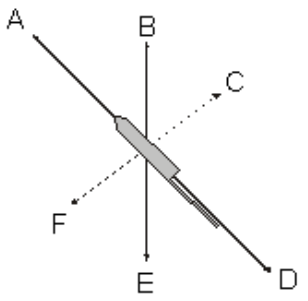
7.3.6 Friction and Air resistance

137 minutes

196 marks

Q1. The diagram shows a firework rocket.



(a) Three forces act as the rocket flies through the air.
Which arrows show the directions of these three forces?

....

3 marks

(b) When there is no fuel left, the rocket falls to the ground.

(i) Give the name of the force which pulls it down.

.....

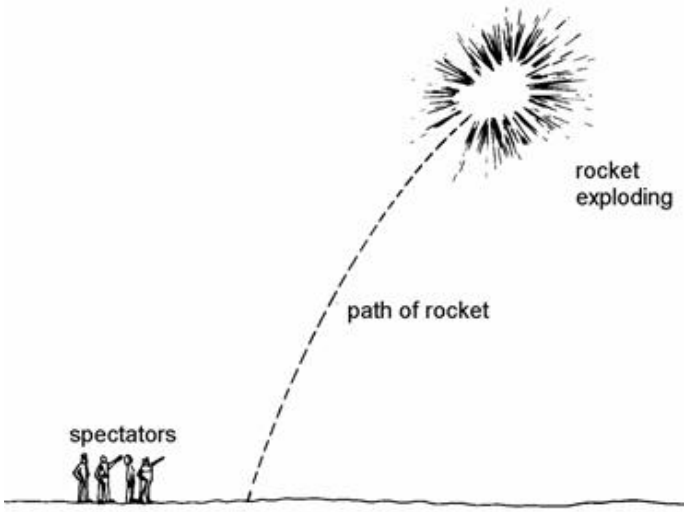
1 mark

(ii) Give the name of the force which acts against the motion of the rocket.

.....

1 mark

(c) Another rocket was sent high into the air. It exploded with a loud bang and a bright flash of light.



Put a tick in the box by the correct statement.

the bright flash of light was seen first	☐
the loud bang was heard first	☐
the flash of light was seen and the bang was heard at the same time	☐

1 mark

Give a reason for your answer.

.....

.....

1 mark
Maximum 7 marks

Q2. The footballer is just going to kick the ball.

(a) When his boot hits the ball, how does the shape of the ball change?

.....

.....

1 mark

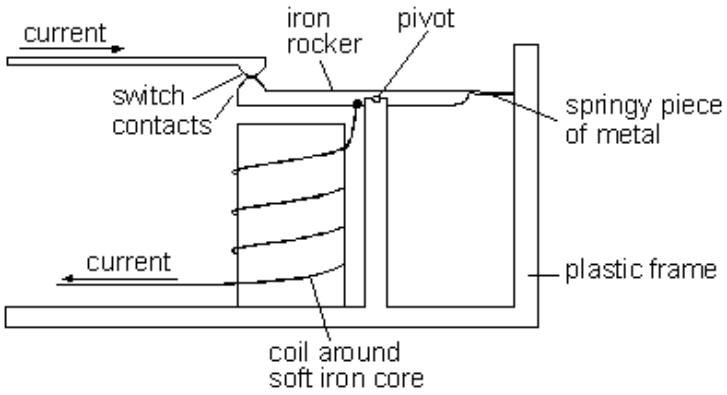
After he has kicked it the ball flies off high into the air.

(b) Tick boxes to describe the shape and movement of the ball after he has kicked it and it is high in the air.

	the same as the picture	**different from the picture**
The shape of the ball is		
The movement of the ball is		

2 marks
Maximum 3 marks

Q3. Circuit breakers are switches which open when the current becomes too large. The diagram shows a simple circuit breaker. The springy piece of metal pushes down on the iron rocker, and this holds the switch contacts together.



(a) (i) There is a current in the coil in the circuit breaker. What is the purpose of the coil?

.....

.....

1 mark

(ii) What is the purpose of the soft iron core in the coil?

.....

.....

1 mark

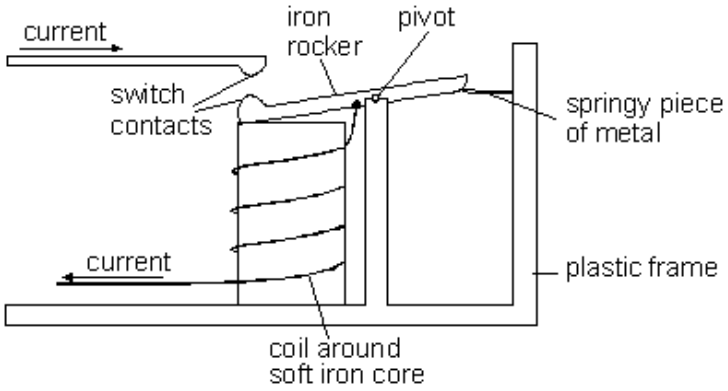
(b) Give **two** properties of iron which make it a good choice of material for the **rocker**.

1. .....

2. .....

2 marks

(c) The diagram below shows the circuit breaker with the switch contacts open.



Why do the switch contacts separate when the current becomes too large?

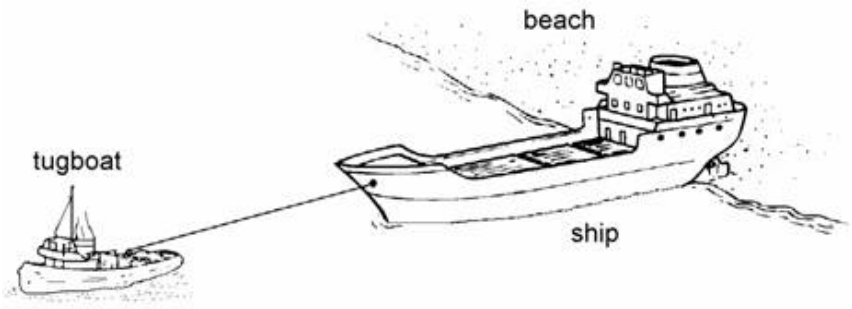
.....

.....

1 mark
Maximum 5 marks

##

In a storm, a small ship was blown onto a beach. Now it is calm and there is no wind. A tugboat is trying to pull the ship off the beach.



(a) The tugboat pulls the ship with a force of 25 000 N.

The ship does not move because of the force of friction acting on it.

(i) Tick **one** box to show the size of the frictional force acting on the ship.

zero	☐
more than zero but less than 25 000 N	☐
25 000 N	☐
more than 25 000 N	☐

1 mark

(ii) Add an arrow to the drawing to show the direction of the frictional force acting on the ship.

1 mark

(b) When the tide is higher, the tugboat again pulls the ship with a steady force of 25 000 N. The ship begins to move.

Once the ship is off the beach, the tugboat continues to pull the ship with a force of 25 000 N.
A frictional force due to the water acts on the ship.

(i) At first, the speed of the ship increases.

Tick **one** box to describe the frictional force acting on the ship while its speed is increasing.

zero	☐
more than zero but less than 25 000 N	☐
25 000 N	☐
more than 25 000 N	☐

1 mark

(ii) After a short while, the ship reaches a steady speed. The tugboat continues to pull with a force of 25 000 N.

Tick **one** box to describe the frictional force acting on the ship while it is going at a steady speed.

zero ☐

more than zero but less than 25 000 N ☐

25 000 N ☐

more than 25 000 N ☐

1 mark

(iii) The ship is towed to the north. What is the direction of the frictional force acting on the ship?

.....

1 mark

Maximum 5 marks

Q5. (a) Some of the statements in the list describe forces, and some do not.

Tick the boxes by the **three** forces.

the movement of a car travelling along a road ☐

the push of a jet engine on an aeroplane. ☐

the flow of electricity through a light bulb. ☐

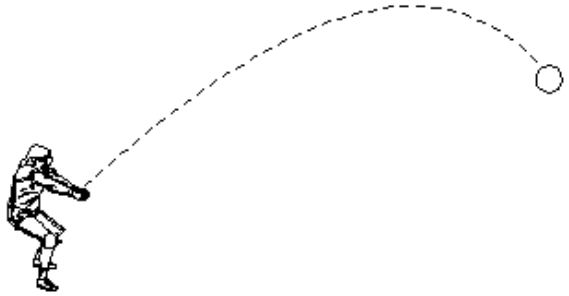
the weight of a book on a table. ☐

the pull of a horse pulling a cart. ☐

the speed of a hockey ball flying through the air. ☐

3 marks

(b) A girl throws a ball. The diagram shows the path of the ball after she has thrown it.



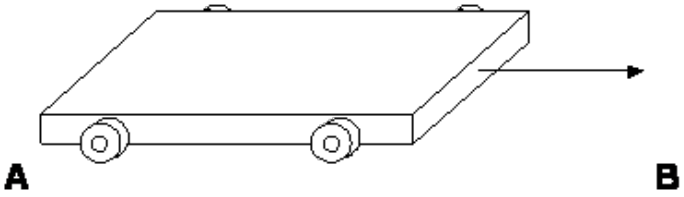
How can you tell from the **path** of the ball that there is a force acting on the ball?

.....

.....

1 mark

(c)



The drawing shows a trolley rolling along a table from **A** to **B**.
Then another force acts on the trolley. This is shown by the arrow on the drawing.

What effect does this force have?

Tick the correct box.

