

**GENERAL CERTIFICATE OF SECONDARY EDUCATION**

**DESIGN AND TECHNOLOGY**

**Systems and Control Technology**

**Paper 7 Mechanisms (Foundation Tier)**

**1957/07**

Candidates answer on the Question Paper

**OCR Supplied Materials:**

None

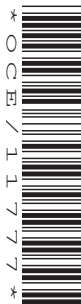
**Other Materials Required:**

None

**Wednesday 26 May 2010**

**Afternoon**

**Duration: 1 hour**



Candidate Forename		Candidate Surname	
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Centre Number						Candidate Number				
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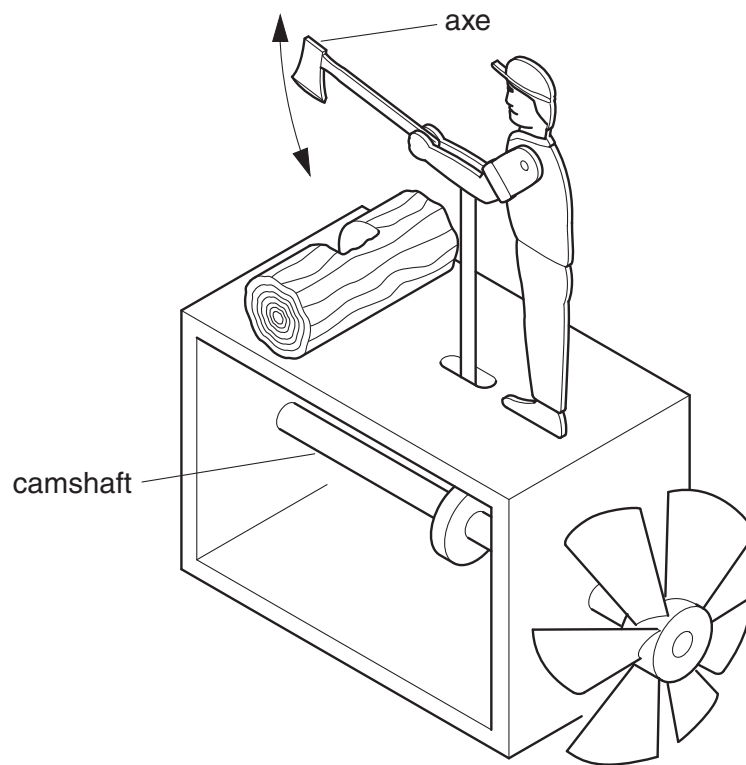
**INSTRUCTIONS TO CANDIDATES**

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Answer **all** the questions.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Show all working out for calculations.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).

**INFORMATION FOR CANDIDATES**

- The number of marks is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **50**.
- Dimensions are in millimetres unless stated otherwise.
- Marks will be awarded for the use of correct conventions.
- This document consists of **12** pages. Any blank pages are indicated.

1 Fig. 1 shows a wind powered garden ornament.



**Fig. 1**

(a) The table below shows the shapes of four different cams.

cam A	cam B	cam C	cam D

(i) Select a suitable cam from the table that will cause the axe to rise slowly and fall quickly.

..... [1]

(ii) Select a suitable cam from the table that will cause the axe to rise and fall in a continuous, smooth movement.

..... [1]

(b) Name the type of motion made by the axe.

..... [1]

- (c) The garden ornament is made from wood.  
Name a suitable finish.

..... [1]

- (d) In use the mechanism does not move very freely.

Give **two** ways that can be used to improve the movement.

1 ..... [1]

2 ..... [1]

- (e) The manufacturer has tested a mains powered version of the garden ornament.

(i) Give **two** benefits of using mains power.

1 ..... [1]

2 ..... [1]

(ii) Give **two** benefits of using wind power.

