

NAME:

SCHOOL:.....

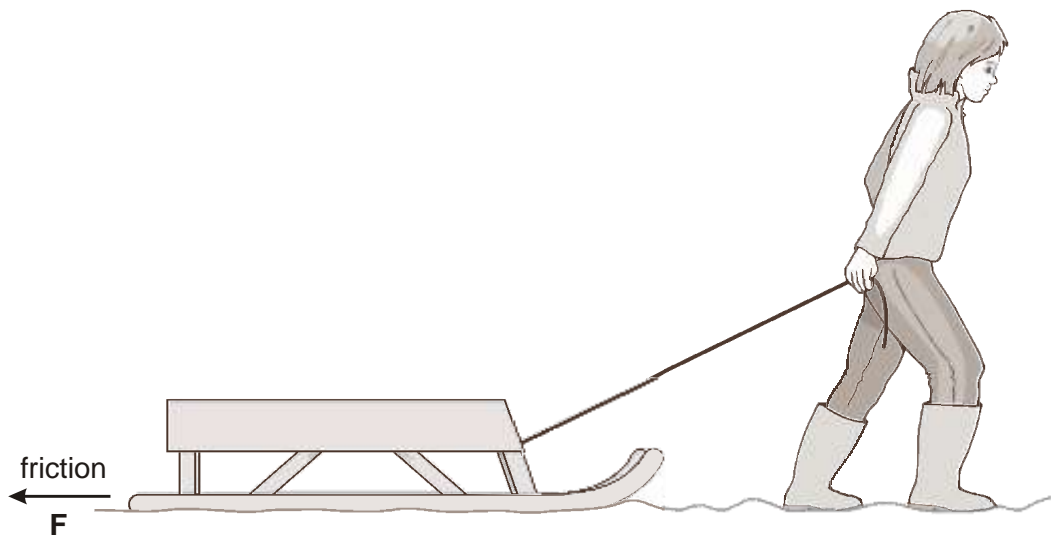
DATE:

FORCE

INSTRUCTIONS TO CANDIDATES

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

1. Sally pulls a sledge in the snow.



- (a) (i) Draw an arrow on the rope to show the direction of the force of the rope on the sledge.
-

Label the arrow **R**.

- (ii) Draw an arrow on the diagram to show the direction of the force of gravity on the sledge.
Label the arrow **G**.

2 marks

- (b) Force **F** is the friction between the sledge and the snow.
Sally then pulled the sledge over a concrete path.

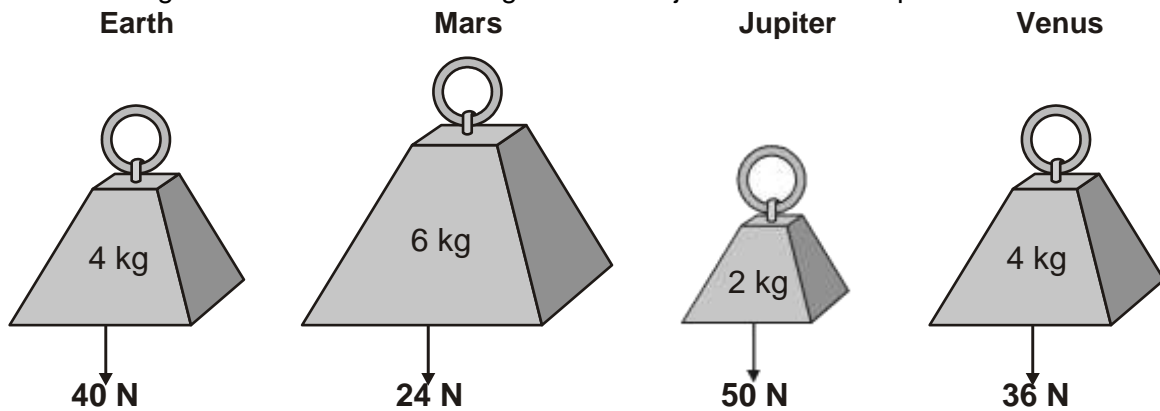
Friction is less on snow than on concrete.
Give the reason for this.

.....

1 mark

maximum 3 marks

2. The drawings show the mass and weight of four objects on different planets.



(a) On which of the four planets is the object with the largest mass?

.....

1 mark

(b) How can you tell, from the drawings, that gravity is greater on Earth than on Venus?

.....

1 mark

(c) Gravity is less on the Moon than on the Earth.

Complete the sentences below to compare the weight and mass of an astronaut on the Moon and on the Earth.

The **weight** of an astronaut on the Moon is the **weight** of an astronaut on the Earth.

1 mark

The **mass** of an astronaut on the Moon is the **mass** of the astronaut on the Earth.

1 mark

(d) The table below gives information about five planets.

planet	distance from the Sun (million km)	time for planet to orbit the Sun (Earth-years)
Venus	110	0.6
Earth	150	1.0
Mars	230	
Jupiter	780	12.0
Saturn	1400	30.0

(i) Look at the information in the table.

How does the time for a planet to orbit the Sun change with its distance from the Sun?

.....
.....

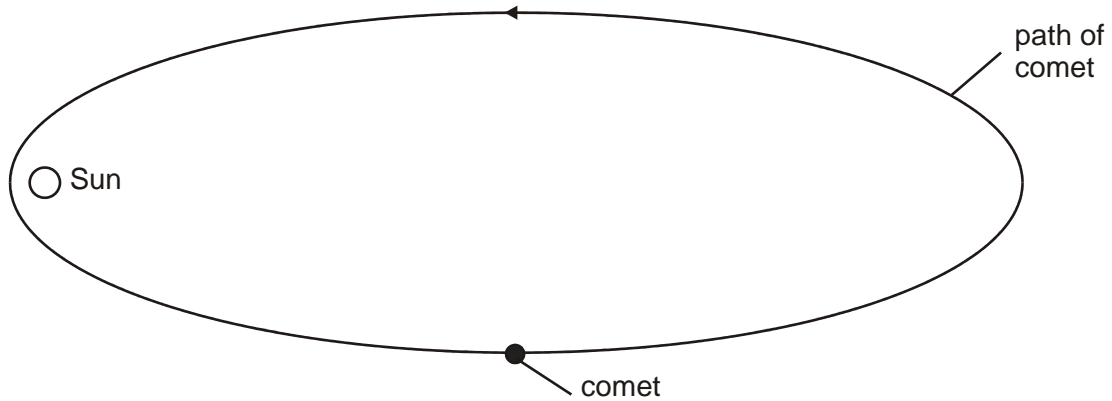
1 mark

(ii) Use information in the table to estimate the time for Mars to orbit the Sun.
..... Earth-years

1 mark

(e) The diagram below shows the path of a comet around the Sun.

