

Wednesday 11 January 2017 – 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	
-----------------------	--	----------------------	--

Centre number						Candidate number				
---------------	--	--	--	--	--	------------------	--	--	--	--

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. 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.

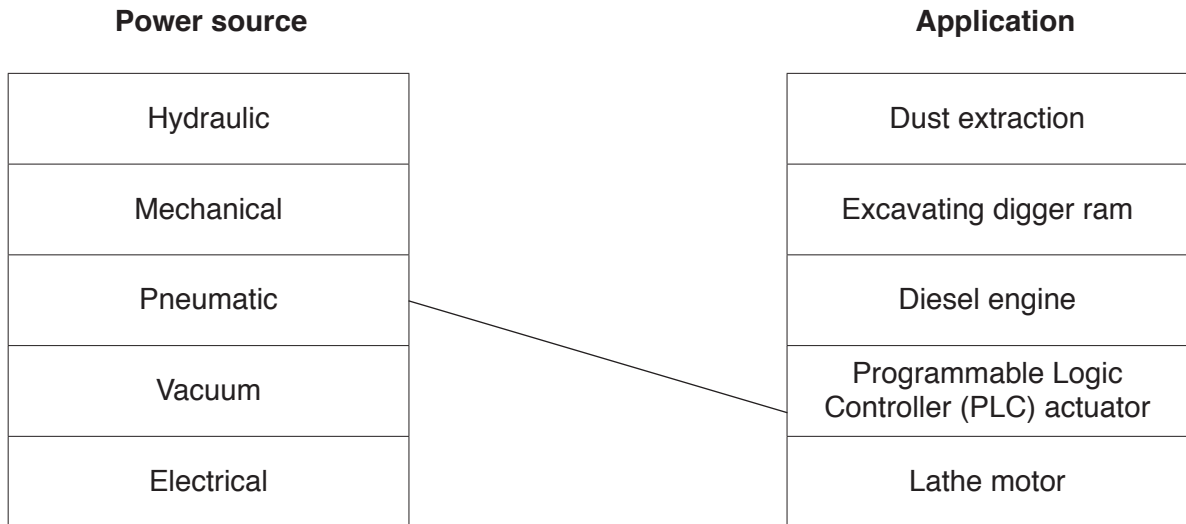
INFORMATION FOR CANDIDATES

- 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.

Answer **all** the questions.

1 Engineering applications use different sources of power.

(a) (i) Draw lines to link the power source to the correct application.
One has been done for you.



[4]

(ii) Describe, giving an example, the use of **one** other application of mechanical power sources.

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

(iii) Give **one** other application of a motor, other than a lathe motor.

..... [1]

(b) (i) Describe how an electrical power source can be used in a workshop tool to create motion.

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

(ii) A generator is one example of an electro-mechanical application.
Give **one** other example of an electro-mechanical application.

..... [1]

2 Fig. 1 shows a workshop tool.

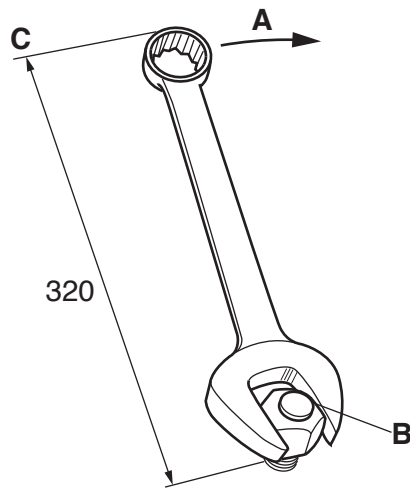


Fig. 1

(a) (i) Match the terms below to the parts identified in Fig. 1.

Fulcrum

Lever arm

Effort

- A
 - B
 - C
- [3]

(ii) Describe how the workshop tool is used to provide mechanical advantage.

-
-
- [2]

(iii) Give **one** other example of a lever mechanism.

- [1]

(b) Fig. 2 shows a gear arrangement.