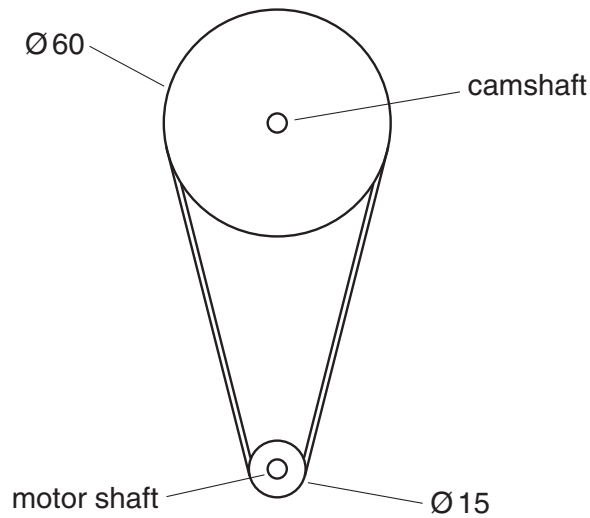
1 ..... [1]

2 ..... [1]

[Total: 10]

- 2 The manufacturer has fitted a low voltage motor directly to the cam shaft of the garden ornament but has found that it runs too fast.

Fig. 2 shows a pulley and belt system that has been added to slow down the shaft.



**Fig. 2**

- (a) Calculate the velocity ratio of the pulley and belt system.

Use the formula  $VR = \frac{\text{driven}}{\text{driver}}$

.....  
 ..... [2]

- (b) Suggest **two** different drive systems that could be used instead of the pulley and belt system.

1 ..... [1]

2 ..... [1]

- (c) Give **two** reasons why the designer has chosen a pulley and belt system for this product.

1 .....  
 ..... [1]

2 .....  
 ..... [1]

(d) The motor shown below needs to be securely fixed to the end of the garden ornament. Add sketches and notes to Fig. 3 to show how the motor can be:

- supported;
- securely fixed to the ornament;
- easily removed for replacement.

[1]

[1]

[1]

Label any important features.

[1]

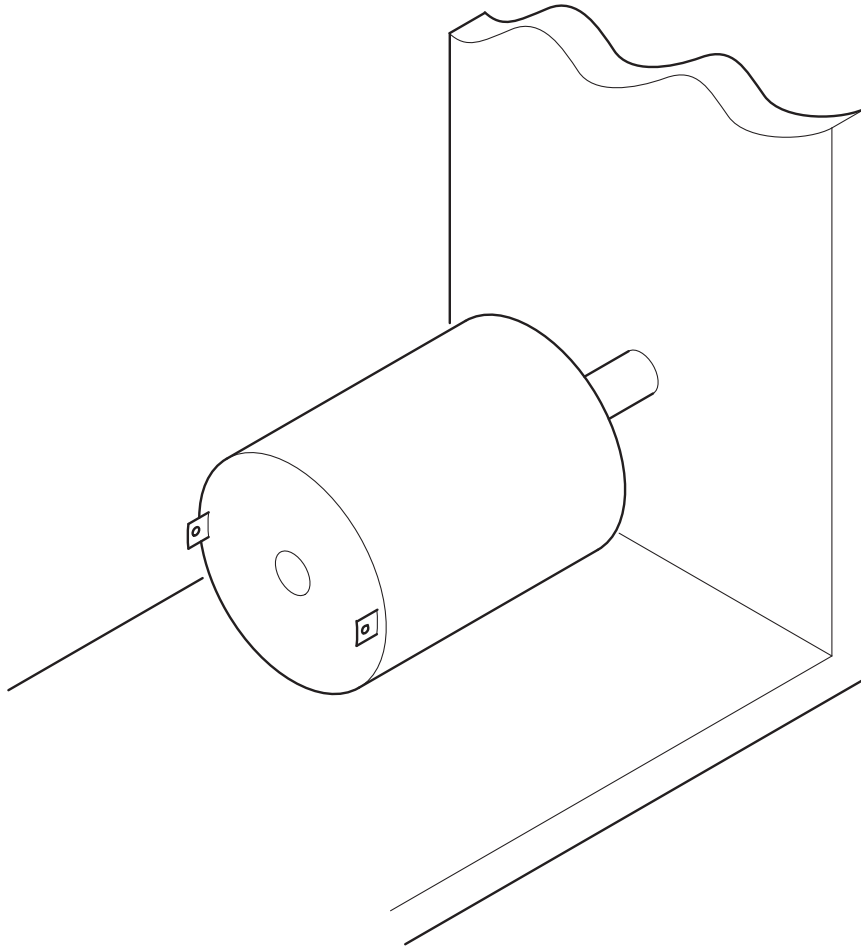
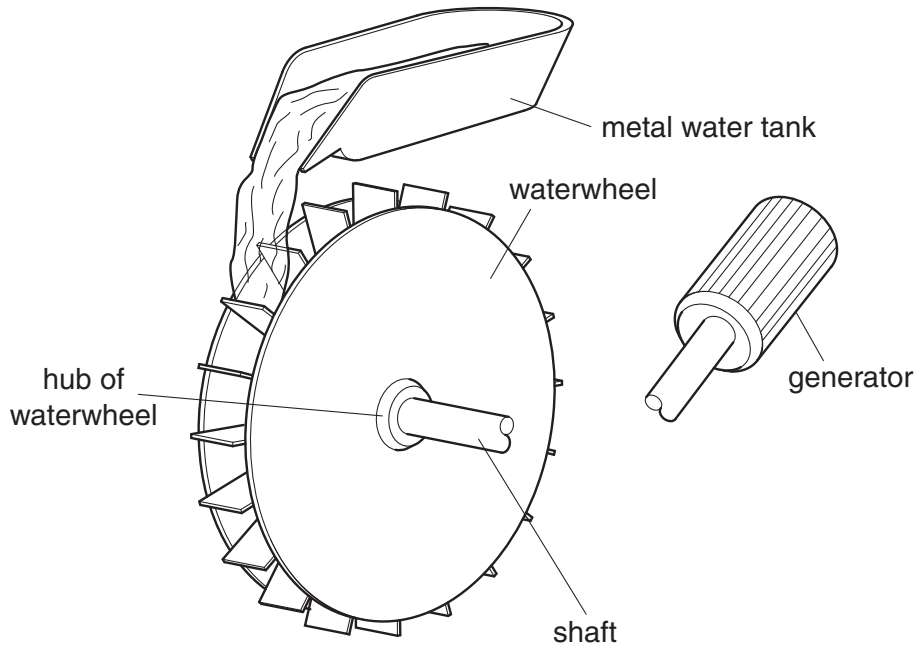


