



## 7.3.8 Balanced forces

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43 minutes



60 marks

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**Q1.** (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.

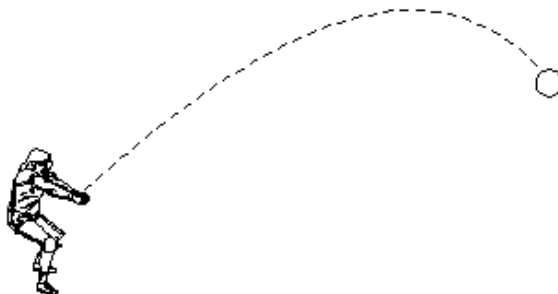
☐

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.



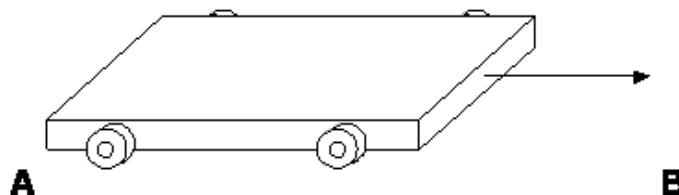
How can you tell from the **path** of the ball that there is a force acting on the ball?

.....

.....

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.

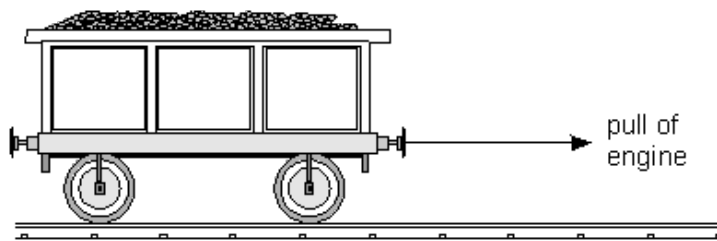
☐

It has no effect.

☐

1 mark  
Maximum 5 marks

Q2.



- (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

☐

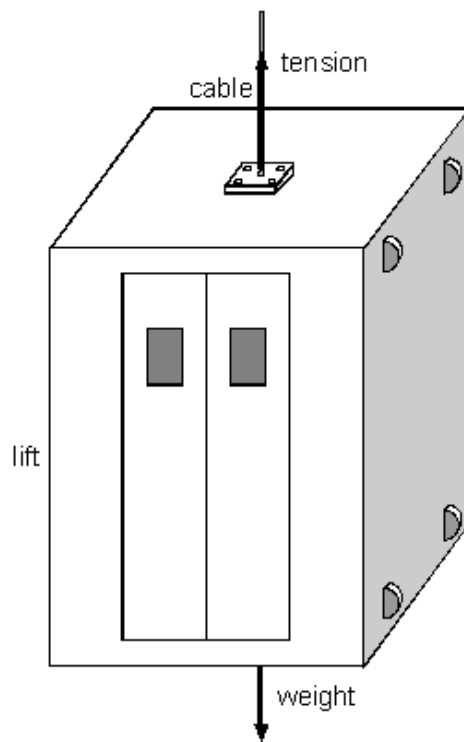
1 mark

Maximum 5 marks

##

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?

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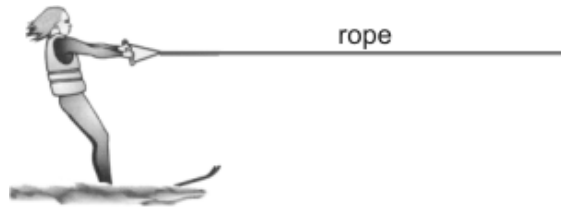
1 mark

- (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

**Q4.** 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

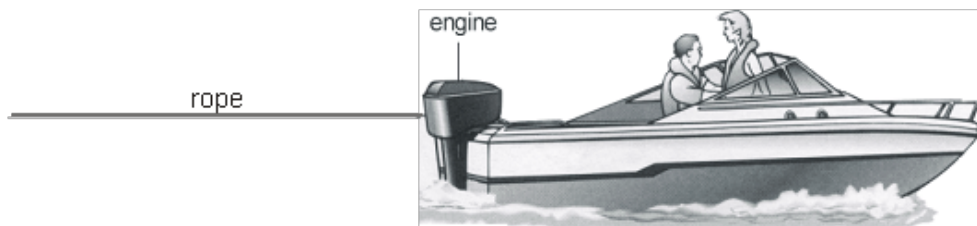
- (b) Give the names of **two** other forces which act on Amy or on her skis.

