Centre of Mass

Question Paper

Level	GCSE
Subject	Physics
Exam Board	AQA
Unit	P3
Topic	Centre of Mass
Difficulty Level	Bronze Level
Booklet	Question Paper

Time Allowed: **43 minutes**

Score: **/43**

Percentage: **/100**

Q1.(a) Use the correct answer from the box to complete the sentence.

concentrated	**stored**	**pivoted**

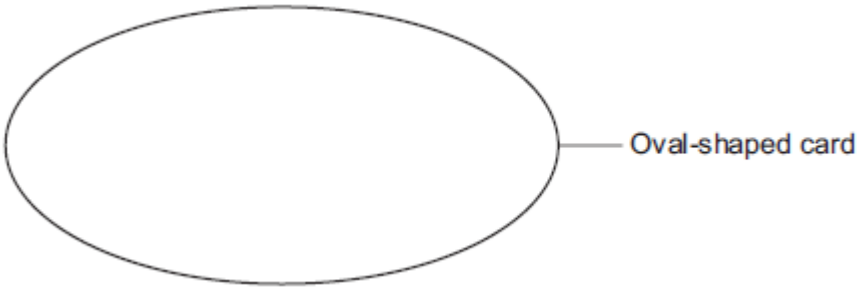
The centre of mass of an object is the point at which the mass of an object maybe thought to be ..... .

(1)

(b) **Figure 1** shows an oval-shaped piece of card.

Draw an **X** on **Figure 1**, so that the centre of the **X** marks the centre of mass of the oval shape.

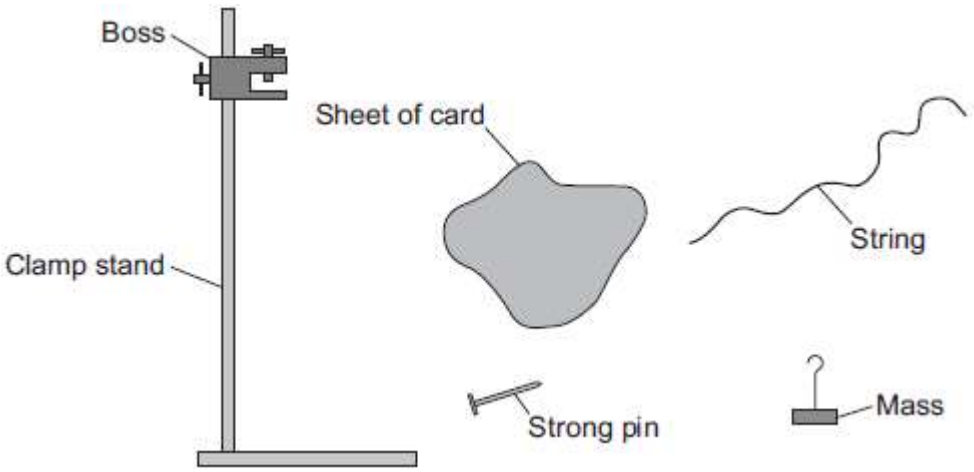
Figure 1



(1)

(c) **Figure 2** shows some apparatus and a sheet of card.

Figure 2



The sentences describe how to find the centre of mass of the sheet of card.

The sentences are in the wrong order.

A Tie the mass to one end of the string and then hang the string from the pin.

B Repeat this using the other hole. The centre of mass is where the two lines cross on the card.

C Put the pin through one of the holes in the card and hold the pin in the boss.

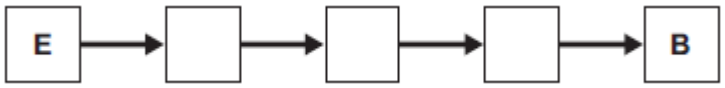
D Draw a line on the card marking the position of the string.

E Make two holes in the card, with each hole near to the edge of the card.

Put the sentences into the correct order to describe how to find the centre of mass of the card.

Start with **E** and end with **B**.

Write the correct order in these boxes.