Fig. 3

[Total: 10]

- 3 Fig. 4 shows part of a garden water feature.  
The waterwheel is driven by water falling from a tank positioned above the wheel.



**Fig. 4**

- (a) The waterwheel turns slowly giving a high turning force on the shaft.  
Give the name of this force.
- ..... [1]
- (b) The waterwheel is to be used to drive a small generator but it is found that the shaft turns too slowly.
- (i) Choose from the table below the most suitable mechanism to increase the output speed from the shaft.

Bevel gear	Worm and wormwheel	Rack and pinion
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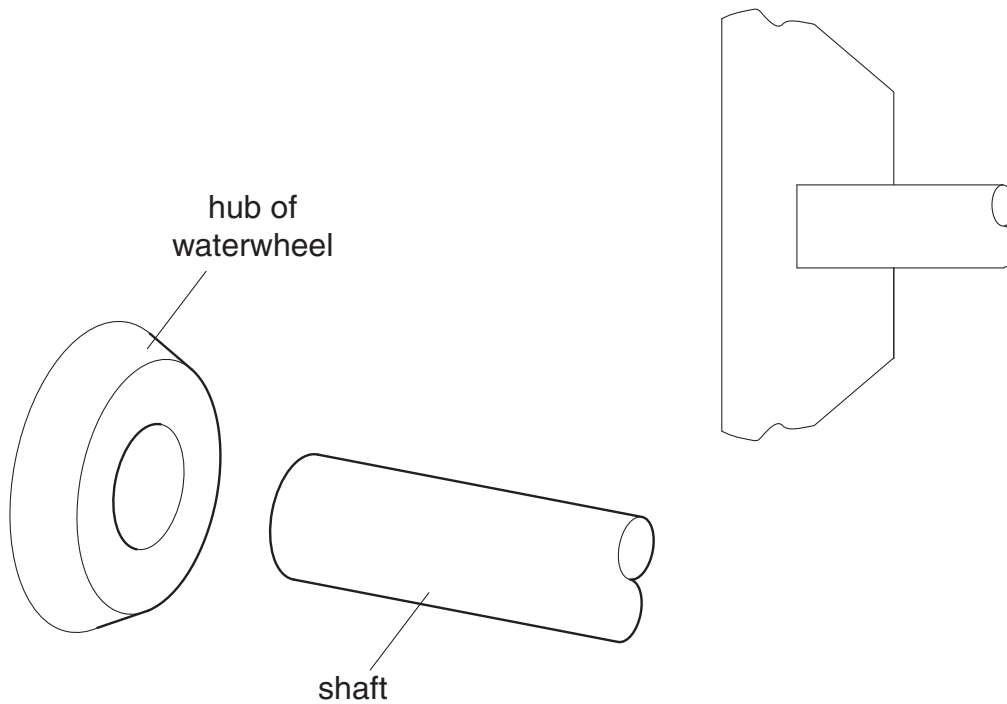
- ..... [1]
- (ii) Explain how your chosen mechanism works.

