

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GCSE

A515/03

DESIGN AND TECHNOLOGY
Electronics and Control Systems

Sustainability and technical aspects of
designing and making – Mechanisms

FRIDAY 23 MAY 2014: Afternoon

DURATION: 1 hour 30 minutes
plus your additional time allowance

MODIFIED ENLARGED

Candidate forename		Candidate surname	
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Centre number						Candidate number				
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Candidates answer on the Question Paper.

OCR SUPPLIED MATERIALS:

None

OTHER MATERIALS REQUIRED:

A calculator may be used for this paper.

Pencil

Ruler (cm/mm)

A calculator may be used for this paper
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READ INSTRUCTIONS OVERLEAF

INSTRUCTIONS TO CANDIDATES

Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.

Use black ink. Pencil may be used for graphs and diagrams only.

Read each question carefully and make sure you know what you have to do before starting your answer.

Answer ALL the questions in Section A AND Section B.

Write your answer to each question in the space provided, however additional paper may be used if necessary.

Show all working out for calculations.

INFORMATION FOR CANDIDATES

Your quality of written communication is assessed in questions marked with an asterisk (*).

The number of marks for each question is given in brackets [] at the end of the question or part question.

Dimensions are in millimetres unless stated otherwise.

The total number of marks for this paper is 80.

Any blank pages are indicated.

BLANK PAGE

SECTION A

Answer ALL questions.

You are advised to spend 40 minutes on this section.

On questions 1–5 circle your answer.

1 Using natural gas central heating contributes to:

(a) Carbon credits

(b) Improving your loft insulation

(c) Global warming

(d) Carbon dioxide reduction

[1]

2 For maximum efficiency, wind turbines should face:

(a) Directly into the wind

(b) South

(c) Sideways on to the wind

(d) Towards the sun

[1]

- 3 The Forest Stewardship Council:**
- (a) Manufactures wooden patio furniture**
 - (b) Promotes the responsible management of the world's forests**
 - (c) Issues tree preservation orders**
 - (d) Encourages people to use wood-burning stoves** [1]
- 4 The Eco-footprint of a product is:**
- (a) Easy to clean off floors**
 - (b) How much carbon dioxide is caused by the production and use of the product**
 - (c) Information about how to return a faulty product**
 - (d) How much it costs the consumer to buy** [1]
- 5 Secondary recycling of an electronic product means:**
- (a) Re-using the materials in different products**
 - (b) Dumping the waste in a landfill site**
 - (c) Using a product twice before throwing it away**
 - (d) Donating the item to a charity shop** [1]

6 Which of the 6Rs describes choosing not to buy a product?

_____ [1]

7 State the name of a smart material.

_____ [1]

8 Give ONE reason why electronic waste may be harmful to humans.

_____ [1]

9 Give ONE method of gathering anthropometric data.

_____ [1]

10 Complete the following to give the meaning of the abbreviation LCA.

L _____ **C** _____ **Analysis** [1]

Decide whether the statements below are TRUE or FALSE.

Tick (✓) the box to show your answer.