On the path of the comet below, place a letter X to show the position where the comet is travelling the fastest.

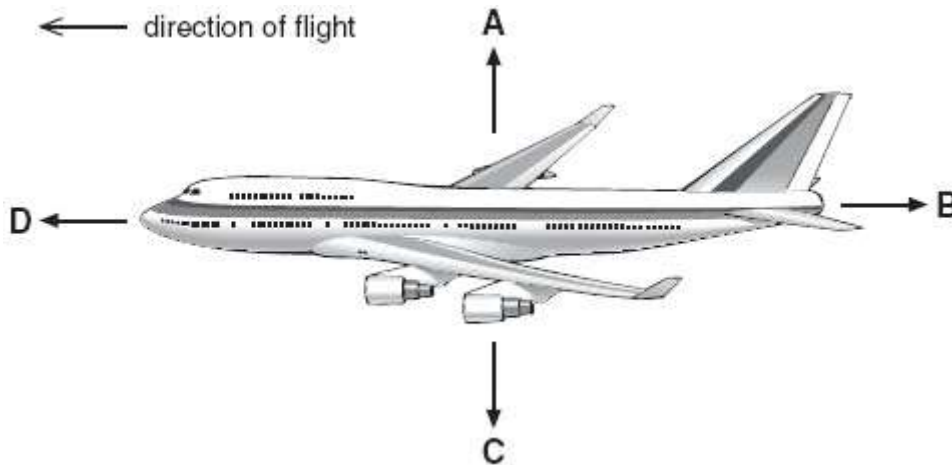


not to scale

1 mark

maximum 7 marks

3. The diagram shows four forces acting on a plane in flight.



(a) Which arrow represents air resistance?
Give the letter.

.....

1 mark

- (b) (i) When the plane is flying at a constant height, which **two** forces must be balanced?
Give the letters.
..... and

1 mark

- (ii) When the plane is flying at a constant speed in the direction shown, which **two** forces must be balanced?
Give the letters.
..... and

1 mark

- (c) (i) Just before take-off, the plane is speeding up along the ground.
Which statement is true?
Tick the correct box.

Force B is zero.

Force B is greater than force D.

Force D is equal to force B.

Force D is greater than force B.

1 mark

(ii) Which statement is true about the plane just as it leaves the ground?
Tick the correct box.

Force C is zero.

Force C is greater than force A.

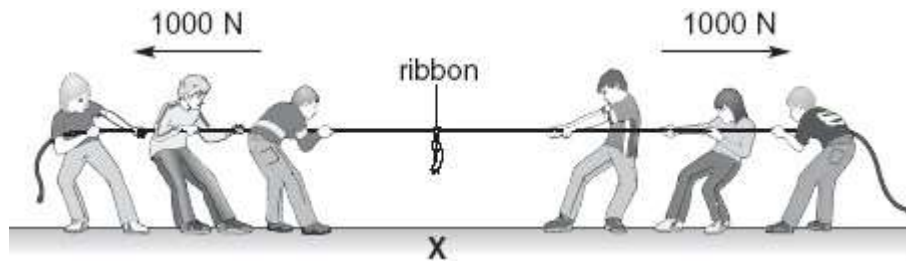
Force A is equal to force C.

Force A is greater than force C.

1 mark
maximum 5 marks

4. The drawings in parts (a), (b) and (c) show two teams of pupils in a tug-of-war. There is a ribbon tied to the middle of the rope.

(a) The sizes and directions of the forces of each team are shown.



team A

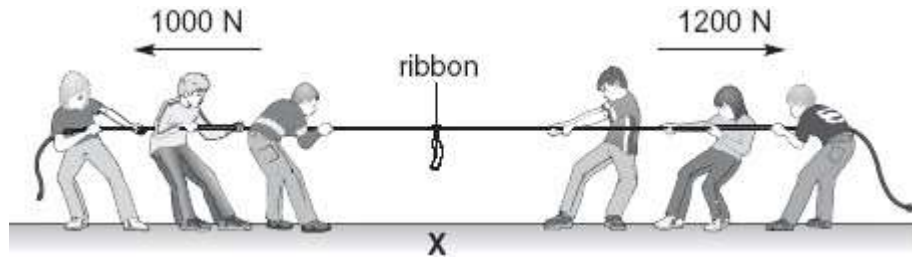
team B

The ribbon stays above point X on the ground.
Give the reason for this.

.....
.....

1 mark

(b) The teams then pull with the forces shown below.



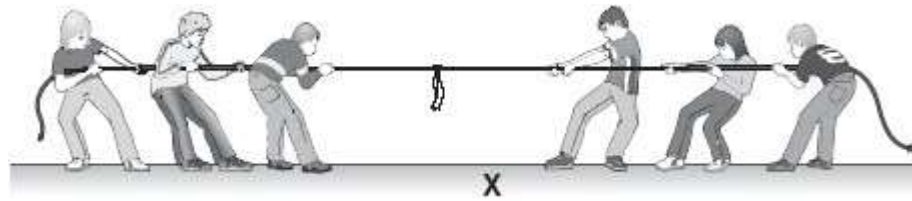
team A

team B

Draw an arrow on the rope to show the direction in which the ribbon will move.

1 mark

(c) Later, the ribbon was to the left of point X as shown below.



team A

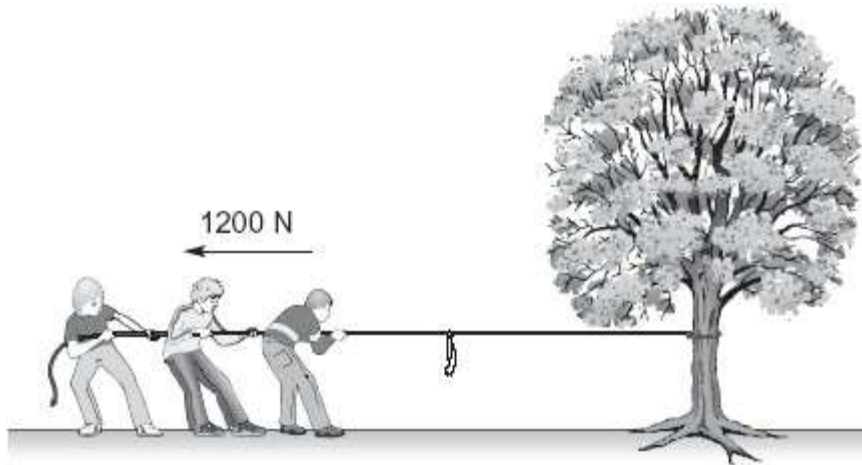
team B

Why did the ribbon move towards the left?

