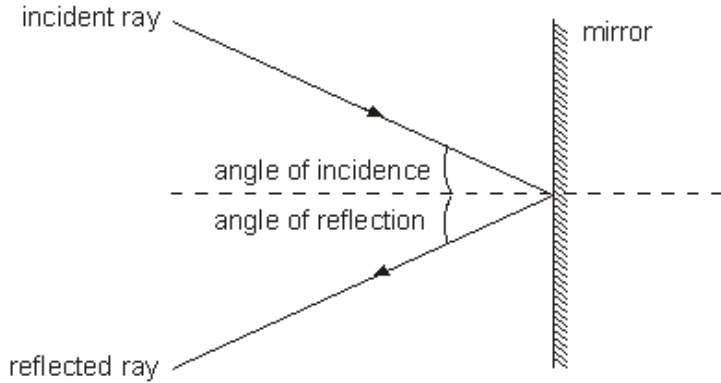


**Q1.** James shone a ray of light at a mirror as shown below.



**diagram 1**

He measured the angle of **reflection** for different angles of incidence. His results are shown below.

angle of <b>incidence</b> ( $^{\circ}$ )	30	40	50	60	70
angle of <b>reflection</b> ( $^{\circ}$ )	30	40	50	65	70

(a) Which angle of reflection was **not** measured accurately?

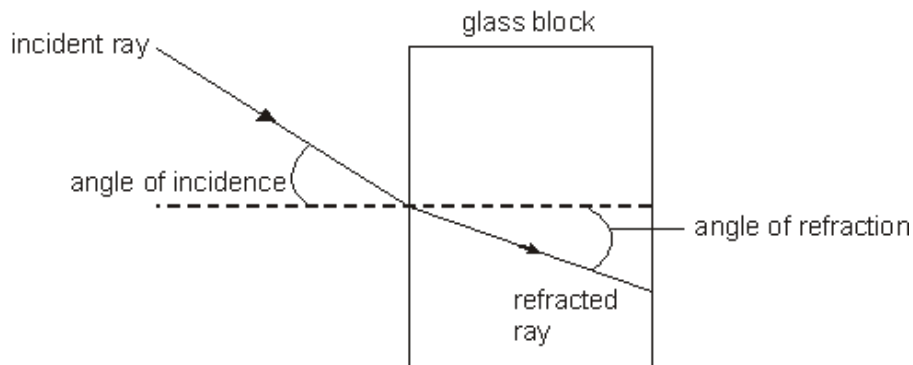
..... $^{\circ}$

How can you tell this from the table?

.....  
 .....

1 mark

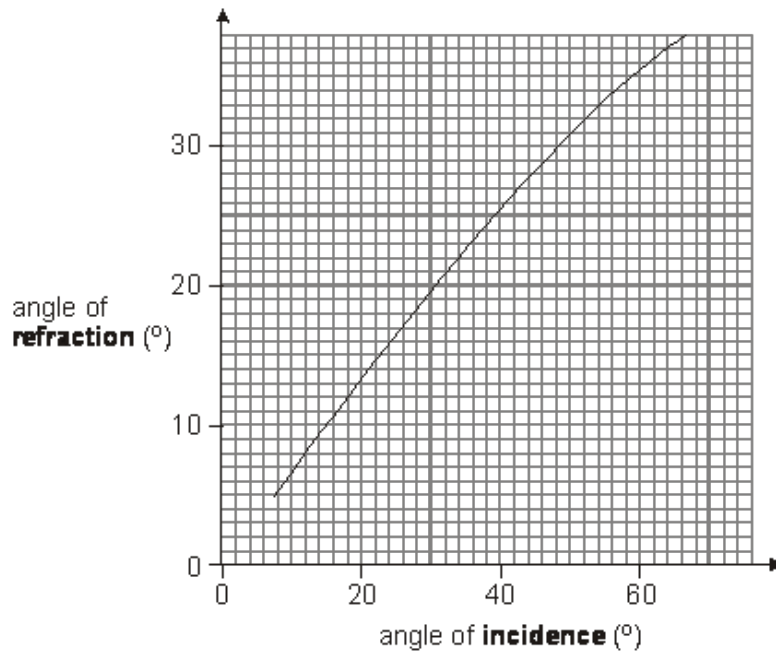
(b) James set up a different experiment as shown below.



**diagram 2**

He measured the angle of **refraction** for different angles of incidence.

