

Tuesday 23 May 2017 – 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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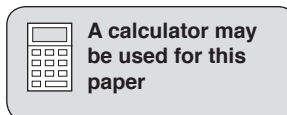
Centre number						Candidate number				
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INSTRUCTIONS TO CANDIDATES

- 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 page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.
- Show all working out for calculations.

INFORMATION FOR CANDIDATES

- The number of marks for each question 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 **20** 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 Screw-on tops are removed from plastic containers before recycling because:
- (a) They contain different chemical properties
 - (b) They are a choking hazard
 - (c) They need cleaning separately
 - (d) It is not practical to recycle them [1]
- 2 Tertiary recycling is described as:
- (a) Using a chemical process to break down an existing product to make a new one
 - (b) The second-hand use of a product without changing or altering it
 - (c) Altering the product to use it in another way without the use of chemicals
 - (d) The dismantling of a product to produce parts that can be re-used [1]
- 3 Which statement is **not** correct?
- (a) Disassembly of a product supports the recycling process
 - (b) Disassembly of products adds to the use of landfill sites
 - (c) Knock down fittings make it easier to disassemble a product
 - (d) Disassembly makes it easier to repair a product [1]
- 4 The symbol below stands for:
-
- (a) Recycling code for plastics
 - (b) Carbon footprint
 - (c) Greenhouse emission warning
 - (d) Recycling code for a specific metal [1]

5 Ergonomics is the study of:

- (a) The human body and its movement
- (b) The cost of manufacturing a product
- (c) The life cycle of a product
- (d) Materials and their properties

[1]

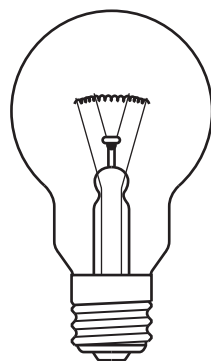
6 Give **one** reason why products should be adapted and re-used to suit an alternative use.

..... [1]

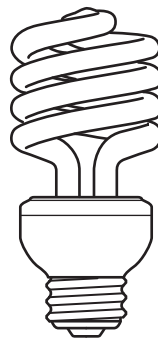
7 State the meaning of the term 'carbon offsetting'.

..... [1]

8 Fig. 1 shows two types of light bulb.



incandescent light bulb



compact fluorescent light bulb (CFL)

Fig. 1

Give **one** reason why a compact fluorescent light bulb (CFL) is more environmentally friendly than an incandescent light bulb.

..... [1]

- 9 The sign shown in Fig. 2 is mainly coloured red.



Fig. 2

Give **one** reason why the sign in Fig. 2 is coloured red.

..... [1]

- 10 State which of the 6Rs describes not using a material because it is harmful to the environment or people.

..... [1]

Decide whether the statements below are **true** or **false**.

Tick [✓] the box to show your answer.

	True	False	
11 ETI stands for Ethical Trading Initiative.	<input type="checkbox"/>	<input type="checkbox"/>	[1]
12 Moral issues protect the safety of users of products.	<input type="checkbox"/>	<input type="checkbox"/>	[1]
13 The British Standards Institute regulates the price of products.	<input type="checkbox"/>	<input type="checkbox"/>	[1]
14 Solar power is a finite source of energy.	<input type="checkbox"/>	<input type="checkbox"/>	[1]
15 Globalisation has decreased international trade.	<input type="checkbox"/>	<input type="checkbox"/>	[1]