.....
.....

1 mark

(d) Team A practises by pulling a rope tied to a tree.



The team pulls with a force of 1200 N but the tree does **not** move.

What is the force of the tree on the rope?

Tick the correct box.

zero	<input type="checkbox"/>	less than 1200 N	<input type="checkbox"/>	1200 N	<input type="checkbox"/>	more than 1200 N	<input type="checkbox"/>
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1 mark

(e) The pupils do **not** slip because there is a force between their shoes and the ground. What is the name of this force?

.....

1 mark

maximum 5 marks

5. Russell investigated the relationship between mass and weight. He weighed five different masses using a force meter.

His results are shown in the table.

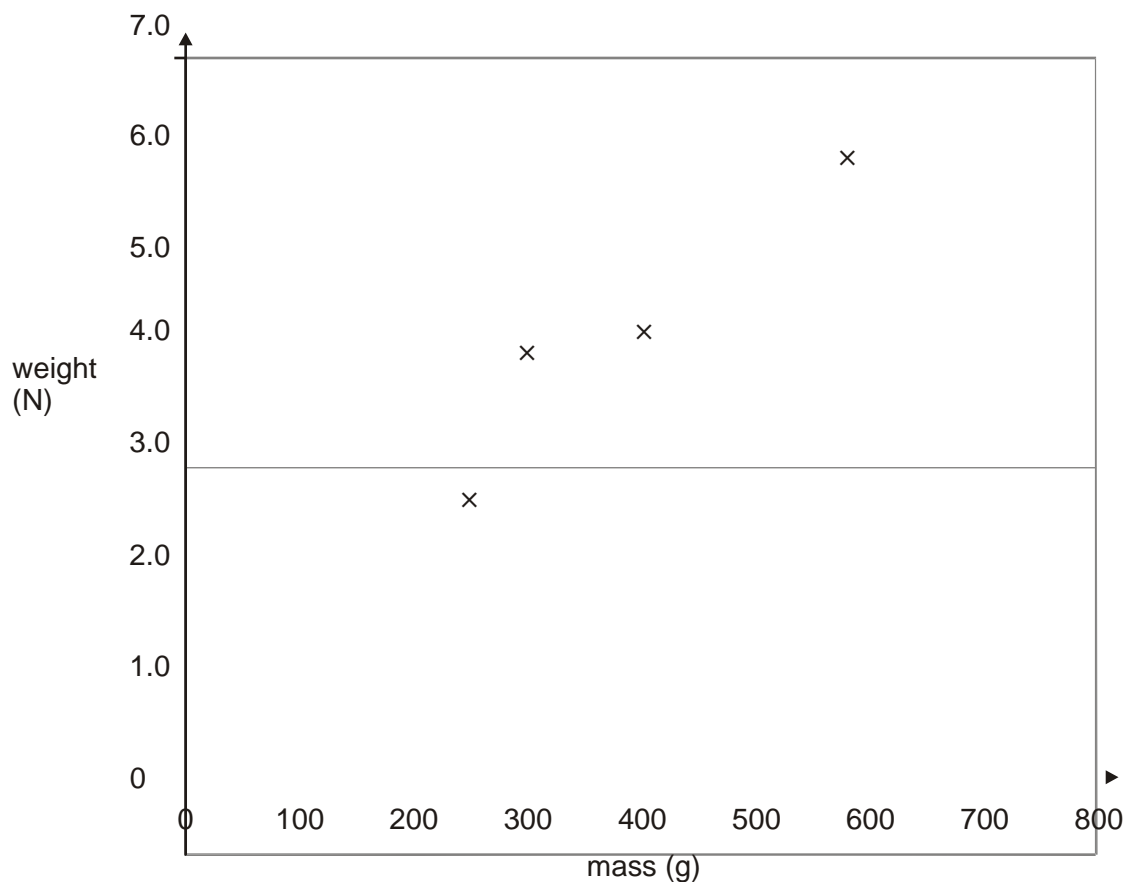
mass (g)	weight (N)
150	1.5
250	2.5
300	3.8
400	4.0
580	5.8

(a) He plotted four of his results on a grid as shown below,

(i) Plot the point for the 150 g mass on the graph.

1 mark

(ii) Draw a line of best fit.



1 mark

(b) One of the points Russell plotted does **not** fit the pattern. Circle this point on the graph.

1 mark

(c) Use your graph to predict:

(i) the mass of an object weighing 6.5 N;
 g

1 mark

(ii) the weight of an object of mass 50 g.
..... N

1 mark

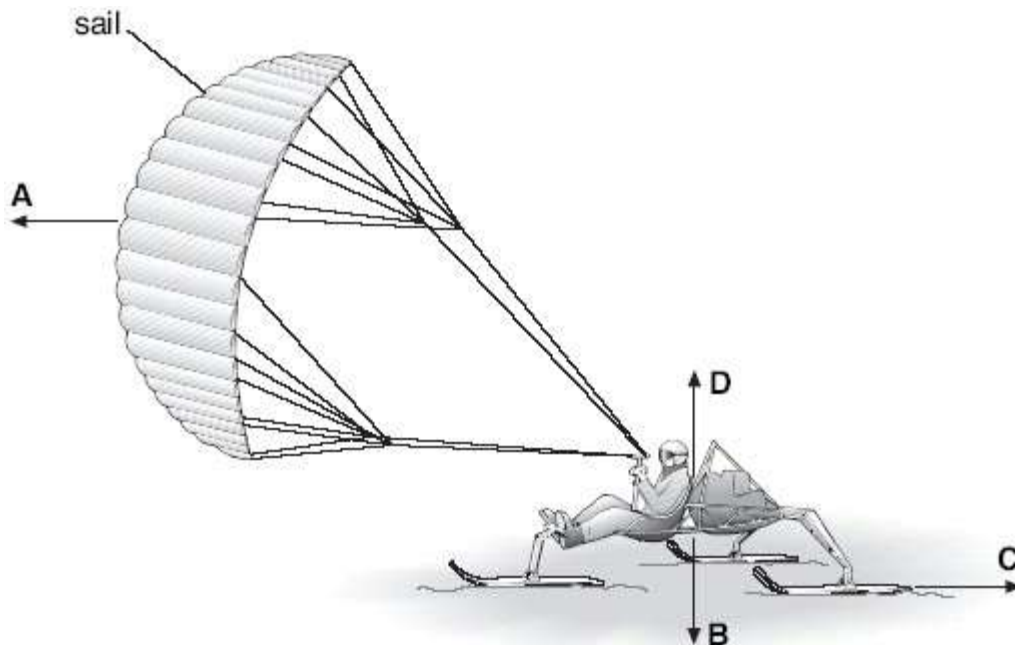
(d) Give **one** reason why it is more useful to present the results as a line graph rather than a table.