His results are shown in the graph.



Use the graph to answer the questions below.

- (i) When the angle of **refraction** is  $20^\circ$ , what is the angle of **incidence**?

..... $^\circ$

1 mark

- (ii) What conclusion could James draw from his graph?  
Complete the sentence below.

When light passes from air into glass, the angle of **incidence** is

always ..... the angle of **refraction**.

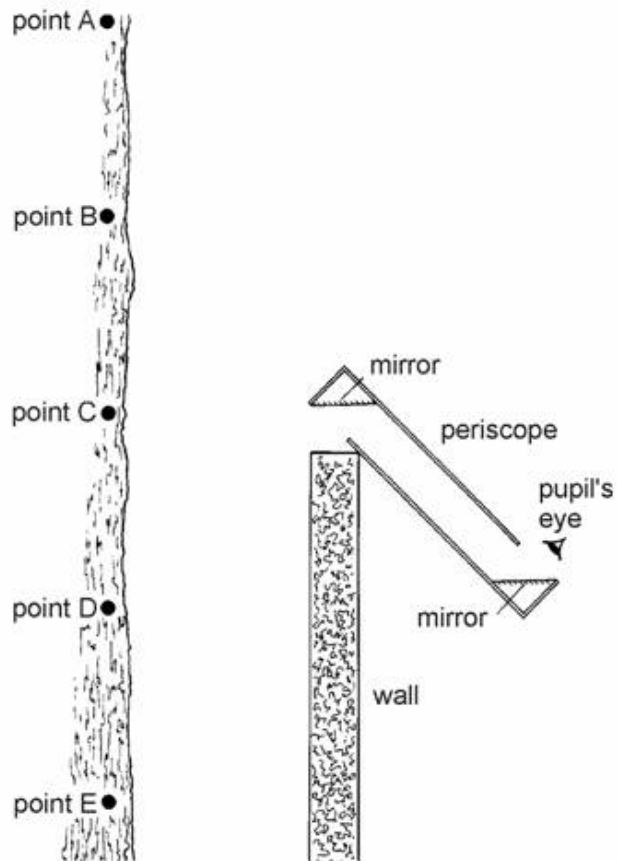
1 mark

- (c) **On diagram 2**, draw a line to continue the refracted ray as it leaves the glass block.

1 mark  
maximum 4 marks

##

A pupil is observing the behaviour of a woodpecker. He uses a periscope to look over a wall at a tree, and waits for the bird to land on the trunk.



The pupil can only watch one part of the tree trunk at a time.

- (a) Tick the box to show the point on the tree trunk which he can see using the periscope in the position shown.

point A	<input type="checkbox"/>
point B	<input type="checkbox"/>
point C	<input type="checkbox"/>
point D	<input type="checkbox"/>
point E	<input type="checkbox"/>

1 mark

- (b) Draw the path of the ray of light to show how the pupil sees this point. Use a ruler. Show the direction of the ray of light.

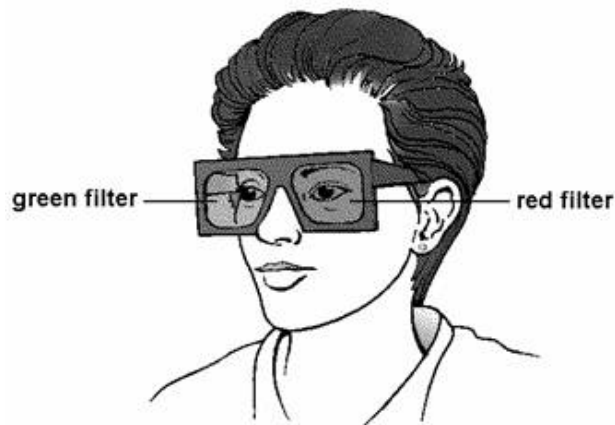
3 marks

(c) What should the pupil do to the periscope to watch point C?

.....  
.....

1 mark  
Maximum 5 marks

**Q3.** Sunita puts on a pair of special glasses as shown below. The glasses have coloured filters in them.



(a) Sunita looks at a lamp through the green filter. The lamp gives out white light, but appears to be green. Explain how this is possible.

.....  
.....  
.....

2 marks

(b) Sunita looks at a red lamp.

(i) What colour will the lamp appear to Sunita, if she looks at it through the red filter?

.....

Explain your answer.