16 Fig. 3 shows a retractable dog lead that can be extended to 10 m.

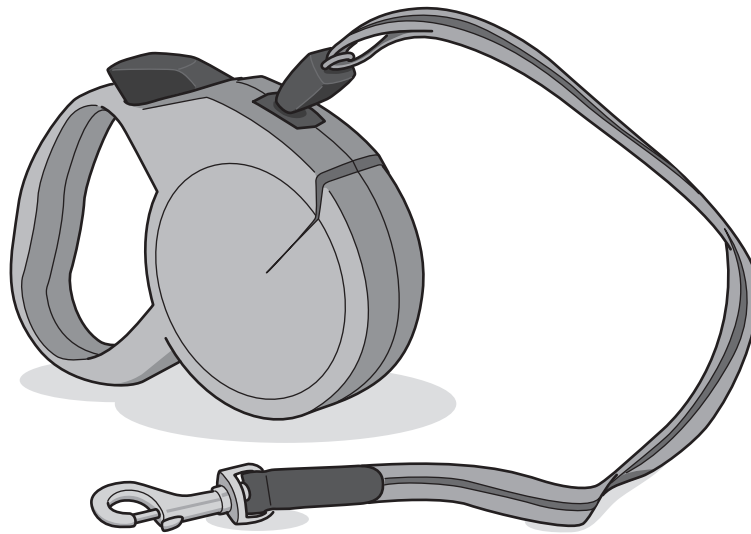


Fig. 3

(a) Identify **three** design features of the retractable dog lead in Fig. 3.

- 1.....
- 2.....
- 3.....

[3]

(b) The retractable dog lead does not require a power source to work. Give **two** benefits this has for the environment.

- 1.....
-
- 2.....
-

[2]

(c) A smart material such as phosphorescent paint can be used to coat the lead so it can be used at night.

Explain what a smart material is.

-
-

[2]

- (d) The manufacturer wishes to improve the dog lead in Fig. 3 so that it includes a night light and dog bag dispenser.

Use sketches and notes to show the improved design.
Label all materials and components used.

[5]

- (e) Corrugated card will be used as packaging for the dog lead.
Give **two** reasons why this is a suitable material for the packaging.

1.....
.....
2.....
.....

[2]

SECTION B

Answer **all** the questions.

You are advised to spend 50 minutes on this section.

- 17 Fig. 4 shows an example of a food mixer and a view with the top cover removed. A gear system is used to rotate the beater shafts.

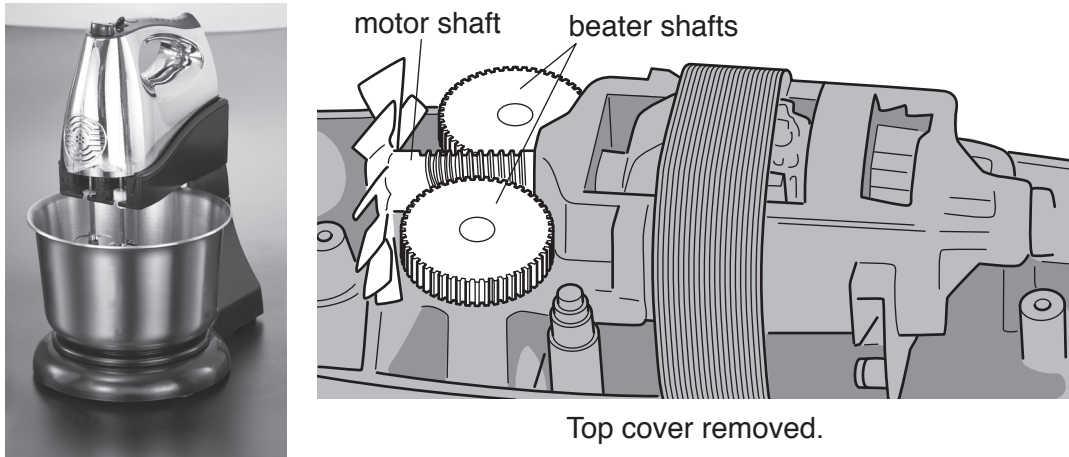


Fig. 4

- (a) (i) Name the gear system shown in Fig. 4.

..... [2]

- (ii) State the effect of the gear system on the speed of the beater shafts.

.....
 [1]

- (iii) Fig. 5 shows a drawing of the gear system used in the food mixer. Use arrows to indicate the direction of rotation of the beater shafts.

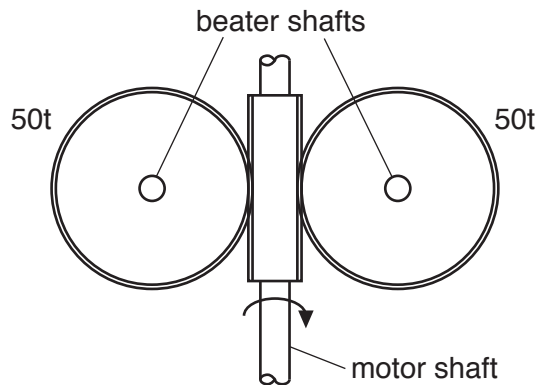


Fig. 5

[1]

- (iv) A change of speed is one effect of using the gear system. State **one** other effect of using the gear system.