TRUE FALSE

11 Carbon offsetting means moving your e-waste to another country ☐ ☐ **[1]**

12 Workers in a sweatshop are well paid ☐ ☐ **[1]**

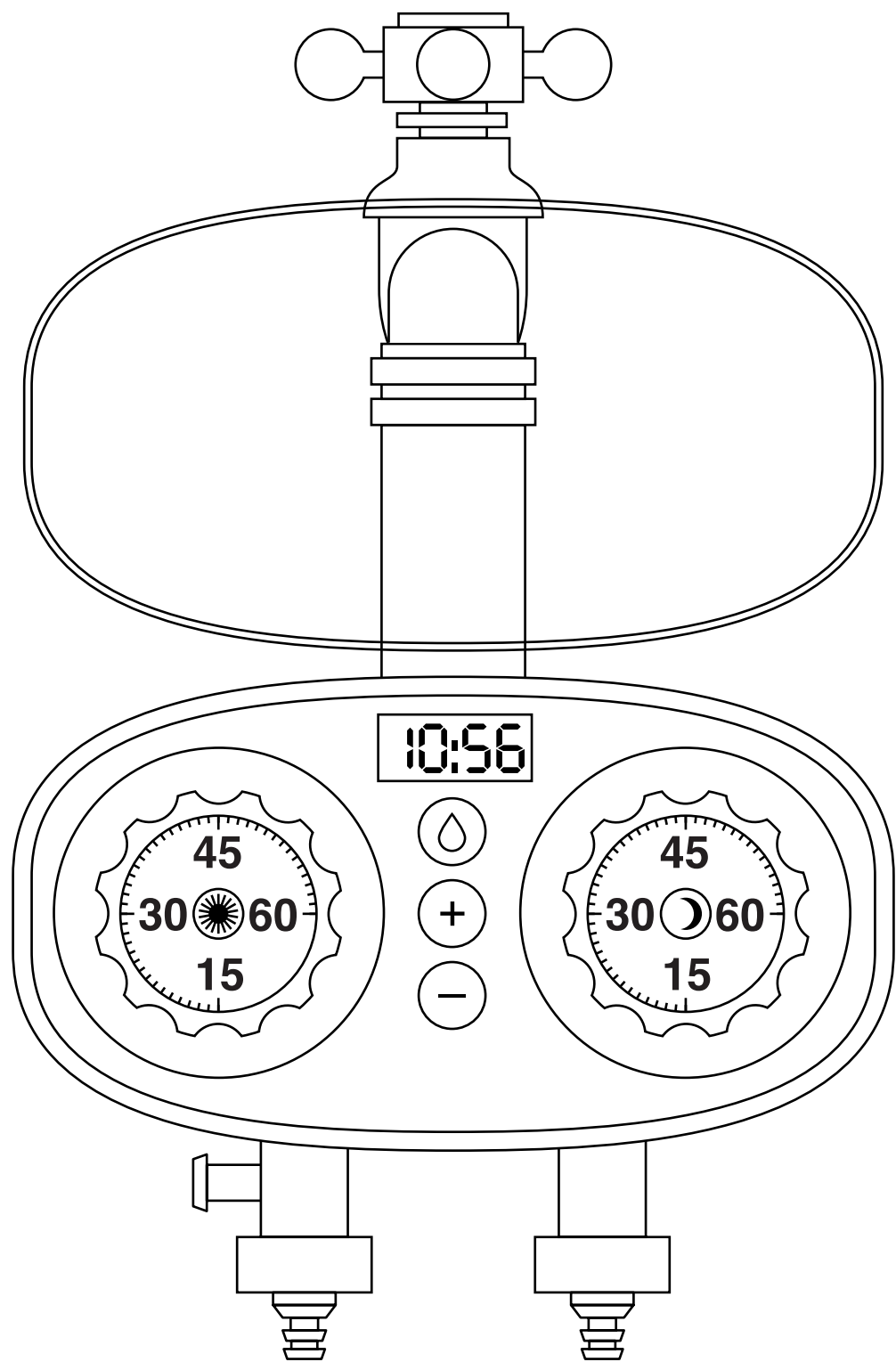
13 LED lamps are energy efficient ☐ ☐ **[1]**

14 NiMH cells contain mercury ☐ ☐ **[1]**

15 CFC means Chloro Fluoro Carbon ☐ ☐ **[1]**

16 Fig. 1 shows a garden watering controller.

FIG. 1



(a) Identify THREE design features of the garden watering controller shown in Fig. 1.

1 _____

2 _____

3 _____

[3]

(b) The garden watering controller is powered by four AA alkaline cells.

Give TWO environmentally friendly improvements that could be made to this power system.

1 _____

2 _____

[2]

(c) Identify ONE sustainable method of disposing of AA alkaline cells.

_____ **[1]**

(d) The garden watering controller is supplied in clear plastic packaging.

Give TWO reasons why the manufacturer may have chosen to use clear plastic packaging.

1 _____

2 _____

[2]

(e) Explain the disadvantages to the environment of using plastic packaging.