(2)

(d) **Figure 3** shows a person in a wheelchair.

Figure 3

AndreyPopov/iStock/Thinkstock

Tipping the wheelchair at a large angle may cause it to become unstable and to topple over.

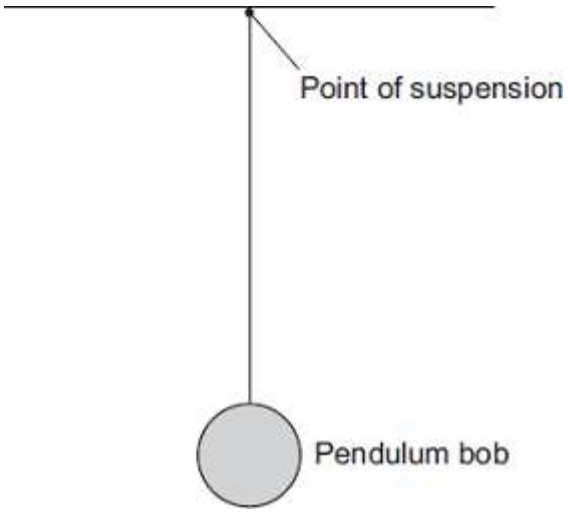
How could the design of this wheelchair be changed to make it less likely to be toppled over?

Tick (✓) **two** boxes.

Lower the person's seating position	☐
Make the wheelchair from lighter materials	☐
Move the wheels further apart	☐
Use taller wheels	☐

(2)
(Total 6 marks)

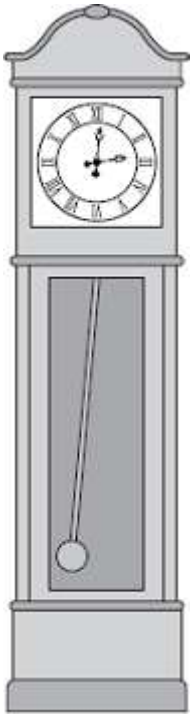
Q2.(a) The diagram shows a pendulum.



Draw an X on the diagram above, so that the centre of the **X** marks the centre of mass of the pendulum bob.

(1)

(b) A large clock keeps time using the swing of a pendulum.



(i) The frequency of the swinging pendulum is 0.5 hertz.

Calculate the periodic time of the pendulum.

Use the correct equation from the Physics Equations Sheet.

.....

.....

.....

Periodic time = ... seconds

(2)

(ii) Calculate the number of complete swings the pendulum would make in 60 seconds.

Use your answer from part (b)(i) in your calculation.

.....

.....

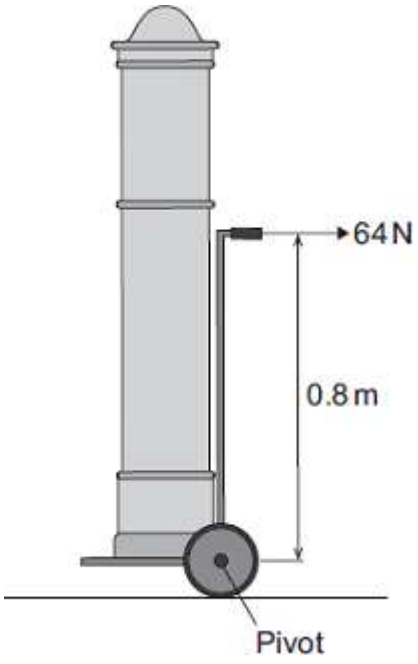
.....

Number of swings in 60 seconds = ...

(2)

(c) The diagram shows a clock on a trolley.

The trolley is being used to move the clock.



Calculate the moment of the 64 N force about the pivot.

Use the correct equation from the Physics Equations Sheet.

.....

