

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
LEVEL 1/2  
R101/01  
CAMBRIDGE NATIONAL  
AWARD/CERTIFICATE IN PRINCIPLES  
IN ENGINEERING AND ENGINEERING  
BUSINESS**

**Engineering principles**

**WEDNESDAY 9 JANUARY 2019: Morning**

**DURATION: 1 hour**

**plus your additional time allowance**

**MODIFIED ENLARGED**

<b>Candidate forename</b>		<b>Candidate surname</b>	
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<b>Centre number</b>						<b>Candidate number</b>				
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**Candidates answer on the Question Paper.**

**OCR SUPPLIED MATERIALS:**

**None**

**OTHER MATERIALS REQUIRED:**

**A calculator may be used**

**READ INSTRUCTIONS OVERLEAF**



## **INSTRUCTIONS TO CANDIDATES**

**Use black ink. HB pencil may be used for graphs and diagrams only.**

**Complete the boxes on the first page with your name, centre number and candidate number.**

**Answer ALL the questions.**

**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.**

## **INFORMATION FOR CANDIDATES**

**The total number of marks for this paper is 60.**

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

**Dimensions are in millimetres unless stated otherwise.**

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

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Answer ALL the questions.

1 Fig. 1 shows a hammer used as a lever.

(a) (i) Add TWO labels TO Fig. 1 to show the position of the Effort and the position of the Load. [2]

Fig. 1



(ii) State the class of lever represented by the hammer being used in Fig. 1.

\_\_\_\_\_ [1]

(iii) Give TWO ways to improve the efficiency when using a hammer to remove nails as shown in Fig. 1.

1 \_\_\_\_\_

2 \_\_\_\_\_

[2]

**(iv) Explain how the hammer used as a lever is different to a wheelbarrow used to carry a load.**

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**[2]**

**(b) (i) Explain what is meant by the term 'mechanical advantage'.**

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**[2]**

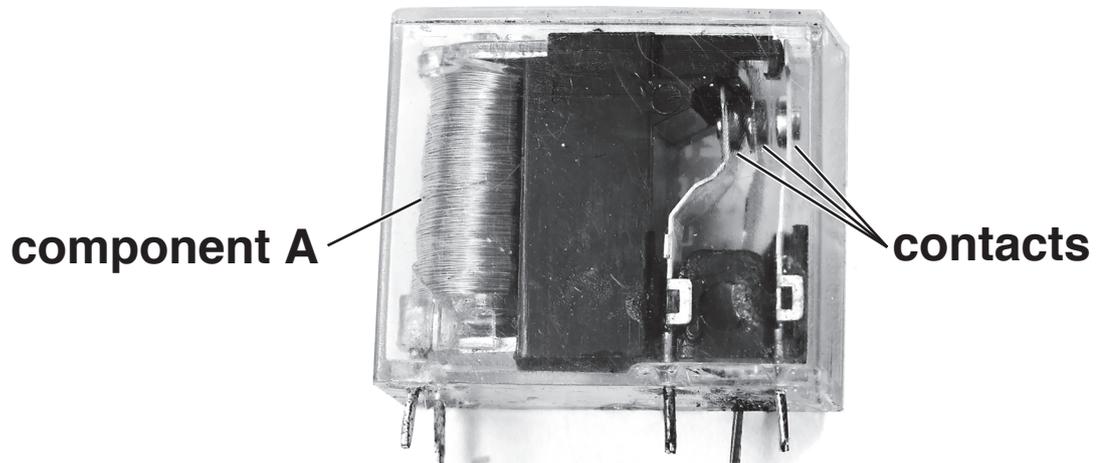
**(ii) Give ONE application, other than a hammer, of a hand tool used to give mechanical advantage.**

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**[1]**

- 2 (a) Fig. 2 shows a direct current (DC) electro-mechanical relay.

Fig. 2



- (i) Name component A shown in Fig. 2.