[3]

- (f) Use sketches and notes to show THREE pieces of information which could be found on the product packaging.**

[3]

[illegible]

[TOTAL: 35]

SECTION B

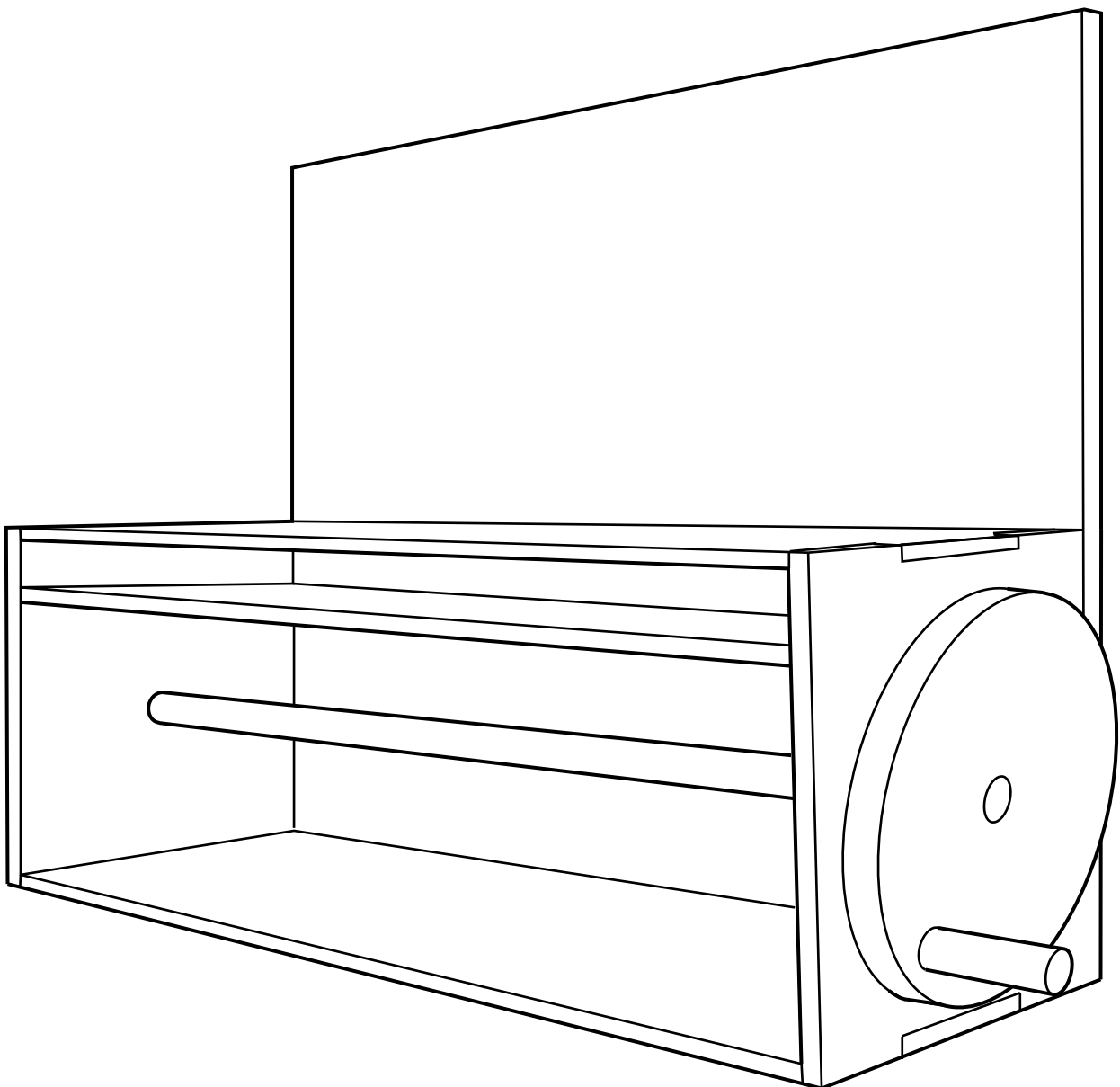
Answer ALL questions

You are advised to spend 50 minutes on this section

17 (a) Fig. 2 shows an incomplete automaton toy.

On Fig. 2 below, use sketches and notes to design a simple automaton that produces TWO different movements.

FIG. 2



- (b) (i) The box is assembled by slotting the parts together.**

Describe the benefits of this method of assembly.

[2]

- (ii) An adhesive is needed to complete the assembly of the box.**

Give the name of ONE water soluble adhesive suitable for wood products.