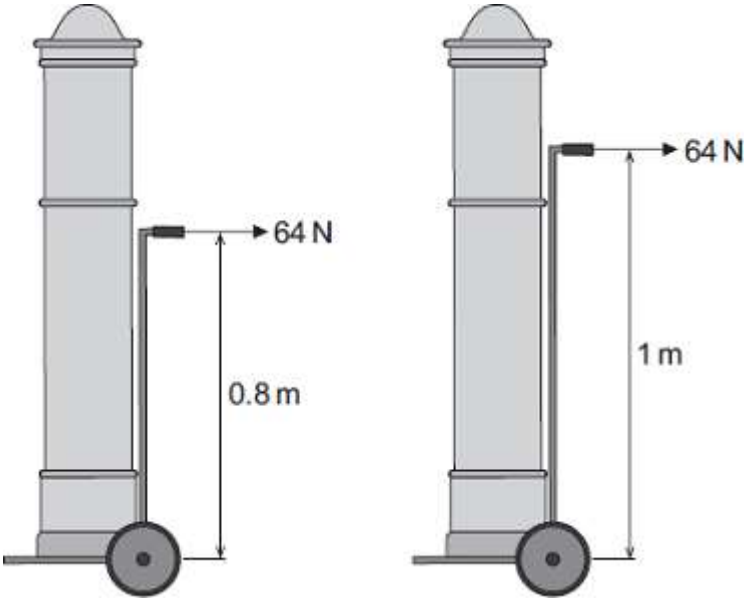
.....

.....

Moment of the force = ... Nm

(2)

(d) The design of the trolley is now changed to make it taller.



How does making the trolley taller affect the moment produced by the 64 N force about the pivot?

.....

.....

(1)

(Total 8 marks)

Q3. The drawing shows a plastic toy which can stand on its feet.

(a) (i) Draw an **X** on the diagram so that the centre of the **X** marks the likely position of the centre of mass of the toy.

Photograph supplied by Hemera/Thinkstock

(1)

(ii) Explain the reason for your choice in part (a)(i).

.....

.....

(1)

(b) Suggest **two** ways in which the design of the toy could be altered to make the toy more stable.

1 .....

.....

2 .....

.....

(2)

(Total 4 marks)

Q4. The centre of mass of an object is where the mass of the object may be thought to be concentrated.

(a) Use a word or phrase from the box to complete the sentence below.

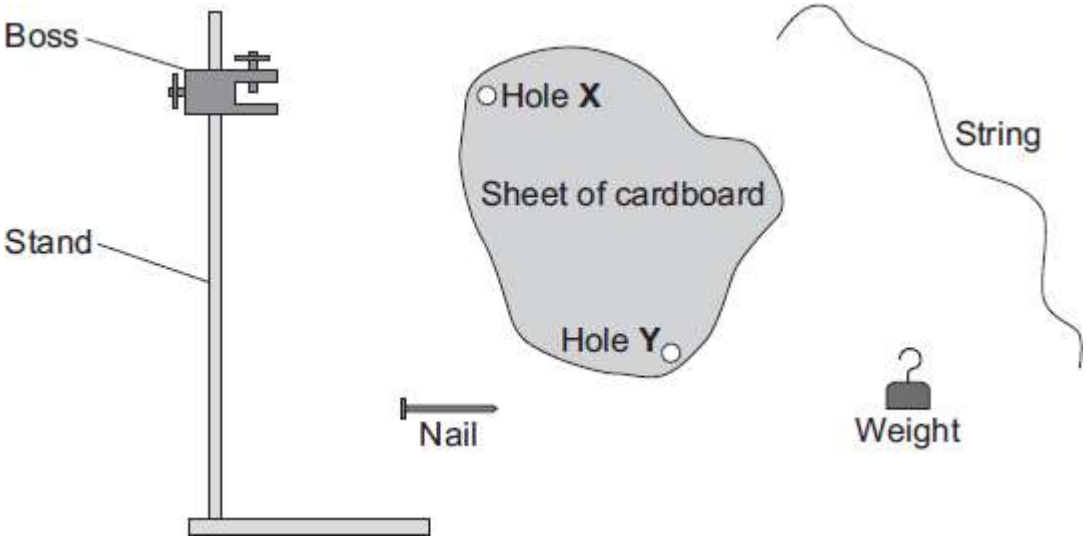
above	**below**	**to the side of**

A hanging object will come to rest with its centre of mass directly

..... the point from which it hangs.