\_\_\_\_\_ [1]

- (ii) Component A has an operating voltage of 12 V and a resistance of 60 ohms. Calculate the current draw of component A. State the unit in your answer.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [3]

**(iii) Explain what happens when a current is applied to component A.**

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**[3]**

**(iv) Give TWO reasons why the device shown in Fig. 2 would be used in a circuit.**

1 

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2 

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**[2]**

**(v) Name ONE other DC electro–mechanical device.**

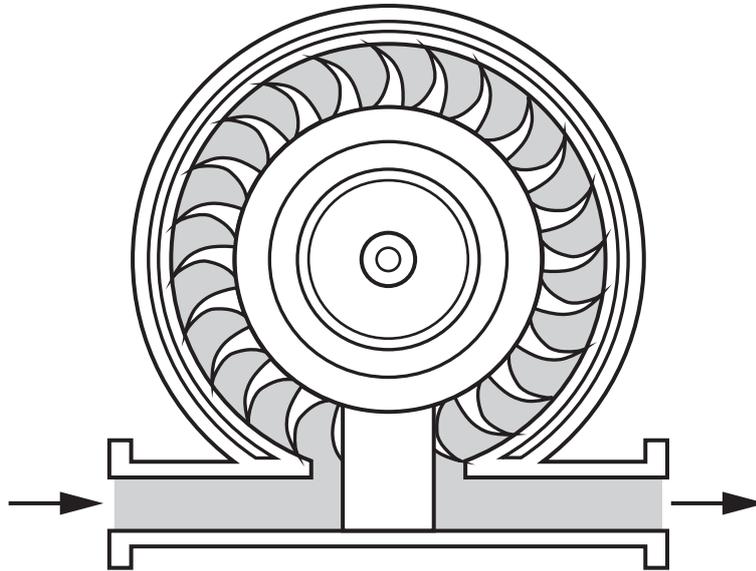
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**[1]**

**3 (a) Fig. 3 shows a vacuum generator.**

**(i) Add ONE label TO Fig. 3 to show the intake port. [1]**

**Fig. 3**



**(ii) Use the terms below to complete the statement describing the operation of the vacuum generator.**

**Suction**

**ambient air pressure**

**friction**

**pressure drop**

**The pressure outside the vacuum is the**

---

**The turning fan creates a**

---

**in the area behind the fan, below**

**the pressure level outside the**

**vacuum generator. This creates**

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**and a partial vacuum, inside the vacuum**