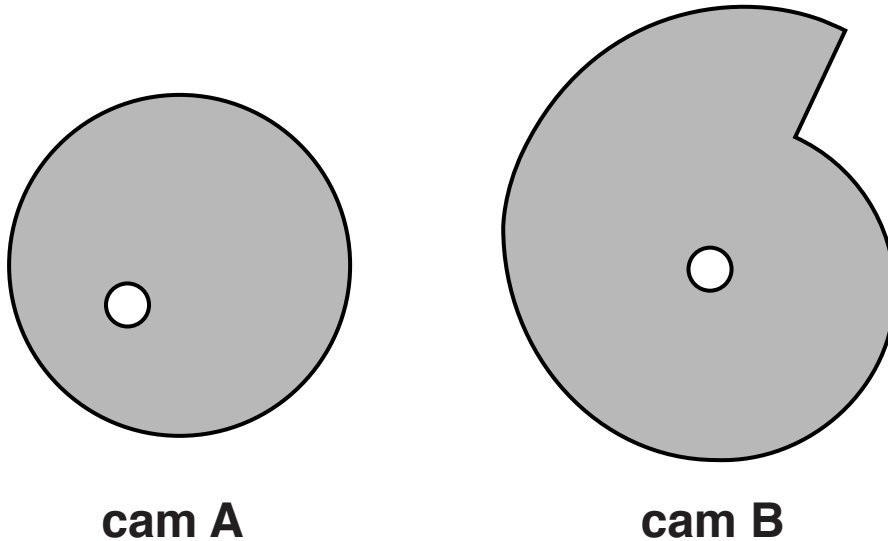
[1]

- (iii) Give the name of ONE adhesive suitable for gluing metal to wood.**

[1]

- (c) Name the cam profiles shown below in Fig. 3 and describe the movement that each one will produce.

FIG. 3



cam A profile _____

cam A description of movement _____

cam B profile _____

cam B description of movement _____

_____ [4]

- (d) The box of the toy has been cut from medium density fibreboard (MDF), using a computer controlled laser cutter.

Give **THREE** advantages of using CAD/CAM in a school workshop.