(1)

(b) The diagram shows the equipment that a student uses to find the centre of mass of a sheet of cardboard.
She intends to draw two lines on the sheet. The centre of mass of the sheet will be where these lines cross.



Use words from the box to complete the sentences below.

boss	**cardboard**	**nail**	**stand**	**string**	**weight**

The nail is put through hole **X** in the cardboard sheet. The nail is held in the

..... . The string is tied to the weight and then the

other

end of the string is hung from the ..... . A line is drawn on

the cardboard sheet to mark the position of the ..... . This is repeated

using hole **Y**.

(3)

(c) The diagram below shows a plastic rectangle.

(i) Use a ruler to draw an axis of symmetry on the rectangle.

(1)

(ii) Draw an **X** on the diagram so that the centre of the **X** marks the centre of mass of the rectangle.

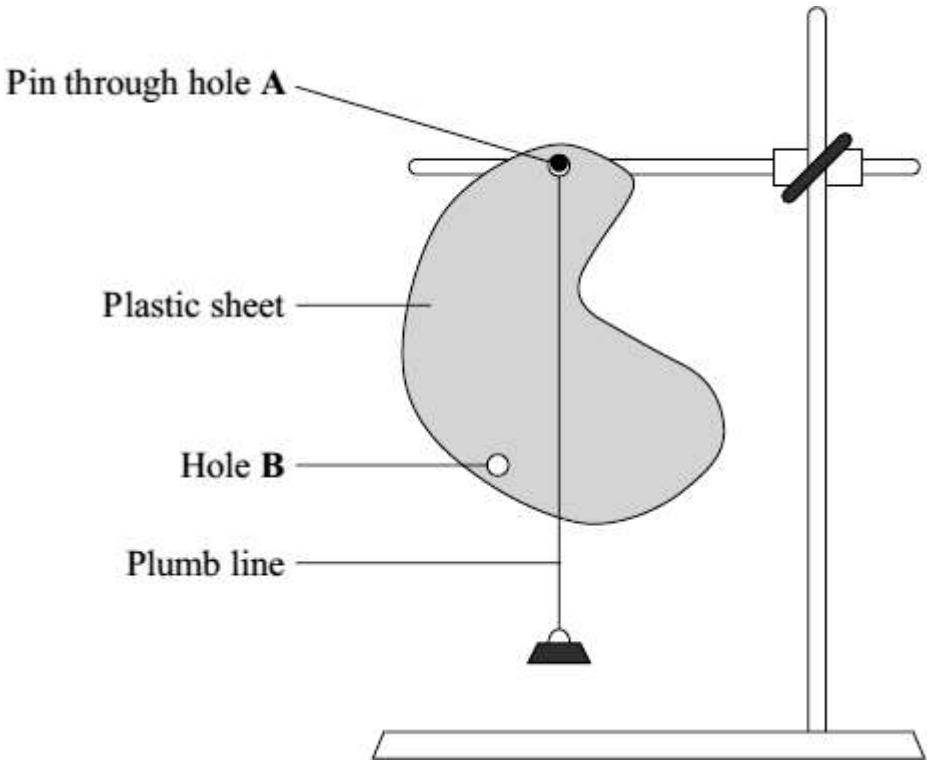
(1)
(Total 6 marks)

Q5. The diagram shows how a student can find the centre of mass of a thin flat sheet of plastic.

Part of his equipment is a plumb line. This is a weight fastened to one end of a piece of string.

He hangs the sheet and the plumb line from a pin through hole **A**.

