

Modified Enlarged 24pt

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Tuesday 12 January 2021 – Morning

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

R101/01 Engineering principles

Time allowed: 1 hour

plus your additional time allowance

YOU MUST HAVE:

a scientific or graphical calculator

a ruler (cm/mm)

Please write clearly in black ink.

Centre number

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Candidate number

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First name(s) _____

Last name _____

READ INSTRUCTIONS OVERLEAF



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 [].

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

ADVICE

Read each question carefully before you start your answer.

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Answer ALL the questions.

1 (a) Fig. 1 opposite shows a lighting circuit.

(i) Draw on Fig. 1 the symbol for a voltmeter, in the correct position to measure the potential difference across the switch. [2]

(ii) Give the reading that would show on the voltmeter when:

the switch is OPEN

the switch is CLOSED.

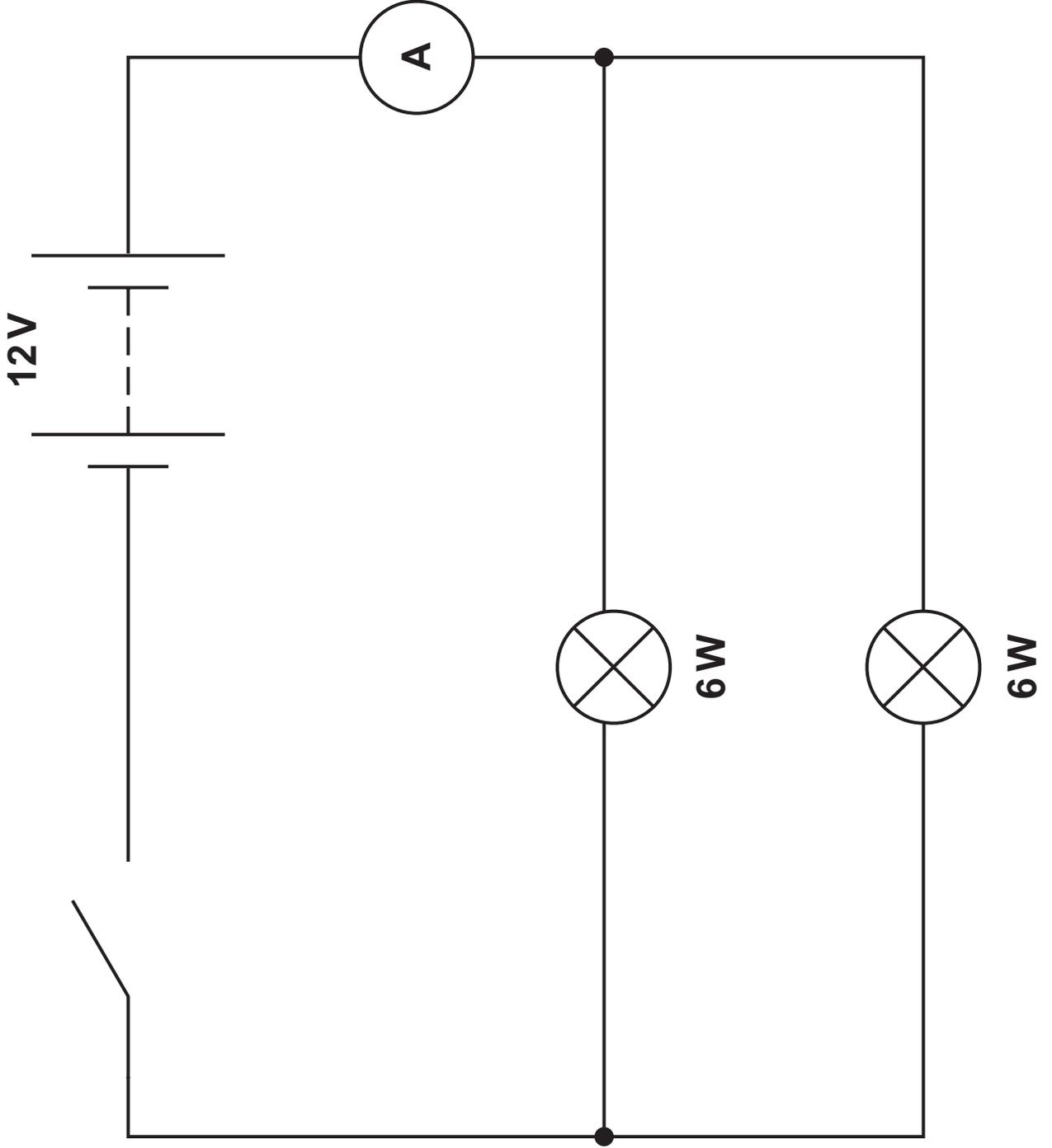
_____ [2]