1 _____

2 _____

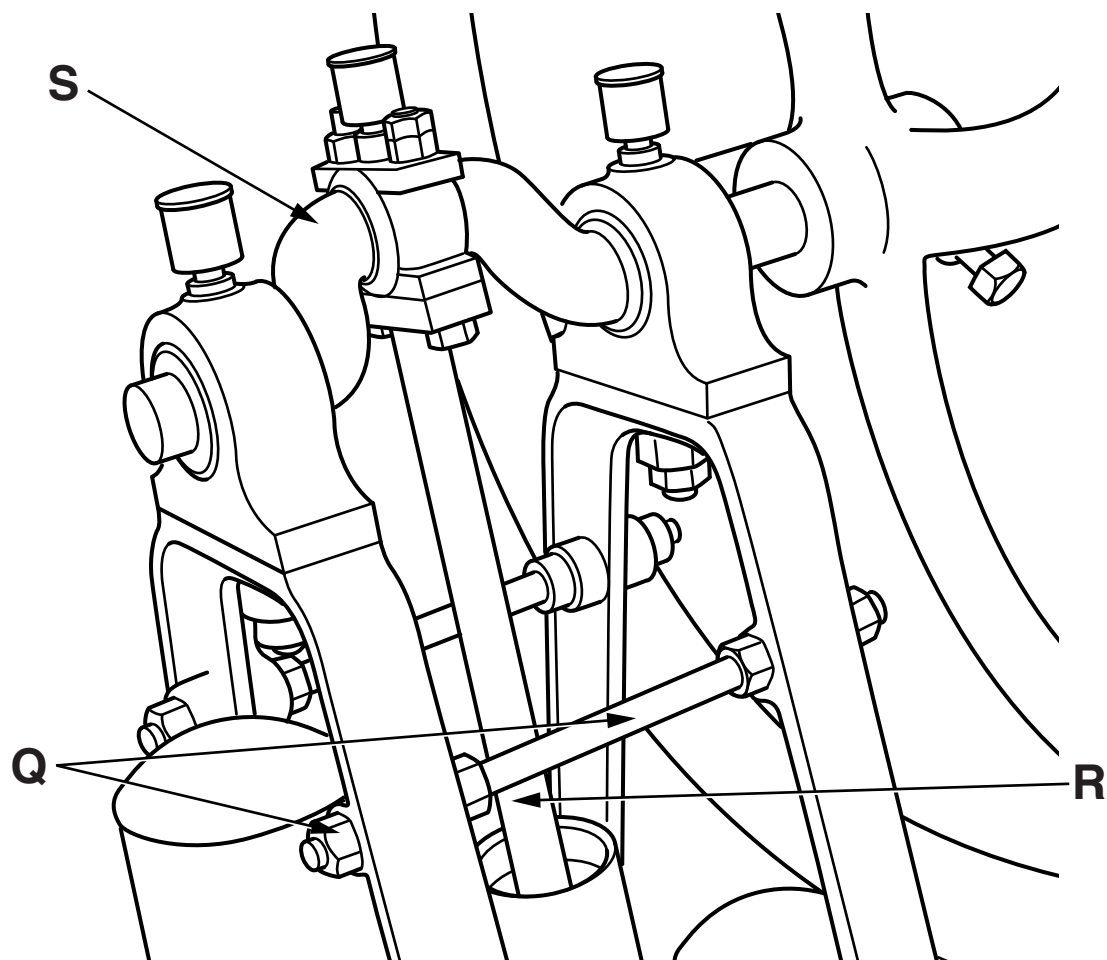
3 _____

[3]

[TOTAL: 15]

18 Fig. 4 shows part of a water pump.

FIG. 4



- (a) (i) State the technical name of the part labelled S shown on Fig. 4.

_____ [1]

- (ii) Part S produces an up and down motion in the piston which pumps the water.

Tick (✓) the statement which describes the motion of rod R which is connected to the piston.

Repeated motion	Rotary motion	Reliable motion	Reciprocating motion	Rough motion

[1]

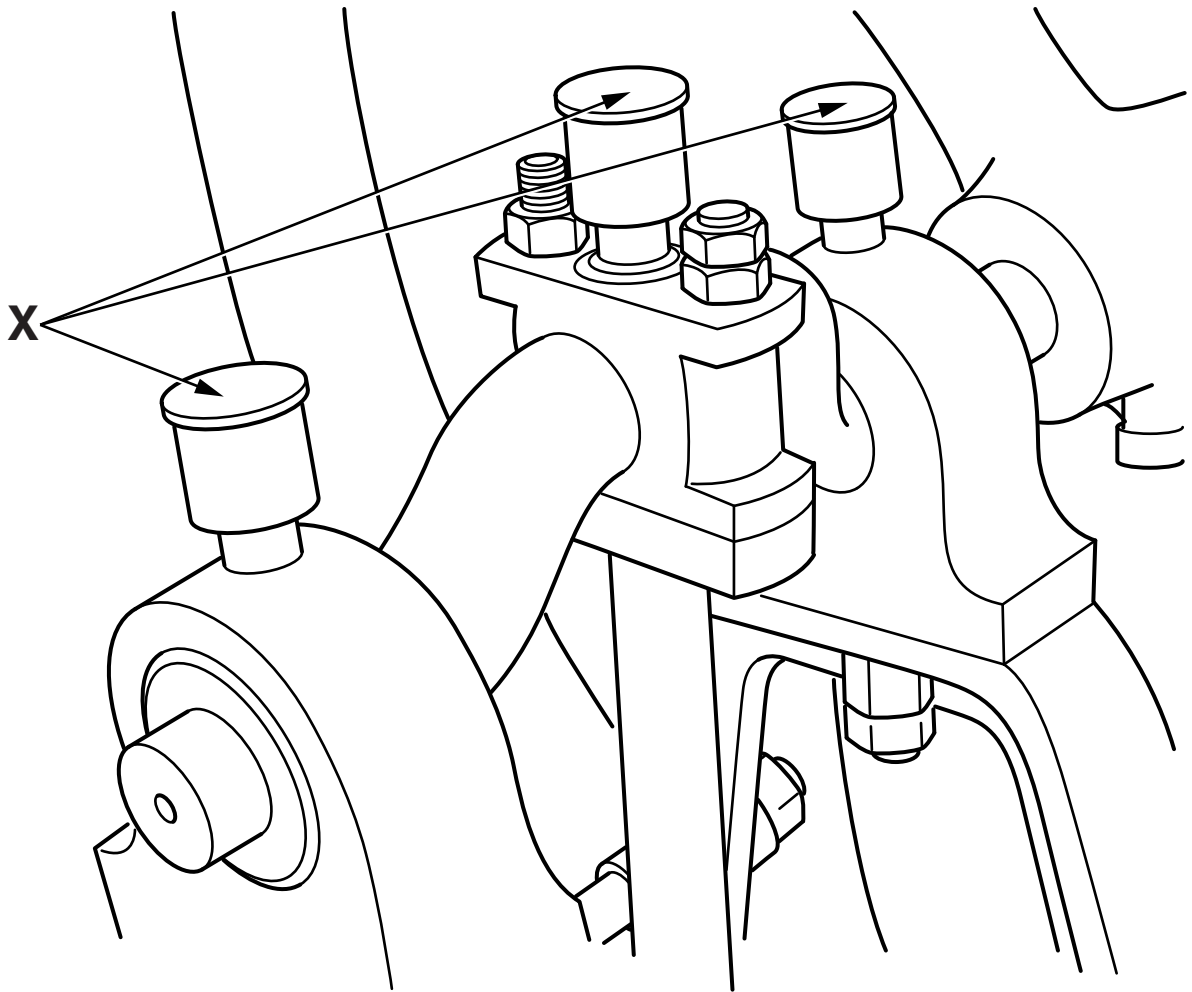
- (iii) The water pump has been designed for ease of assembly.