.....
.....

1 mark

maximum 6 marks

6. The drawing shows a snow-buggy being pulled by a sail.
The buggy rests on three skis on the snow.



- (a) The drawing shows four forces that act when the snow-buggy is moving.

Draw a line from each force in the list below to the correct letter from the diagram.
Draw only **three** lines.

force	letter
<div style="border: 1px solid black; padding: 5px; width: fit-content;">the weight of the buggy</div>	<div style="border: 1px solid black; padding: 5px; width: fit-content; text-align: center;">A</div>
<div style="border: 1px solid black; padding: 5px; width: fit-content;">the force pulling the buggy along</div>	<div style="border: 1px solid black; padding: 5px; width: fit-content; text-align: center;">B</div>
<div style="border: 1px solid black; padding: 5px; width: fit-content;">the friction between the skis and the snow</div>	<div style="border: 1px solid black; padding: 5px; width: fit-content; text-align: center;">C</div>
	<div style="border: 1px solid black; padding: 5px; width: fit-content; text-align: center;">D</div>

3 marks

- (b) A scientist travelled 80 kilometres (km) each day in the buggy.

How many kilometres did he travel in 10 days?

..... km

1 mark

- (c) The buggy carried the scientist, food and equipment for the journey. The table shows how the total mass changed.

	total mass at start of journey (kg)	total mass at end of journey (kg)
mass of buggy, scientist, food and equipment	295	130

The buggy sank deeper into the snow at the start of the journey than at the end.

Why did it sink deeper at the start? Use the table to help you.

.....
.....

1 mark

- (d) The buggy rests on three skis instead of three wheels.

Why are skis better than wheels for travelling on snow?

.....
.....

1 mark

- (e) When a bigger sail is used, the buggy goes faster.

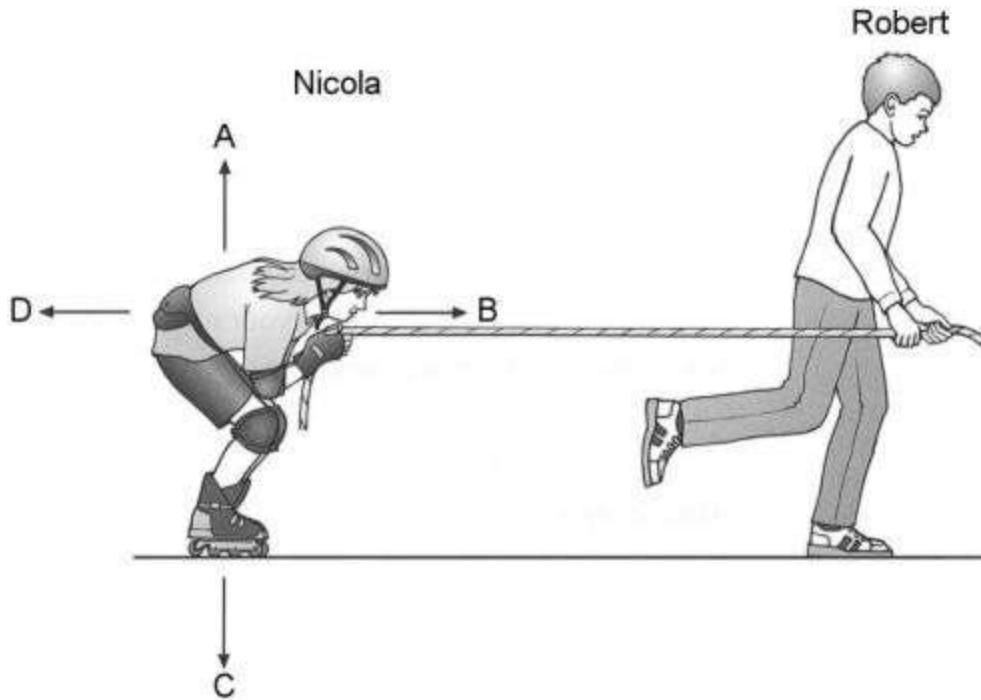
How does a bigger sail help the buggy to go faster?

.....
.....

1 mark

maximum 7 marks

7. (a) Nicola is trying out her new roller blades. Robert is pulling her along with a rope. Arrows A, B, C and D show the directions of four forces acting on Nicola.



- (i) Which arrow shows the direction of the force of **gravity** on Nicola?
Give the letter.

.....

1 mark

- (ii) Which arrow shows the direction of the force of the **rope** on Nicola?
Give the letter.

.....

1 mark

- (b) Robert pulls Nicola at a steady speed of 2 metres per second. How far will Nicola travel in 10 seconds?

..... metres

1 mark

(c) Nicola lets go of the rope and she slows down. Gravity still acts on Nicola.

Give the name of **one** other force still acting on Nicola after she lets go of the rope.

.....

1 mark

maximum 4 marks

8. (a) Megan was doing time-trials on her bike around a 400 metre horizontal track.

(i) She took 32 seconds to travel 400 m.
What was her average speed? Give the unit.

.....
.....

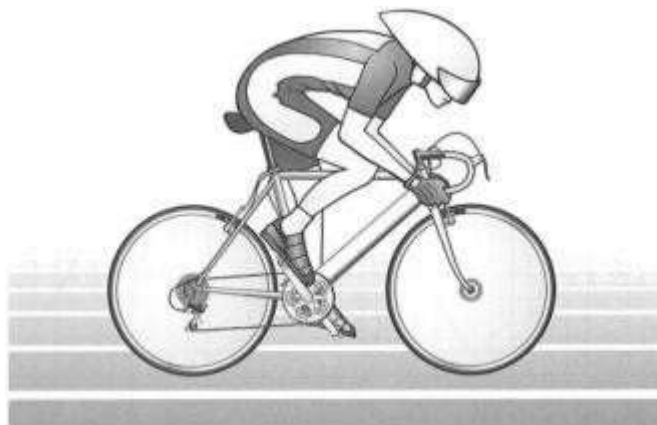
1 mark

(ii) Compare the forward force on the bike with the backward force on the bike when Megan was travelling at a constant speed.