.....  
.....

1 mark

(ii) What colour will the lamp appear to Sunita, if she looks at it through the green filter?

.....

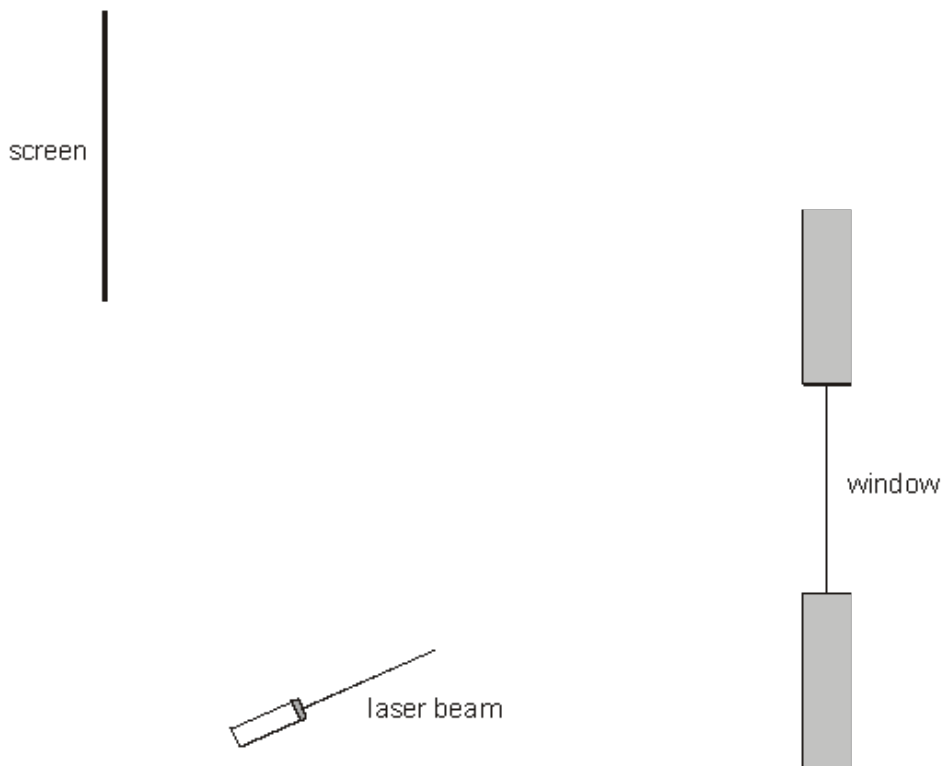
Explain your answer.

.....

.....

2 marks  
Maximum 5 marks

**Q4.** (a) A teacher shines a laser beam onto a classroom window. It reflects off the window and onto a screen.



On the diagram above, continue the laser beam to show its path as it reflects off the window and onto the screen. Use a ruler. Add arrows to show the direction of the laser beam.

2 marks

(b) (i) When a pupil plays her flute in the classroom the window vibrates. Give the reason for this.

.....

.....

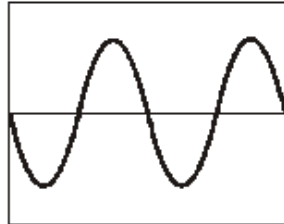
1 mark

- (ii) When the window vibrates, what happens to the laser beam that is reflected off the window?

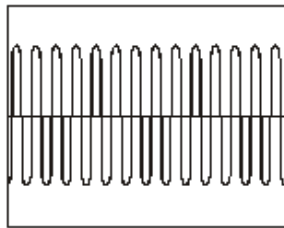
.....  
.....

1 mark

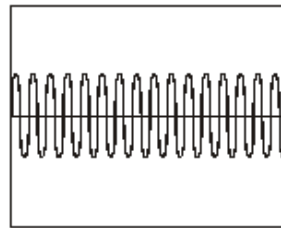
- (c) The teacher places a microphone near the pupil as she plays her flute. The diagram below shows the pattern on an oscilloscope screen.



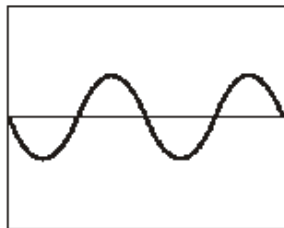
The pupil then plays her flute at a **higher pitch** and **more quietly**.  
Which diagram below shows the pattern that would be seen on the oscilloscope?  
Tick the correct box.