- ..... [2]
- (c) Explain any maintenance that needs to be carried out regularly on this mechanical system.
- ..... [2]

- (d) Give a suitable finish for the metal water tank in Fig. 4.

..... [1]

- (e) Fig. 5 shows the hub of the waterwheel and the shaft.  
Add details to show how the shaft can be fitted to the water wheel to ensure a positive drive but still allow removal for maintenance.  
Label any additional components.

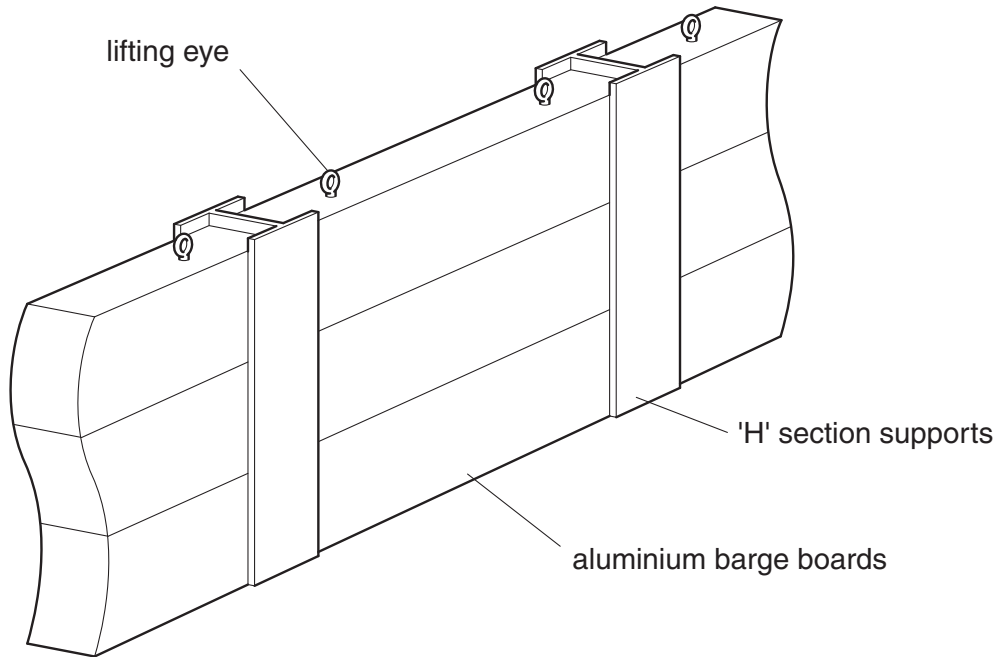


**Fig. 5**

[3]

**[Total: 10]**

- 4 Fig. 6 shows part of a flood defence system. Aluminium barge boards are lowered from lorries into fixed 'H' section supports at times of danger from rising floodwater.



**Fig. 6**

- (a) Give **two** reasons why aluminium is used for the barge boards.

Reason 1 ..... [1]