.....
.....

1 mark

- (b) Megan then crouched down over the handlebars to make herself more streamlined, as shown below.
She continued to pedal with the same force as before.



Compare the forward and backward forces on Megan and her bike now.

.....
.....

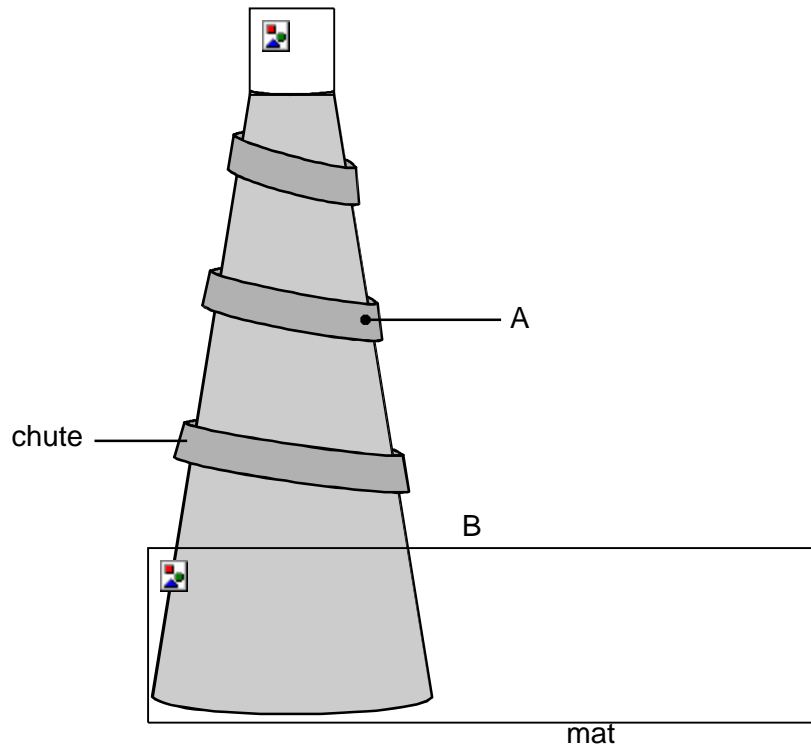
1 mark

Explain your answer.

.....
.....

1 mark
maximum 4 marks

9. Anil sits on a mat at the top of a helter-skelter and then slides down a chute around the outside.



- (a) (i) Name **two** of the forces acting on Anil as he slides from point A to point B.

- 1.
- 2.

2 marks

- (ii) As Anil slides from point A to point B, the forces acting on him are balanced.

Describe Anil's speed when the forces acting on him are balanced.

.....

1 mark

- (b) Anil goes back for a second go. This time he sits on a smooth cushion instead of a mat.

He goes much faster on the cushion. Give the reason for this.

.....

1 mark

- (c) On his third go Anil lies back on the cushion with his arms by his side.

What happens to his speed? Give the reason for your answer.

.....

.....

.....

2 marks

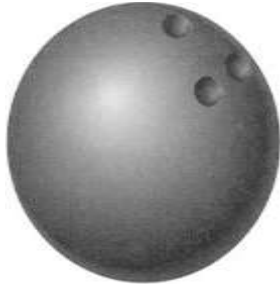
Maximum 6 marks

10. The picture shows a man called Aristotle. He lived in Greece over 2000 years ago.



Aristotle said that the heavier an object is, the faster it will fall to the ground.

- (a) The drawings below show a bowling ball, a cricket ball and a ping-pong ball. Lila dropped them all at the same time from the same height.



bowling ball
mass=5 000 g



cricket ball
mass=160 g



ping-pong
mass=2.5 g

If Aristotle was correct, which of the three balls would you expect to reach the ground first?
Give the reason for your answer.

.....
.....

1 mark

- (b) Joe said that it would be a fairer test if Lila had only used a cricket ball and a hollow plastic ball as shown below.



cricket ball
mass = 160 g



hollow plastic ball
mass=56 g

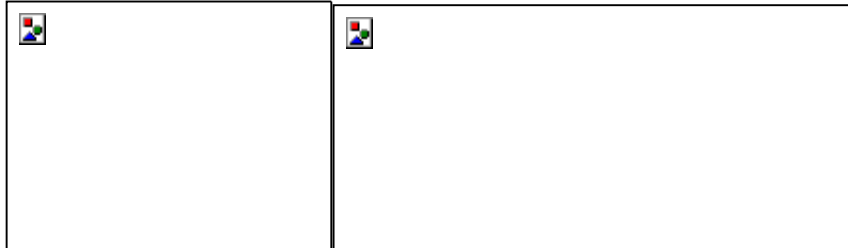
Why was Joe correct?

.....
.....

1 mark

(c) About 400 years ago in Italy, a man called Galileo had a different idea. He said that all objects dropped from the same height would reach the ground at the same time.

(i) Lila dropped a hammer and a feather at the same time from the same height.



If Galileo was correct, which, if either, would reach the ground first?

.....

1 mark

(ii) Gravity acts on both the hammer and the feather as they fall. Give the name of **one** other force which acts on them as they fall.

.....

1 mark

(iii) An astronaut on the moon dropped a hammer and a feather at the same time from the same height.



How would the results of the astronaut's experiment on the Moon be different from Lila's experiment on the Earth?

.....

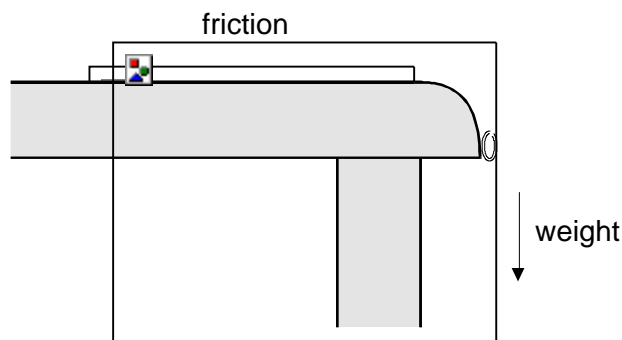
Explain your answer.

