

Friday 8 January 2016 – Morning

**LEVEL 1/2 CAMBRIDGE NATIONAL IN PRINCIPLES IN
ENGINEERING AND ENGINEERING BUSINESS**

R101/01 Engineering principles

Candidates answer on the Question Paper.

OCR supplied materials:

None

Other materials required:

- A scientific calculator may be used

Duration: 1 hour



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.
- 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. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- 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 **60**.
- Your quality of written communication will be assessed in questions marked with an asterisk (*).
- This document consists of **12** pages. Any blank pages are indicated.

PLEASE DO NOT WRITE ON THIS PAGE

Answer **all** questions.

1 Mechanical examples are used in different applications.

(a) (i) Match the examples to the term in the table below. One has been done for you.

Example	Term
A pulley used to lift a load	Load
Weight of a car on a jack	Effort
Playground seesaw	Class 1 lever
Pulling a spanner	Mechanical advantage
Nutcracker	Class 2 lever

[4]

(ii) Describe, using an example, **one** other application of mechanical advantage.

.....
 [2]

(iii) Give **one** example of a Class 3 lever.

..... [1]

(b) Describe what is meant by the term 'fulcrum'.

.....
 [2]

2 Fig. 1 shows a simple gear train.

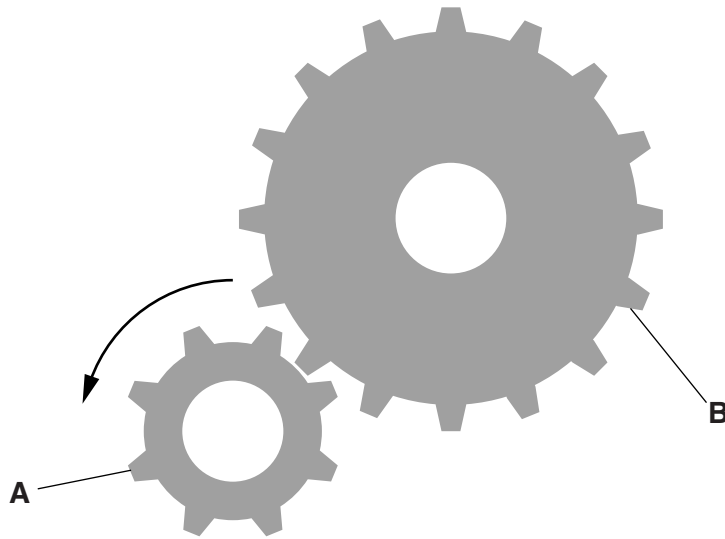


Fig. 1

(a) (i) Draw an arrow on Fig. 1 to show the direction of rotation of gear B. [1]

(ii) State the purpose of using an idler gear in this type of application.
..... [1]

(iii) A force of 300 N is used to move an assembly 3 m on a production line.
Calculate the work done.
.....
..... [2]

(b) Describe how the design of a typical wheelbarrow is used to assist in moving heavy loads.
.....
.....
.....
..... [2]

(c) Energy can be in many forms.

Use the terms below to complete the description of energy conversions.

electrons

chemical

kinetic

electrical

Generators and alternators use energy in a rotating motion to produce energy which is stored in a battery in the form of energy. This energy is used by the flow of through a conductor to power lamps, relays, motors, and other electrical devices.

[4]

- 3 Fig. 2 shows an electrical circuit with three resistors.

