

Tuesday 19 May 2015 – Morning

**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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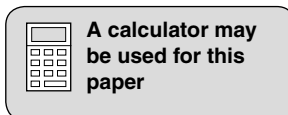
Centre number						Candidate number				
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INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions in Section A **and** Section B.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined pages at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

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 **80**.
- Your quality of written communication is assessed in questions marked with an asterisk (*).
- This document consists of **16** pages. Any blank pages are indicated.



SECTION A

Answer **all** the questions.

You are advised to spend 40 minutes on this section.

On questions 1 – 5 **circle** your answer.

- 1 Using a rechargeable battery can reduce your carbon footprint if you:
- (a) Charge it from a mains socket
 - (b) Recycle it when it's flat
 - (c) Charge it from a solar electric panel
 - (d) Fit it backwards into your product [1]
- 2 Some smart materials:
- (a) Know what you are thinking
 - (b) Respond to tree growth
 - (c) Change their properties when heated
 - (d) Generate carbon credits automatically [1]
- 3 Solar panels harvest energy from:
- (a) Any fossil fuel
 - (b) Sustainable forest timber
 - (c) The movement of the planets
 - (d) The sun [1]
- 4 Coal-fired power stations can contribute to:
- (a) Volcanic ash clouds
 - (b) Acid rain
 - (c) Potholes in roads
 - (d) Improved tree growth [1]
- 5 Reducing the use of chemicals dangerous to the environment can:
- (a) Increase charity shop profits
 - (b) Save you money
 - (c) Help keep your garden fence green
 - (d) Contribute to preserving the world's eco-systems [1]

6 Complete the following to give the meaning of the abbreviation RoHS.

Restriction of H S [1]

7 State **one** source of renewable energy.

..... [1]

8 Give **one** reason why excessive carbon dioxide emissions may be harmful to the environment.

.....
 [1]

9 State the meaning of the term 'biodegradable'.

..... [1]

10 Which of the 6Rs describes the disassembly and reprocessing of materials for use in new products?

..... [1]

Decide whether the statements below are **True** or **False**.

Tick (✓) the box to show your answer.

	True	False	
11 Globalised companies only sell their products in the United Kingdom	<input type="checkbox"/>	<input type="checkbox"/>	[1]
12 All redundant products should be sent to landfill	<input type="checkbox"/>	<input type="checkbox"/>	[1]
13 All designers of mobile phones include built-in obsolescence	<input type="checkbox"/>	<input type="checkbox"/>	[1]
14 Leaving televisions on standby wastes energy	<input type="checkbox"/>	<input type="checkbox"/>	[1]
15 WEEE regulations help with safe disposal of faulty electronic products	<input type="checkbox"/>	<input type="checkbox"/>	[1]

16 Fig. 1 shows a wind-up rechargeable radio.



Fig. 1

(a) Identify **three** design features of the wind-up radio shown in Fig. 1.

- 1
- 2
- 3 [3]

(b) The wind-up radio includes a small rechargeable battery.

Give **one** benefit of including a rechargeable battery in the wind-up radio.

-
- [1]

(c) The wind-up radio can be dismantled into its component parts using only a small cross-point screwdriver.

Give **two** benefits of this to the environment.

- 1
-
- 2
- [2]

(d) The wind-up radio contains components made of different materials.

Choose from the following recycling processes to complete the table below, matching a recycling process to each material.

- Tertiary recycled
- Removed, tested and re-used
- Melted down and refined
- Sorted then melted down and re-used
- Ground up and used as filler

Material	Recycling process
Metal	<i>Melted down and refined</i>
Different thermoplastics	
Thermosetting plastics	
Electronic components	

[3]

(e) Give **two** ways that the wind-up radio could be disposed of by primary recycling.

1

.....

2

.....

[2]

- (f) Use sketches and notes to illustrate to the user how to operate the wind-up radio.

[3]

SECTION B

Answer **all** the questions.

You are advised to spend 50 minutes on this section.