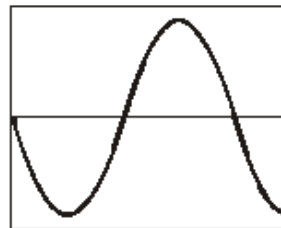
A



B



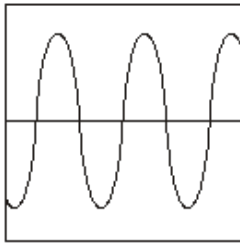
C



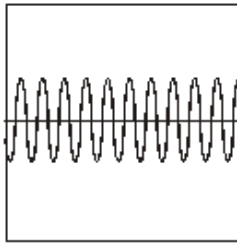
D

1 mark  
maximum 5 marks

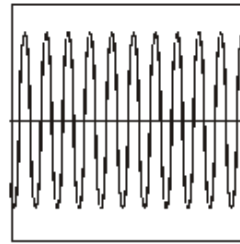
**Q5.** (a) The diagrams below show the patterns produced on an oscilloscope by three different sound waves.



**A**



**B**



**C**

(i) Which **two** waves have the same loudness?  
Write the letters.

..... and .....

How do the diagrams show this?

.....  
.....

1 mark

(ii) Which **two** waves have the same pitch?  
Write the letters.

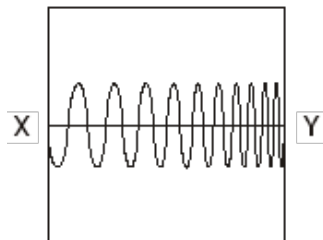
..... and .....

How do the diagrams show this?

.....  
.....

1 mark

(iii) Shuli is listening to a sound that produces the pattern below.



Describe how the sound that Shuli **hears** changes between X and Y.

.....

1 mark

- (b) The table below shows the maximum time a person can listen to music at different sound levels without damage to the ear.

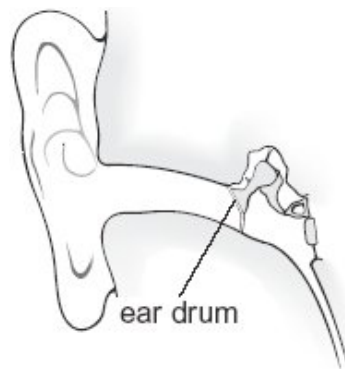
sound level (decibels)	maximum time (hours)
86	8
88	4
90	2
92	1
94	0.5

Estimate the maximum time a person could listen to a sound of 87 decibels.

..... hours

1 mark

- (c) The diagram below shows part of the human ear.



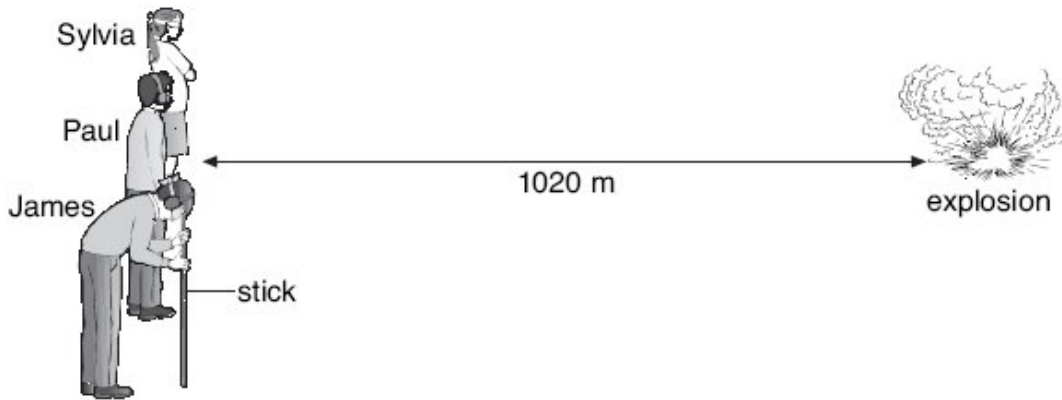
What happens to the ear drum as a sound gets louder?

.....  
.....

1 mark  
maximum 5 marks



**Q6.** Three pupils took part in an investigation into the speed of sound. All three pupils stood 1020 m from an explosion.



- Sylvia wore a blindfold.
- Paul wore ear defenders.
- James wore a blindfold **and** ear defenders. He rested his head on a wooden stick pushed into the ground so that he could feel vibrations.