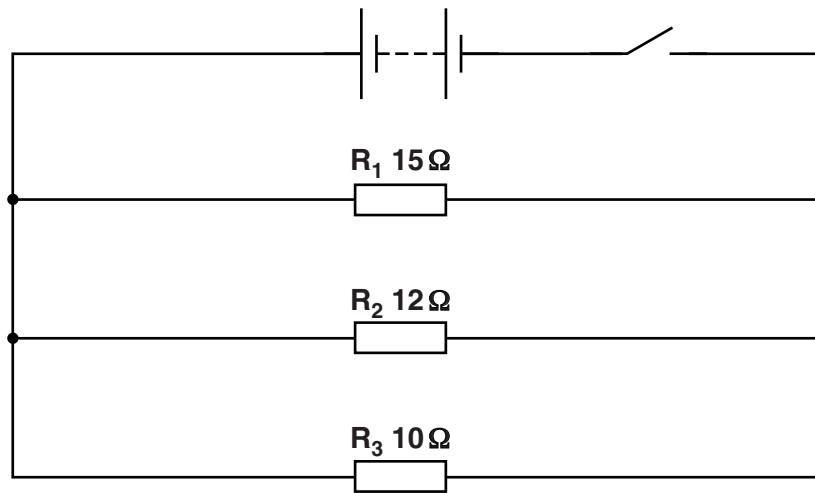


Fig. 2

- (a) (i) State the resistor arrangement for R_1 , R_2 and R_3 .

..... [1]

- (ii) Describe how you could check the resistance value of R_3 using an ohmmeter.

.....

..... [2]

- (iii) Calculate the total resistance in the circuit.

.....

.....

.....

..... [3]

(b) Fig. 3 shows a circuit using a transformer.

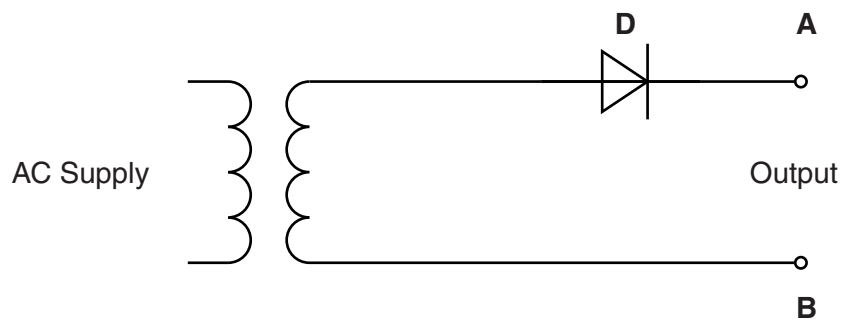


Fig. 3

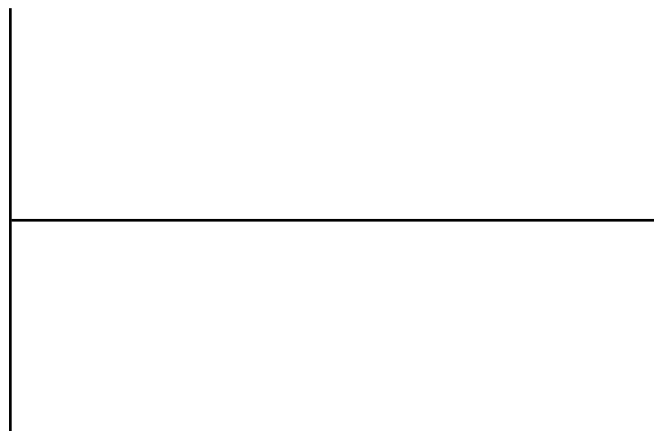
(i) Name component **D**.

..... [1]

(ii) State the purpose of component **D** in the circuit.

.....
 [1]

(iii) Draw a wave form to show the output voltage across points **A** and **B**.



[3]

4 (a) Fig. 4 shows a simplified drawing of an electrical motor.

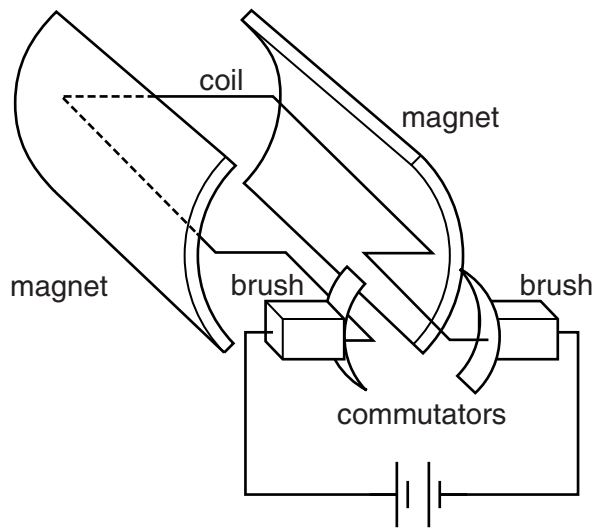


Fig. 4

- (i) State the type of motor shown in this arrangement.
 [1]
- (ii) Describe what happens when a current is applied to the coil.