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

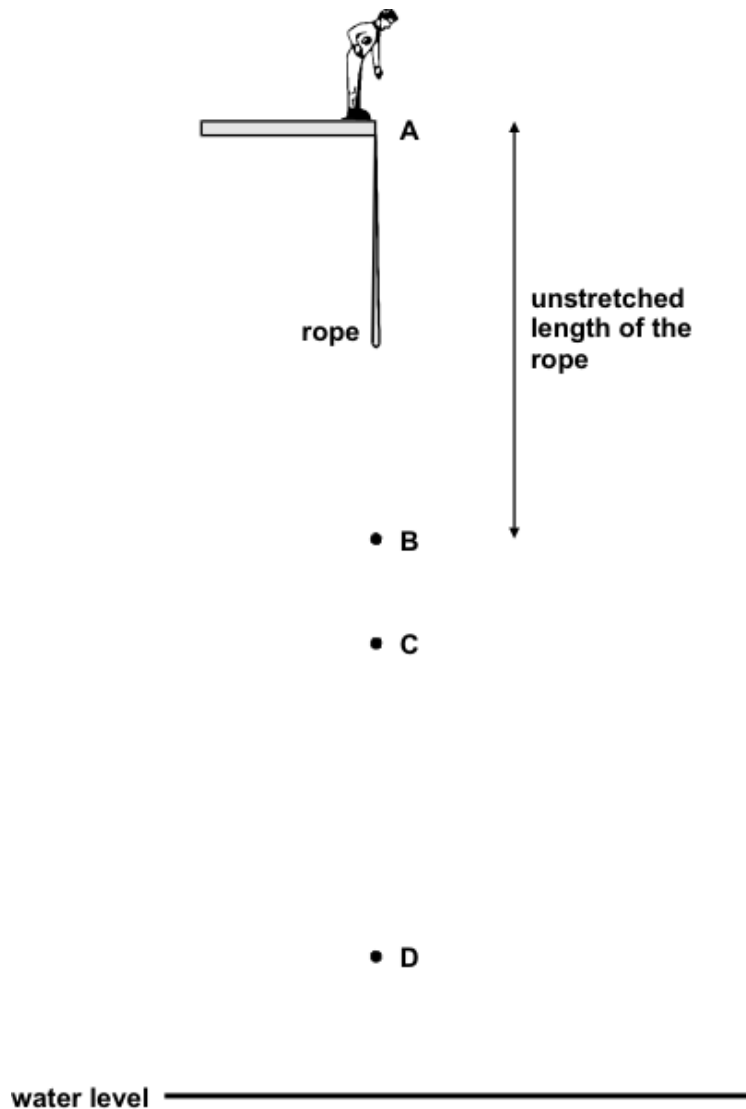
- (d) The force of the engine on the boat is increased.  
What effect will this have on the speed of the boat?

.....

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.

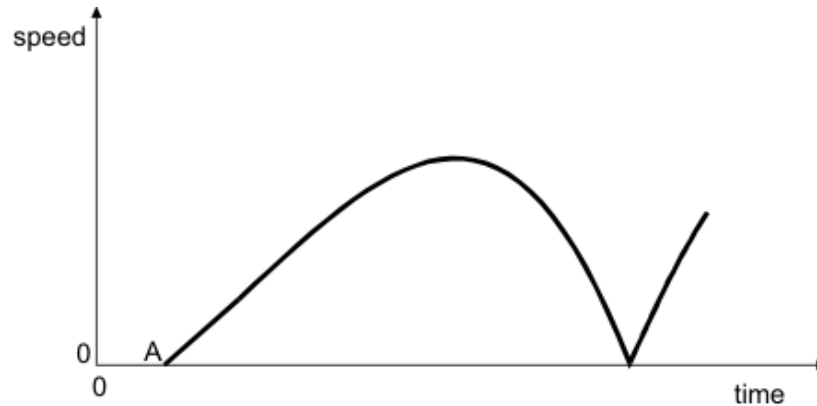
- (a) (i) At which point, A, B, C or D, is the man when the tension in the rope is greater than his weight? .....

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.

.....

.....

.....

.....