It makes the trolley go faster. ☐

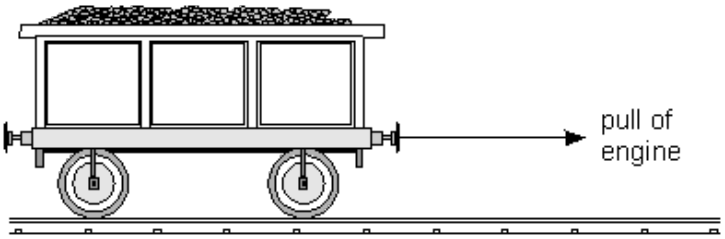
It makes the trolley go slower. ☐

It makes the trolley change direction. ☐

It has no effect. ☐

1 mark
Maximum 5 marks

Q6.



(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

Q7. (a) The diagram shows two bar magnets.

The north pole and south pole are shown on magnet A. The poles are not shown on magnet B.

Describe an experiment you could do, using magnet A, to find which end of magnet B is the north pole **and** which is the south pole.

.....

.....

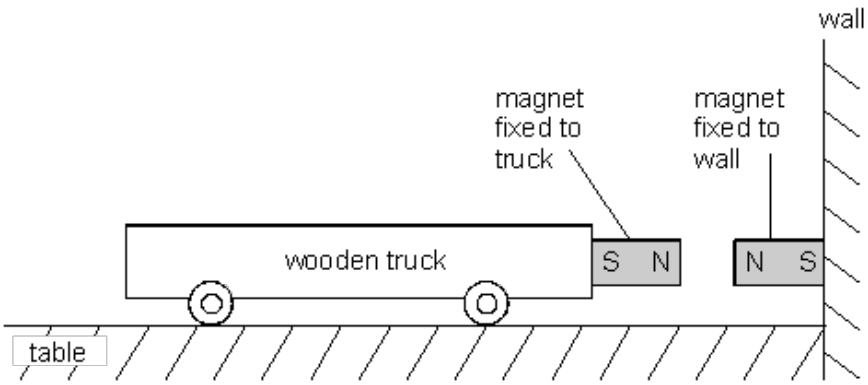
.....

.....

.....

3 marks

(b) The diagram shows a wooden truck near a wall. There is a strong magnet fixed to the wall and a strong magnet fixed to the front of the wooden truck.



James holds the wooden truck so that it does not move.
Then he lets go of the wooden truck. In which direction will it move?

.....

1 mark

(c) James removes the magnet from the wooden truck. He gives the truck a push so that it rolls along the table.

What effect will friction have on the speed of the truck as it rolls along?

.....

.....

1 mark
Maximum 5 marks

Q8. 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.

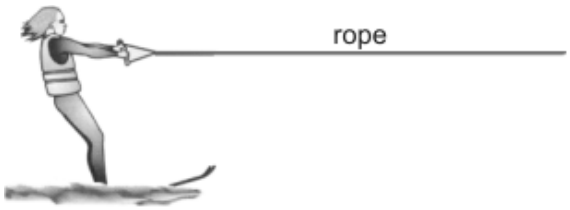
What effect does the force of gravity have on the speed of the brick as it falls?

.....

.....

1 mark
Maximum 4 marks

Q9. 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

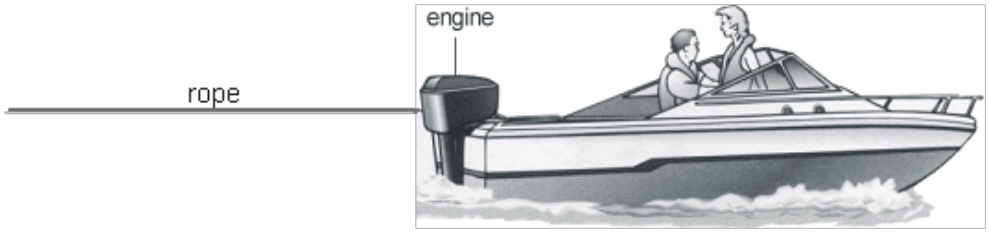
(b) Give the names of **two** other forces which act on Amy or on her skis.

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

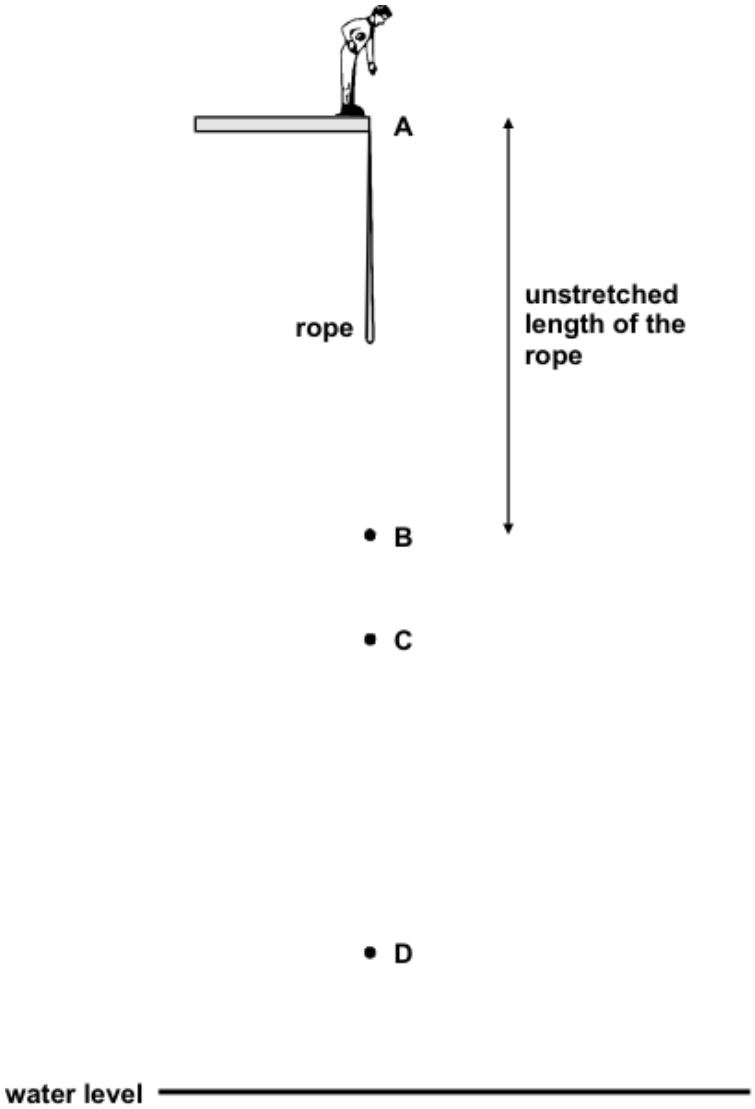
(d) The force of the engine on the boat is increased.
What effect will this have on the speed of the boat?

……..……..

1 mark
Maximum 6 marks

##

A man does a ‘bungee jump’ over a lake. He jumps from point A with an elasticated rope tied to his ankles. The rope reaches down to point B when it is not being stretched.



The man falls past B, and the rope begins to stretch. He falls past point C to point D, which is the lowest point he reaches. Then he begins to move upwards again. Eventually he comes to rest at point C.

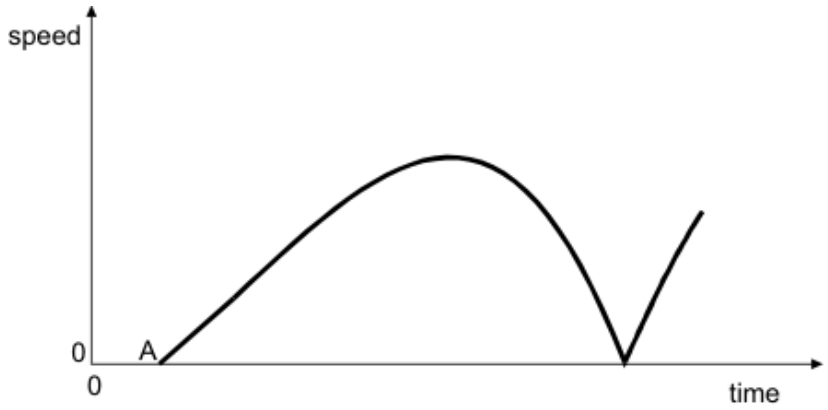
(a) (i) At which point, A, B, C or D, is the man when the tension in the rope is greater than his weight? .....

1 mark

(ii) At which point, A, B, C or D, is the man when the tension in the rope is equal to his weight? .....

1 mark

(b) The graph shows how the man's speed varies with time as he falls from point A to point D and bounces back upwards.



The point when the man jumped from A has been labelled on the curve.
Label the points on the curve when the man was at points B, C and D as he fell.

3 marks

(c) The total energy of the man and the rope includes the man's potential energy, his kinetic energy, and the elastic (strain) energy stored in the stretched rope.

Describe how the elastic (strain) energy in the rope changes as the man falls from point A to point D.

.....

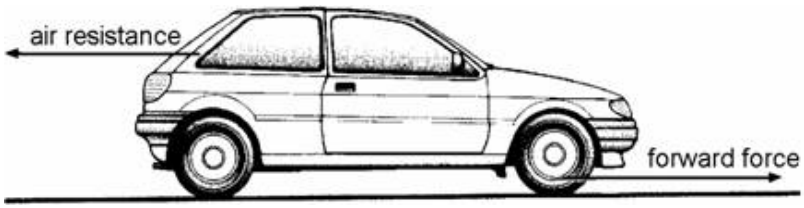
.....

