



Friday 23 May 2014 – Afternoon

**GCSE DESIGN AND TECHNOLOGY
Electronics and Control Systems**

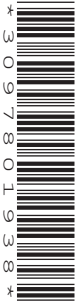
A515/03 Sustainability and technical aspects of designing and making –
Mechanisms

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)

Duration: 1 hour 30 minutes



Candidate forename		Candidate surname	
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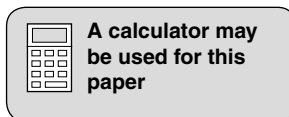
Centre number						Candidate number				
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INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- 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.
- Do **not** write in the bar codes.
- 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**.
- This document consists of **16** pages. Any blank pages are indicated.



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	<input type="checkbox"/>	<input type="checkbox"/>	[1]
12 Workers in a sweatshop are well paid	<input type="checkbox"/>	<input type="checkbox"/>	[1]
13 LED lamps are energy efficient	<input type="checkbox"/>	<input type="checkbox"/>	[1]
14 NiMH cells contain mercury	<input type="checkbox"/>	<input type="checkbox"/>	[1]
15 CFC means Chloro Fluoro Carbon	<input type="checkbox"/>	<input type="checkbox"/>	[1]

16 Fig. 1 shows a garden watering controller.

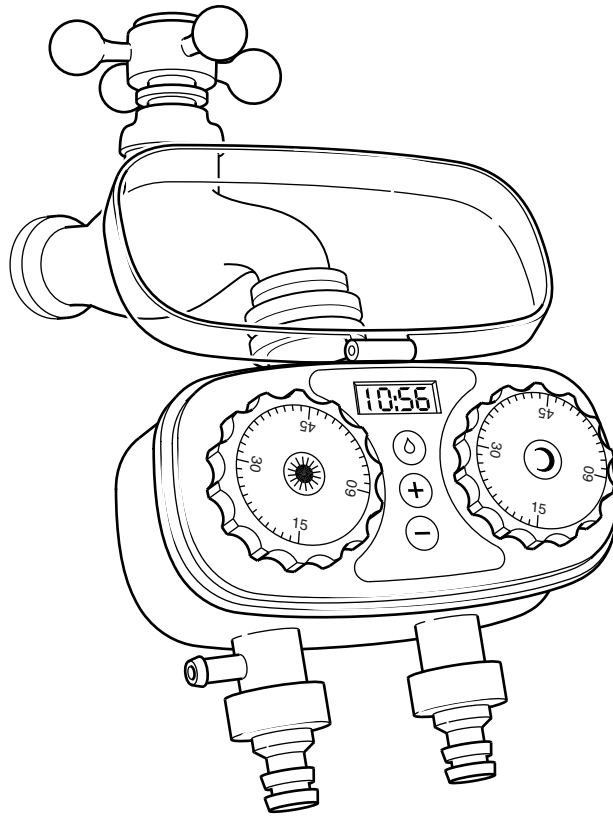


Fig. 1

(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]

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.

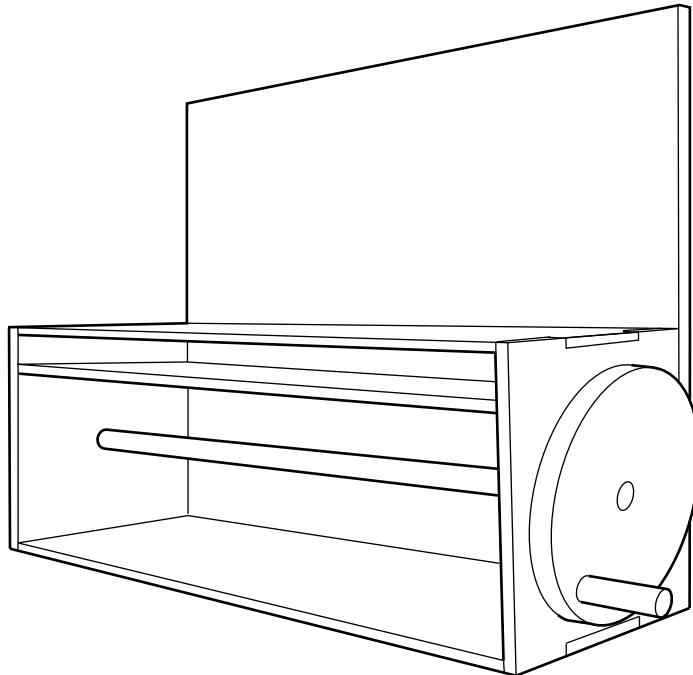


Fig. 2

[4]

(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.