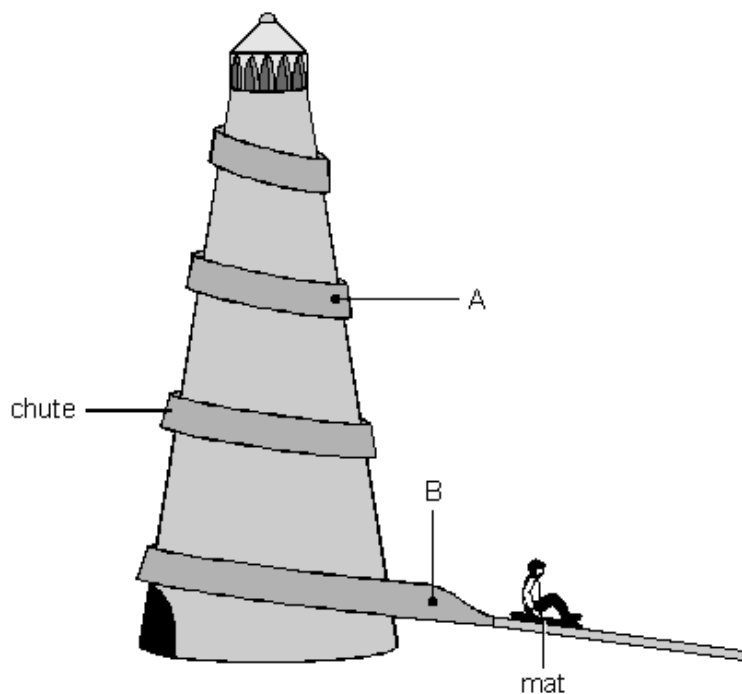
2 marks

Maximum 7 marks



##

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.

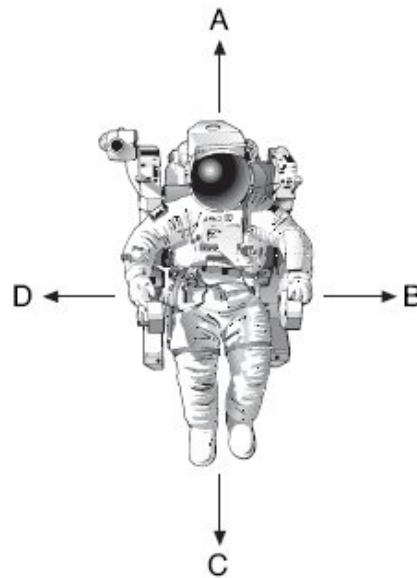
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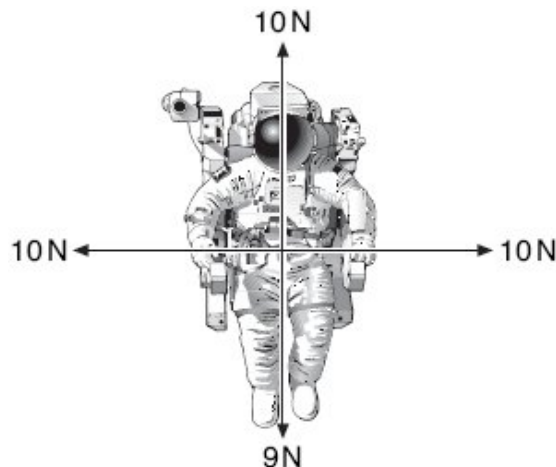
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2 marks  
Maximum 6 marks

- Q7.** The drawing below shows an astronaut in space.  
He has four small jets attached to his space suit.  
These jets produce forces on the **astronaut** in the directions A, B, C and D.



- (a) The drawing below shows the size and direction of four forces acting on the astronaut.



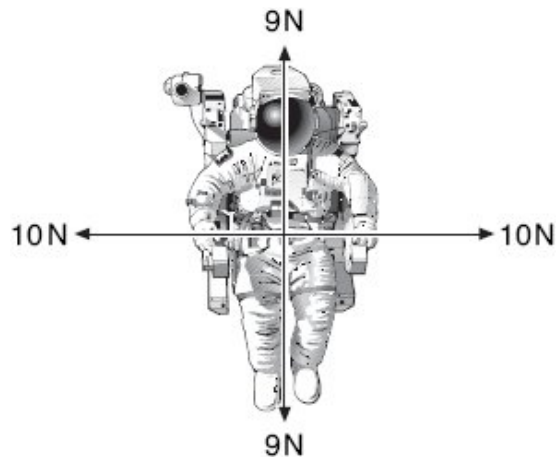
In which direction, A, B, C or D, will the astronaut move?

