



Oxford Cambridge and RSA

Monday 6 June 2022 – Morning

**Level 1/2 Cambridge National in Principles in
Engineering and Engineering Business**

R101/01 Engineering principles

Time allowed: 1 hour



You must have:

- a scientific or graphical calculator
- a ruler (cm/mm)



Please write clearly in black ink. **Do not write in the barcodes.**

Centre number

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Candidate number

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First name(s)

Last name

INSTRUCTIONS

- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.

INFORMATION

- The total mark for this paper is **60**.
- The marks for each question are shown in brackets [].
- Dimensions are in millimetres unless the question says something different.
- Quality of written communication will be assessed in questions marked with an asterisk (*).
- This document has **16** pages.

ADVICE

- Read each question carefully before you start your answer.

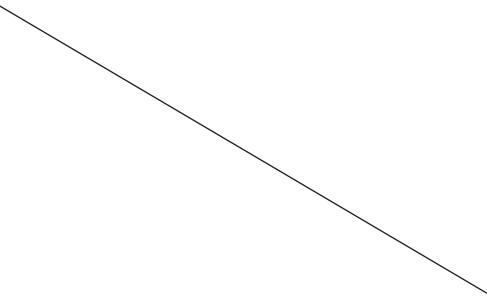
Answer **all** the questions.

1 Units are used when describing numerical values in engineering measurement.

(a) Match the engineering measurement with the correct unit.

One has been completed for you.

Engineering Measurement	Unit
Electrical Power	Gram
Metric unit of mass	Pascal
Electrical Resistance	Watt
Force	Amp
Liquid pressure	Ohm
Rate of flow of electric charge	Newton



[4]

(b) A loaded truck weighing 2000 kilograms travels at a constant speed (velocity) of 5 metres per second on a flat surface.

(i) Calculate the kinetic energy used to move the load.

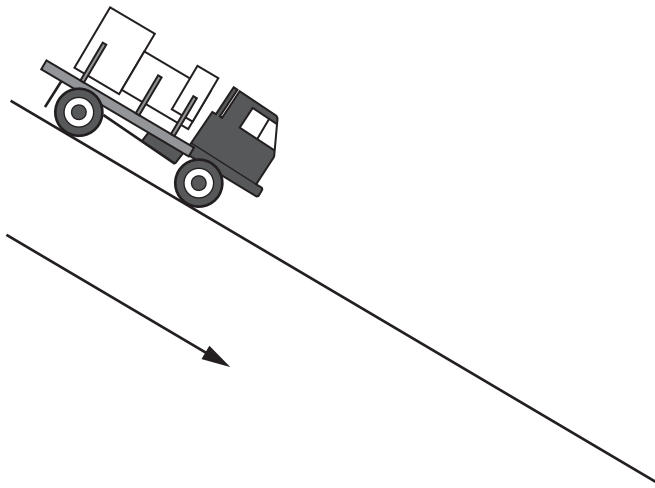
Use the formula $W_{KE} = \frac{1}{2}mv^2$ where m is the mass and v is the velocity.

.....

 [2]

(ii) Fig. 1 shows the same truck travelling downwards from the top of a hill.

Fig. 1



State the type of energy force that the truck has, as it travels down the hill.

..... [1]

(c) Complete the statements below using the correct term to explain mechanical efficiency. Not all of the terms will be used.

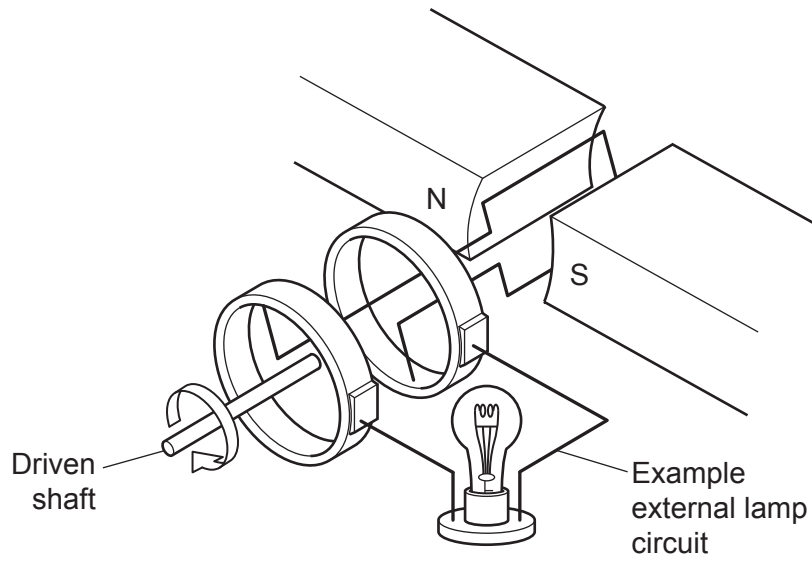
- energy conversion energy supplied force heat
- mechanical advantage work done

The mechanical efficiency of an internal combustion engine is found to be 35%.