17 Fig. 2 shows two garlic presses.

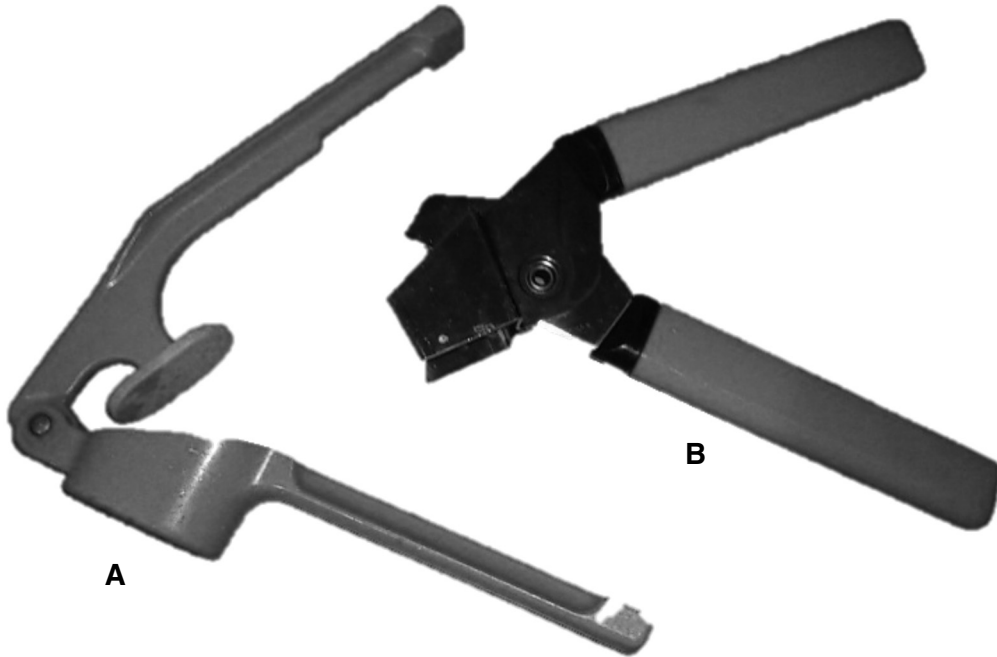


Fig. 2

(a) For each garlic press, state the class of lever employed in its operation.

A

B

[2]

(b) On Fig. 2 label the Fulcrum (F) Effort (E) and Load (L) of garlic press **A**.

[3]

(c) Garlic press **B** has been assembled using a rivet.

Give **two** reasons why a rivet has been used.

1

2

[2]

(d) Garlic press **B** has a plated finish on the metal parts and is fitted with plastic handles.

State **one** metal suitable for the plated finish.

..... [1]

(e) (i) Many plastic self-assembly scale models are available to buy and build at home.

State the name of a thermoplastic suitable for mass production of self-assembly scale models.

..... [1]

(ii) Name the manufacturing process used to produce plastic models in quantity.

..... [1]

(iii) State the name of a thermoplastic used in schools for modelling mechanisms.

..... [1]

(f) Fig. 3 shows an incomplete toy windmill.

Use sketches and notes to design a mechanism that will make the sails rotate when the handle is turned.

Indicate on your drawing the direction of the rotation of the handle and sails.

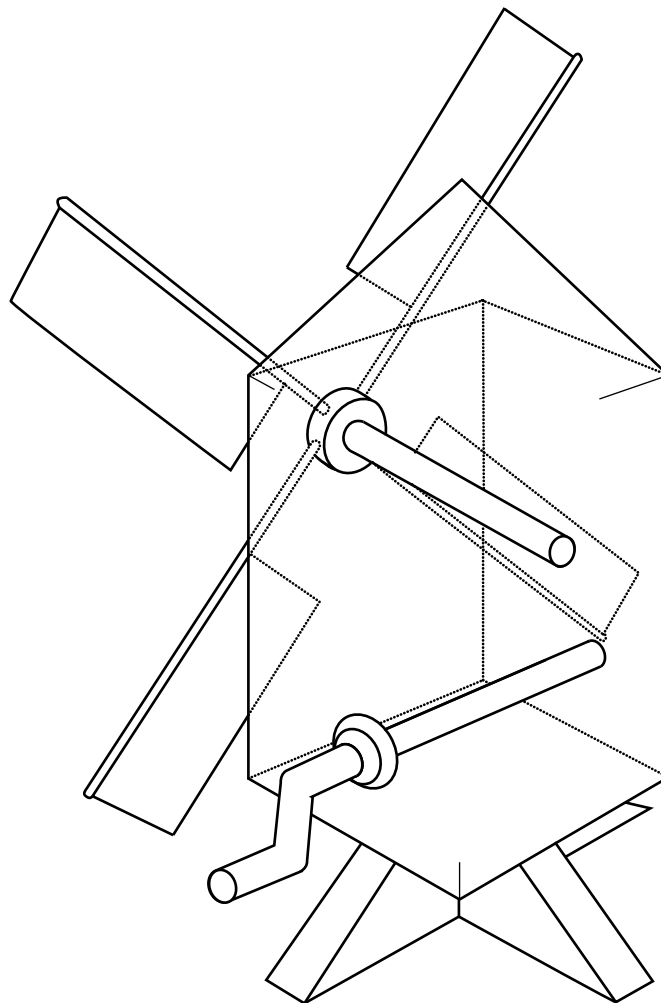


Fig. 3

[4]