Give the letter.

.....

1 mark

- (b) The drawing below shows the size and direction of four different forces acting on the astronaut.



What will happen to the astronaut when the jets produce these four forces?

.....

1 mark

Explain your answer.

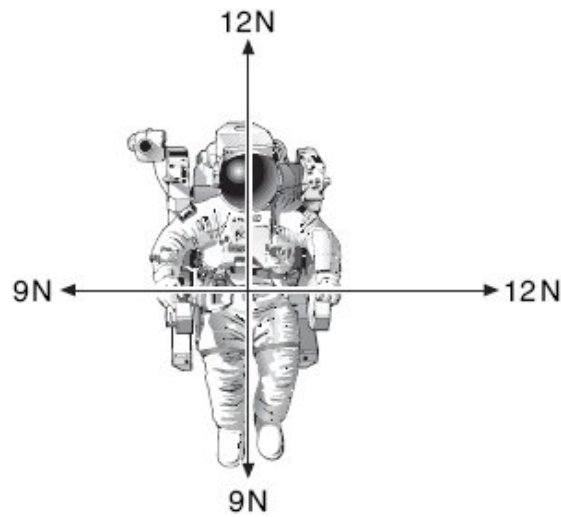
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1 mark

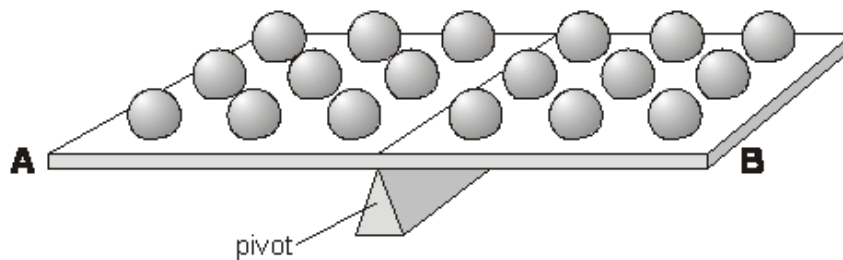
- (c) The drawing below shows the size and direction of four different forces acting on the astronaut.

Draw an arrow on the diagram below to show the direction in which he will move.

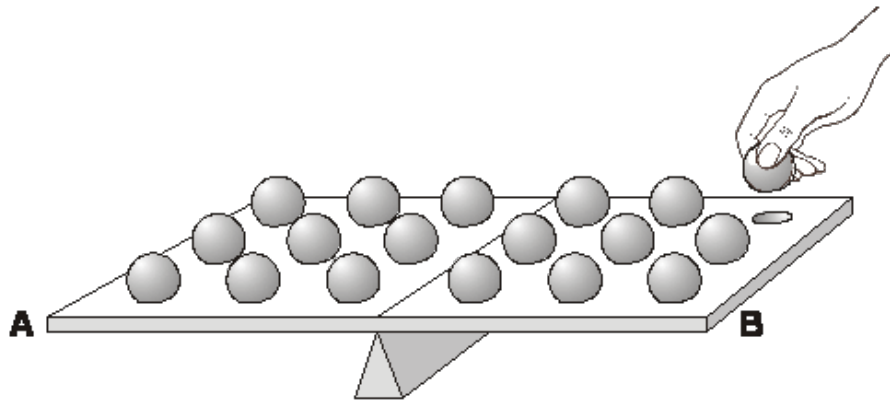


1 mark  
maximum 4 marks

- Q8.** Fran has a balancing game.  
On each side of the pivot there are nine steel balls. The tray is balanced.



- (a) Fran removes one of the steel balls as shown below.



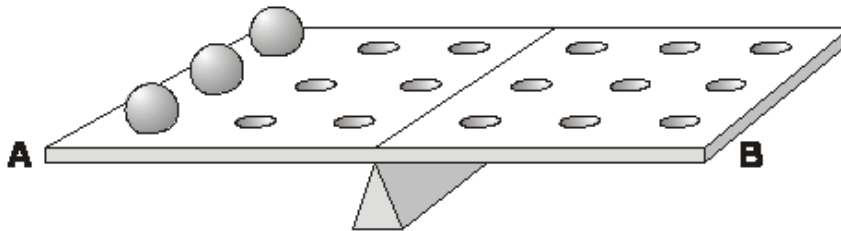
What will happen to end A?

