OCR
Oxford Cambridge and RSA

Wednesday 5 June 2019 – Morning

LEVEL 1/2 CAMBRIDGE NATIONAL AWARD/ CERTIFICATE IN PRINCIPLES IN ENGINEERING AND ENGINEERING BUSINESS

R101/01 Engineering principles

Time allowed: 1 hour

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
· A scientific calculator
· A ruler (cm/mm)

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

Centre number ☐☐☐☐☐   Candidate number ☐☐☐☐

First name(s) _____

Last name _____

INSTRUCTIONS
· Use black ink. HB pencil may be used for graphs and diagrams only.
· 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
· 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 the 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 (*).
· This document consists of **16** pages. Any blank pages are indicated.

A calculator may be used for this paper

Turn over
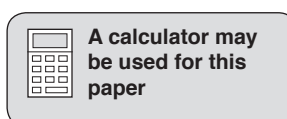
Answer **all** the questions.

1   Fig. 1 shows a workshop tool, which acts as a lever when used to loosen or tighten nuts.

fulcrum
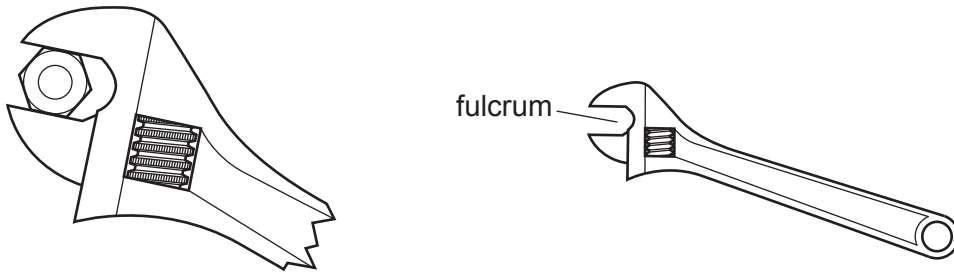
Fig. 1

(a)   Name the other **two** parts of the lever mechanism.

1 ....

2 ....

[2]

(b)   Fig. 2 shows a torque wrench being used on the wheel nuts.
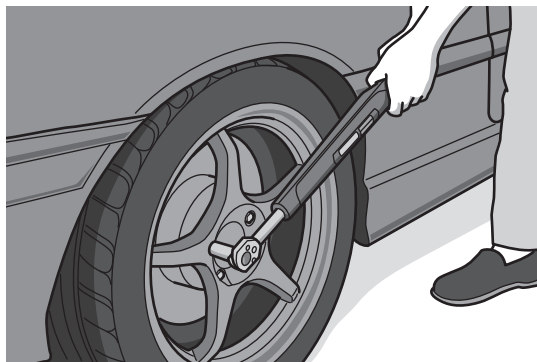
Fig. 2

(i)   Give **two** features of the torque wrench that make it a suitable manual lever in this application.

1 ....

2 ....

[2]

(ii)   Circle the correct term from the list below to complete the statement.

pressure   rotational force   power   resistance

Torque is the measure of .... **[1]**

(c) Fig. 3 shows a vehicle gear system used to connect the driveshaft from the gearbox to the driven wheels.