..... [1]

- (b) (i) Calculate the velocity ratio of the gear system in Fig. 6.

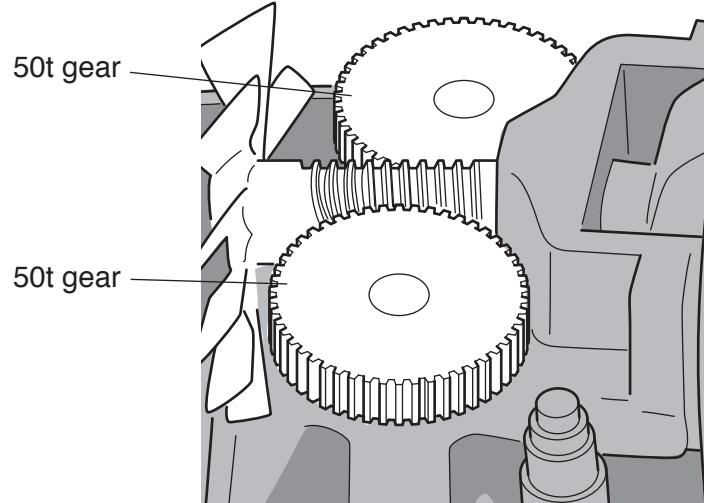


Fig. 6

Use the formula $VR = \text{Driven}/\text{Driver}$

..... [1]

- (ii) The speed of the motor is 2000 rpm. Calculate the speed of the beaters.

..... [2]

- (c) A range of materials are used in the manufacture of the food mixer shown in Fig. 4.

- (i) The 50t gears shown in Fig. 6 are made from a thermoplastic material. State the name of a suitable thermoplastic material.

..... [1]

- (ii) The food mixing bowl is made from stainless steel. State **two** properties that make this material suitable for this purpose.

1

2

[2]

- (d) Fig. 7 shows a piece of acrylic that will be bent at 90°. The acrylic will be used as a cover in the food mixer.

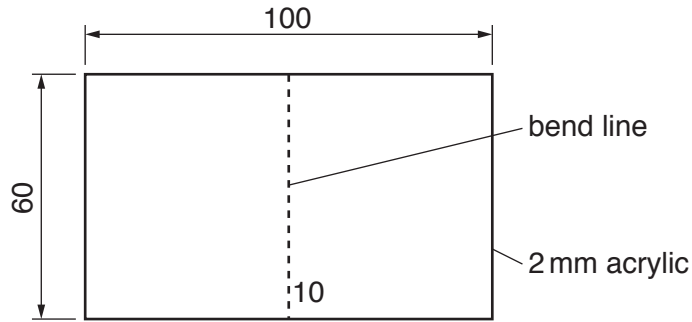


Fig. 7

- (i) Name the piece of equipment used to heat the acrylic before bending.

..... [1]

- (ii) Use sketches and notes to design a jig that will enable a batch of 100 identical acrylic covers as shown in Fig. 8 to be made.

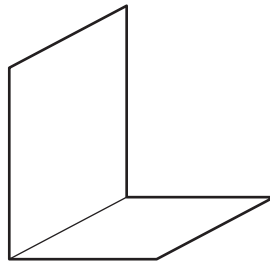


Fig. 8

[3]

- 18 (a) A pop rivet tool shown in Fig. 9 is an example of a class 1 lever. Name the **three** parts of the lever identified on Fig. 9.