.....

1 mark

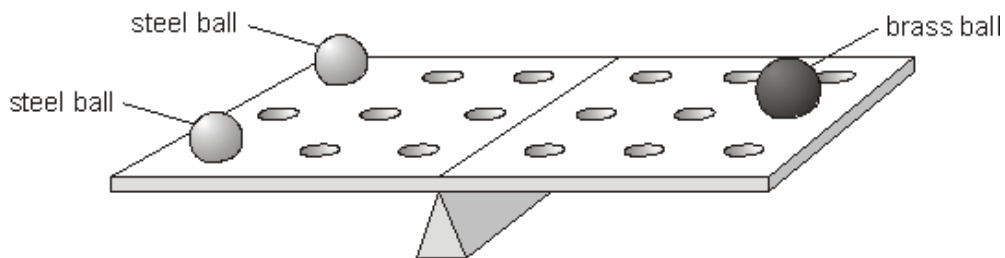
- (b) There are three balls on side A as shown below.

Draw three other balls in the correct positions to balance the tray.



1 mark

- (c) Fran puts two steel balls on one side and one brass ball on the other side. The tray is balanced.



The mass of each steel ball is 50 g.

What is the mass of the brass ball

..... g

1 mark

- (d) The table below gives information about the brass and steel balls.

	Is it attracted to a magnet?	elements in the ball
brass	no	copper and zinc
steel	yes	iron and carbon

- (i) Which element is **not** a metal?  
Tick the correct box.

carbon

☐

copper

☐

iron

☐

zinc

☐

1 mark

- (ii) Look at the elements in the brass ball and the steel ball.

Why is steel attracted to a magnet but brass is **not**?

.....

1 mark  
maximum 5 marks

- Q9.** 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

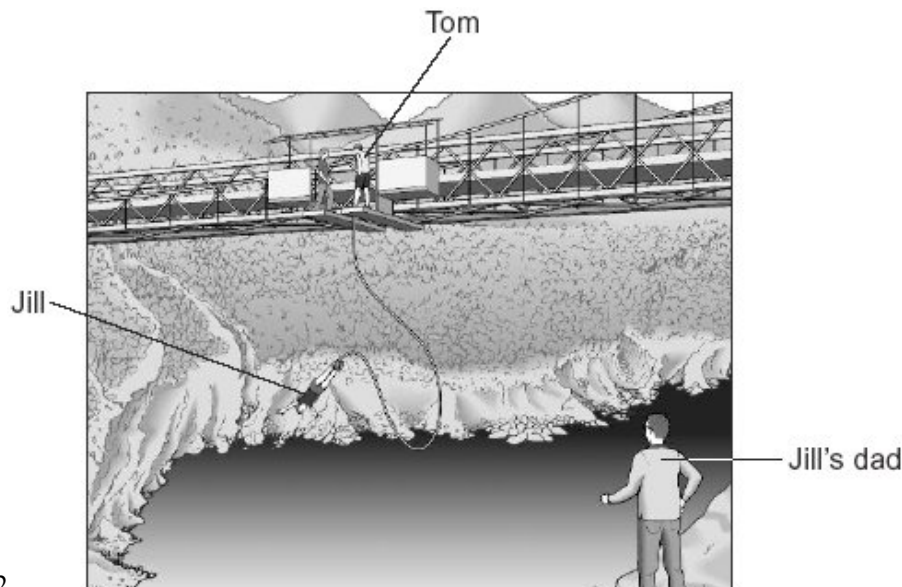
the same as

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.



- (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.

<b>louder</b>	<b>higher</b>	<b>lower</b>	<b>quieter</b>
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The shout will sound ..... to Tom.

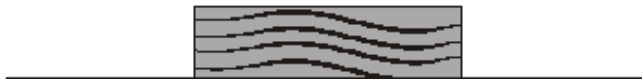
1 mark

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

.....

1 mark  
maximum 6 marks

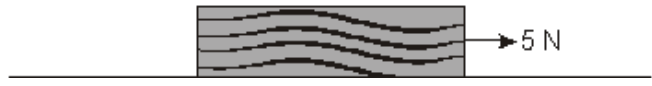
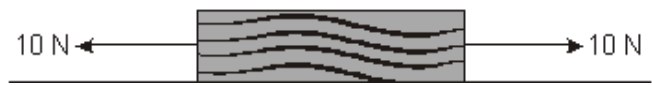
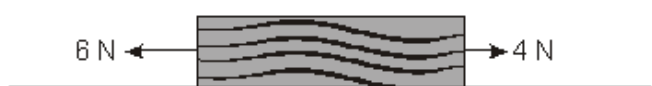

- Q10.** (a) Tasha puts a small block of wood on a smooth surface.