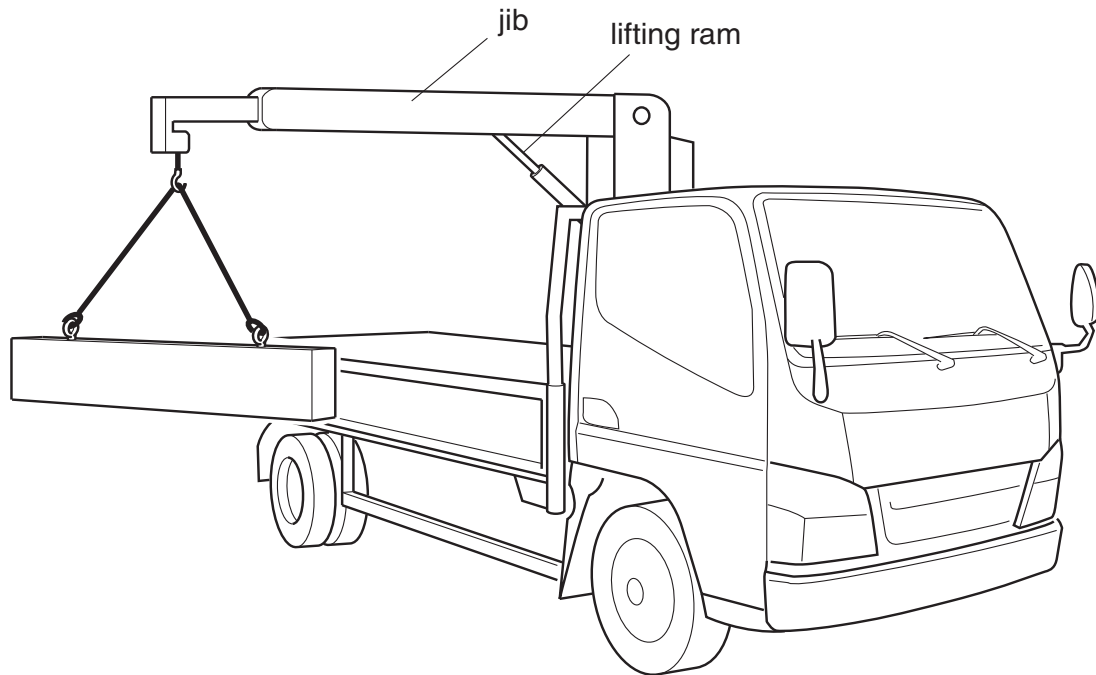
Reason 2 ..... [1]

- (b) Explain **two** ways that designers would have used computers in the design of the flood defence system.

1 ..... [2]

2 ..... [2]

Fig. 7 shows a hoist used to lift the barge boards from the lorry into position. The hoist uses a lever system.



**Fig. 7**

(c) State the class of leverage in the jib.

..... [1]

(d) Give **two** reasons why this class of lever is used in this hoist system.

..... [1]

..... [1]

(e) Give **one** disadvantage that this class of lever has when used in a hoist system.

..... [1]

**[Total: 10]**

- 5 Fig. 8 shows an alternative flood defence system with a height adjustable barrier.