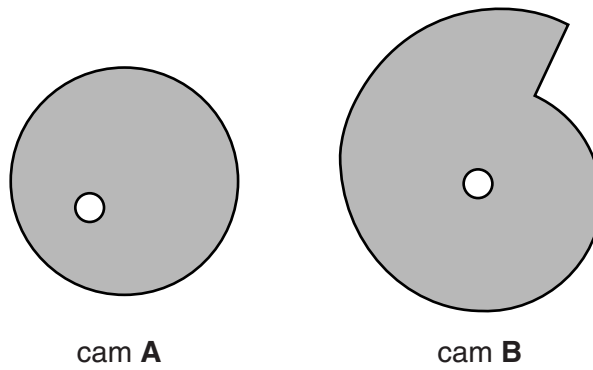


Fig. 3

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.

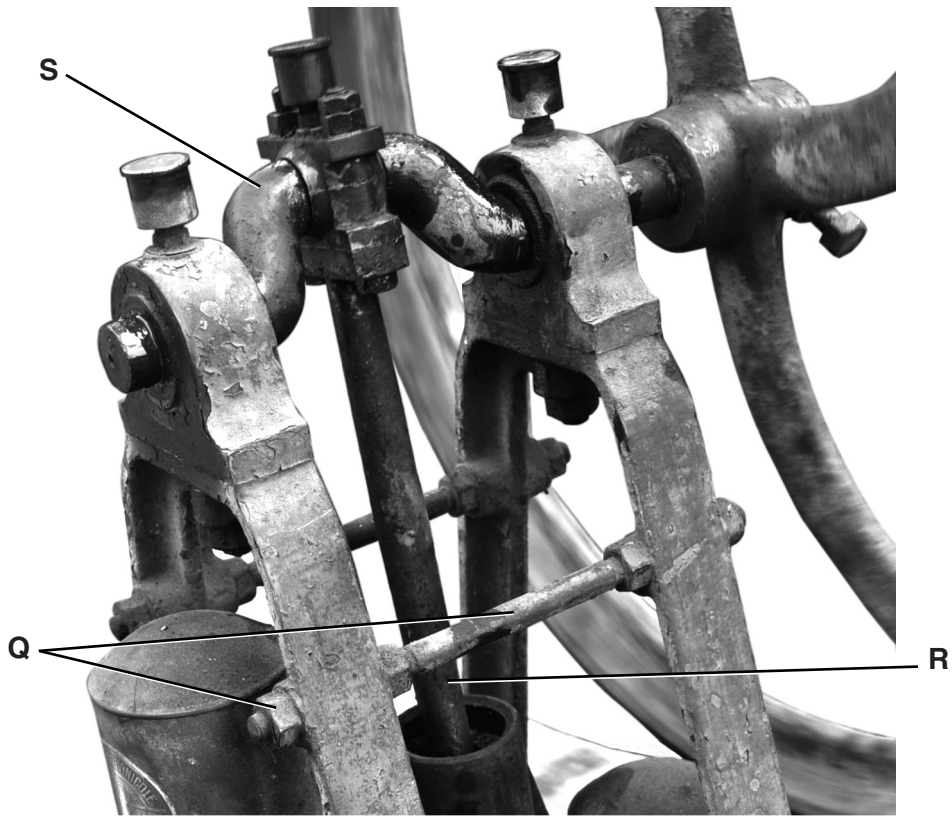


Fig. 4

(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]

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

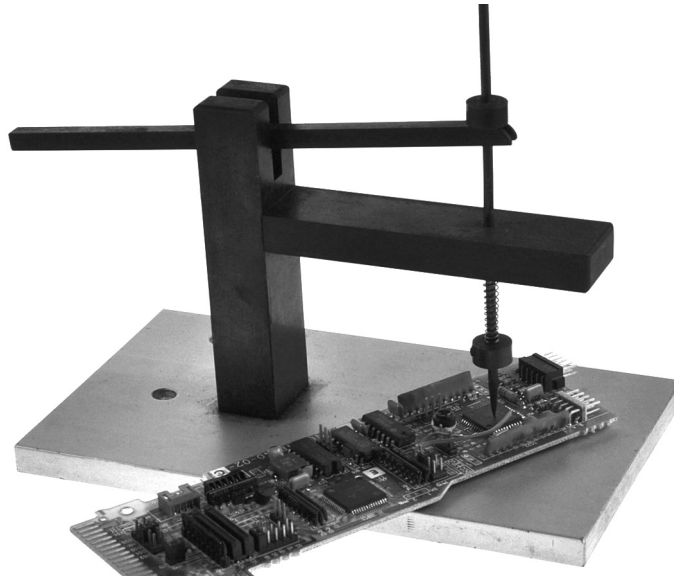


Fig. 6

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

[3]