.....
.....

2 marks

Maximum 6 marks

11. The diagram shows a chain hanging down over the edge of a table.



Two of the forces on the chain are:

- ✓ the weight of the part of the chain which is hanging over the edge;
- ✓ friction between the chain and the table.

(a) The chain is **not** moving. What does this tell you about these two forces acting on the chain?

1 mark

(b) The chain is moved slightly to the right. It begins to slide off the table.

(i) What does this tell you about these two forces now?

.....

1 mark

(ii) Describe how the size of each force changes as the chain slides off the table.

✓ weight of the part of the chain hanging over the edge

.....

✓ friction between the chain and the table

.....

2 marks

(iii) How does the speed of the chain change as it slides off the table?

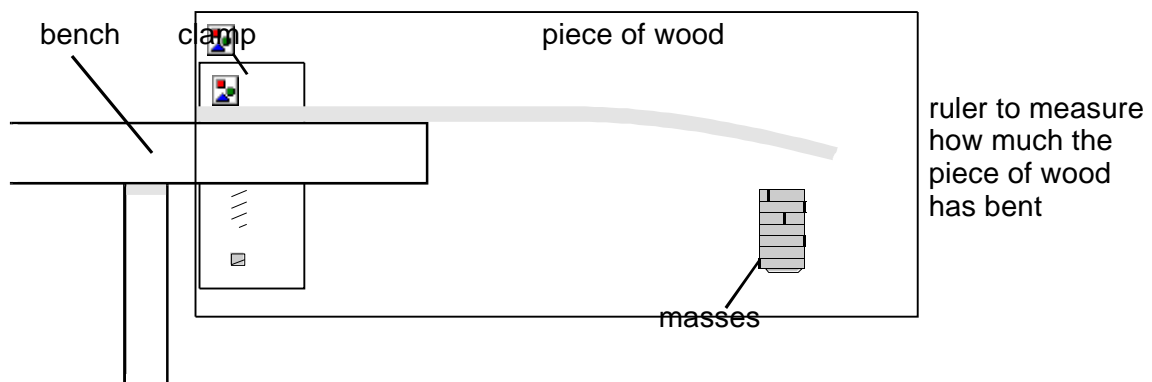
.....

.....

1 mark

Maximum 5 marks

12. Ruth is investigating how much a piece of wood can bend. She hangs some masses on the end of the piece of wood and measures how far the wood has bent.

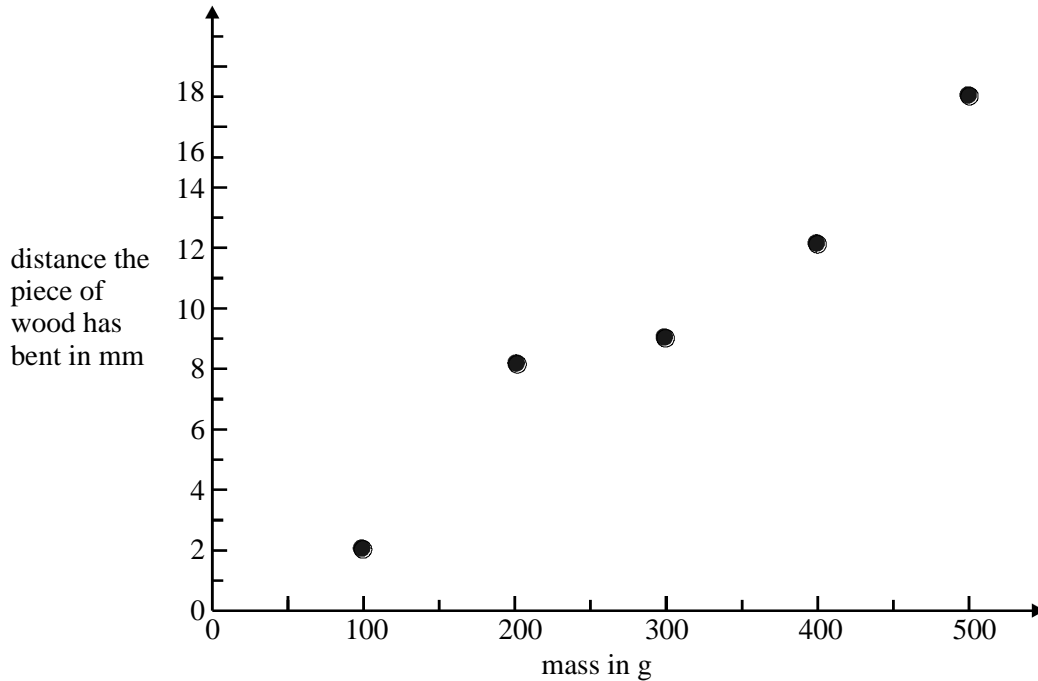


(a) Give the name of the force which pulls the masses downwards.

.....

1 mark

(b) The graph below shows Ruth's results.



(i) Complete the graph by drawing a straight line of best fit.

1 mark

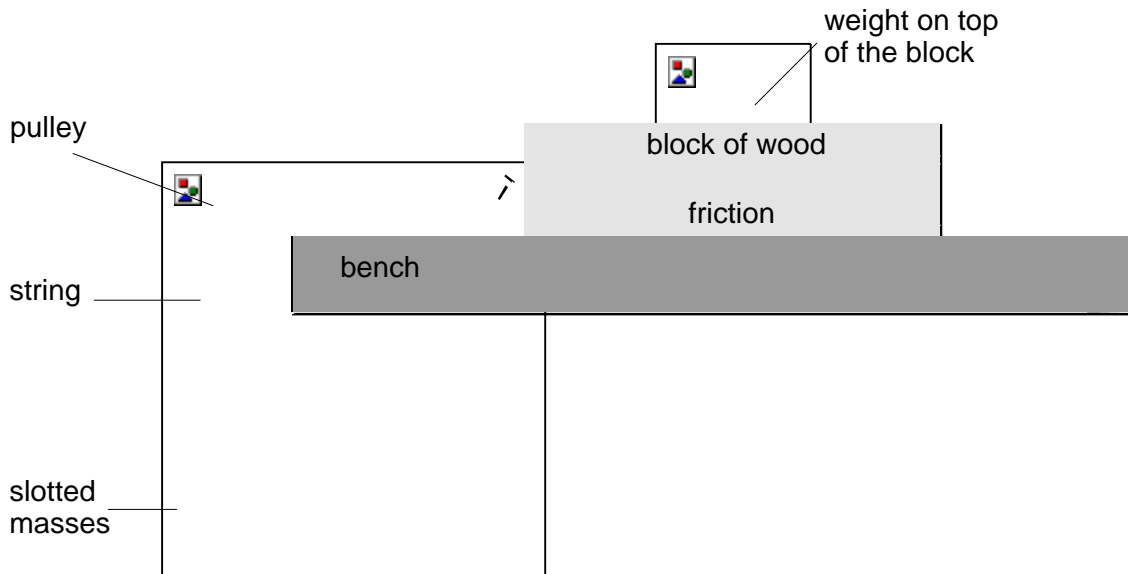
(ii) A mass of 350 g is hung on the piece of wood. How much does the wood bend?