 [2]
- (iii) State how the polarity of the motor could be changed.
 [1]
- (iv) State the effect of reversing the polarity of the motor.
 [1]
- (v) Give **one** application of this type of motor.
 [1]

(b) Fig. 5 shows an electrical component.

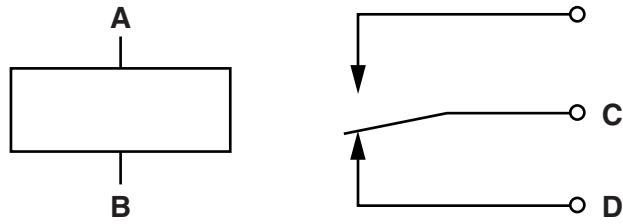


Fig. 5

Name the component shown in Fig. 5.

..... [1]

(c) The component shown in Fig. 5 needs to be tested to make sure it works correctly.

Describe tests that could be carried out on the component:

(i) between points **A** and **B**

.....
 [2]

(ii) between points **C** and **D**.

.....
 [2]

5 (a) Fig. 6 shows a pneumatic circuit.

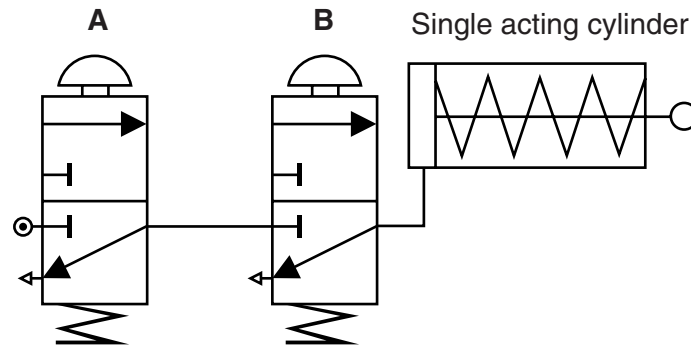


Fig. 6

(i) Name component **A** and **B**.

.....
 [2]

(ii) Describe why both components **A** and **B** are required to operate the cylinder.

.....
 [2]

(iii) Describe the operation of the single acting cylinder.

.....

 [2]

(b) A cylinder has a piston of a cross-sectional area of 0.01 m^2 . Calculate the working pressure applied to the cylinder when the force exerted by the piston is 20 kN .

Use the formula: Pressure = Force/Cross-sectional area.

.....
 [2]

(c) Fig. 7 shows a lifting platform.

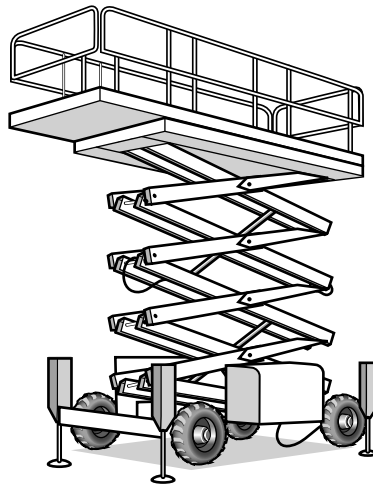


Fig. 7

(i) State the type of system used to lift the platform.

..... [1]

(ii) Give **one** reason why this system is used in this application.

..... [1]

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6 (a) Describe the differences in operation between a hydraulic cylinder and pneumatic cylinder.

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

(b) Give **one** example of an electrical-pneumatic application.

..... [1]

(c)* Discuss the advantages of using vacuum systems for precision placing, handling and lifting rather than using mechanical handling equipment.

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END OF QUESTION PAPER