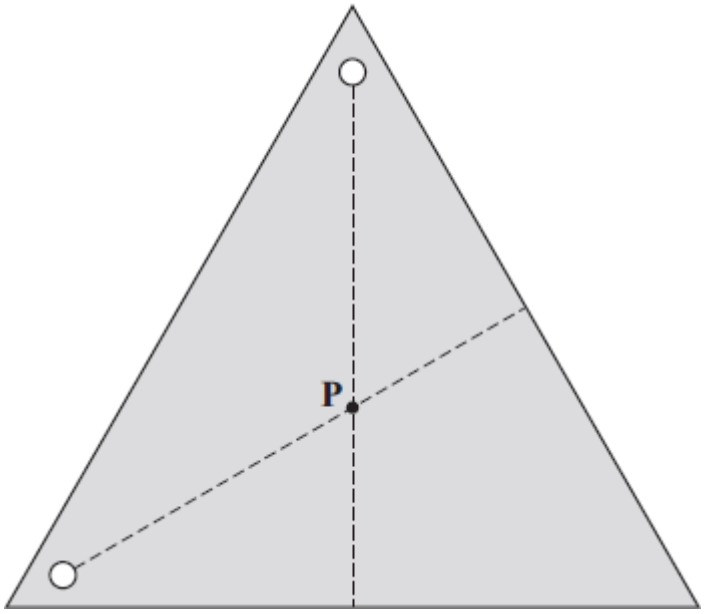
(a) Mark an **X** on the diagram so that the centre of the **X** marks the likely position of the centre of mass of the plastic sheet.



(1)

(b) The dashed lines on the diagram below show the position of the plumb line from each hole when the student uses a different plastic sheet.

Point **P** is on both the dashed lines.



Complete the following sentence by drawing a ring around the correct line in the box.

Point **P** shows the

axis
centre of mass
moment
symmetry

of the plastic sheet.

(1)

(c) Complete the following sentence by drawing a ring around the correct word in the box.

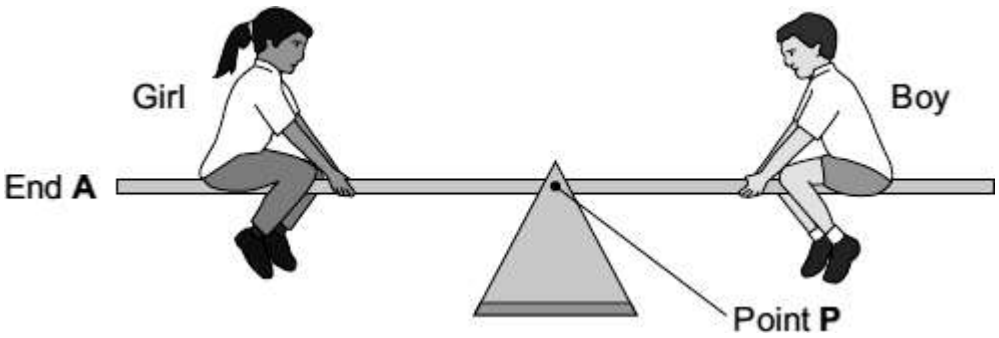
A plumb line always hangs so that it is

curved
horizontal
parallel
vertical

(1)
(Total 3 marks)

Q6. Two children visit a playground.

(a) The diagram shows them on a see-saw. The see-saw is balanced.



Complete the following sentences by drawing a ring around the correct word or line in the box.

(i) The turning effect of the girl's weight is called her

force.
load.
moment.

(1)

(ii) Point **P** is the axis of

balance
rotation
turning

of the see-saw.

(1)

(iii) To make end **A** of the see-saw go up,

the boy moves nearer to point **P**.
the girl moves nearer to point **P**.
the girl moves nearer to end **A**.

(1)

(b) In another part of the playground, a tyre has been suspended from a bar.

(i) Draw an **X** on the diagram so that the centre of the **X** marks the centre of mass of the tyre.