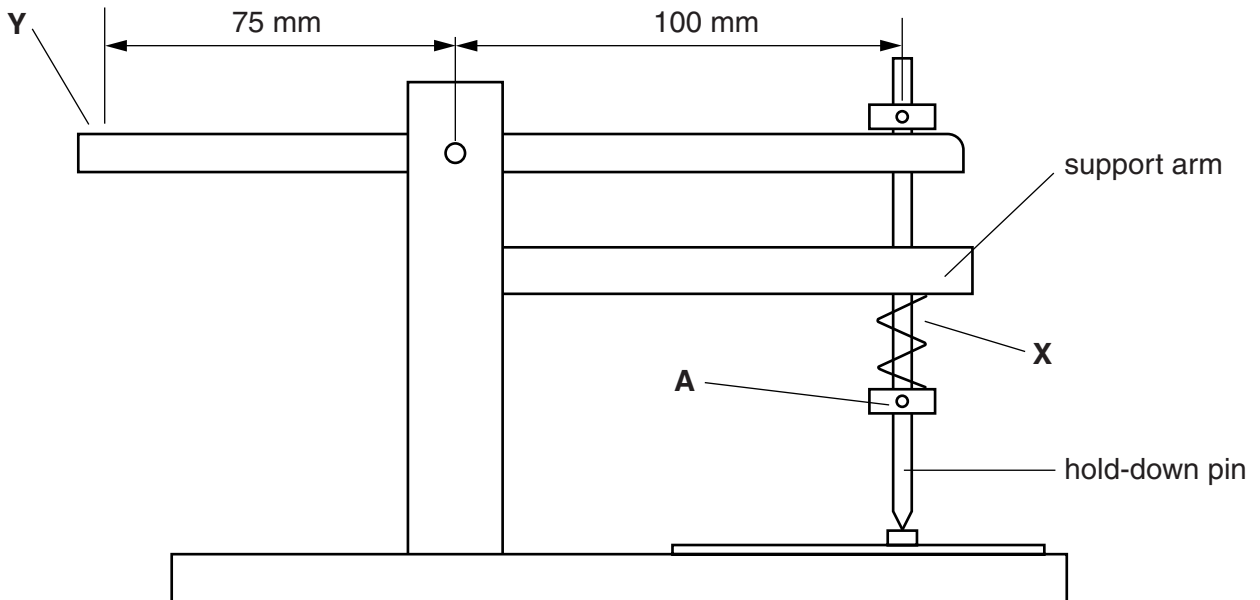


Fig. 7

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

If the spring **X** exerts a downwards force of 0.5N, 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.

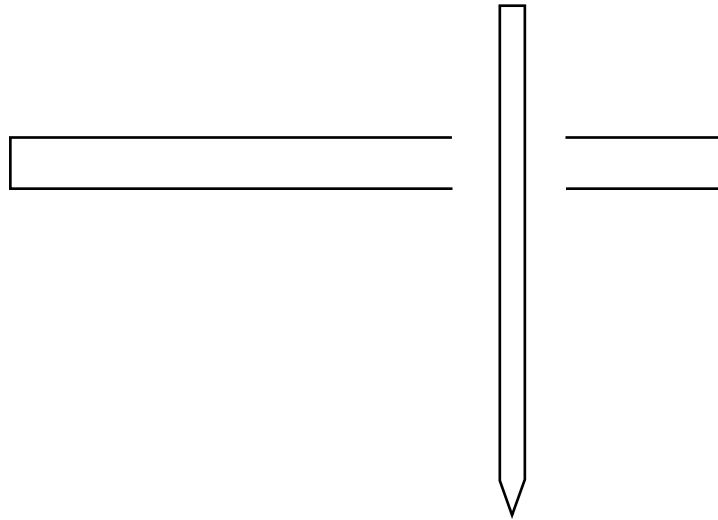


Fig. 8

[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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