.....

.....

2 marks
Maximum 7 marks

Q11. 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

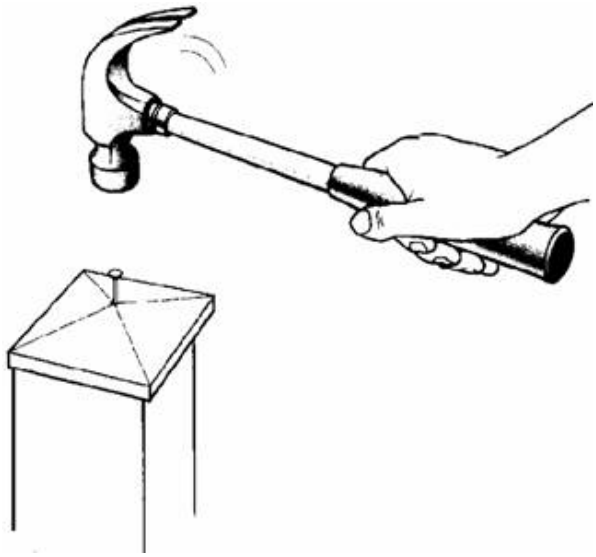
(d) The forward force is the result of the tyres **not** being able to spin on the road surface. What is the name of the force that stops the tyres spinning?

.....

1 mark

Maximum 6 marks

Q12. A man was hammering nails into a wooden fence post.
The drawing shows the hammer just before it hit a nail.



(a) The hammer hit the nail. What is the direction of the force of the hammer on the nail?
Draw an arrow on the diagram to show this.

1 mark

(b) What effect did this force have on the nail?

.....

1 mark

(c) How did the speed of the hammer change when the hammer hit the nail?

.....

1 mark

(d) The hammer hit the nail again. The hammer was moving faster this time.
The size of the force of the hammer on the nail was different.
In what way was it different?

.....

1 mark

(e) Mark could see the man mending the fence. The man was at the other end of a large field. Mark saw the man hit a nail with the hammer. One second later he heard the sound.

Why did Mark hear the sound **after** he saw the hammer hit the nail?

.....

.....

1 mark

(f) Mark walked half way across the field, nearer to the man. Again he saw the hammer hit a nail, then heard the sound.

This time, how long was the gap between seeing and hearing the hammer hit the nail?

Tick the correct box.

longer than one second ☐

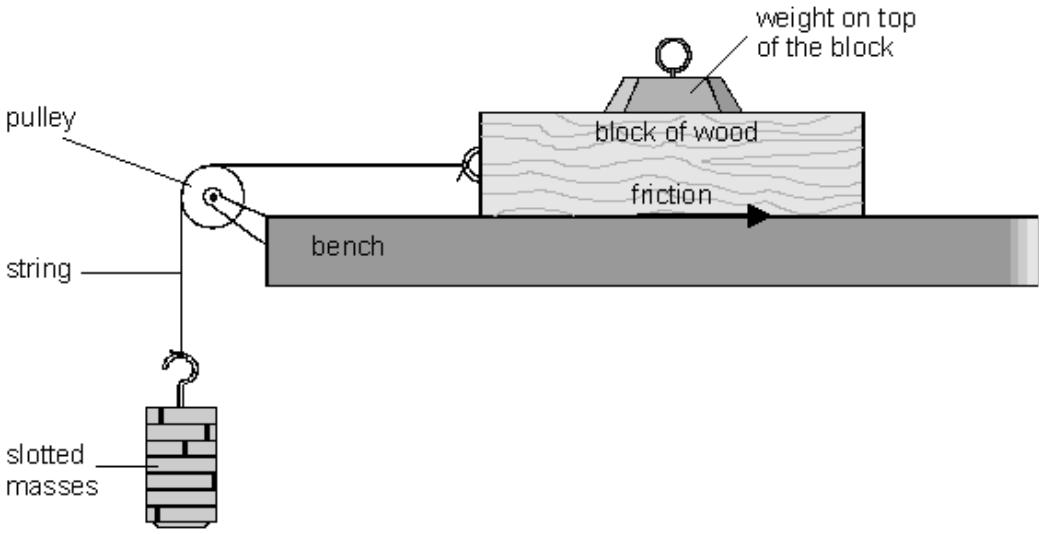
one second ☐

less than one second ☐

there was no gap ☐

1 mark
Maximum 6 marks

Q13. 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	11
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.

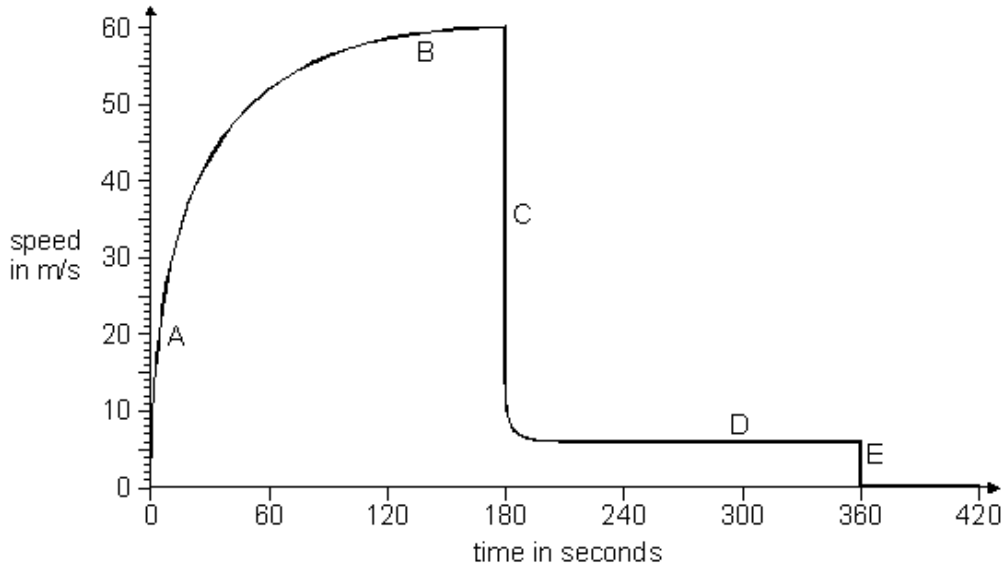
.....

.....

1 mark

Maximum 4 marks

Q14. A sky-diver jumped out of an aeroplane. After falling for some time she opened her parachute. The graph below shows how the speed of the sky-diver changed from the moment she jumped out of the aeroplane until she landed on the ground.



(a) What happened at 180 seconds and at 360 seconds after the sky-diver jumped out of the aeroplane?

180 seconds ……..

360 seconds ……..…….

2 marks

(b) There was an increase in air resistance on the sky-diver as her speed increased. Explain how the graph shows this.

…….

…….

1 mark

(c) Two sections of the graph show where the air resistance was equal and opposite to the sky-diver's weight. Which sections are they?

Give the letters.

…… and …….

1 mark

(d) (i) Use the graph to estimate how far the sky-diver fell between 180 s and 360 s.

……

……

1 mark

(ii) Why can this only be an approximate figure?

……

……

1 mark
Maximum 6 marks

Q15. The photograph shows two rubber tyres.
One is old and worn and the other is new.

old tyre with worn tread

new tyre with deep tread

(a) A car is moving along a road. What force between the tyres and the road makes the car stop? Tick the correct box.

air resistance	☐	friction	☐
gravity	☐	weight	☐

1 mark

(b) The diagram and the table show the stopping distance of a car.

type of road surface	stopping distance, in metres			
	new tyres on a dry road	new tyres on a wet road	old, worn tyres on a dry road	old, worn tyres on a wet road
smooth tarmac	18	19	20	50
rough tarmac	13	18	17	23
concrete	12	17	16	21

(i) What happens to the stopping distance when a road gets wet?

……

1 mark

(ii) Why does the stopping distance change when a road gets wet?

……

……

1 mark

(iii) What happens to the stopping distance as tyres get old and worn?

……

1 mark

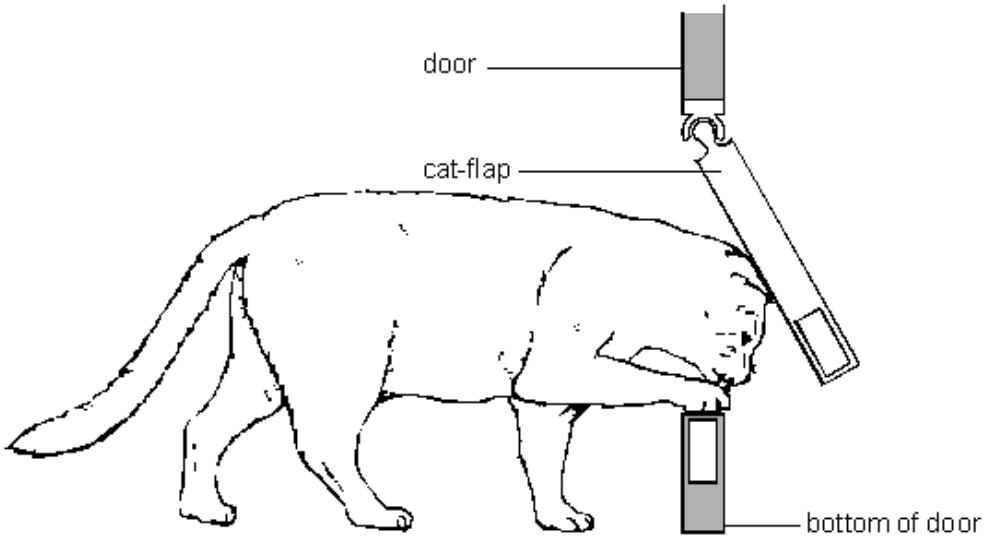
(iv) What is the safest type of road surface in the table?