(1)

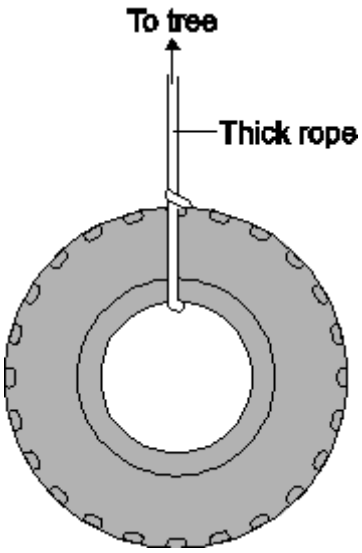
(ii) Complete the sentence by using the correct word or phrase from the box.

above	**below**	**to the left of**	**to the right of**

If the suspended tyre is pushed, it will come to rest with its centre of mass directly ..... the point of suspension.

(1)
(Total 5 marks)

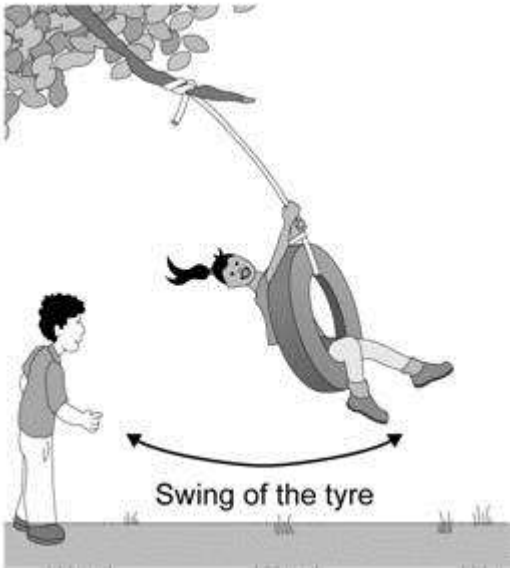
Q7. The drawing shows a car tyre which is hanging from the branch of a tall tree.



(a) Draw an **X** on the diagram to mark the centre of mass of the tyre.

(1)

(b) Some children use the tyre as a swing. Pulling the tyre to one side and letting it go makes the tyre swing backwards and forwards like a pendulum.



The time it takes the tyre to swing from one side to the other and back again is called the time period.

(i) What is the unit for time period?

.....

(1)

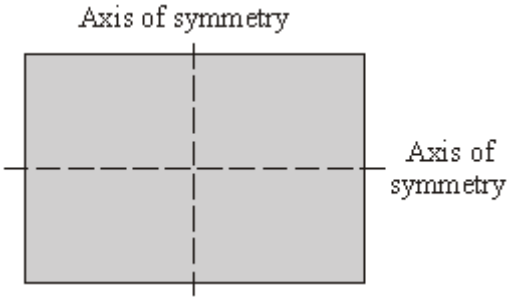
(ii) How would using a shorter rope change the time period of the swing?

.....

.....

(1)
(Total 3 marks)

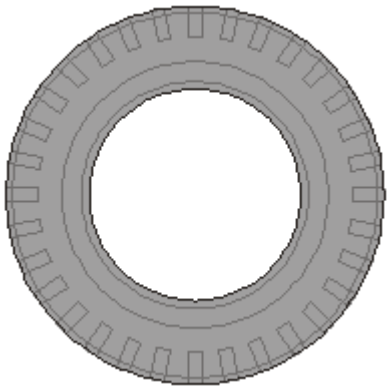
Q8. (a) The diagram shows a rectangle made out of a sheet of cardboard.



Draw an **X** on the diagram so that the centre of the **X** is at the centre of mass of the rectangle.

(1)

(b) The drawing shows a car tyre.



(i) Where is the centre of mass of the tyre?

.....

(1)

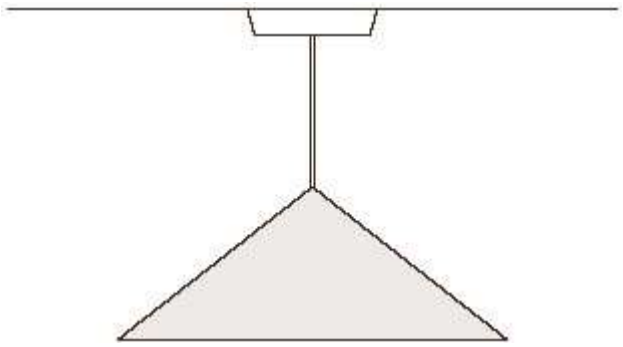
(ii) Explain your answer to (b)(i).