18 Fig. 4 shows part of a small engine-driven generator.

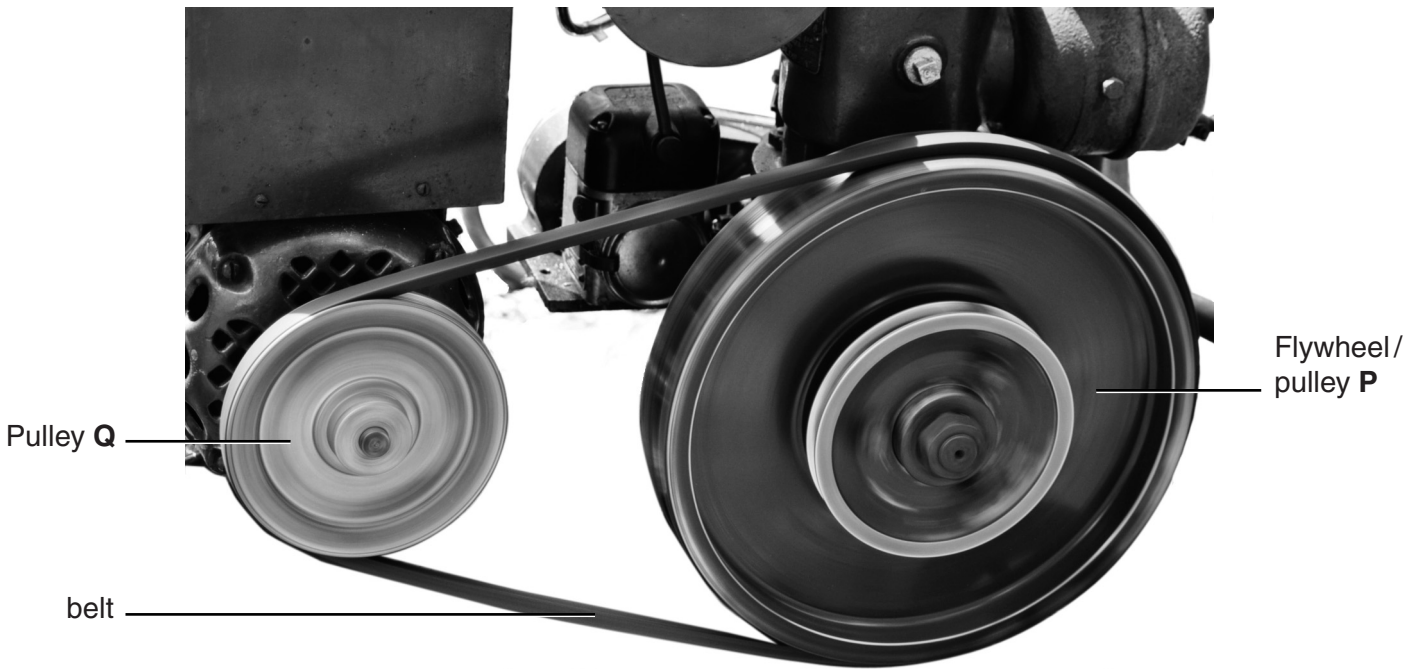


Fig. 4

(a) (i) Name the type of belt shown in Fig. 4.

..... [1]

(ii) For a given engine speed, state which of the pulleys will rotate the fastest.

..... [1]

(iii) Explain why the engine has a large flywheel.

.....

 [2]

(iv) The belt type used in Fig. 4 has advantages over other types of belt.

Tick (✓) the **three** statements which are advantages.

Low maintenance	Needs regular adjustment	Never slips	Requires lubrication	Can be twisted	Slips if machine jams

[3]

(b) Give **two** reasons why modern generators are usually connected directly to the engine.

1

.....

2

.....