……

1 mark

Maximum 5 marks

Q16. Ali made a cat-flap to fit into a door.



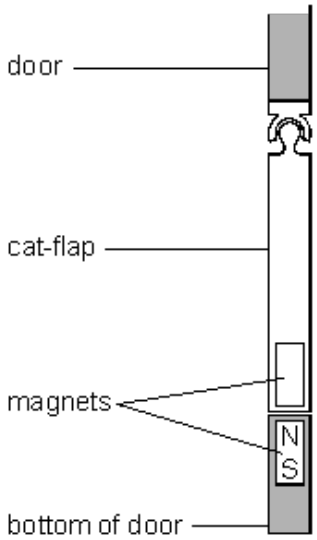
(a) (i) On the diagram above, draw an arrow to show the direction of the force of the cat's head on the cat-flap.

1 mark

(ii) Add a label to the diagram to show the pivot of the cat-flap.
Label it P.

1 mark

When the cat has gone through the cat-flap, the weight of the cat-flap makes the flap close.



(b) Ali used two bar magnets to keep the cat-flap closed, so that it does **not** blow open in the wind.

On the diagram above, label **both** the North and South poles on the magnet in the cat-flap.

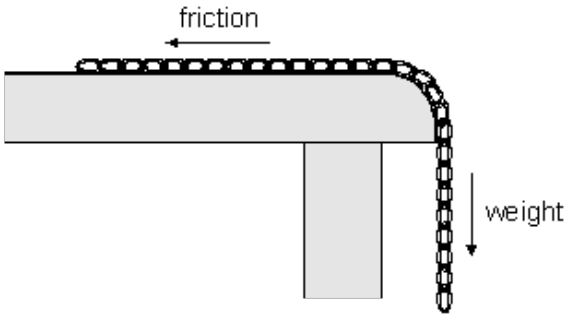
1 mark

(c) Friction at the pivot made the cat-flap squeak. What could Ali put on the pivot to make the friction less?

……

1 mark
Maximum 4 marks

Q17. 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

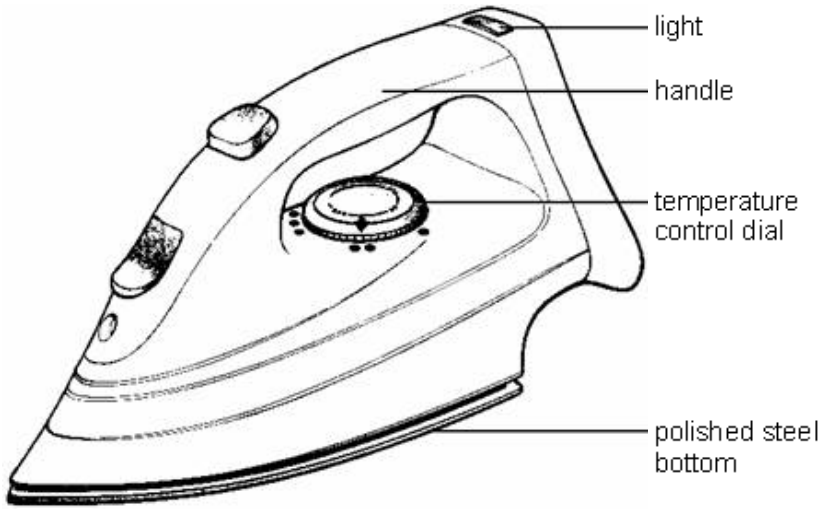
(iii) How does the speed of the chain change as it slides off the table?

……..……

……..……

1 mark
Maximum 5 marks

Q18. The diagram shows the parts of an iron.



(a) Choose words from the list below to fill the gaps in the sentences.

low **high** **heat** **poor**

sound **gravity** **friction** **electricity**

The bottom of the iron is made of steel because steel is a good conductor of ……, and because steel has a …… melting point.
The steel is polished until it is very smooth to reduce the force of …… between the iron and the cloth.

3 marks

(b) Suggest what material the handle could be made from.

……

1 mark

Give a reason for your answer.

……

……

1 mark

(c) The iron has three temperature settings.
The settings for different fabrics are shown below.

symbol	 (120°C Max) Cool	 (160°C Max) Warm	 (210°C Max) Hot
control knob settings	●	● ●	● ● ●
fabric	nylon	wool or polyester	cotton or linen

What might happen if nylon clothes are ironed on the ● ● ● setting?

……

1 mark

(d) After it is switched on, the iron heats up. The time it takes to heat up is shown below.

setting	time to heat up, in seconds
●	38
● ●	
● ● ●	68

Suggest the time to heat up on the ● ● setting.
Write your answer in the table.

1 mark
Maximum 7 marks

Q19. 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?

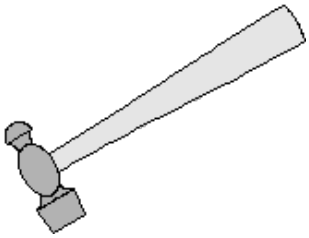
.....

.....

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.

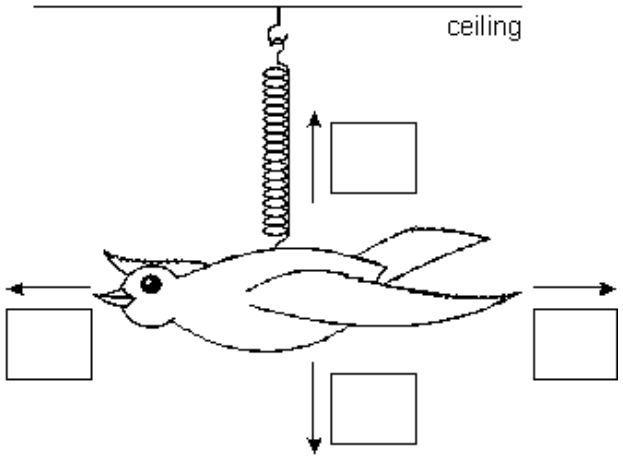
.....

.....

2 marks
Maximum 6 marks

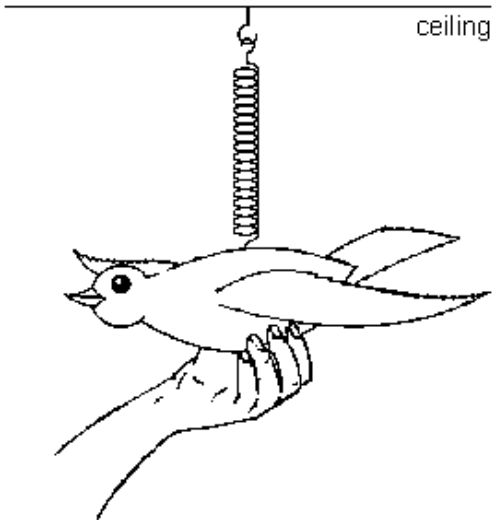
Q20. Anne has a toy bird on a spring.

(a) Which arrow shows the direction of the force of gravity on the bird? Tick the box by the correct arrow.



1 mark

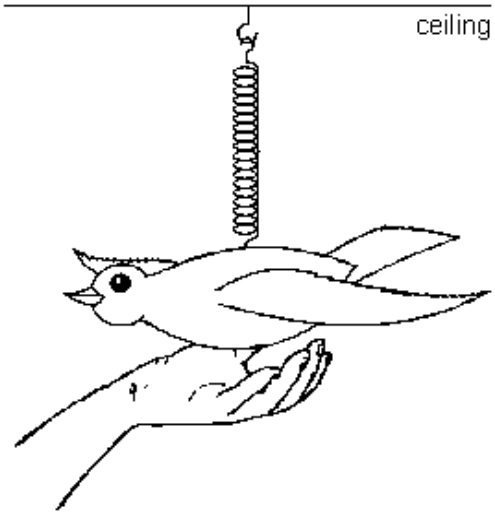
(b) Anne pulls the toy bird down. On the diagram below, draw an arrow to show the direction of Anne's force on the bird.
Label the arrow F.



1 mark

(c) Anne lets go of the bird.

(i) On the diagram below, draw an arrow to show which way the bird will start to move. Label this arrow M.



1 mark

(ii) What makes the bird move in this direction?

.....