Mechanical efficiency is the ratio of to the
 to an engine. Two sources of where
 efficiency is lost are and friction. [3]

2 Fig. 2 shows a DC electro mechanical device.

Fig. 2



(a) (i) Name the device shown.

..... [1]

(ii) Add labels to **Fig. 2** to identify **three** component parts of the device. [3]

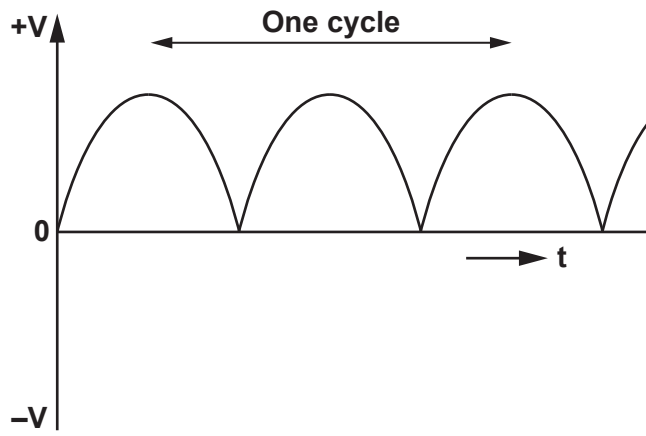
(iii) Describe how a current is produced to illuminate the lamp.

.....

 [3]

(b) The output of the device in Fig. 2 is shown as a graph in Fig. 3.

Fig. 3



Explain what the graph is showing about the output.

.....

.....

.....

.....

.....

.....

..... [3]

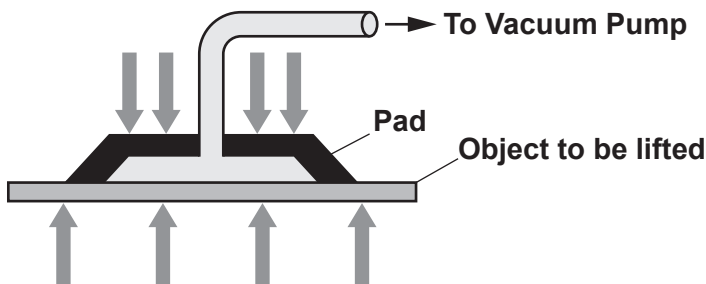
3 (a) (i) Name an electro mechanical device different to the one shown in Fig. 2.
..... [1]

(ii) The driven shaft of the device in Fig. 2 is turned by a belt and a driving pulley.
The driving pulley has a diameter of 160mm. The driven pulley has a diameter of 80mm.
Calculate the rotational speed of the driven pulley when the driving pulley is rotating at 900rpm.
..... [2]

(iii) State **one** effect of reducing the diameter of the driven pulley on the electrical output of the device in Fig. 2.
..... [1]

(b) Fig. 4 shows vacuum mechanical handling equipment.

Fig. 4



(i) Give **two** advantages of using vacuum to handle and move products.
1 [2]
.....
2
.....

(ii) Describe how vacuum is created and can be used to lift objects.

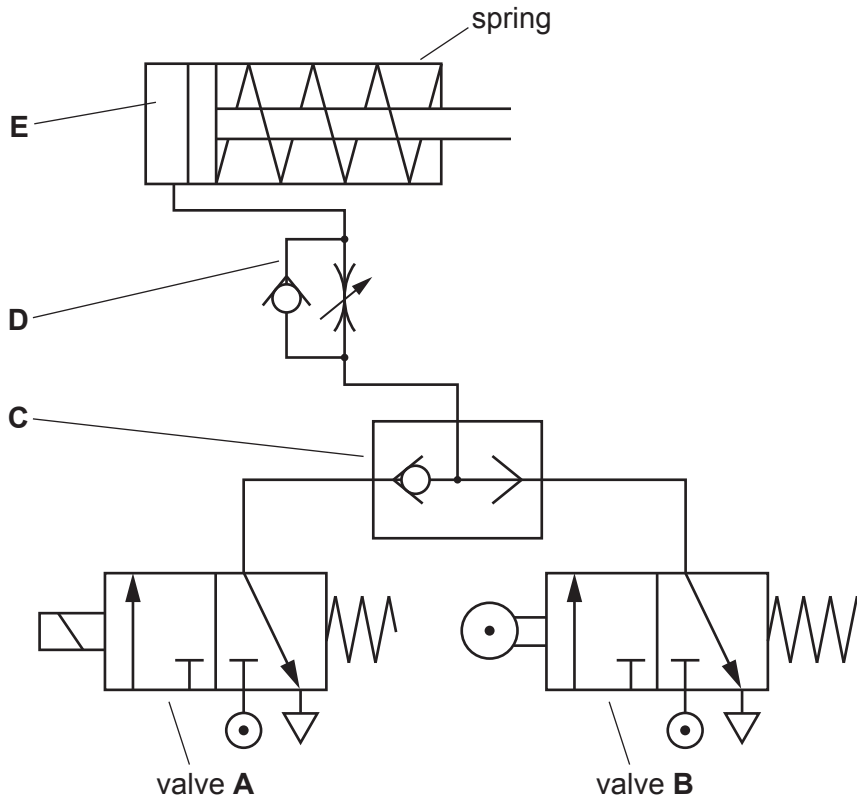
.....
.....
.....
.....
..... [3]