..... mm

1 mark

Maximum 3 marks

13. Nazia is investigating how easily a block of wood slides along a wooden bench. The diagram shows her experiment.



- (a) Nazia does the experiment with different weights on top of the block. She counts how many slotted masses she needs to hang from the string to make the block of wood slide. Her results are shown in the table.

weight on top of the block in N	number of slotted masses needed
0	5
1	7
2	9
3	1
4	13

- (i) Describe how the number of slotted masses needed to move the block varies with the weight on top of the block.

.....
.....

1 mark

- (ii) Nazia does the experiment with a weight of 3.5 N on top of the block of wood.

How many slotted masses would she need to make the block slide?

.....

1 mark

- (b) Nazia does her experiment again. This time she slides the block of wood over a sheet of glass instead of the bench top.

- (i) Suggest how her results would be different this time.

.....
.....

1 mark

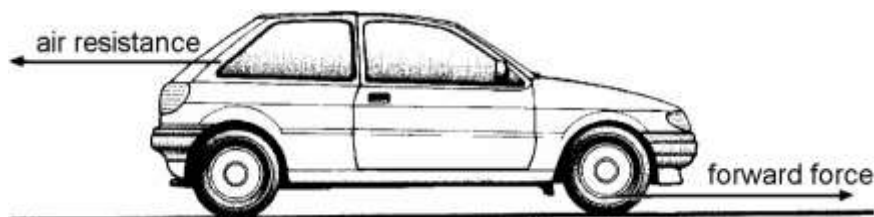
- (ii) Using the same sheet of glass and block of wood, and keeping the same weight on top, suggest **one** way Nazia could reduce the force of friction.

.....
.....

1 mark

Maximum 4 marks

- 14. When a car is being driven along, two horizontal forces affect its motion. One is air resistance and the other is the forward force.



(a) (i) Explain how molecules in the air cause air resistance.

.....
.....

1 mark

(ii) Explain why air resistance is larger when the car is travelling faster.

.....
.....

1 mark

(b) (i) Compare the sizes of the forward force and the air resistance when the car is speeding up.

The forward force is

1 mark

(ii) Compare the sizes of the two forces while the car is moving at a steady 30 miles per hour.

The forward force is

1 mark

(c) The forward force has to be larger when the car is travelling at a steady 60 mph than when it is travelling at a steady 30 mph. Why is this?

.....
.....

1 mark

(d) The forward force is the result of the tyres **not** being able to spin on the road surface.

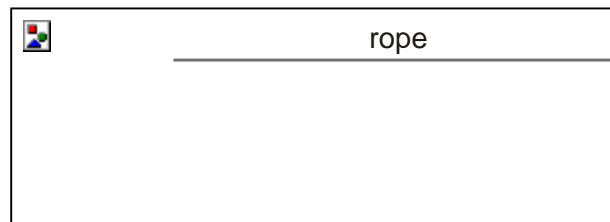
What is the name of the force that stops the tyres spinning?

.....

1 mark

Maximum 6 marks

15. The drawing shows Amy water-skiing.



(a) (i) The rope is pulling Amy. Draw an arrow on the rope to show the direction of this force.
Label the arrow A.

1 mark

(ii) Draw an arrow to show the direction of Amy's weight.
Label the arrow B.

1 mark

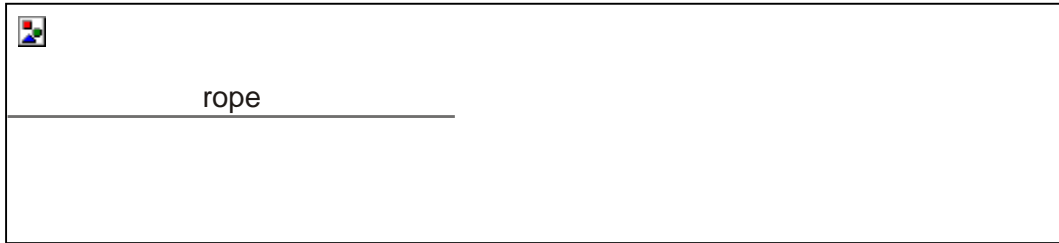
(b) Give the names of **two** other forces which act on Amy or on her skis.

1.

2.

2 marks

The drawing below shows the speed boat which is pulling Amy along.



- (c) The rope which pulls Amy also exerts a force on the boat. Draw an arrow on the rope to show the direction of this force. Label the arrow C.

1 mark

- (d) The force of the engine on the boat is increased. What effect will this have on the speed of the boat?

.....

1 mark

Maximum 6 marks

16. The drawing shows a man moving a wheelbarrow full of bricks.



(a) Tick the boxes by **two** forces on the wheelbarrow.

the weight of the bricks

the speed of the wheelbarrow

the size of the wheel

the energy of the wheelbarrow

the push of the man's hands on the handles

the weight of the man

2 marks

(b) The man lets go of the handles and the wheelbarrow hits the ground while it is still moving. The wheelbarrow soon stops moving forward.

Give the name of the force which makes the wheelbarrow stop moving forward.

.....

1 mark

(c) One brick drops off the wheelbarrow.