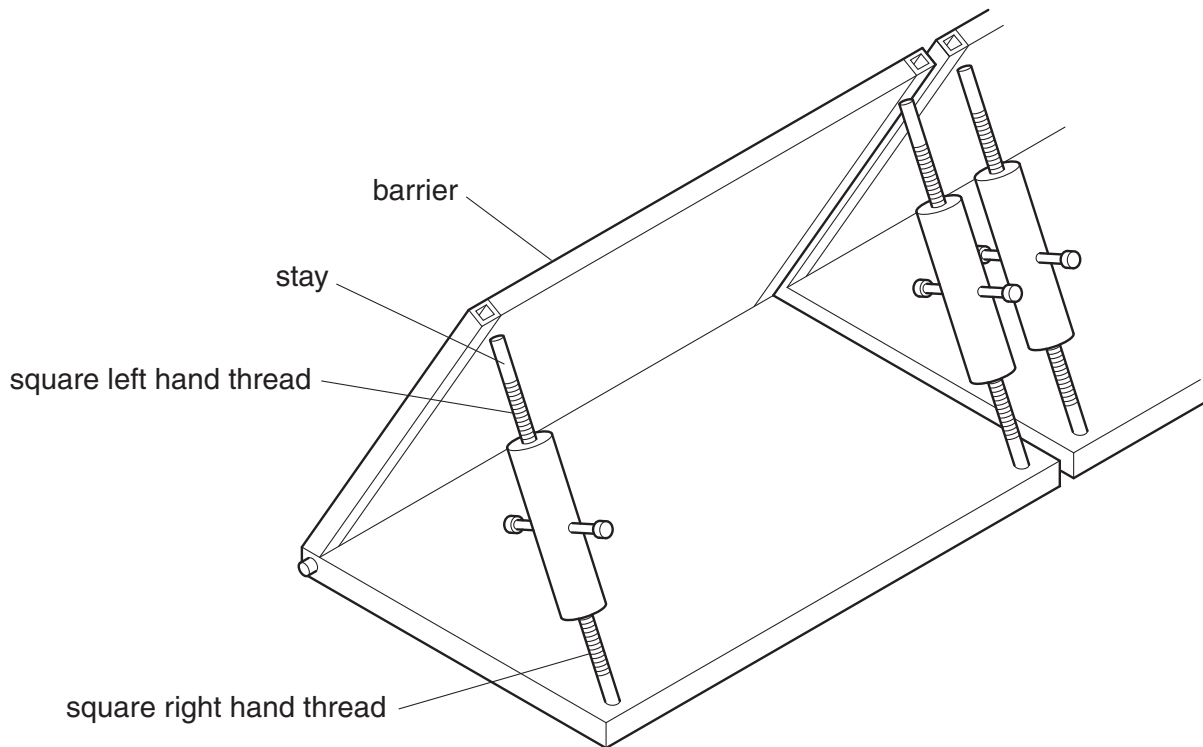


Fig. 8

- (a) Give **two** reasons why screw threads are used in adjustable systems.

1 ..... [1]

2 ..... [1]

- (b) Explain why a square thread has been used in the flood barrier system instead of a V-thread.

..... [2]

- (c) Give **one** other mechanical system that uses a square thread for adjustment.

..... [1]

- (d) Give the conversion of motion that takes place in this type of system.

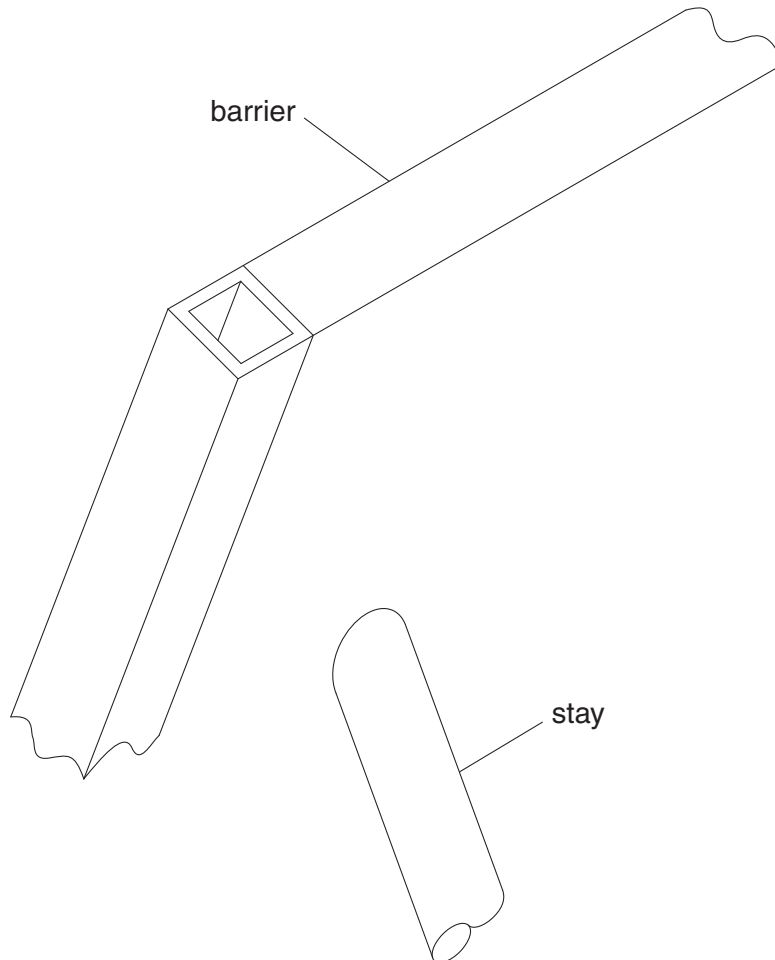
..... [1]

- (e) Fig. 9 shows part of the barrier and stay. The adjustable stays need to be securely attached to the top of the barrier.

Draw a fitting on Fig. 9 that will:

- allow the stay to pivot as the screw is adjusted; [1]
- prevent the stay from rotating while the screw is adjusted; [1]
- securely attach the stay to the barrier. [1]

Label any additional fittings. [1]



**Fig. 9**

**[Total: 10]**

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