(iii) State the type of circuit arrangement for the lamps in Fig. 1.

_____ [1]

(iv) Draw an arrow on Fig. 1 to show the direction of travel for the current flow. [1]

FIG. 1



(b) Complete the statement using the correct terms from the list below.

Not all the terms will be used.

parallel

voltage

current

the same

series

different

**The sum of the _____ in each
branch of the circuit equals the current leaving**

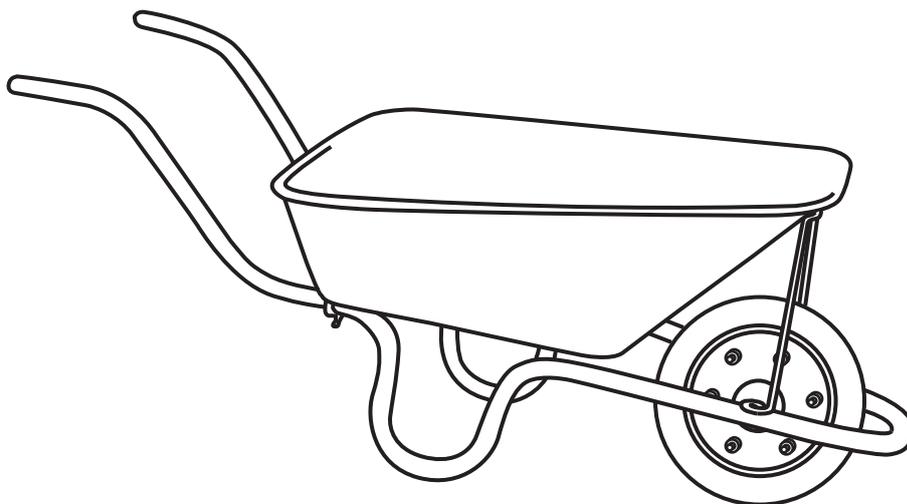
the power supply. The _____ is

_____ across all _____

components. [4]

2 Fig. 2 shows a wheelbarrow.

FIG. 2



(a) (i) Add a label to Fig. 2 to indicate the position of the fulcrum. [1]

(ii) State what is meant by the term 'fulcrum'.

_____ [1]

(iii) State the effect on the effort required if the wheelbarrow handles were made longer.