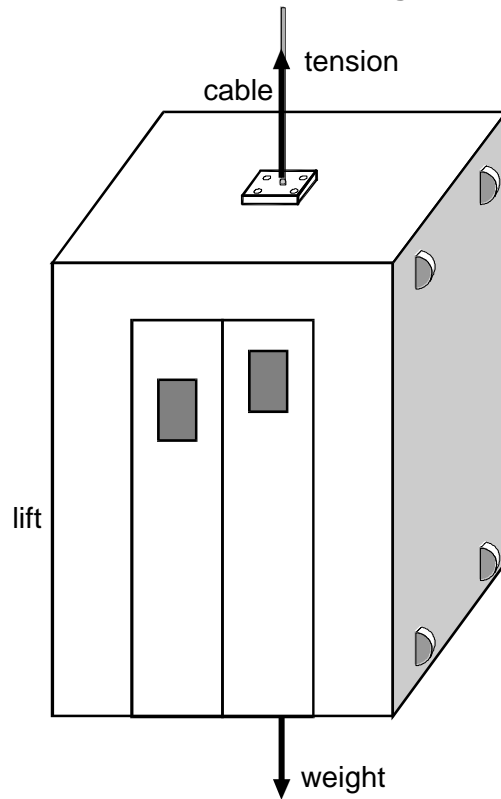
What effect does the force of gravity have on the speed of the brick as it falls?

.....
.....

1 mark

Maximum 4 marks

17. The lift in a tall building hangs from a strong cable. The movement of the lift is affected by only two forces. These forces are the **tension** in the cable and the **weight** of the lift.



- (a) The lift is **not** moving. How do the sizes of the two forces compare? Tick the correct box.

The tension is greater than the weight.

The tension equals the weight.

The tension is less than the weight.

It is impossible to know which is greater.

1 mark

(b) When the lift is moving upwards and its speed is increasing, how do the sizes of the two forces compare?

.....

1 mark

(c) When the lift is moving upwards at a constant speed, how do the sizes of the two forces compare?

.....

1 mark

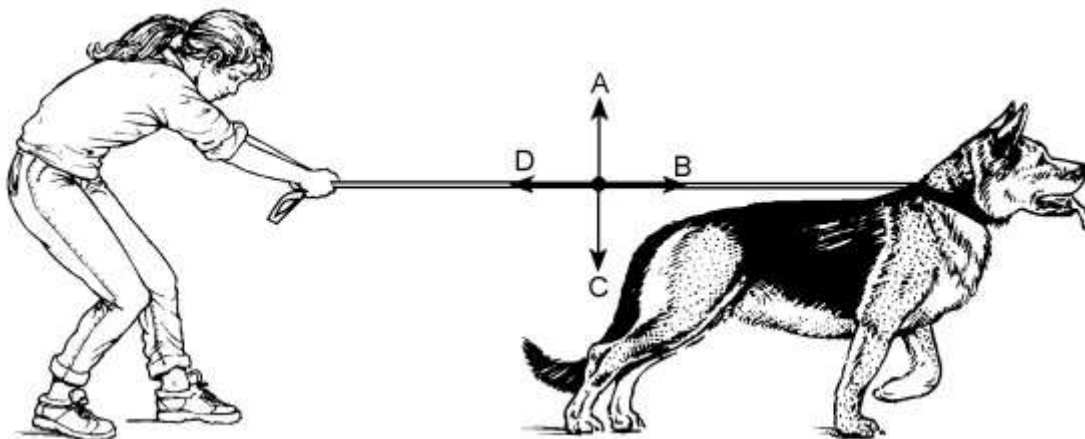
(d) Near the top of the building the lift is moving upwards, but slowing down. How do the sizes of the two forces now compare?

.....

1 mark

Maximum 4 marks

18.



(a) Megan's dog is pulling on his lead. Which arrow, A, B, C or D, shows the direction of this force? Give the letter.

.....

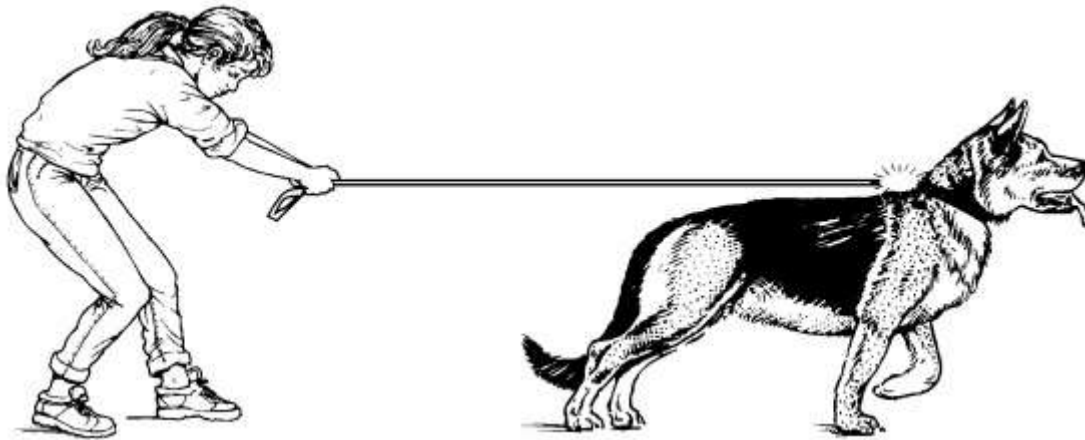
1 mark

- (b) Megan has to pull to keep the dog still.
Which arrow shows the direction of this force? Give the letter.

.....

1 mark

- (c) Suddenly the dog's collar breaks.



- (i) When the collar breaks, the lead moves.
Draw an arrow on the diagram to show which way the lead starts to move.

1 mark

- (ii) Why does the lead move when the collar breaks?

.....
.....

1 mark

Maximum 4 marks

19.



(a) A railway engine is being used to try to pull a wagon along a level track. The wagon's brakes are on, and the wagon does not move.

(i) Draw **one** arrow on the diagram to show the direction of the force which prevents the wagon from moving.

1 mark

(ii) Is the force which prevents the wagon from moving **greater than**, **equal to** or **less than** the pull of the engine?

.....

1 mark

(b) (i) When the wagon's brakes are off, the engine pulls the wagon forwards. A frictional force also acts on the wagon. In what direction does the frictional force act?

1 mark

(ii) The pull of the engine is 5000 N. When the wagon's speed is increasing, how large is the frictional force?
Tick the correct box.

zero

between 0 and 5000 N

5000 N

more than 5000 N

1 mark

- (c) After a while, the wagon travels at a steady speed. The engine is still pulling with a force of 5000 N.

How large is the frictional force now?
Tick the correct box.

zero

between 0 and 5000 N

5000 N

more than 5000 N

1 mark
Maximum 5 marks