The explosion produced sound and light at the same time. The table shows the speed of sound in two different materials.

material	Speed of sound (m/s)
air	340
soil	3200

(a) Use all the information above to help you answer parts (i) and (ii) below.

(i) In which order would the pupils notice the explosion?

first .....

second .....

third .....

1 mark

(ii) From the information given, calculate the time it would take for the sound to travel through the air to Sylvia.

.....

..... **s**

1 mark

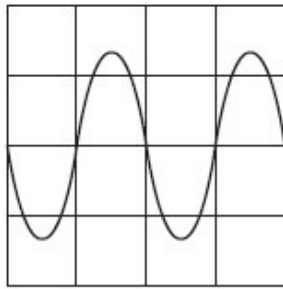
(b) Another pupil, Nasah, stood 2000 m away from the explosion.

- (i) The sound heard by Nasah was quieter than the sound heard by Sylvia.  
The further sound travels the quieter it becomes.  
Give the reason for this.

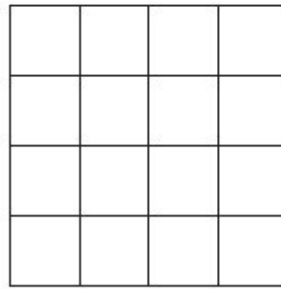
.....  
.....

1 mark

- (ii) The oscilloscope trace below represents the sound Sylvia heard.



Sylvia



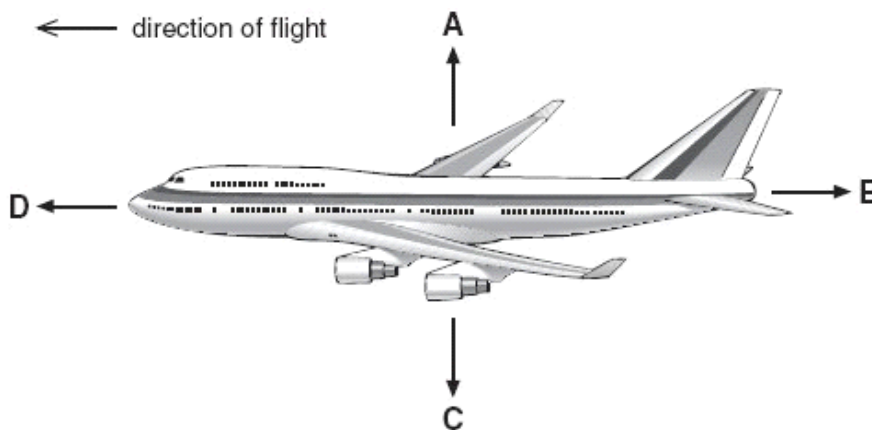
Nasah

The sound Nasah heard was quieter but the pitch was the same.

On the right-hand grid, draw the trace to show the pattern of the sound Nasah heard.

2 marks  
maximum 5 marks

**Q7.** 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.

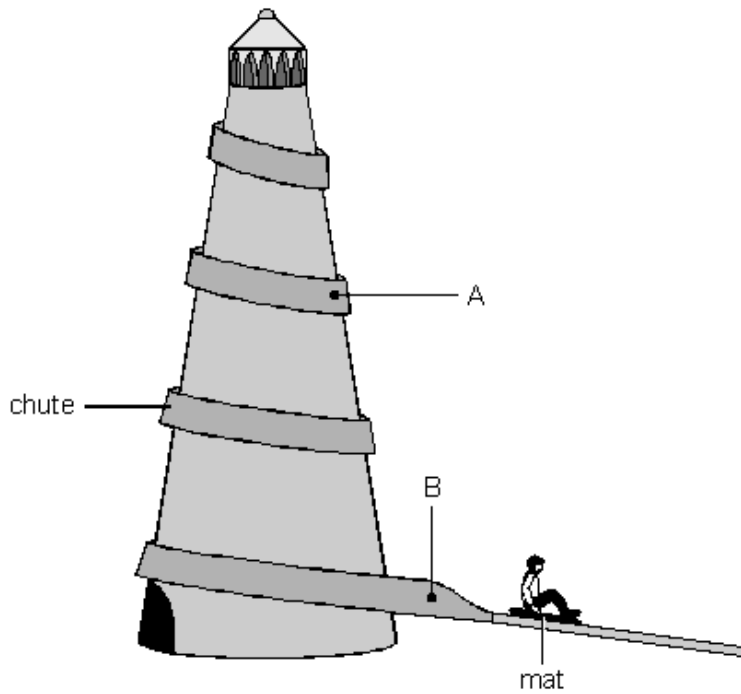
Force A is equal to force C.

