melted the fastest?

(1)

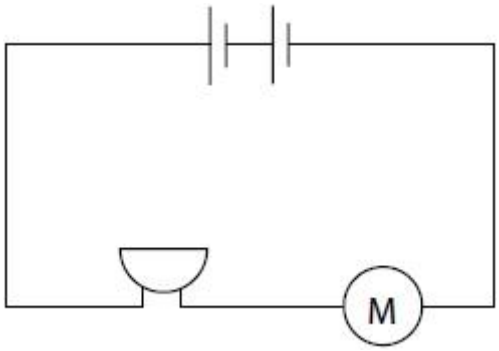
.....

(Total for question = 5 marks)

Q16.

The diagram shows an electric circuit.

A student wants to make the buzzer in this circuit louder. They cannot change the buzzer but they can add or remove components.



Give **two** changes the student could make to the circuit to make the buzzer louder.

1 .....

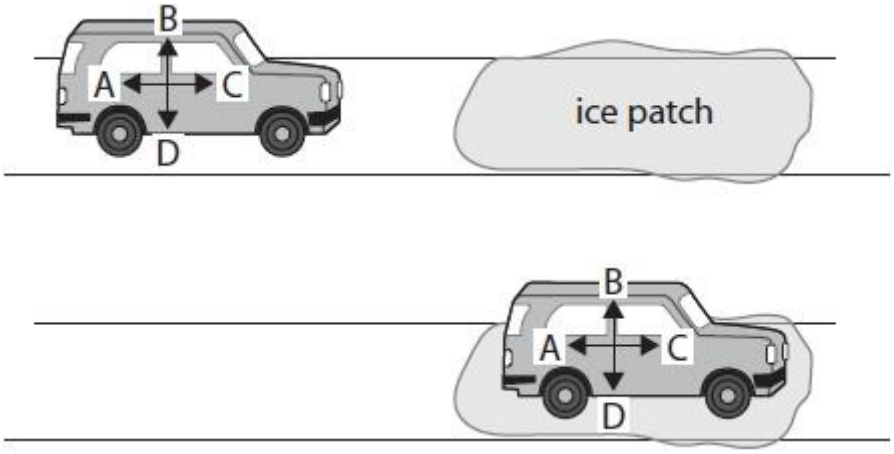
2 .....

(Total for question = 2 marks)

Q17.

The diagrams show a car slowly moving along a road.

There are four forces acting on it, A, B, C and D.



The car reaches an icy area. The wheels start spinning and the car does not move.

(a) (i) Which **two** of the forces, A, B, C or D, have **not** changed?

(1)

..... and .....

(ii) Give the **name** of the force that is no longer affecting the car.

(1)

.....

(b) Another car goes by with snow chains on its tyres.

(Source: © Anastasia Pelikh/Shutterstock)

Explain why the car with the snow chains is able to move through the icy area.

(2)

.....

.....

.....

.....

(Total for question = 4 marks)

Q18.

A ball is kicked up into the air.

What effect does gravity have on the ball?

(1)

.....

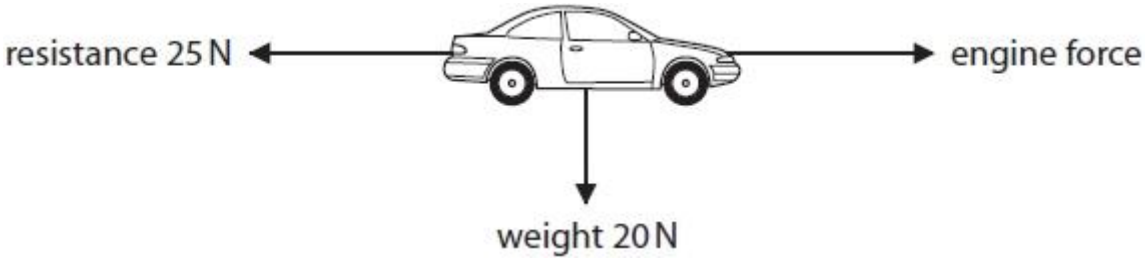
(Total for question = 1 mark)

Q19.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

The diagram shows some of the forces acting on a model car.

The forces on the model car are balanced.



What is the size of the engine force?

- ☐ **A** 0 N
- ☐ **B** 20 N
- ☐ **C** 25 N
- ☐ **D** 45 N

(Total for question = 1 mark)

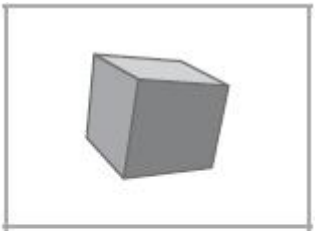
Q20.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross .

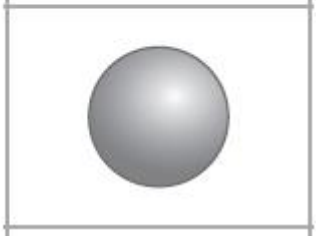
Four identical pieces of plasticine are made into four shapes, A, B, C and D. They are each dropped into water.

Which of the four shapes will fall through the water quickest?

☐ **A**



☐ **B**



☐ **C**

☐ **D**

(Total for question = 1 mark)

Q21.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

A class compares the friction acting between the bottom of a mug and four different materials.

They place the mug near the edge of a wooden board (Diagram A).

They measure the distance they have to raise the board before the mug starts to slide (Diagram B).

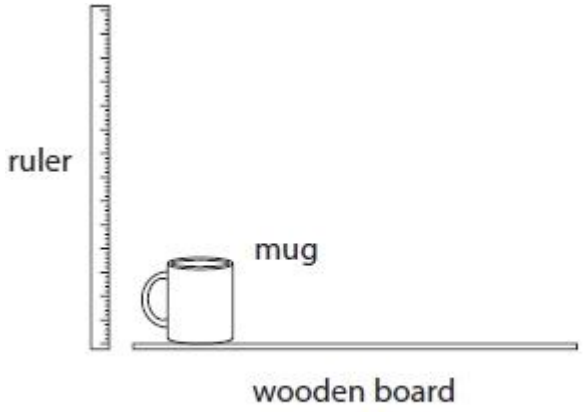


Diagram A

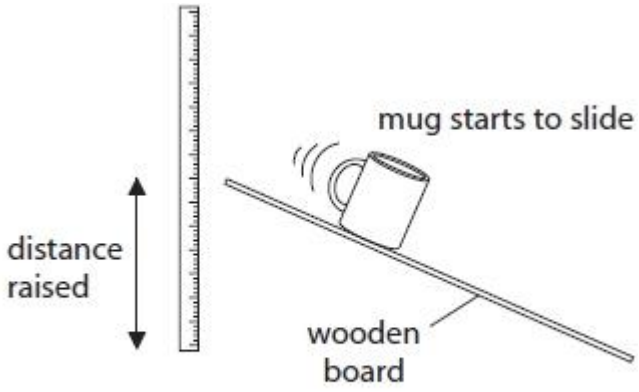


Diagram B

They repeat the experiment with different materials covering the board.

Here are their results.

material	distance board raised in cm
wood	26
rubber mat	48
carpet	35
sandpaper	54

Which of these statements is a correct conclusion from these results?

- ☒ **A** the type of material does not affect the amount of friction
- ☒ **B** the friction is greatest between the sandpaper and the mug
- ☒ **C** the friction is greatest between the wood and the mug
- ☒ **D** the friction is least between the sandpaper and the mug

(Total for question = 1 mark)

TOTAL FOR PAPER = 60 MARKS