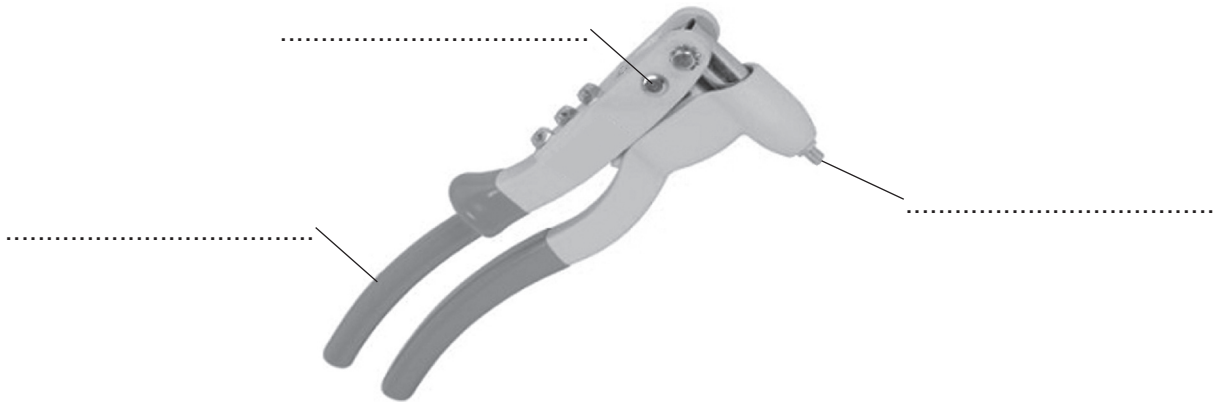


Fig. 9

[3]

- (b) Fig. 10 shows a ventilation system that allows a greenhouse window to open and close. Smart grease is used to dampen the movement when the ventilation system is opening and closing.



Fig. 10

- (i) State the change that must happen for the smart grease to react and open or close the ventilation system.

..... [1]

- (ii) Name **one** other smart material that can be used in a mechanism and state how it would be used.

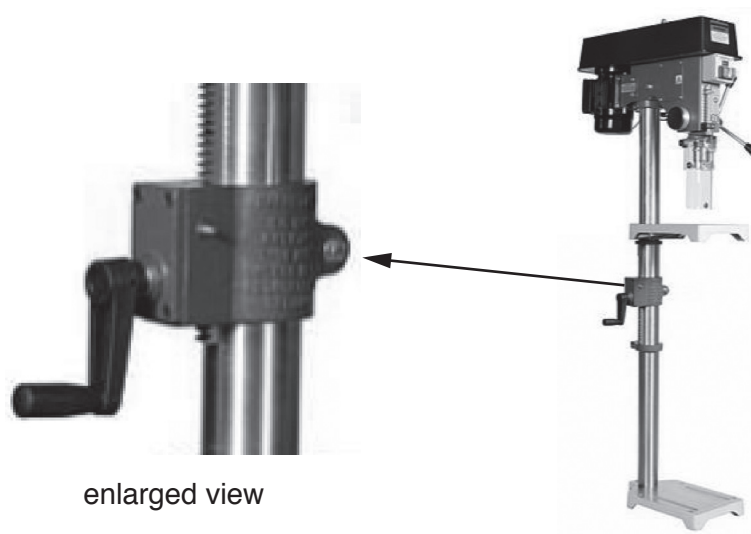
Smart material.....

Use.....

.....

[2]

(c) Fig. 11 shows a mechanical system used on a pillar drill to raise and lower the table.



enlarged view

Fig. 11

(i) Name the mechanism shown in Fig. 11.

..... [1]

- (ii) The mechanism shown used on the pillar drill is also suitable for opening heavier windows in a greenhouse. Fig. 12 shows the outline of a greenhouse window. Use sketches and notes to show how the mechanism from Fig. 11 could be used to open and close the greenhouse window.