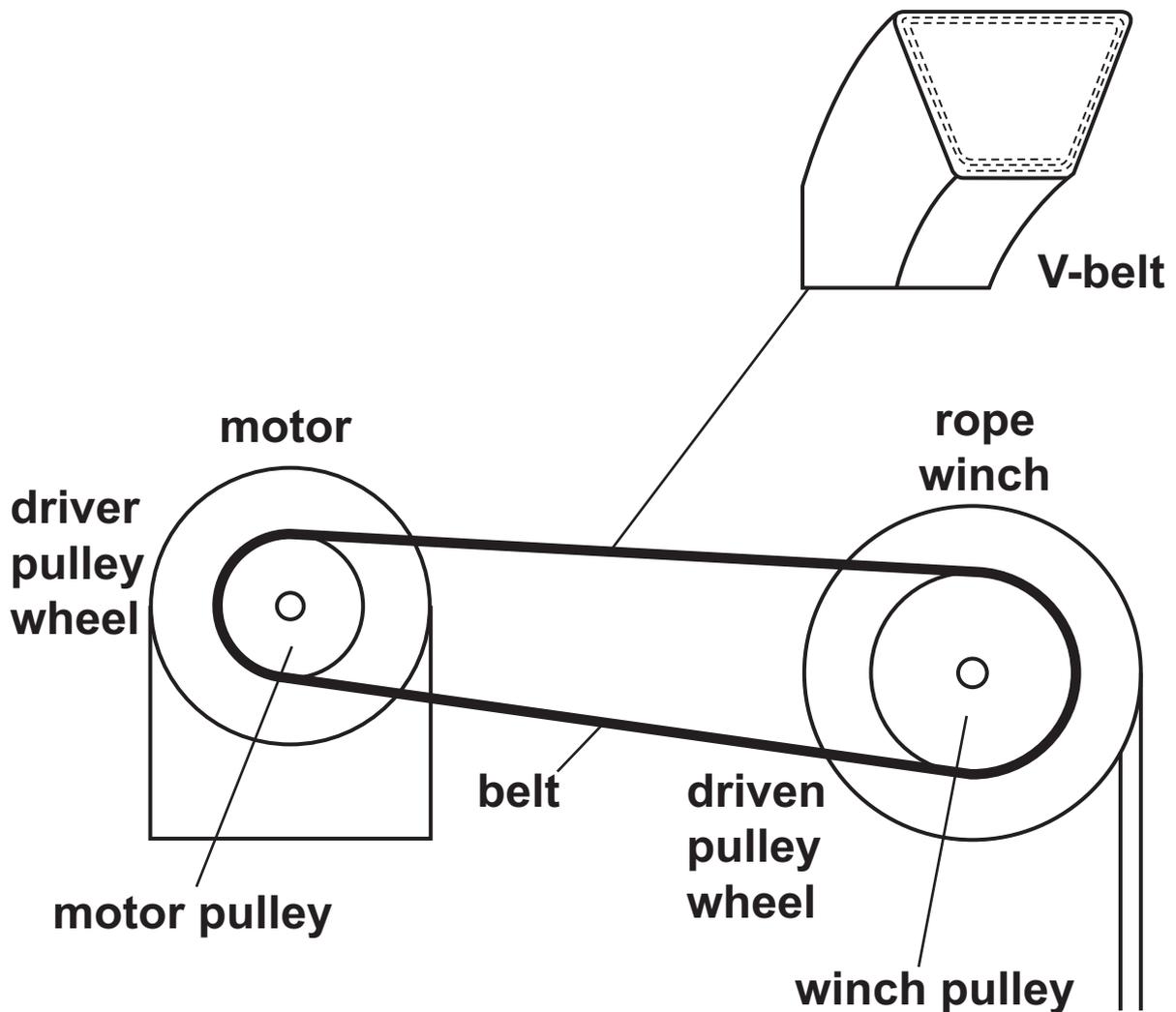
_____ [1]

(iv) Explain how the position of the load from the fulcrum influences the effort required.

_____ [3]

- (b) Fig. 3 shows a motor used to power a rope winch. The system uses a V-belt as shown.

FIG. 3



- (i) Give ONE disadvantage of using the V-belt shown in Fig. 3 compared to using a toothed belt.

_____ [1]

- (ii) Give ONE alternative way of connecting the motor to the rope winch.

_____ [1]

- (iii) The motor pulley has a diameter of 80 mm and the winch pulley has a diameter of 160 mm. Calculate the velocity ratio.**

[1]

- (iv) The motor pulley rotates at 60 rpm. Calculate the speed of the driven pulley wheel.**

[1]

3 (a) Fig. 4 opposite shows a motor used in a hairdryer.