[2]

(c)* Many aircraft and car manufacturers are replacing metal parts with composite materials. Discuss the advantages and disadvantages of using composite materials.

.....

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..... [6]

19 Fig. 5 shows part of a large water pump drive mechanism.

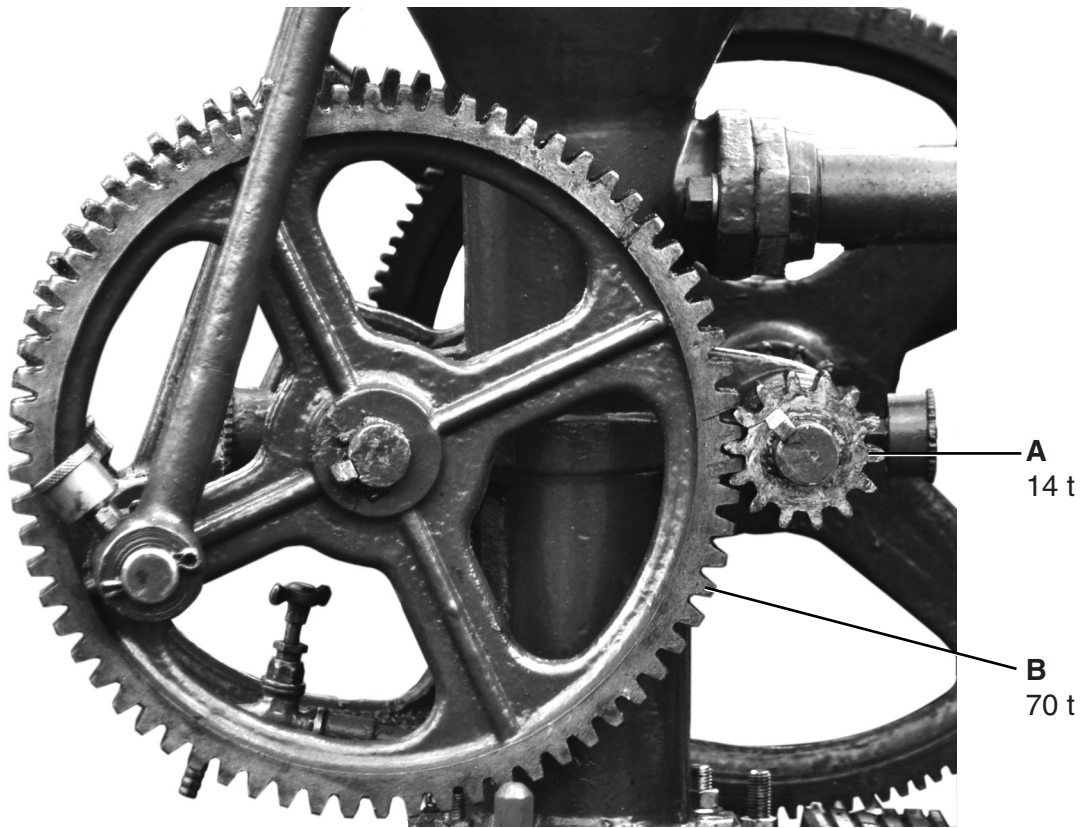


Fig. 5

(a) (i) Calculate the velocity ratio of the gear wheels A and B shown in Fig. 5.

Use the formula $VR \text{ (gear ratio)} = \text{number of teeth on driven} / \text{number of teeth on driver}$.

.....
 [2]

(ii) If the small gear wheel rotates at 60 rpm, calculate the rpm of the large gear wheel.

.....
 [2]

(iii) The gears shown in Fig. 5 are unguarded.
 State **one** risk to operators from unguarded machinery.

.....
 [1]

(iv) 'Gearing down' is a term used when a small gear wheel drives a larger gear wheel.

Explain the benefits of 'gearing down' the drive to a machine.

.....

.....

.....

..... [2]

(b) Fig. 6 shows a close-up view of part of a mechanism.