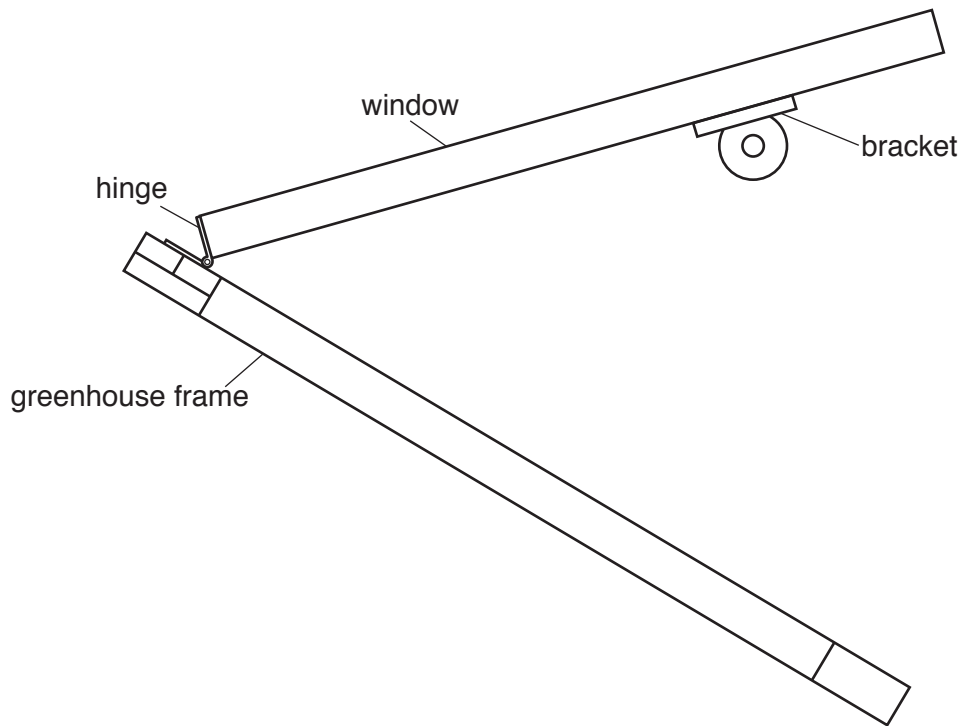


Fig. 12

[3]

- (iii) Use notes and sketches on Fig. 13 to show how the mechanism you have added in Fig. 12 is connected to the bracket. The connection must be moveable.

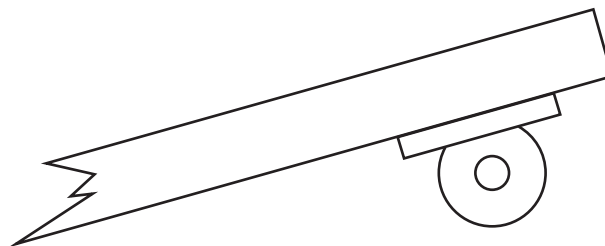


Fig. 13

[2]

Turn over

(iv) Give **one** reason why the connection to the bracket must be moveable.

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

(v) Fig. 14 shows a part section of the handle and shaft arrangement that operates the mechanism for opening and closing the greenhouse window.

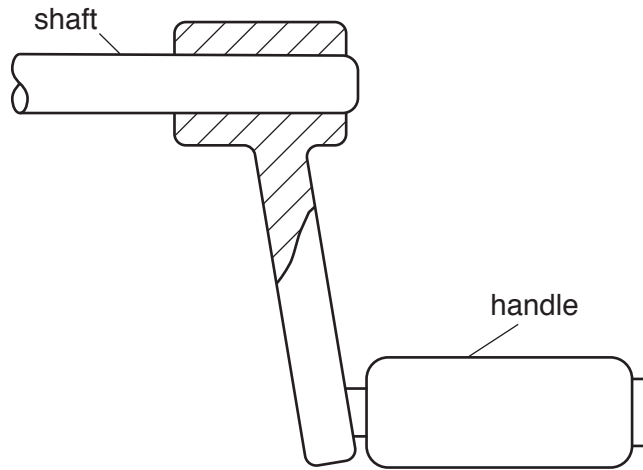


Fig. 14

Use sketches and notes in the space below to show how the handle could be secured to the shaft.