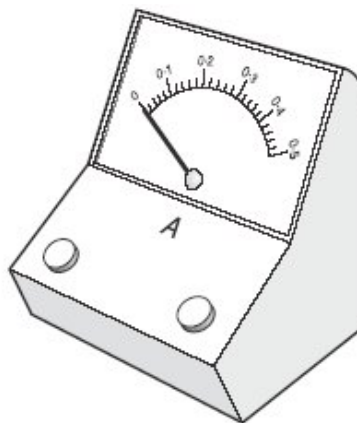
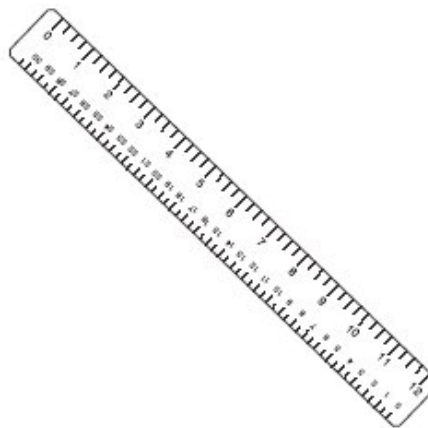
She puts different forces on the block.  
The diagrams below show the size and direction of these forces.

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)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 mark
(ii)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 mark
(iii)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 mark
(iv)		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1 mark

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

Tick the correct box.

☐☐☐☐

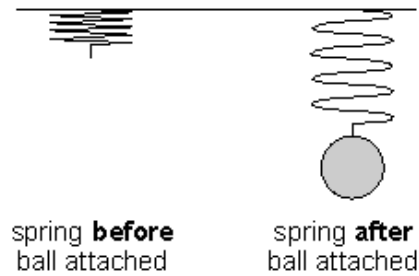
1 mark

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

.....

1 mark  
maximum 6 marks

- Q11.** (a) John attaches a ball to a spring. The diagram below shows what happens.



- (i) Which arrow shows the direction of the **force of the ball on the spring**?  
Tick the correct box.



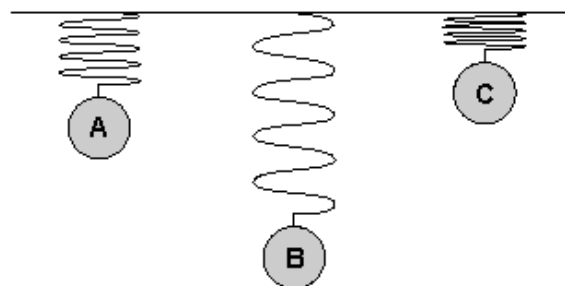
1 mark

- (ii) Which arrow shows the direction of the **force of the spring on the ball**?  
Tick the correct box.



1 mark

- (b) The diagram below shows three metal balls attached to **identical** springs.



Which ball is the heaviest?  
Write the letter.

.....

1 mark

Explain your answer.

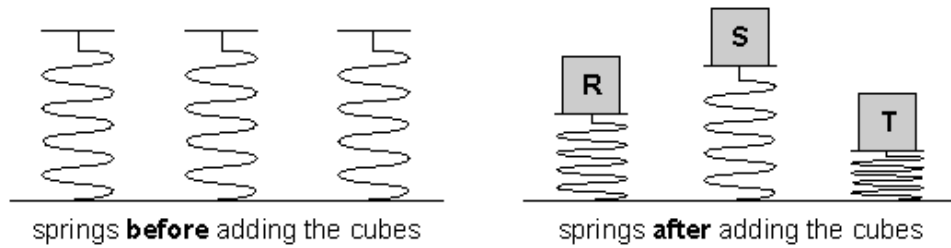
.....

.....

1 mark

- (c) John has another three **identical** springs.  
He puts a cube on each spring. Each cube has a different mass.

The diagrams below show the springs before and after John added the cubes.



Which cube is the heaviest?  
Write the letter.

.....

1 mark

Explain your answer.

.....

.....

1 mark  
maximum 6 marks