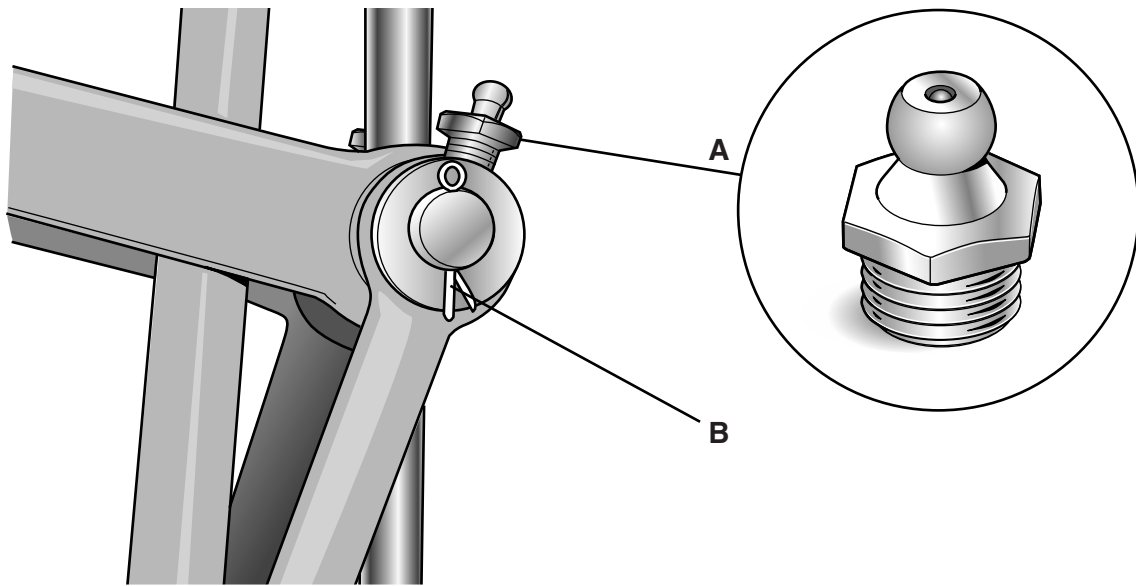


Fig. 6

(i) Name the part labelled **A** in Fig. 6.

..... [1]

(ii) A temporary fixing is shown at **B** in Fig. 6.
State why a temporary fixing has been used at **B**.

.....

..... [1]

(iii) The frame of the mechanism is made of cast iron.
State why the cast iron should be painted.

..... [1]

(c) Fig. 7 shows the whole mechanism.

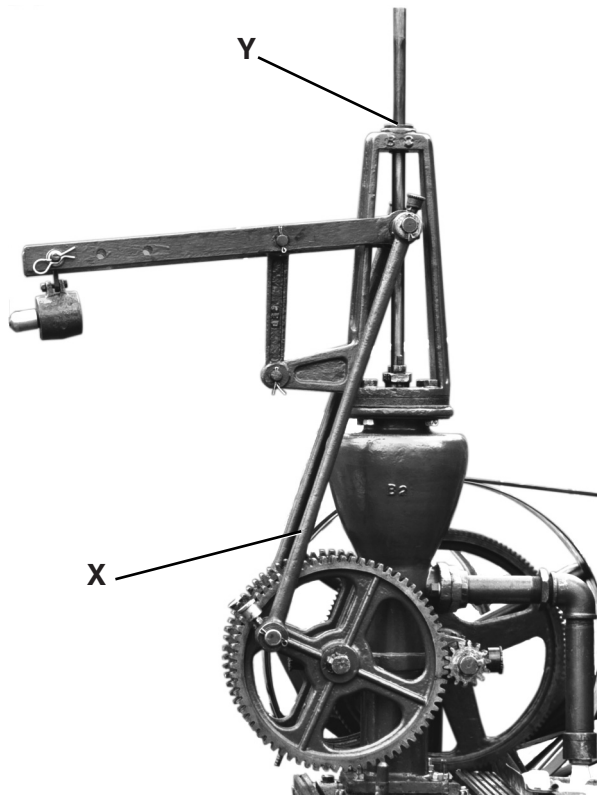


Fig. 7

(i) Name the engineering part labelled X in Fig. 7.

..... [1]

(ii) Complete the following sentence.

R..... motion from the c..... is converted into reciprocating motion of the piston. [2]

(iii) Engineering part X drives a parallel motion mechanism.

A sintered bronze bearing bush, part Y, is fitted at the top.

Explain why a sintered bronze bearing bush has been used.

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

END OF QUESTION PAPER

ADDITIONAL ANSWER SPACE

If additional answer space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margins.

A large area of lined paper for writing answers. It features a vertical margin line on the left side and horizontal dotted lines for writing. The lines are evenly spaced and extend across the width of the page.

Blank writing area with horizontal dotted lines and a vertical solid line on the left side.



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