



Rewarding Learning

General Certificate of Secondary Education
2013

Centre Number

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Candidate Number

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Technology and Design

Unit 2:
Systems and Control

Element 2: Mechanical and
Pneumatic Control Systems



[GTD22]

GTD22

FRIDAY 7 JUNE, AFTERNOON

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

Write your answers in the spaces provided in this question paper.

Complete in blue or black ink only. **Do not write in pencil or with a gel pen.**

Answer **all** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 80.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.



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Formulae for GCSE Technology and Design

You should use, where appropriate, the formulae given below when answering questions which include calculations.

1 Gear ratio of a simple gear train = $\frac{\text{number of teeth on driven gear}}{\text{number of teeth on driver gear}}$

For a compound gear train:

Total Gear ratio = the product of the gear ratios of all the subsystems

i.e. $GR_T = GR_1 \times GR_2 \times GR_3 \dots$

2 Mechanical Advantage = $\frac{\text{Load}}{\text{Effort}}$

3 Velocity Ratio = $\frac{\text{Distance moved by effort}}{\text{Distance moved by load}}$

4 Pneumatics
Force = Pressure \times Area ($F = P \times A$)

[Turn over



Element 2

Mechanical and Pneumatic Control Systems

Answer **all** questions

Examiner Only

Marks Remark

- 1 (a) (i) **Table 1** shows the symbols for different methods of operating pneumatic valves.

Table 1

Symbol	Name of Symbol
	
	
	
	

[4]

Complete **Table 1** by inserting the correct name for each symbol from **Table 2**.

Table 2

Roller
Push Button
Plunger
Lever
Pilot Air



(ii) Select the methods from **Table 2** that would be used to operate:

- A valve to confirm the position of a piston rod

_____ [1]

- A valve which is to be operated from a distance

_____ [1]

(b) Fig. 1 shows the components used to give a time delay.

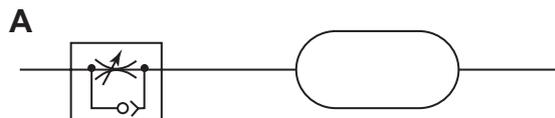


Fig. 1

(i) Describe the function of valve **A** in the circuit.

_____ [1]

(ii) State **two** ways in which the time delay can be increased.

1. _____

2. _____

_____ [4]

Examiner Only

Marks Remark

[Turn over



(iii) Explain the purpose of valve **E** in **Fig. 3**.

[2]

(iv) During the building of the circuit two errors were made:

Error 1: Valve **D** was omitted as shown in **Fig. 4**.
(Compare with **Fig. 3**).

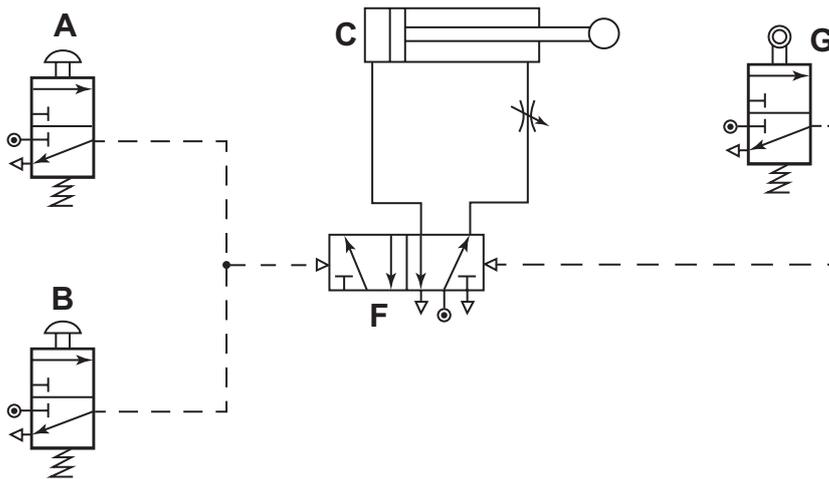


Fig. 4

Explain what happens to the supply air when button **A** is pressed.

[3]

Error 2: The valve shown below was fitted in **Fig. 4** instead of valve **E**, as shown in **Fig. 3**.



Explain the effect this error would have on the operation of the circuit.

[3]

Examiner Only

Marks Remark

[Turn over



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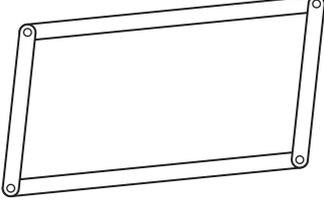
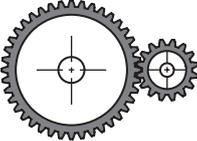
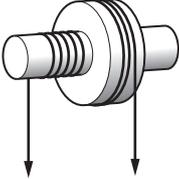
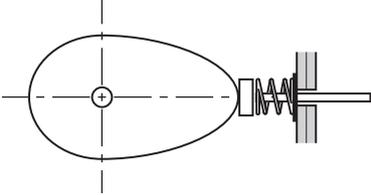
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- 2 (a) Table 3 shows four different mechanisms. Complete Table 3 by inserting the correct name for each mechanism and the appropriate letter from the list below to describe its function. Each letter may be used only once.