Name the TWO parts labelled Q in Fig. 4.

_____ [2]

(b) Fig. 5 shows a close-up view of part of the water pump.

FIG. 5



- (i) The devices labelled X should be screwed down one turn for each day of use.

State the purpose of the devices labelled X.

_____ [1]

- (ii) Explain why these devices should be screwed down one turn for each day of use.

_____ [2]

- (iii) The water pump is made mainly of a ferrous alloy.

Explain the term ferrous alloy.

_____ [2]

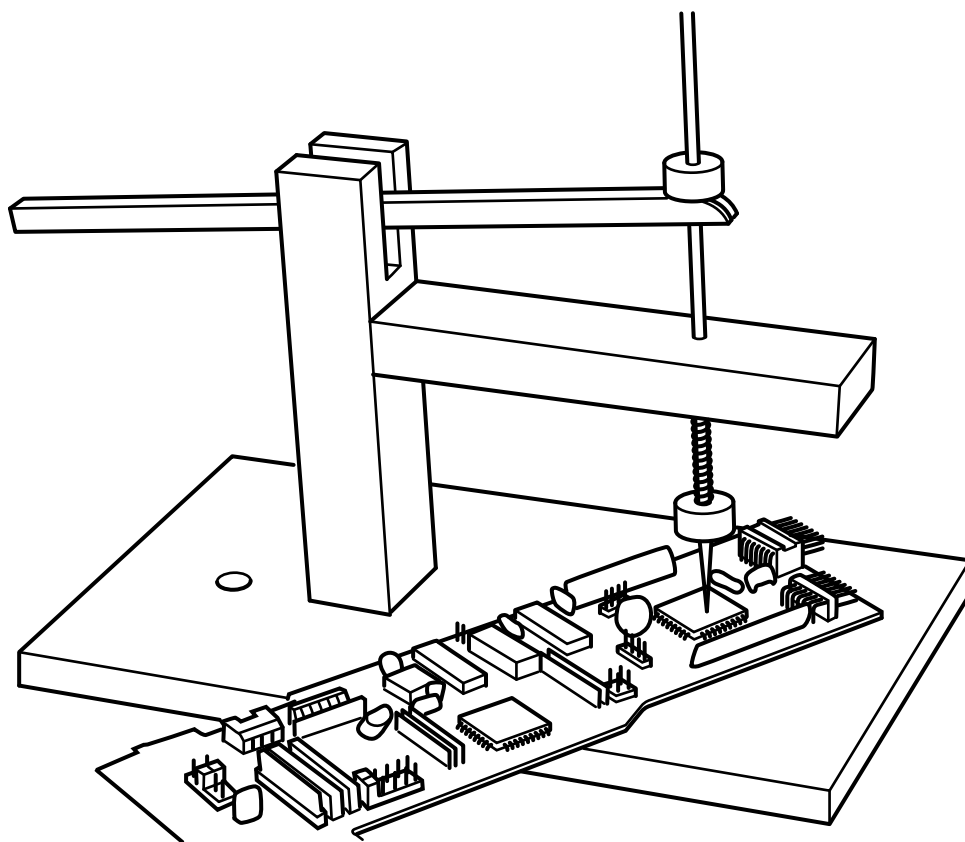
[6]