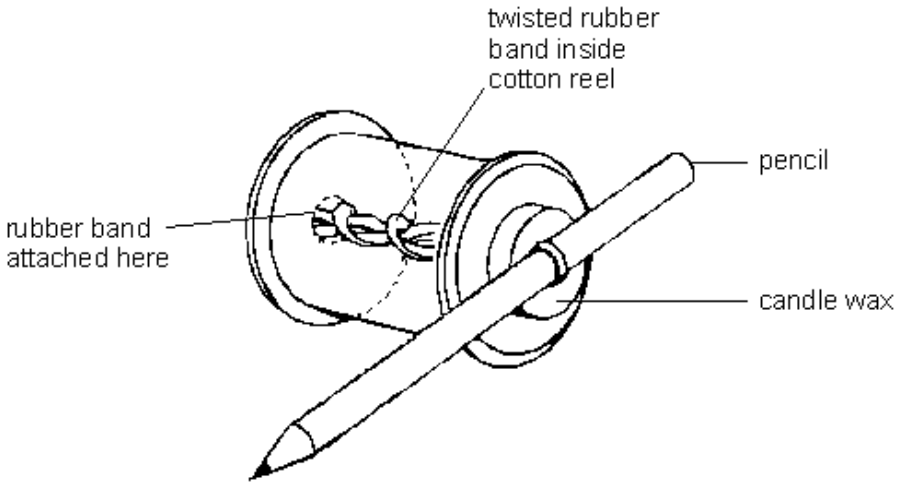
1 mark

(d) The bird bounces up and down for several minutes, and then stops. Why does the bird stop moving?
Tick the correct box.

Air resistance slows it down.	☐
Gravity gets less.	☐
The bird gets heavier.	☐
The spring stretches.	☐

1 mark
Maximum 5 marks

Q21. Sarah made a cotton reel vehicle like the one shown in the diagram. The pencil is wound round and round so that it winds up the rubber band.
A piece of candle wax next to the cotton reel lets the rubber band slowly unwind.



(a) As the rubber band unwinds, the candle wax slips and the cotton reel turns.
Name the force which acts between the cotton reel and the candle wax.

.....

1 mark

(b) Sarah tested the vehicle by letting it run along a horizontal table top.

(i) She noticed that the vehicle gradually slowed down.
Give the reason for this.

.....

.....

1 mark

(ii) Describe what Sarah could do to make the rubber band move this vehicle faster.

.....

.....

1 mark
Maximum 3 marks

Q22. Tom tries on four types of footwear in a sports shop.

ski boot

trainer

ice skate

walking boot

(a) (i) When Tom tries on the footwear, which one sinks into the carpet the most?

.....

1 mark

(ii) When Tom tries on the footwear, what is the same for each type of footwear? Tick the correct box.

the area of the footwear	☐
Tom's weight on the footwear	☐
the material of the footwear	☐
the weight of the footwear	☐

1 mark

(b) The drawing below shows a snowshoe.

How do snowshoes help people to walk in deep snow?

.....

.....

1 mark

(c) Choose the correct word from the list to complete the sentence below.

air resistance **friction** **gravity** **magnetism**

When Tom is ice skating the force of .....

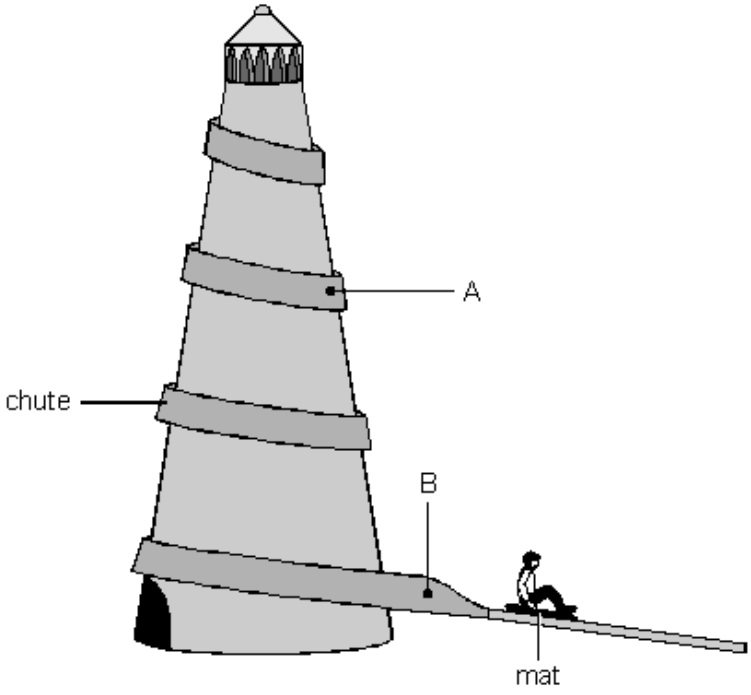
between the skate and the ice is less than when he is walking on a carpet.

1 mark

Maximum 4 marks

##

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

Q24. (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

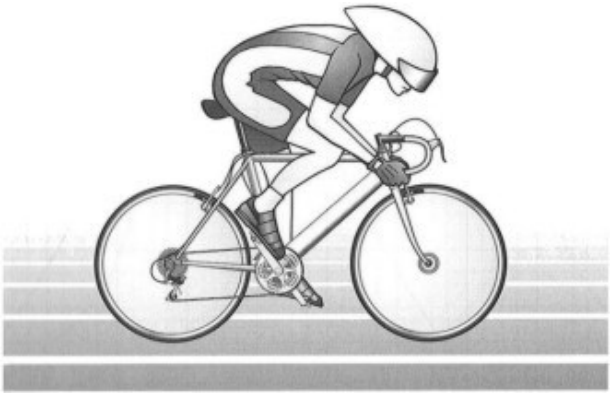
(ii) Compare the forward force on the bike with the backward force on the bike when Megan was travelling at a constant speed.

.....

.....

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

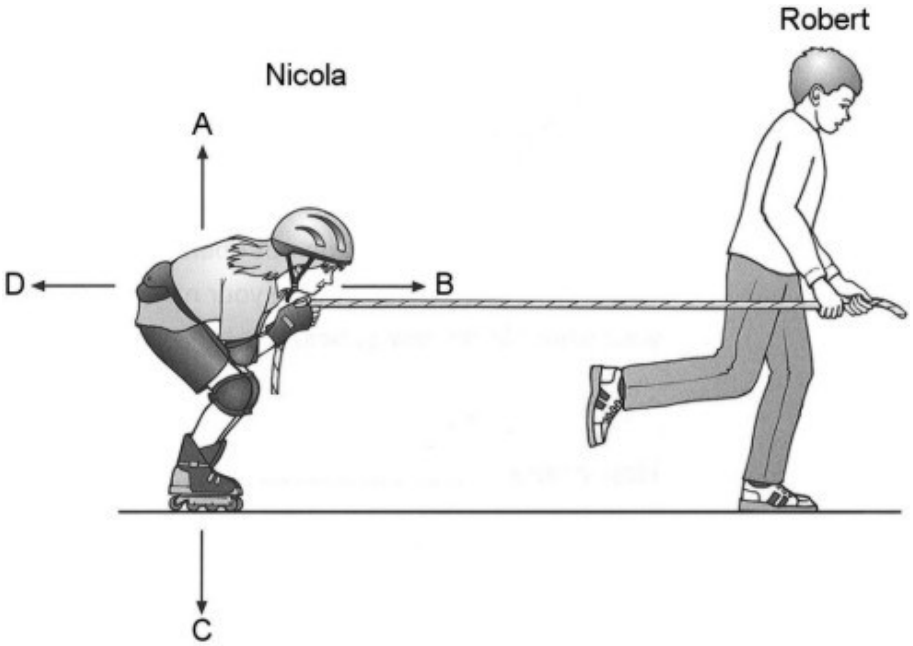
Explain your answer.

.....

.....

1 mark
maximum 4 marks

Q25. (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

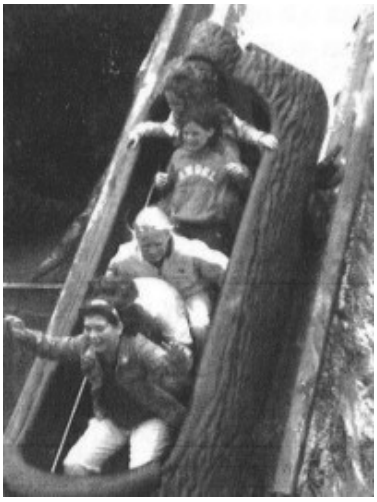
(c) Nicola lets go of the rope and she slows down. Gravity still acts on Nicola.

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

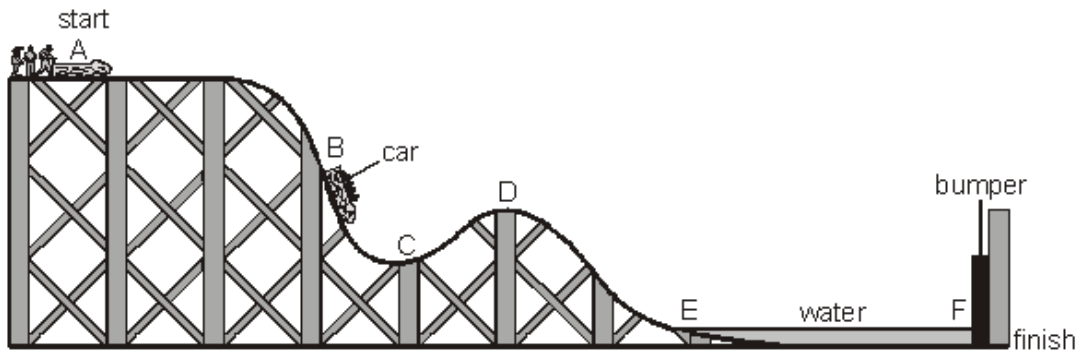
.....

1 mark
maximum 4 marks

Q26. The photograph shows some pupils in a log car on a theme-park ride.



The drawing below shows the ride.
The letters A, B, C, D, E and F show different points along the track.



The car starts from A and travels to F, where it stops by hitting a bumper.
At E the car enters a trench filled with water.