Table 3

Mechanism	Name	Function
		
		
		
		

[8]

Function

- A To transmit motion between parallel shafts.
- B To convert rotary motion into reciprocating motion.
- C To keep surfaces an equal distance apart as they are moved.
- D To enable heavy loads to be raised by small efforts.



(b) Fig. 6 shows a lever used in a can crusher.

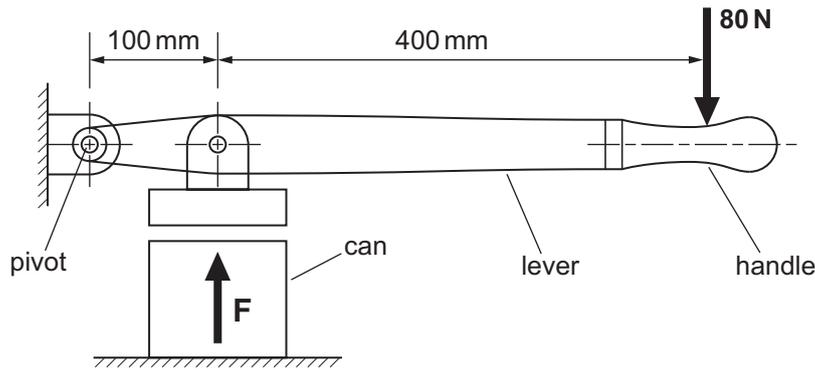


Fig. 6

- (i) Suggest a suitable material for the lever. Give a reason for your answer.

Lever material _____

Reason _____ [2]

- (ii) Calculate the force F at the can when a force of 80 N is applied to the handle.

_____ [4]

Examiner Only

Marks Remark

[Turn over



(c) (i) Name **three** types of belt and give **one** application for each type.

1. _____

Application _____

2. _____

Application _____

3. _____

Application _____ [6]

(ii) Some belts can become slack. Explain why this can be a disadvantage and describe **one** method for overcoming it.

Disadvantage _____

Method for overcoming _____

_____ [4]

Examiner Only	
Marks	Remark



(iii) Fig. 7 shows a gearbox which is driven by an electric motor through a belt and pulley system.

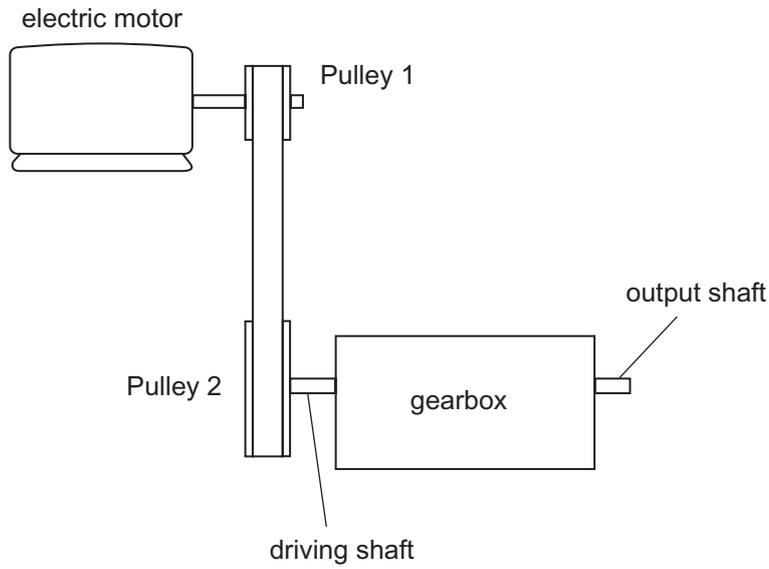


Fig. 7

Is the speed of Pulley 1 faster or slower than Pulley 2?

Give a reason for your answer.

[2]

Examiner Only

Marks Remark

[Turn over



- (iv) The gearbox in **Fig. 8** is to be changed to give an output speed of 3200 rev/min by changing wheels **C** and **D** only. The following gear wheels are available. 30T, 45T, 60T, 75T.

Select **two** of the above wheels to replace **C** and **D** and make up a suitable drive.

Label the chosen wheels as **C** and **D**.

[4]

THIS IS THE END OF THE QUESTION PAPER

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Marks	Remark
Total Question 2	



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Question Number	Marks
1	
2	

Total Marks	
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Examiner Number

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