**generator. [3]**

**(b) Describe how a vacuum power source could be used in manufacturing, other than for cleaning.**

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**[3]**

**(c) Give TWO benefits of using vacuum power in food manufacturing.**

1 \_\_\_\_\_

2 \_\_\_\_\_

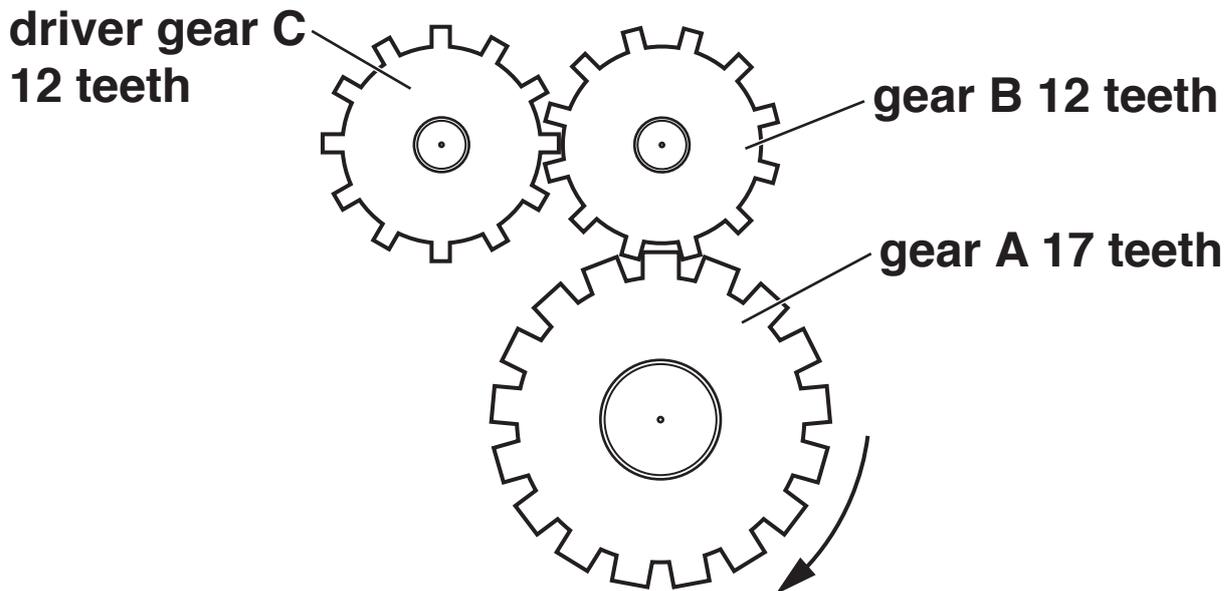
**[2]**

**(d) Name ONE other power source used in engineering.**

\_\_\_\_\_ **[1]**

4 Fig. 4 shows a gear train.

Fig. 4



(a) (i) State which gear, A, B or C, in Fig. 4 is the idler gear.

\_\_\_\_\_ [1]

(ii) State the purpose of the idler gear used in this example.

\_\_\_\_\_ [1]

(iii) Calculate the velocity ratio of the gear train in Fig. 4.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

(b) (i) State what is meant by the term ‘compound gear’.

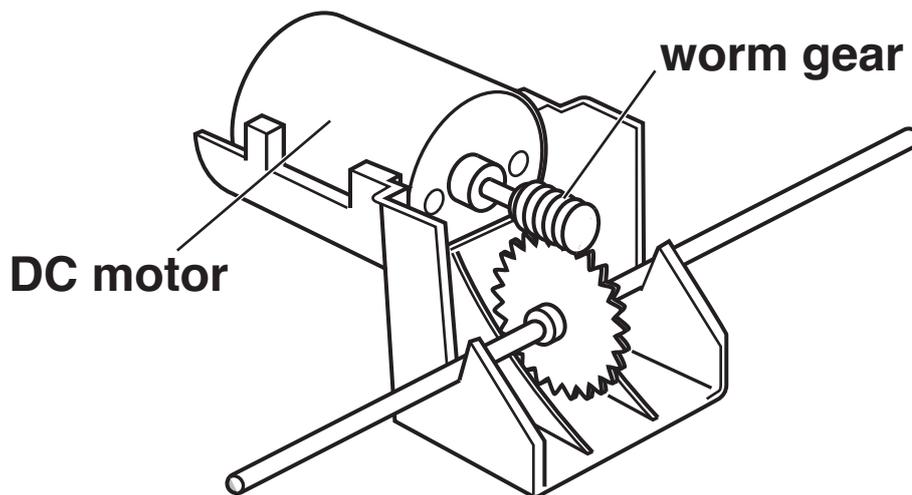
\_\_\_\_\_ [1]

(ii) Give ONE application that could use compound gears.

\_\_\_\_\_ [1]

(c) Fig. 5 shows a gearbox for a toy car driven by a direct current (DC) motor using a worm gear.

Fig. 5



(i) Give ONE advantage of using this arrangement to make the toy car move.

\_\_\_\_\_ [1]

(ii) State the energy conversion that takes place to make the toy car move.