(i) Add labels to Fig. 4 to show any TWO component parts of the motor. [2]

(ii) State the function of ONE of the parts that you have labelled in Fig. 4.

_____ [1]

(iii) Calculate the current usage of a 230 V hairdryer used at a constant power setting of 500 W. Give the units in your answer.

_____ [2]

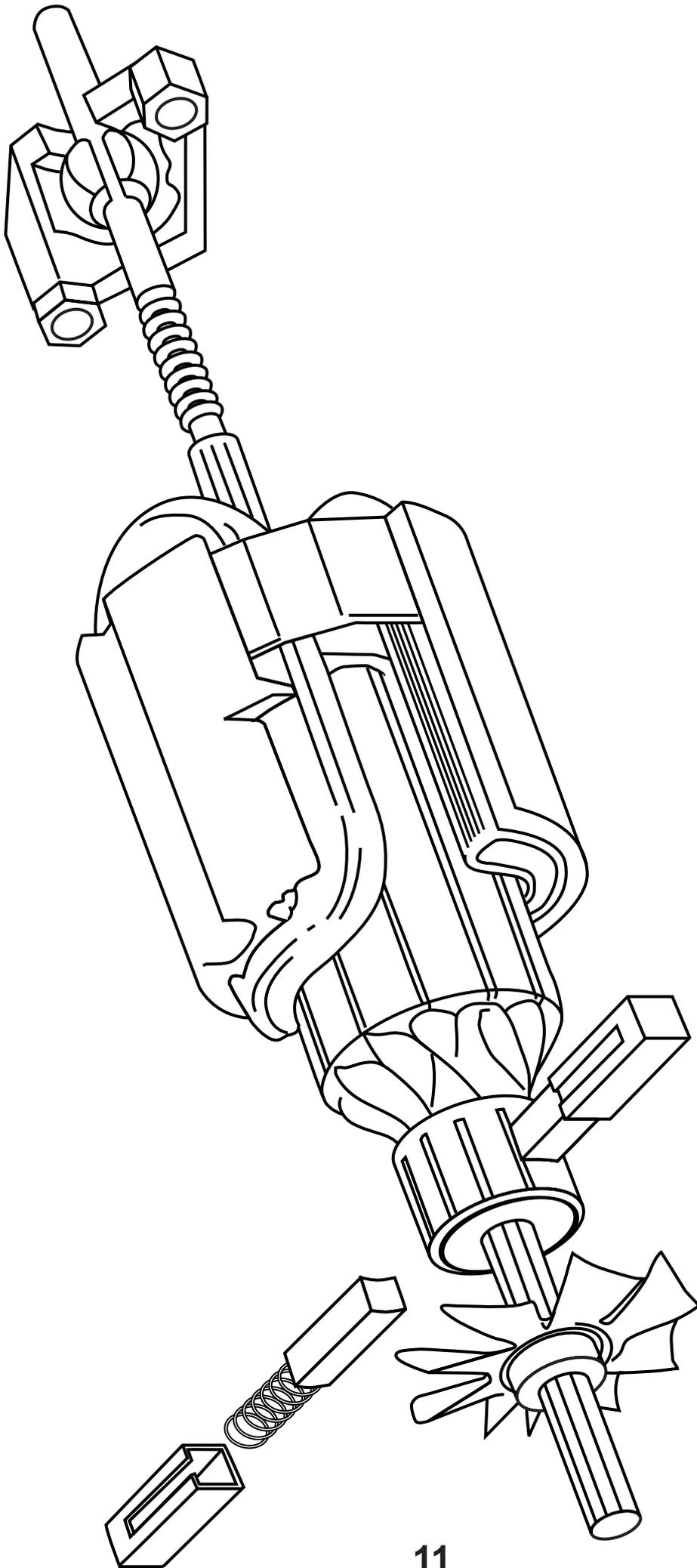
(iv) Complete the statement below.