[illegible]

[TOTAL: 15]

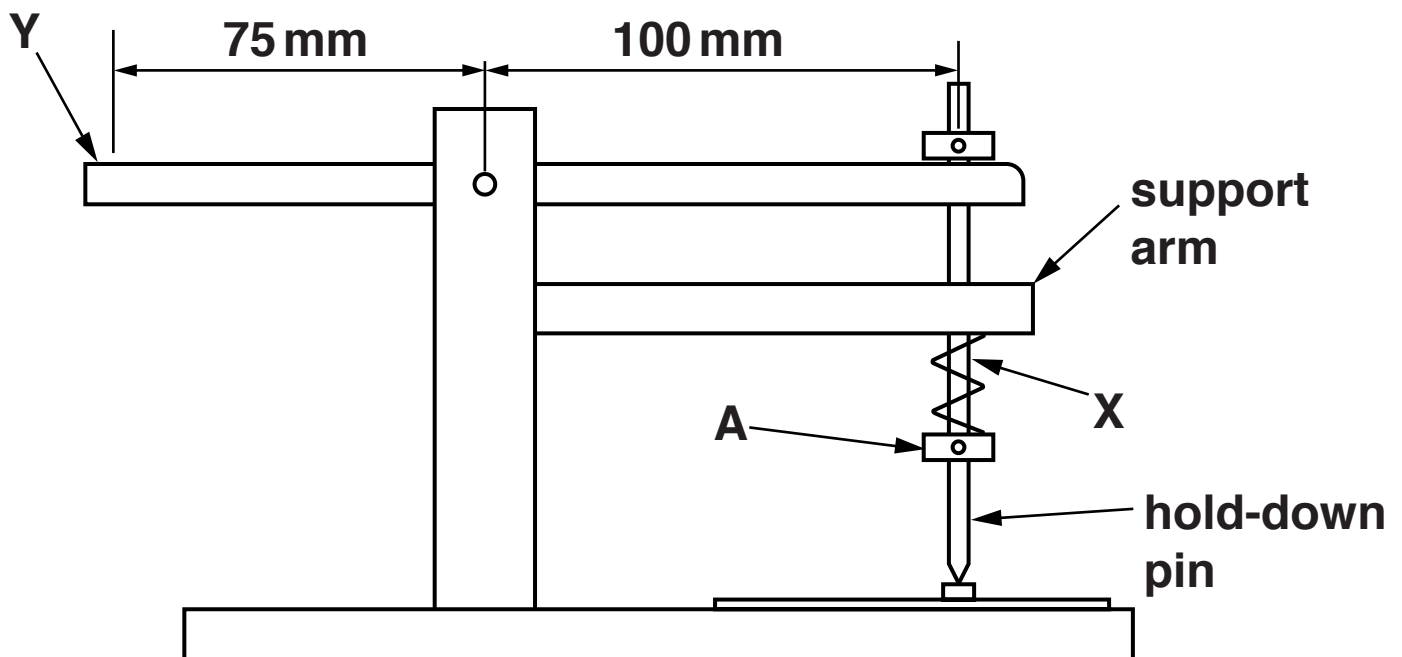
19 Fig. 6 shows a jig used for holding surface mounted electronic components in place whilst soldering.

FIG. 6



- (a) Indicate on Fig. 7 below the Load (L) Effort (E) and Fulcrum (F). [3]

FIG. 7



- (b) Fig. 7 shows the surface mount assembly jig mechanism.

If the spring X exerts a downwards force of 0.5 N, calculate the force required to lift the hold-down pin by pressing on Y.

Use the formula below.

Moment = force x distance

In equilibrium $M_c = M_{ac}$

M_c = clockwise moment

M_{ac} = anticlockwise moment

 [2]

(c) Give TWO reasons why high carbon steel has been used for the hold-down pin.

1 _____

2 _____

[2]

(d) Describe the purpose of the collar labelled A on Fig. 7.

[2]

(e) The hold-down pin is operating in a steel support arm.

To allow it to move freely some lubricant is needed.