(a) (i) At which **two** points does the car have **no** kinetic energy?
Give the **two** correct letters.

..... and .....

1 mark

(ii) At which point does the car have the **most** gravitational potential energy?
Give the correct letter.

.....

1 mark

(iii) At which point does the car have **some** kinetic energy and the **least** gravitational potential energy?
Give the correct letter.

.....

1 mark

(b) (i) The cars are **not** powered by a motor.
What force causes the cars to move along the track from B to C?

.....

1 mark

(ii) When a car splashes through the water at E, it slows down.
What force acts on the car to slow it down?

.....

1 mark

(c) Complete the sentence below by choosing from the following words.

chemical	gravitational potential	kinetic	light	sound	thermal

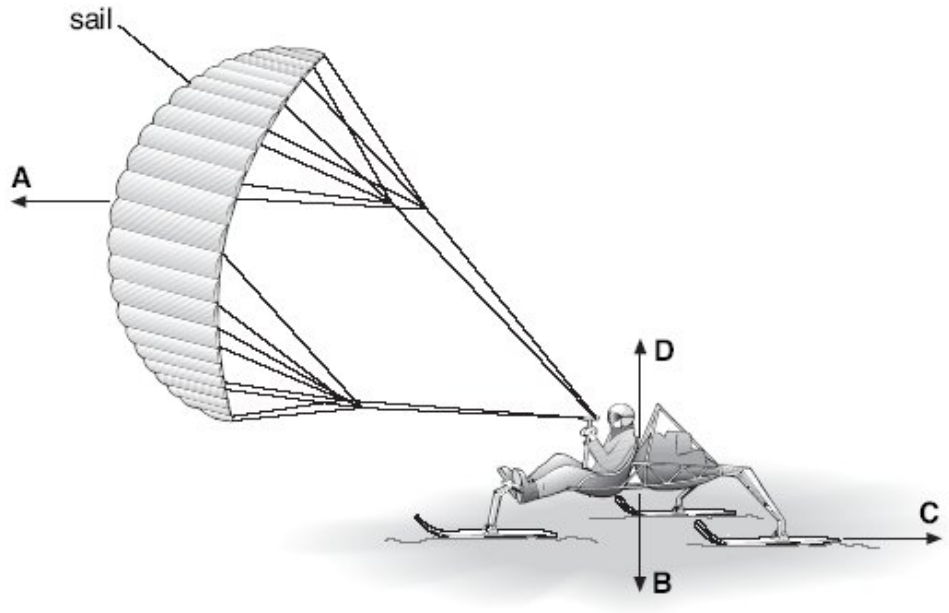
When the car hits the bumper at F, its ..... energy

is transferred into ..... energy and

..... energy.

3 marks
maximum 8 marks

Q27. 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
the weight of the buggy	A
the force pulling the buggy along	B
the friction between the skis and the snow	C
	D

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?

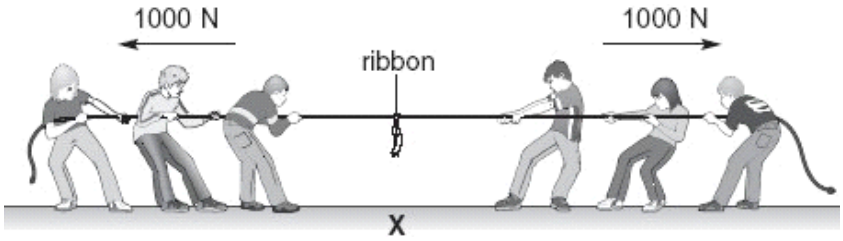
.....

.....

1 mark
maximum 7 marks

Q28. 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**

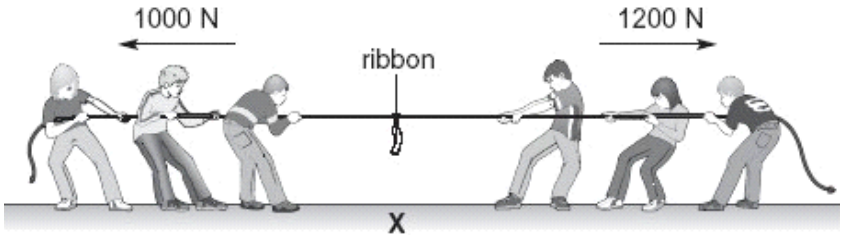
The ribbon stays above point X on the ground.
Give the reason for this.

.....

.....

1 mark

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

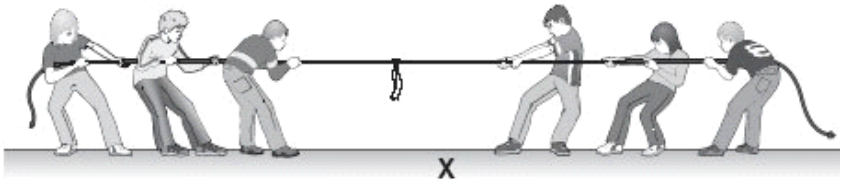


team A **team B**

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**

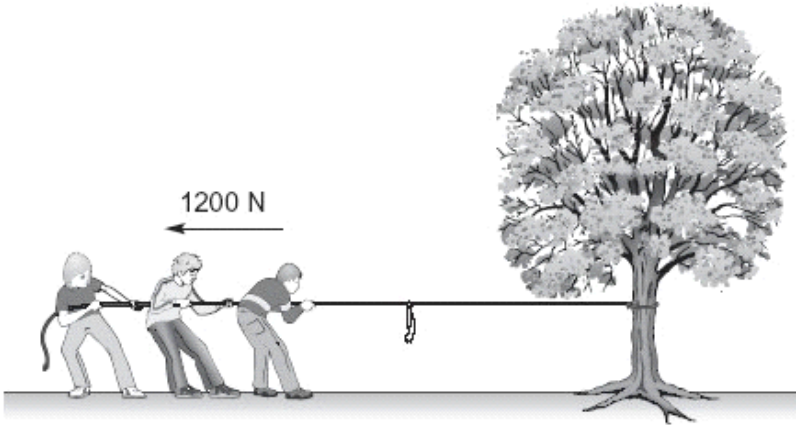
Why did the ribbon move towards the left?

.....

.....

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 ☐ less than 1200 N ☐ 1200 N ☐ more than 1200 N ☐

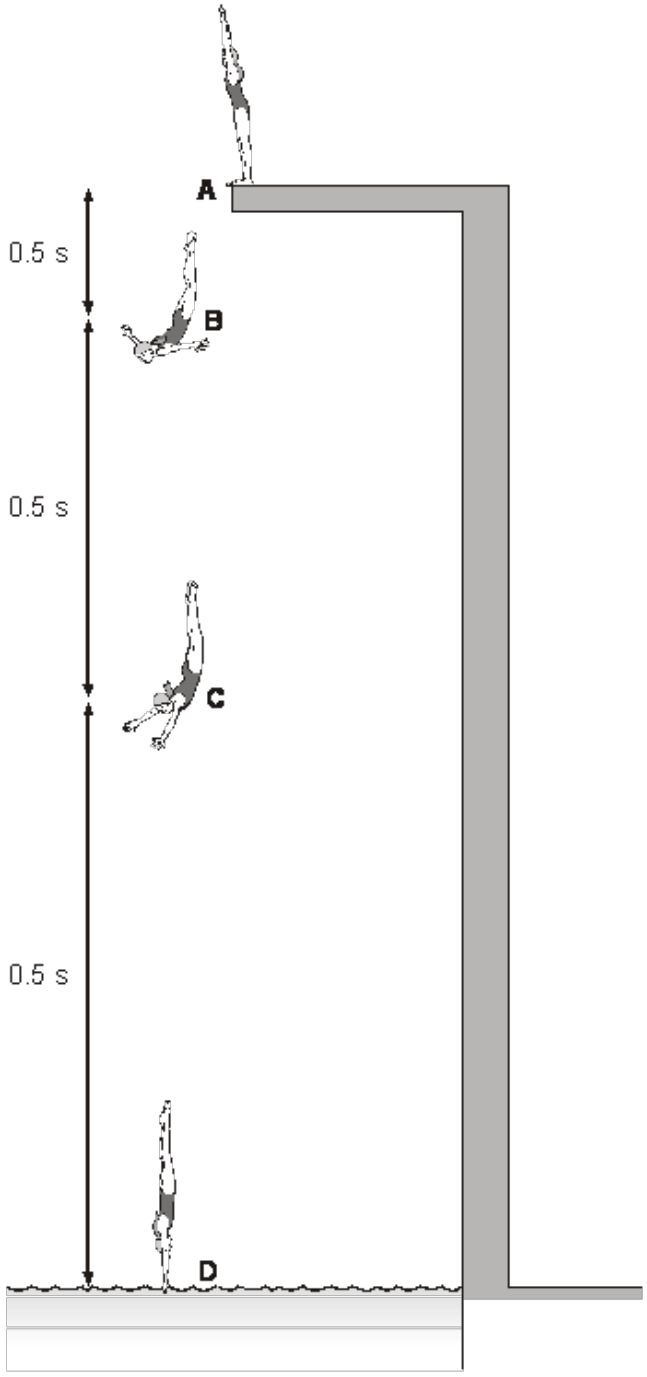
1 mark

(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

Q29. The drawings below show Caroline diving into a swimming pool.
As she falls, gravitational potential energy is changed into kinetic energy.



(a) Why does Caroline have **no** kinetic energy at A?

.....

.....