.....

.....

(1)
(Total 3 marks)

Q9. (a) The diagram shows a lampshade hanging from the ceiling. Draw an **X** on the diagram so that the centre of the **X** marks the centre of the mass of the lampshade.



(1)

-

(a) Complete the sentence using the correct word or phrase from the box.

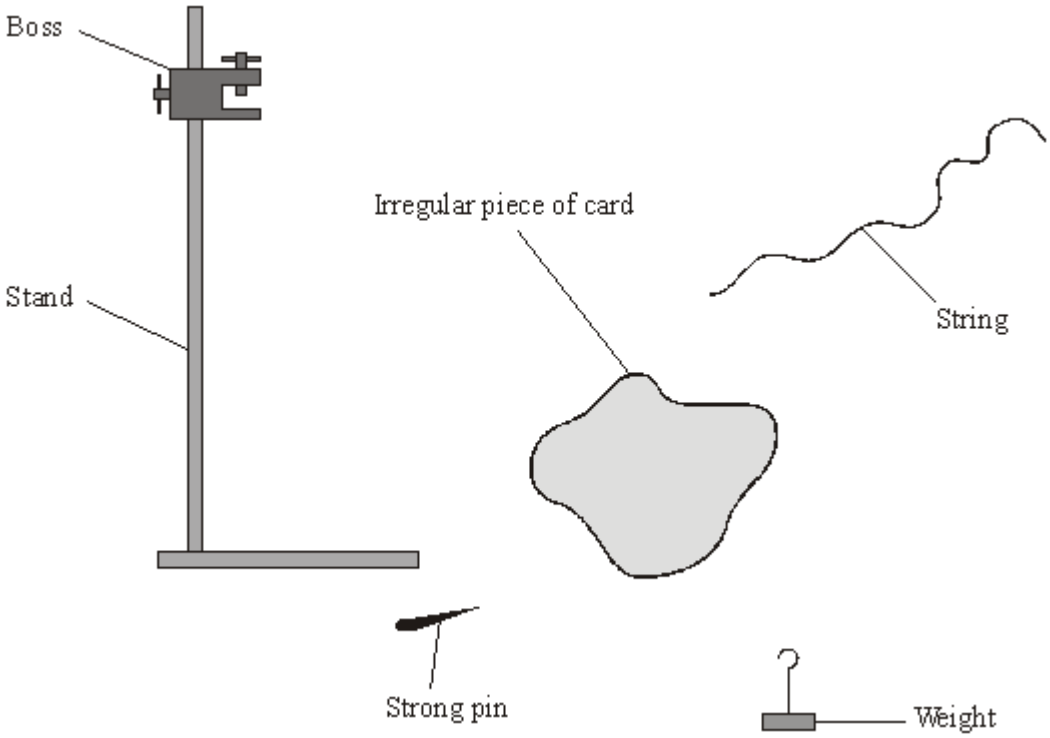
above	**below**	**to the left of**	**to the right of**

A suspended object will come to rest with its centre of mass directly

..... the point of suspension.

(1)

(c) The diagrams show equipment that a student uses to find the centre of mass of a thin sheet of card.



Arrange these sentences in the correct order to describe how the student can find the centre of mass of the card.

The sequence starts with sentence **D** and finishes with sentence **E**.

A A line is drawn on the card marking the position of the string.

B The pin is put through one of the holes in the card and held in the boss.

C This is repeated using the other hole.

D Two holes are made in the card with each hole near to the edge of the card.

E The centre of mass is where the lines cross on the card.

F The weight is tied to the string and then the string is hung from the pin.

D					**E**

(3)
(Total 5 marks)