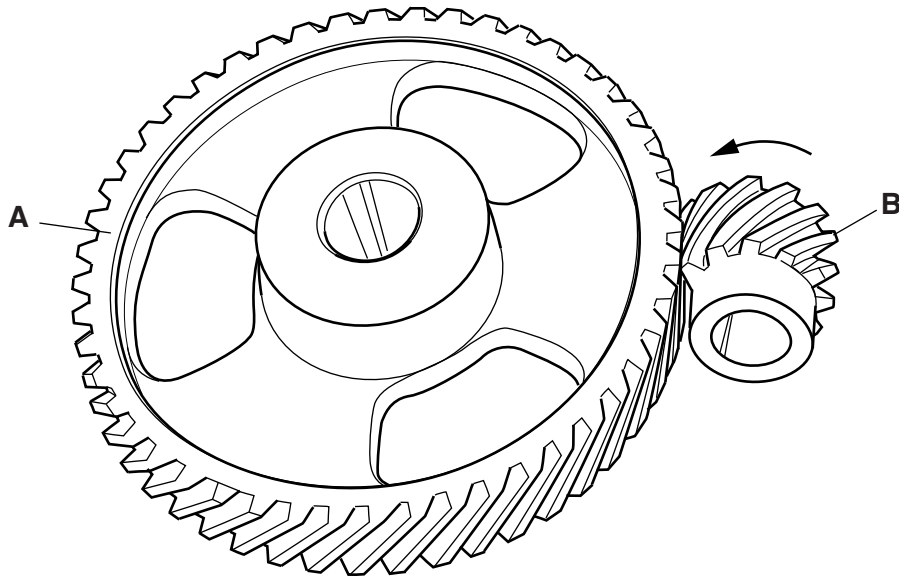


Fig. 2

(i) Gear **B** turns in an anti clockwise direction.
Draw an arrow on Fig. 2 to show the direction of travel for gear **A**. [1]

(ii) Give **one** application that uses this type of gear.
..... [1]

(iii) Give **one** benefit of using this type of gear arrangement.
..... [1]

(c) State **one** advantage of using gears instead of pulleys to transmit power.
..... [1]

3 Fig. 3 shows a circuit with two identical lamps connected in series.

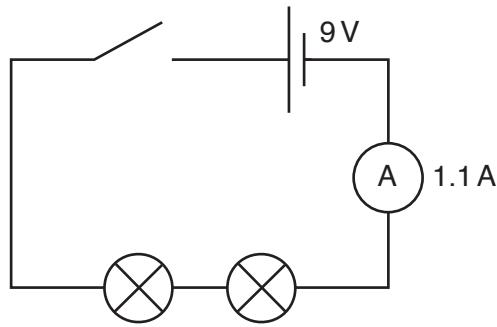


Fig. 3

(a) Calculate the power rating of the two lamps in Fig. 3.

.....

.....

..... [2]

(b) Draw a circuit in the space below using the same components in Fig. 3 but with the lamps connected in parallel.

[2]

(c) State the effect that the parallel circuit will have on:

(i) the brightness of the lamps

..... [1]

(ii) the current flowing through the circuit.

..... [1]

- (d) The two lamps in the parallel circuit are to be replaced with two 180Ω resistors. Calculate the total resistance of the two resistors in parallel.

Use the formula $1/R_T = 1/R_1 + 1/R_2$

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

- (e) Complete the following sentence using the correct terms from the list below.

- | | | | |
|----------------|------------------|-----------------|--------------|
| Electro | Current | Chemical | Force |
| | Effective | Farads | |

E Motive F..... (EMF) is the energy per unit charge that is converted from c....., mechanical, or other forms of energy into electrical energy in a battery. [2]

4 Fig. 4 shows a pneumatic circuit.

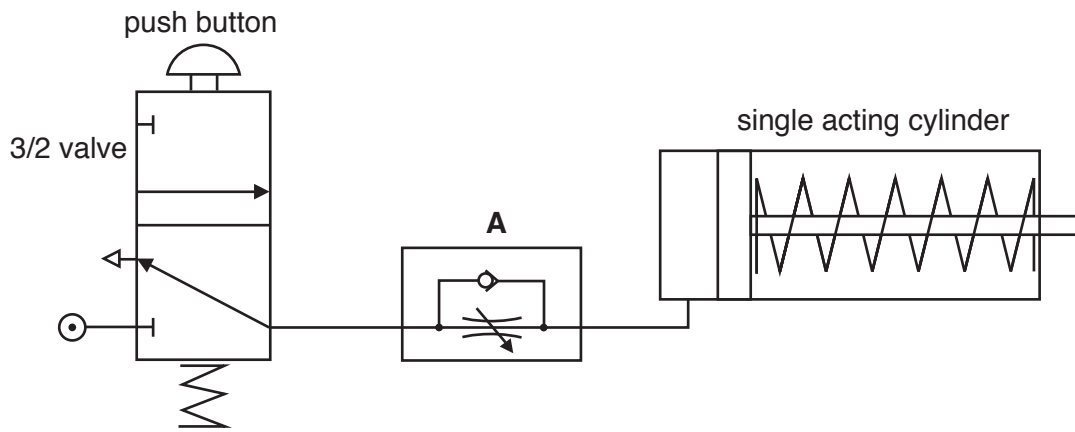


Fig. 4

(a) (i) Label the diagram in Fig. 4 to show the main air and exhaust ports of the 3/2 valve. [2]

(ii) Give the name of component A.