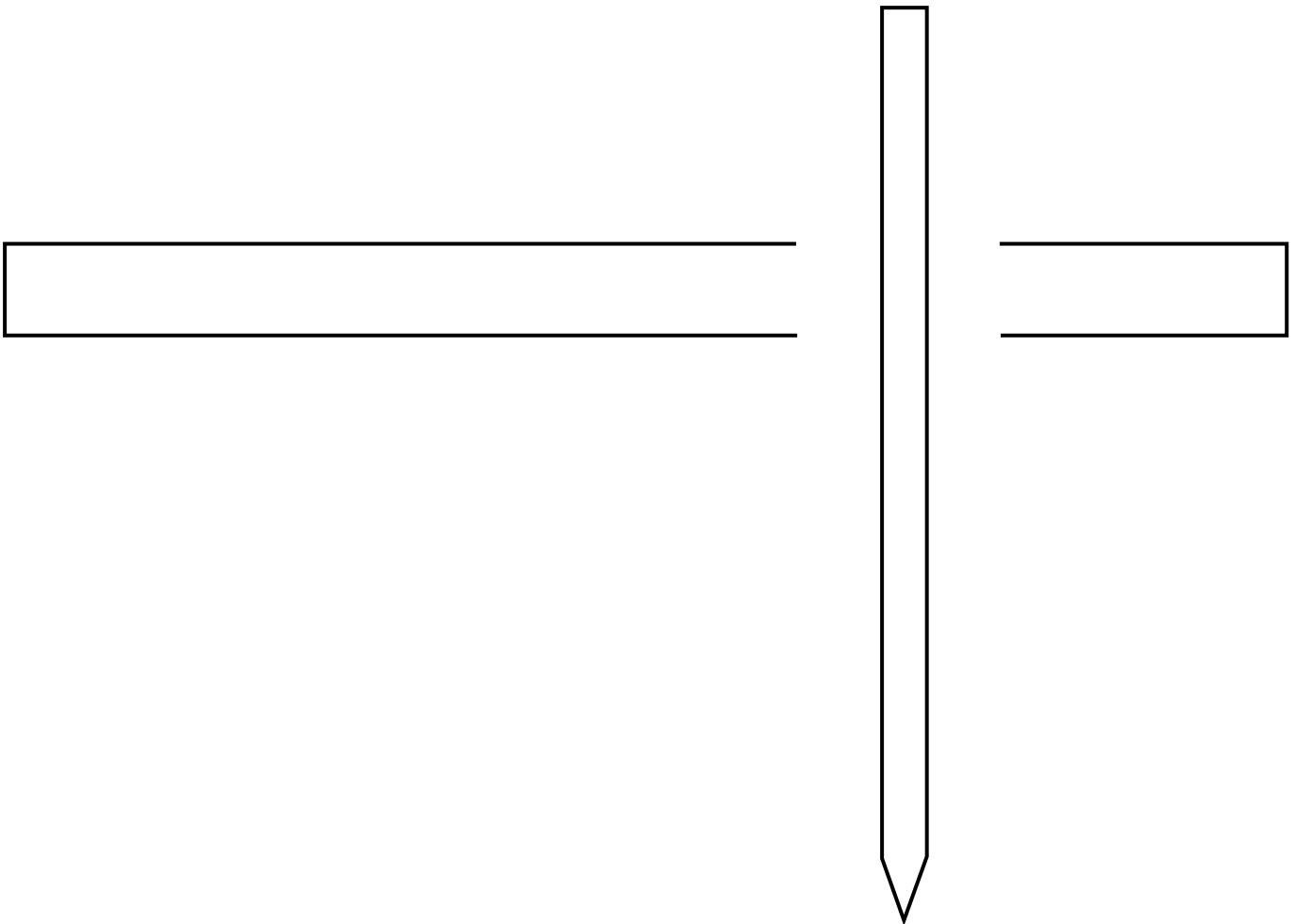
Give the name of a suitable lubricant for the hold-down pin.

[1]

After several years of use the hole for the hold-down pin has worn.

- (f) (i) Draw on Fig. 8 a plain bearing bush that could repair the support arm.**

FIG. 8



[2]

- (ii) State the names of TWO materials that would be suitable for making the plain bearing bush.**

1 _____

2 _____

[2]

(g) Give ONE method of preventing corrosion in steel.

_____ **[1]**

[TOTAL: 15]

END OF QUESTION PAPER



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