1 mark

(b) The table shows Caroline's gravitational potential energy and kinetic energy at four stages of the dive.

stage of the dive	total energy (kJ)	gravitational potential energy (kJ)	Kinetic energy (kJ)
A	8	8	0
B	8	7	1
C	8	4	4
D	8	0	

(i) Write the missing kinetic energy value for stage D in the table.

(ii) As Caroline falls there is **no** loss of energy to the air.
How do the energy values for stages A, B, C and D show this?

.....

.....

2 marks

(c) (i) Give the name of the force that causes Caroline to speed up as she falls.

.....

(ii) Caroline takes 0.5 s to fall from A to B **and** from B to C **and** from C to D.

How can you tell from the drawings that she is speeding up as she falls?

.....

.....

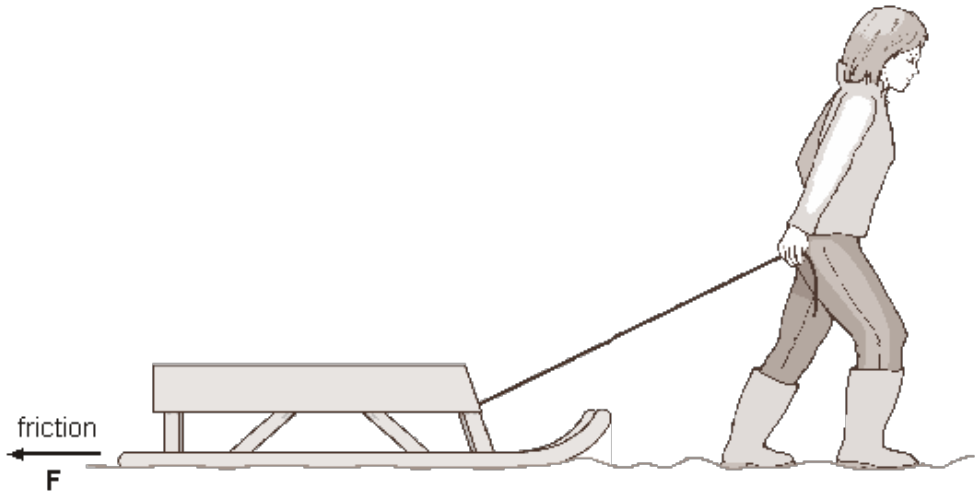
2 marks

(d) When Caroline enters the water she slows down.
Give the name of the force that slows her down.

.....

1 mark
maximum 6 marks

Q30. 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

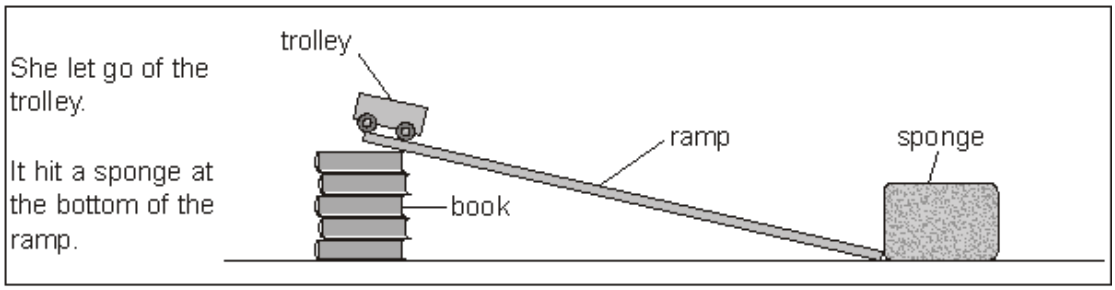
(b) Force **F** is the friction between the sledge and the snow.
Sally then pulled the sledge over a concrete path.

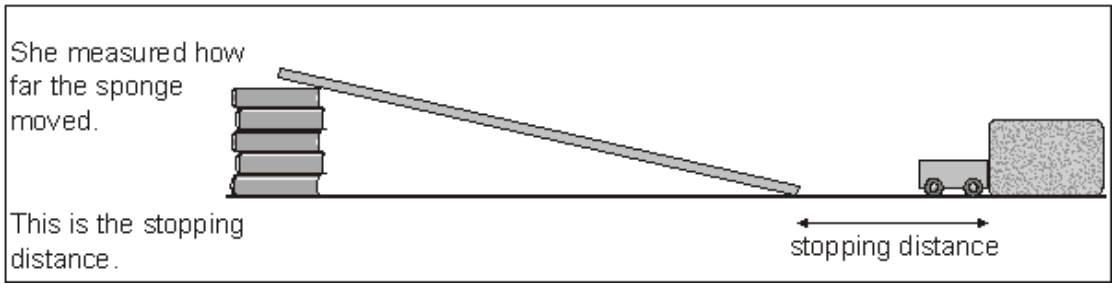
Friction is less on snow than on concrete.
Give the reason for this.

.....

1 mark
maximum 3 marks

Q31. Yasmin investigated the stopping distance of a trolley.





(a) Yasmin did the investigation five times.
She changed the steepness of the ramp each time.

(i) How could she make this ramp steeper?

.....

.....

1 mark

(ii) Yasmin's results are shown in the table.

steepness of ramp	stopping distance (cm)
A	10
B	16
C	16
D	28
E	34

She predicted, 'The steeper the ramp, the greater the stopping distance'.
If Yasmin was correct, which ramp was the steepest? Write the letter.

.....

1 mark

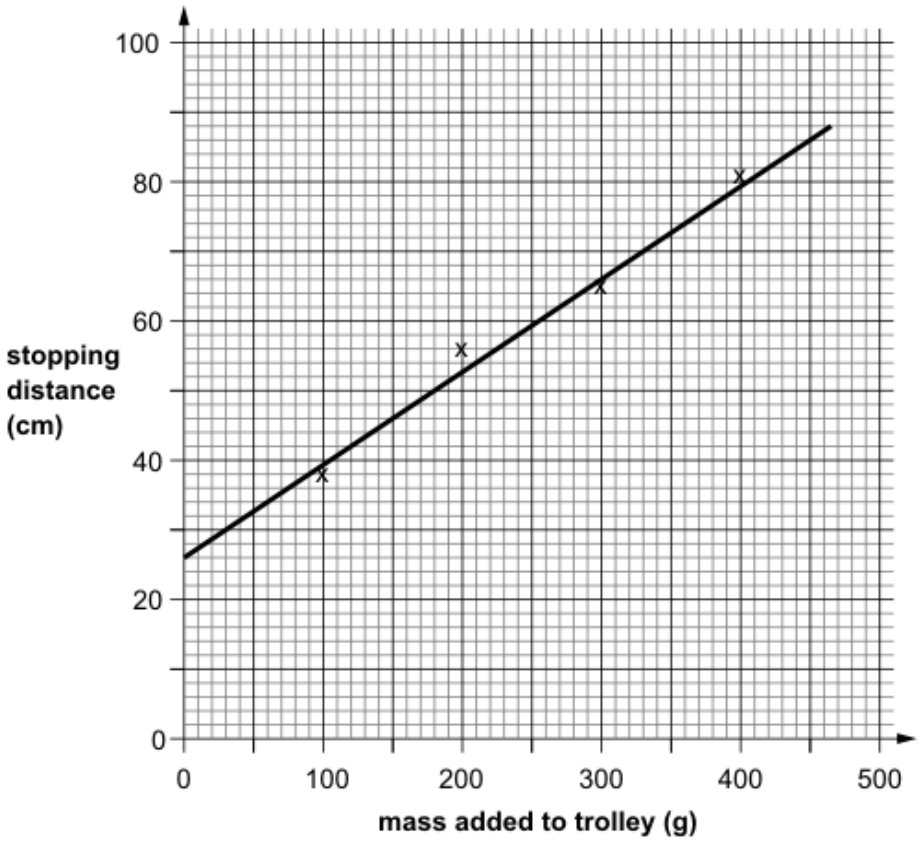
(iii) Yasmin looked at her results and decided she should repeat her investigation.
Look at Yasmin's results.

Suggest why she decided to repeat her investigation.

.....

1 mark

(b) Yasmin then investigated the stopping distance of a trolley with different masses on it.
The graph shows her results.



(i) What would be the stopping distance if 0 g were on the trolley?

..... cm

1 mark

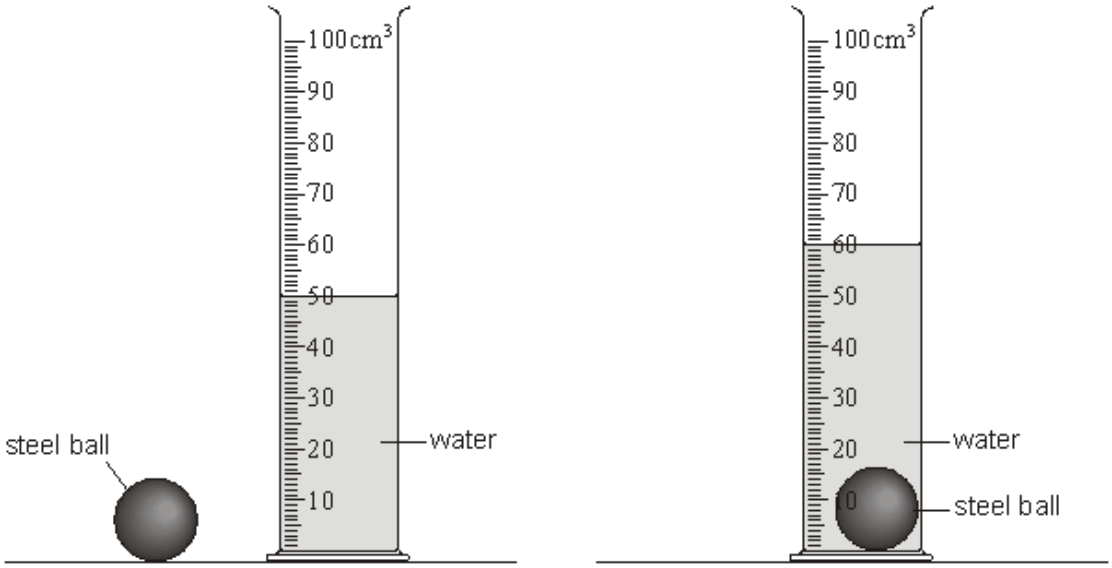
(ii) Complete the sentence with **decreases**, **increases** or **stays the same**.