..... [1]

(iii) State the purpose of the spring in the single acting cylinder.

..... [1]

(iv) Describe how the circuit in Fig. 4 operates.

.....

 [3]

(b) The piston in the single acting cylinder has a radius of 20 mm and the main air pressure is 0.4 N/mm².

Calculate the force produced by the piston.

Use the formula Force (F) = pressure (p) × area (a)

.....

 [3]

5 Fig. 5 shows an incomplete pneumatic circuit used to open and close a security gate.

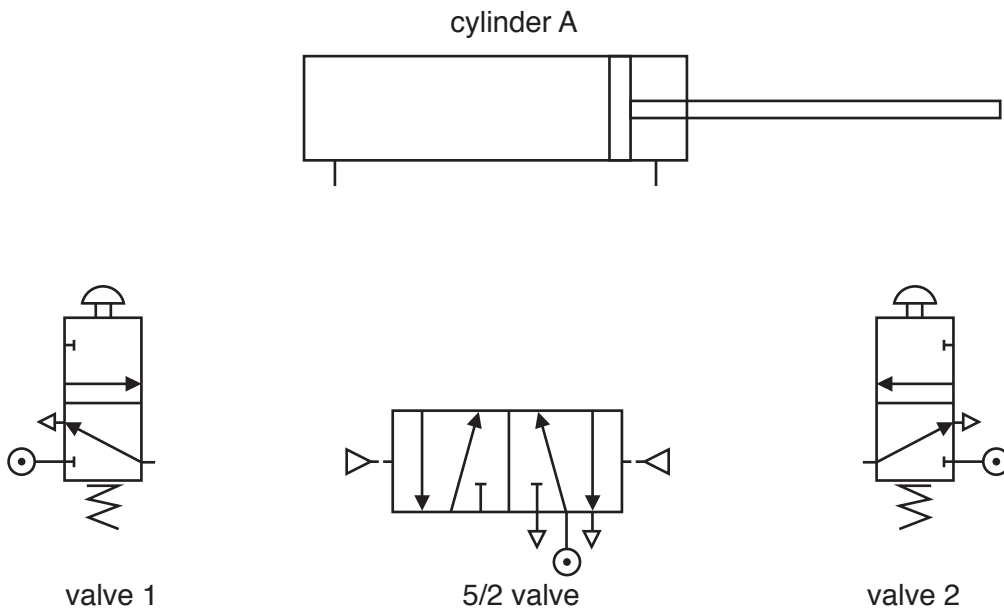


Fig. 5

(a) Complete the circuit in Fig. 5 with pilot and main air line connections. [3]

(b) Fig. 6 shows an electro-pneumatic 5/2 solenoid valve.

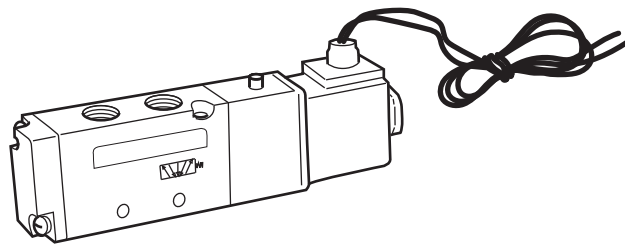


Fig. 6

Describe an electrically controlled pneumatic system that could be used to operate a single acting cylinder, using terms from the list below.

air supply 12V electrical supply single acting cylinder push switch

.....

.....

.....

..... [3]

(c) Pneumatics is usually used in light, fast acting applications.
Give **one** example of hydraulic application.

..... [1]

(d) Describe, giving an example, how a factory worker could use pneumatics to move products, such as on a production line.

.....
.....
.....
..... [3]

6 Fig. 7 shows a wind turbine.

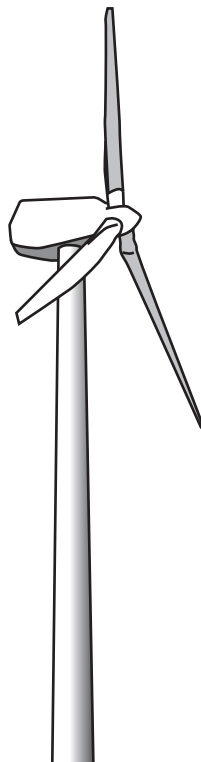


Fig. 7

(a) Complete the statement of energy conversions that take place when a wind turbine is used to generate electricity.

Kinetic energy is converted to energy, which is then converted to energy. [1]

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. It features a vertical solid line on the left side, creating a margin. The rest of the page is filled with horizontal dotted lines, providing space for writing answers.

A large rectangular area with a solid vertical line on the left side and horizontal dotted lines extending across the page, providing a space for writing answers.



Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.