The hairdryer motor converts _____
energy to _____ energy, to
turn a fan. An electrical current is passed
through the heater element coils. The coils
have _____ which creates
_____ energy. [4]

(b) Give ONE different example of energy conversion in engineering.

_____ energy to _____ energy. [1]

FIG. 4



4 (a) Give ONE example of a hydro-mechanical application.

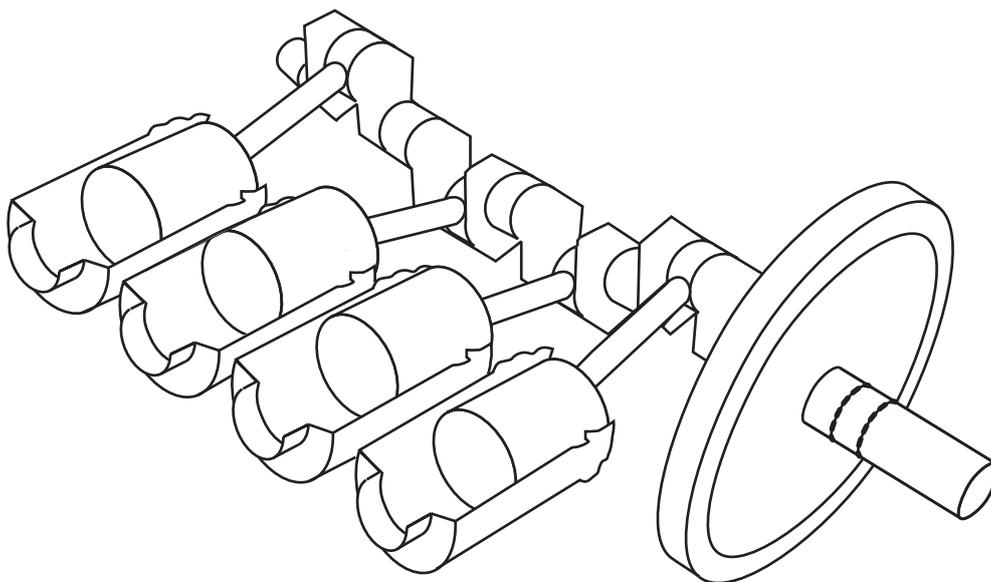
_____ [1]

(b) Describe how a hydro-mechanical application can be used to control the flow of water.

_____ [3]

(c) Fig. 5 shows an engine piston and crankshaft assembly.

FIG. 5



(i) State the type of rotating force produced by the engine.

_____ [1]

(ii) Describe a method that can be used to connect the engine to an external component that uses the output of the engine.

_____ [3]

(iii) Give TWO ways that a hydraulic pump could be connected to an engine assembly to provide power to lifting equipment.

1 _____

2 _____

[2]

5 Fig. 6 opposite shows a manually operated pneumatic circuit.

(a) (i) The statements below describe the stages of the outstroke operation of the double acting cylinder circuit in Fig. 6.

Draw lines to show the correct sequence of these stages.

One has been completed for you. [4]

Sequence

Stage

1	Air is exhausted through port X
2	Port 2 is connected to port Y on the double acting cylinder
3	The double acting cylinder outstrokes
4	Operator presses the button on valve A
5	Valve A changes state to supply air to the 5/2 valve
6	The 5/2 valve changes state

(ii) State the purpose of valve B in Fig. 6.

_____ [1]

(iii) State ONE change to the circuit that would be needed to replace the double acting cylinder with a single acting cylinder.

_____ [1]

(iv) Add a label to Fig. 6 to show ONE pilot air control line. [1]

(b) Explain how pressure is created in a pneumatic system.

_____ [3]

- 6 (a) Complete the table using a tick (✓) to identify **THREE** types of fluid power component. [3]

Description	Fluid power component
receiver	
shuttle valve	
relay	
non-return valve	
alternator	

- (b) Name **ONE** type of input device that could be found in a hydraulic circuit.

_____ [1]