Force A is greater than force C.

1 mark  
maximum 5 marks

##

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

**Q9.** Josh has a helium-filled balloon.



(a) He wants to calculate the speed of his balloon as it rises to the ceiling.

(i) What **two** measurements should he take to calculate the average speed of his balloon?

1 .....

2 .....

1 mark

(ii) How can he use these measurements to calculate the speed of his balloon?

.....

.....

1 mark

- (b) Josh attached different masses to his balloon. For each mass, he calculated the speed of rise of the balloon. His results are shown below.

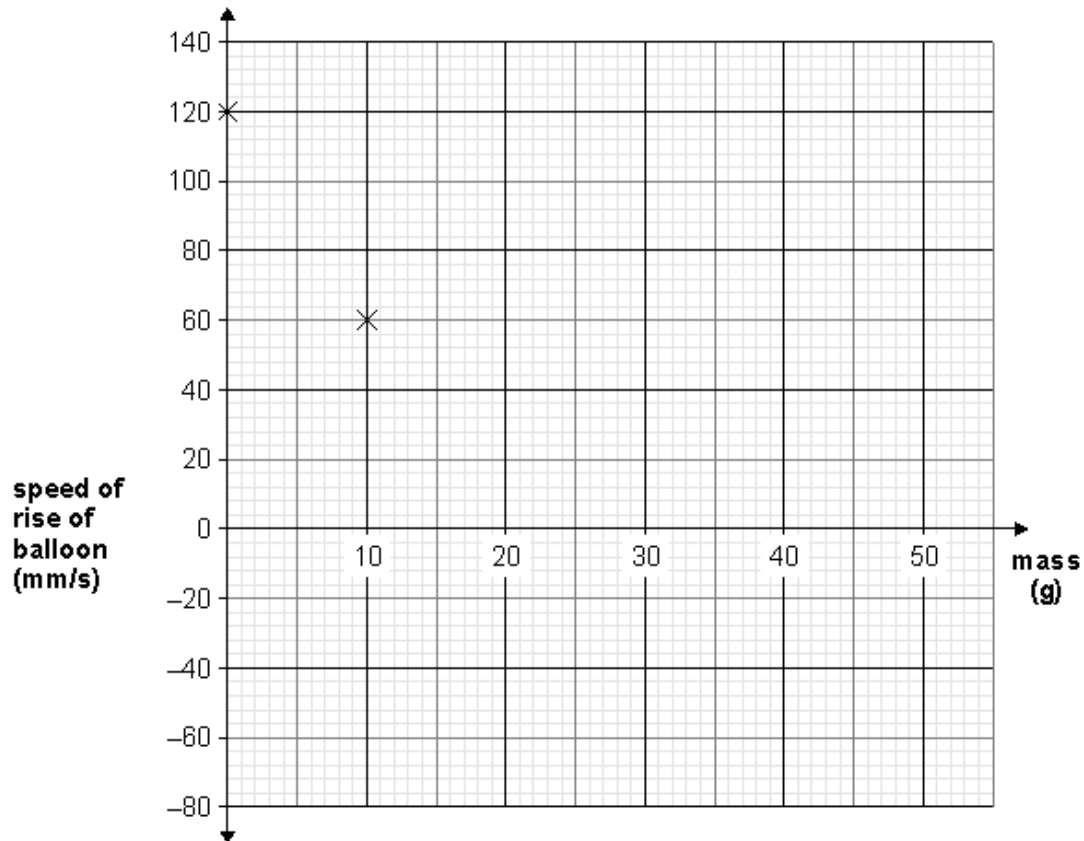
mass (g)	speed of rise (mm/s)
0	120
10	60
20	40
30	-20
40	-70

- (i) How does the table show that the balloon went downwards?

.....

1 mark

- (ii) Josh plotted two points on the graph as shown. Complete the graph by plotting the missing points **and** draw a line of best fit.



2 marks

(iii) From the graph, find the mass needed to keep the balloon floating in one place.

..... g

1 mark  
maximum 6 marks