As the mass added to the trolley increases,

the stopping distance ..... .

1 mark
maximum 5 marks

Q32. (a) Gary poured 50 cm^3 of water into a measuring cylinder.
He then put a steel ball into the measuring cylinder.



(i) What is the new reading on the measuring cylinder?

..... cm^3

1 mark

(ii) What is the volume of the steel ball?

..... cm^3

1 mark

(b) The table below shows the mass and volume of four objects.

object	mass (g)	volume (cm^3)
aluminium figure	230	85
lead weight	800	70
steel block	200	25
wood puzzle	400	500

(i) Which object is the heaviest? .....

1 mark

(ii) Which object takes up the most space? .....

1 mark

(c) The frame of a bike is made of aluminium.

(i) Give **one** reason why aluminium is a suitable material for the frame.

.....

.....

1 mark

(ii) A force between the tyres and the road stops the bike skidding.

What is the name of this force?

.....

1 mark

maximum 6 marks

Q33. Tom is doing a bungee jump from a bridge.

He is attached to one end of an elastic rope.
The other end of the rope is attached to the bridge.
Tom jumps from the bridge.

(a) (i) What force makes Tom fall towards the ground?

.....

1 mark

(ii) Tom does **not** hit the river below the bridge.
What makes Tom stop falling before he hits the river?

.....

1 mark

(b) The next person to do a bungee jump is Jill.

Jill weighs less than Tom.
Complete the sentence below using words from the box.

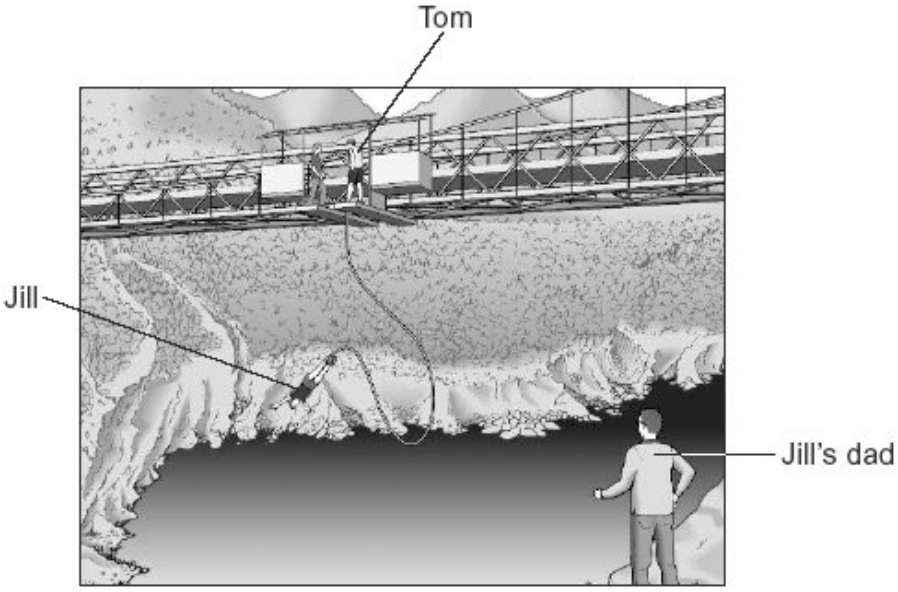
more than	**less than**	**the same as**

When Jill jumps, the rope will stretch .....

it did when Tom jumped.

1 mark

(c) Jill's dad watches her doing the bungee jump.
He is standing a long way from the bridge.
Jill shouts 'bungee' at the same time as she jumps off the bridge.
Jill's dad sees her jump before he hears her shout.



2

(i) Why does Jill's dad **see** her jump before he **hears** her shout?

.....

.....

1 mark

(ii) Tom is near Jill when she shouts. Her dad is far away.

Complete the sentence to describe how the shout will sound to Tom compared with Jill's dad. Use one word from the box.

louder	**higher**	**lower**	**quieter**

The shout will sound ..... to Tom.

1 mark

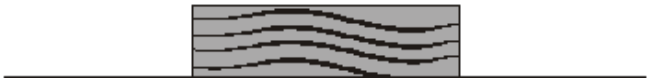
(iii) What part of Tom's ear vibrates when he hears Jill shout?

.....

1 mark

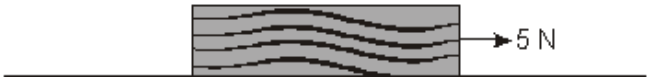
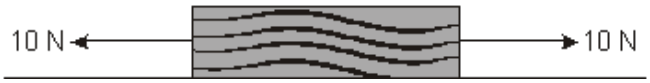
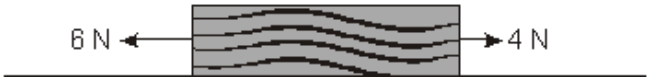
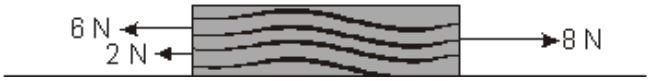
maximum 6 marks

Q34. (a) Tasha puts a small block of wood on a smooth surface.



She puts different forces on the block.
The diagrams below show the size and direction of these forces.

Will each block move to the **left**, to the **right** or **stay still**?
Tick the correct box in each row.

forces on block	moves to the left ←	moves to the right →	stays still
(i) 	☐	☐	☐
(ii) 	☐	☐	☐
(iii) 	☐	☐	☐
(iv) 	☐	☐	☐

1 mark

1 mark

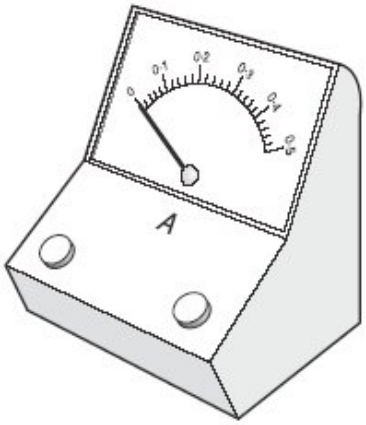
1 mark

1 mark

(b) (i) Which piece of equipment should Tasha use to measure the forces on the block?

Tick the correct box.

☐



☐

☐

☐

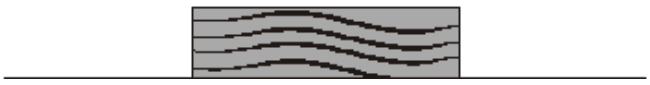
1 mark

(ii) Give the name of the equipment used to measure force.

.....

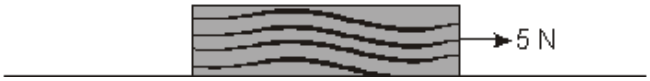
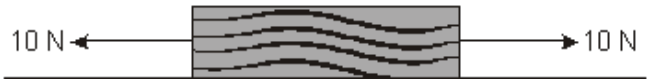
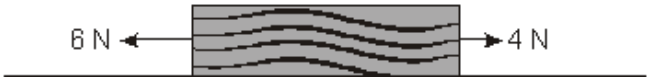
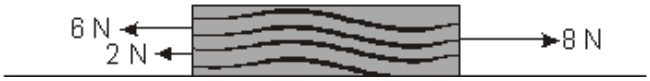
1 mark
maximum 6 marks

Q35. (a) Tasha puts a small block of wood on a smooth surface.



She puts different forces on the block.
The diagrams below show the size and direction of these forces.

Will each block move to the **left**, to the **right** or **stay still**?
Tick the correct box in each row.

forces on block	moves to the left ←	moves to the right →	stays still
(i) 	☐	☐	☐
(ii) 	☐	☐	☐
(iii) 	☐	☐	☐
(iv) 	☐	☐	☐

1 mark

1 mark

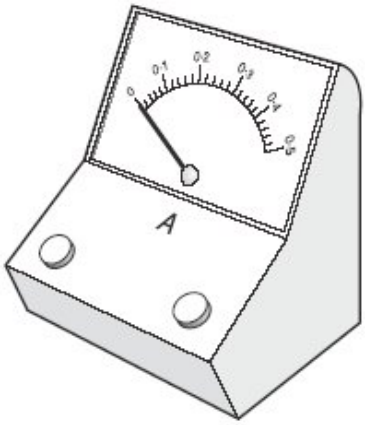
1 mark

1 mark

(b) (i) Which piece of equipment should Tasha use to measure the forces on the block?

Tick the correct box.

☐



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☐

☐

1 mark

(ii) Give the name of the equipment used to measure force.

.....

1 mark

maximum 6 marks