\_\_\_\_\_ to \_\_\_\_\_ [2]

**(iii) State how the direction of the motor can be reversed.**

\_\_\_\_\_ **[1]**

**5 Fig. 6 opposite shows a pneumatic door system used on a bus.**

**(a) (i) Name components A and C.**

**A** \_\_\_\_\_

**C** \_\_\_\_\_

**[2]**

**(ii) Explain how components B and C are used to control the operation of the door.**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**[4]**

**(iii) Explain why component A does not use a return spring.**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**[2]**

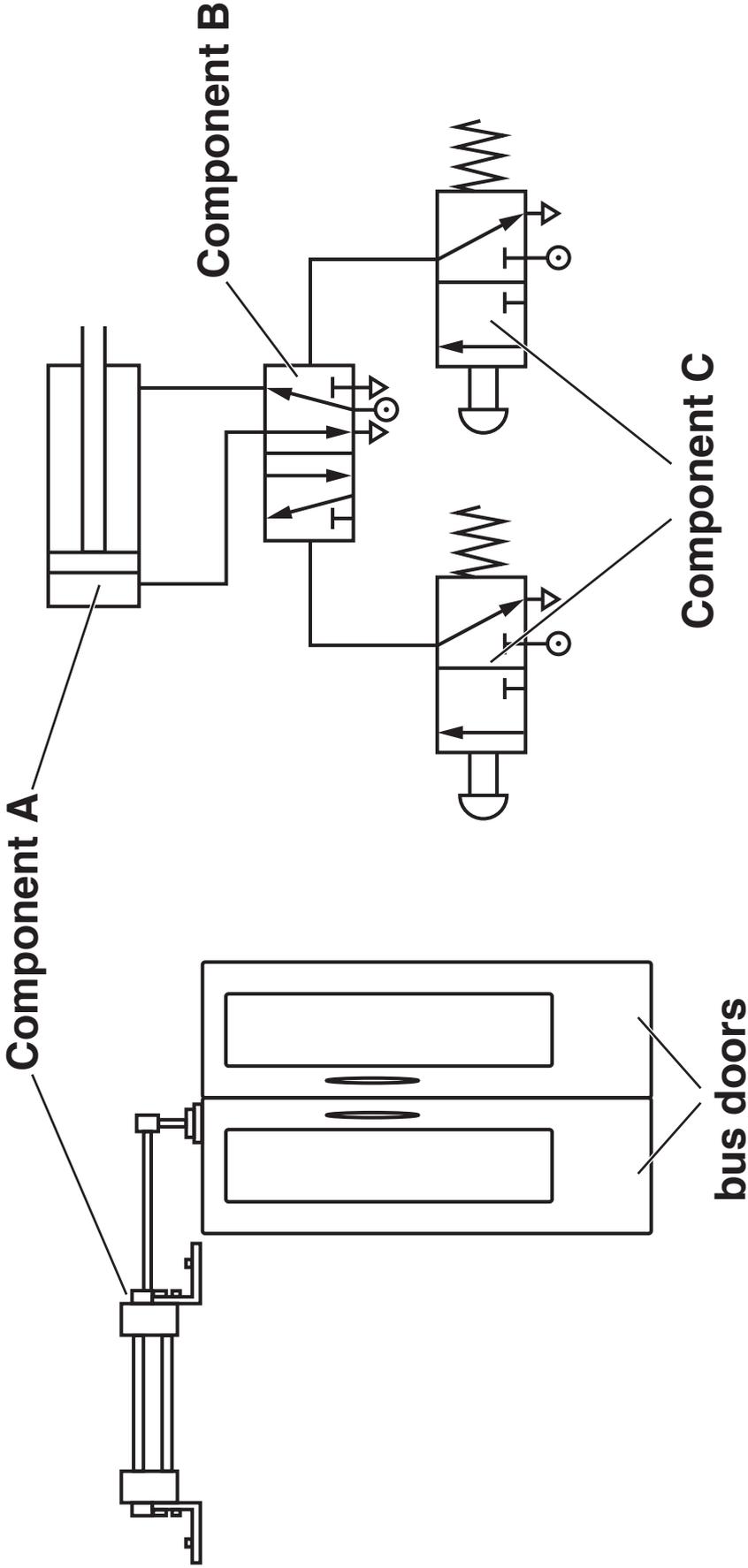
**(iv) Give the meaning of the term 'main air'.**

\_\_\_\_\_

\_\_\_\_\_

**[1]**

Fig. 6



- (v) Add ONE label TO the pneumatic circuit in Fig. 6 to show ONE of the main air ports. [1]