(iii) Give **one** application, other than lifting, where vacuum is used in manufacturing.

..... [1]

4 Fig. 5 shows a pneumatic circuit.

Fig. 5



(a) State why component **E** uses a spring.

.....
 [1]

(b) Add labels to **Fig. 5** to identify the roller tip valve and the flow control valve. [2]

(c) Valves **A** and **B** are both types of 3/2 control valves.

State the number of ports and positions each of these valves has.

..... ports

..... positions

[2]

(d) Add a label to **Fig. 5** to identify **one** of the exhaust ports.

[1]

- (e) Use the stages of operation given below to complete the table, giving the stages in the correct sequence for the circuit in **Fig. 5**.

One stage has been completed for you.

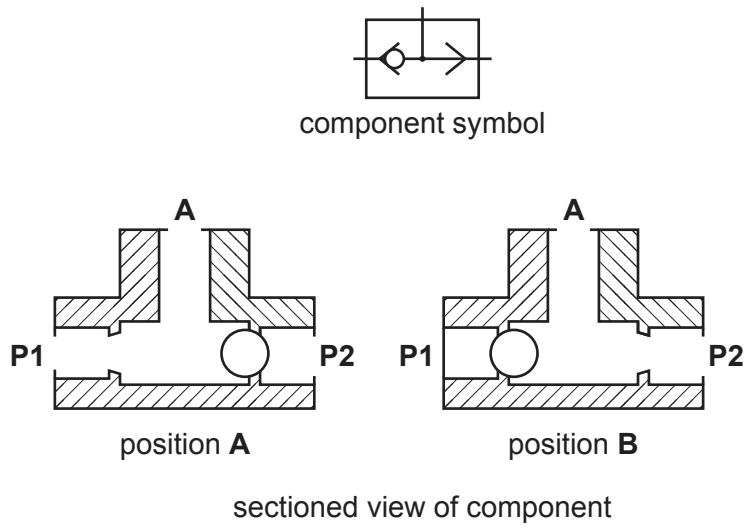
Stage	Description of stage of operation
P	After out-stroking, component E in-strokes quickly
Q	Component C changes state to allow air to component D
R	Component E out-strokes slowly
S	The in-stroking cylinder causes air to exhaust through the valve used to operate it
T	The speed of the out-stroking cylinder is controlled by the directional control valve
U	Valve A or B is operated

Sequence	1	2	3	4	5	6
Stage of operation				T		

[4]

5 (a) Fig. 6 shows the symbol and the sectioned view of a component from a fluid power system.

Fig. 6



(i) Give the name of the component shown in Fig. 6.

..... [1]

(ii) Describe the operation of the component using the sectioned views in Fig. 6.

.....

.....

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.....

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.....

.....

.....

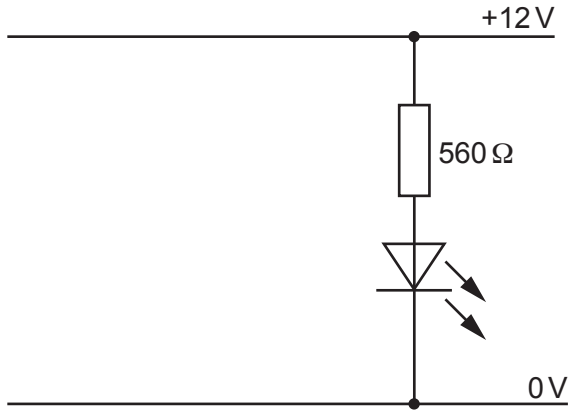
.....

..... [4]

- 6 (a) Light emitting diodes (LED) are increasingly replacing traditional filament lamps.

Fig. 8 shows an LED circuit with a resistor in series. There is a 2V drop across the LED.

Fig. 8



- (i) Calculate the current draw in the circuit.

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

- (ii) Give **two** benefits of using LEDs in a cycle lamp.

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 features a vertical margin line on the left side and horizontal dotted lines for writing. The lines are evenly spaced and extend across the width of the page.

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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