[2]

19 The cams in Fig. 15 are used to produce movement in a follower.

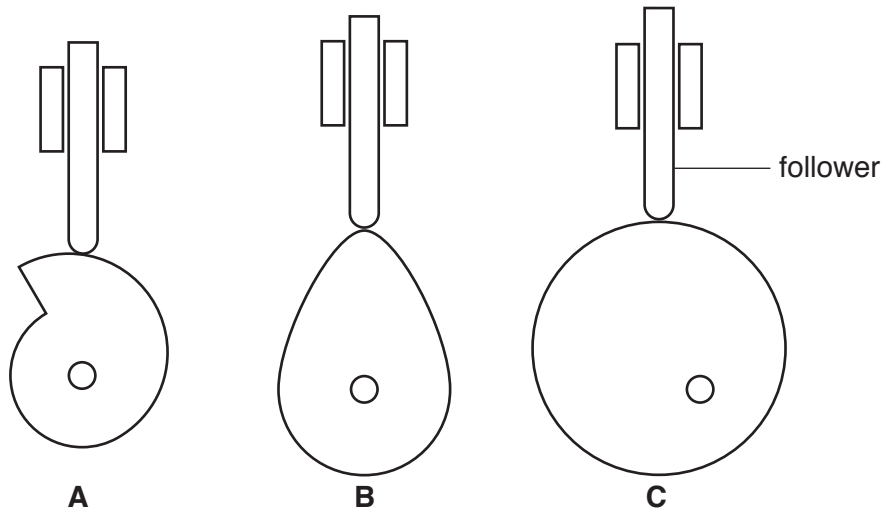


Fig. 15

(a) (i) State the name of each cam.

A.....

B.....

C.....

[3]

(ii) Put a tick (✓) in the box below for the cam which provides a smooth rise and fall for the follower.

A	B	C
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

[1]

(b) Fig. 16 shows the drive system of a drilling machine. The system uses two stepped pulleys.

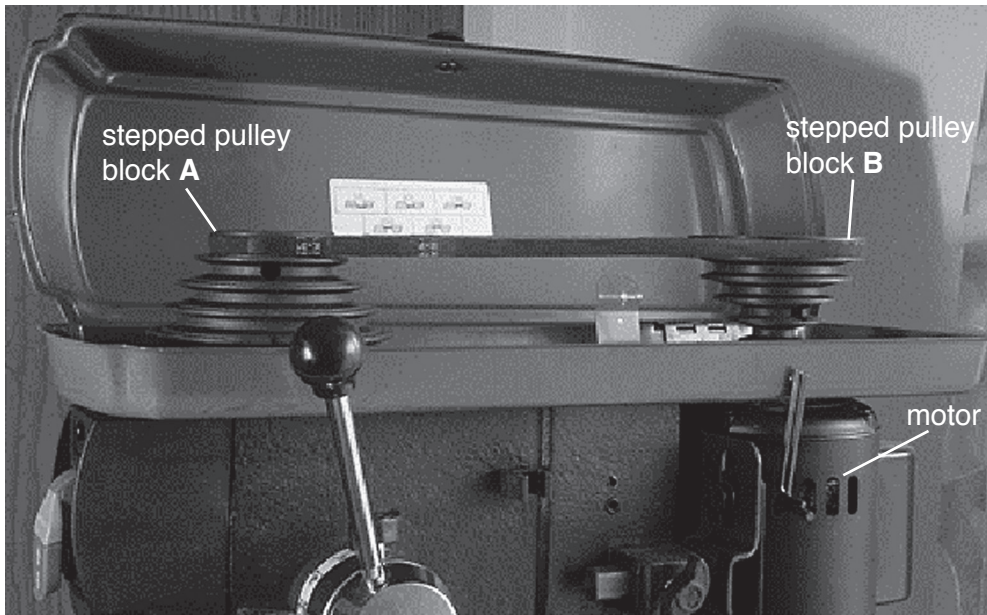


Fig. 16

(i) State which of the stepped pulley blocks in Fig. 16 provides the drive.

..... [1]

(ii) Give **two** reasons why the stepped pulley system is used on a drilling machine.

1

.....

2

.....

[2]

(c) Bicycles use a sprocket and chain as a drive mechanism as shown in Fig. 17.



Fig. 17

Give **two** reasons why a sprocket and chain is used rather than a pulley and belt system on a bicycle.

- 1.....
.....
- 2.....
.....

[2]

ADDITIONAL ANSWER SPACE

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

A large area of lined paper for writing answers. It consists of a vertical solid line on the left side, creating a margin. To the right of this line, there are 25 horizontal dotted lines spaced evenly down the page, providing a guide for writing.

A large area of the page is reserved for writing, featuring a vertical solid line on the left side and horizontal dotted lines extending across the page.



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