pinion gear 18 teeth input from vehicle gear box

crown wheel 68 teeth

output to driven wheels
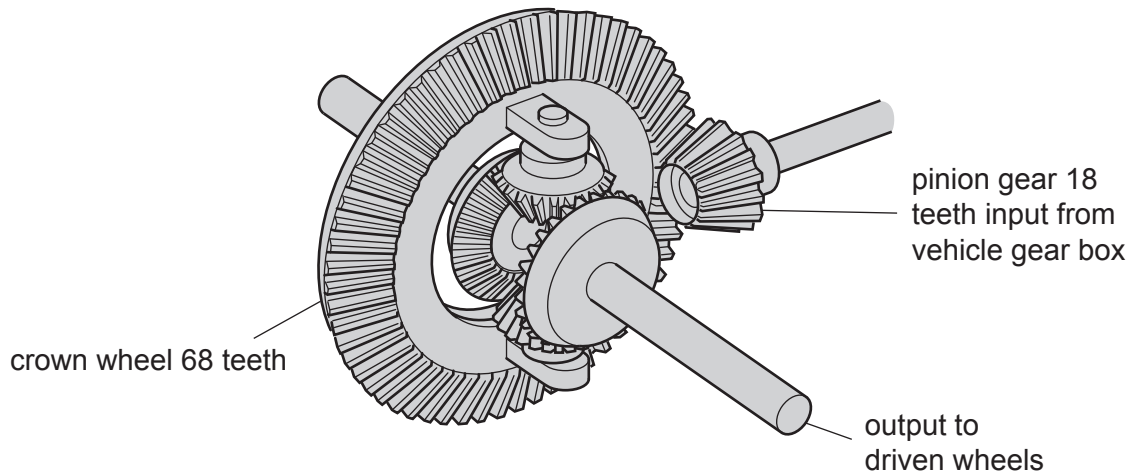
Fig. 3

   (i) State the type of gears shown in Fig. 3.

   .... **[1]**

  (ii) Give **two** benefits of using the gear system to connect the gearbox output and the driven wheels.

   1 ....

   ....

   2 ....

   ....
   [2]

 (iii) Calculate the gear ratio of the crown wheel and pinion using the information given in Fig. 3.

   ....

   .... **[2]**

2 Fig. 4 shows a hydraulic press and the hydraulic circuit for the press.

component **A**   component **B**
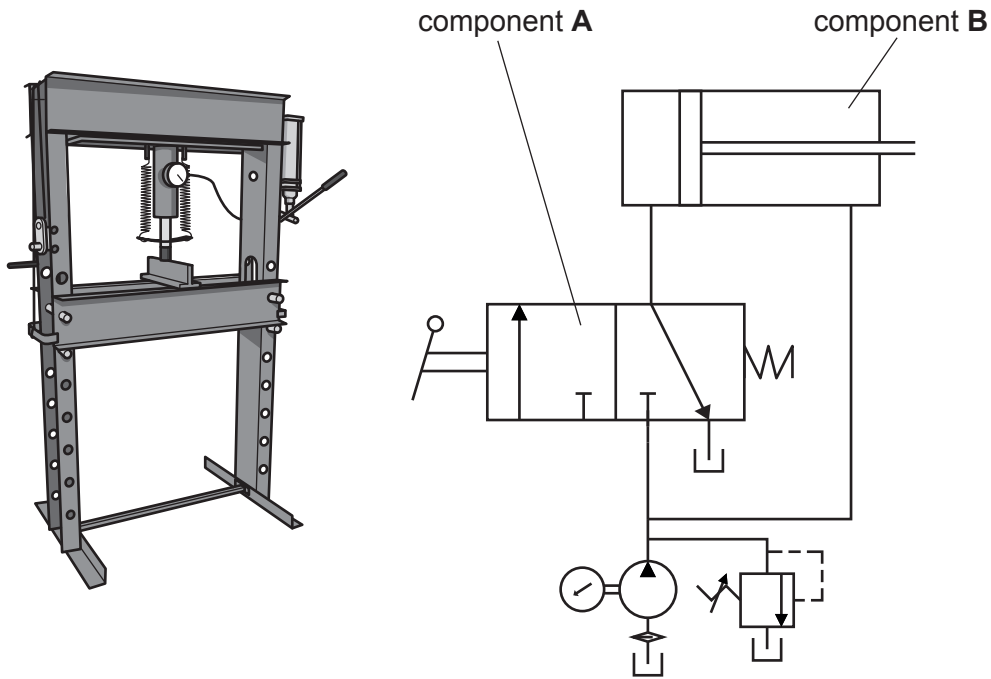
Fig. 4

(a) (i) Name the hydraulic circuit components **A** and **B**.

A .... **[1]**

B .... **[1]**

(ii) Component **A** is manually operated by the user of the press.

Describe how component **A** is used to control component **B**.

....

....

....

....

....

.... **[3]**

(b) Give **one** benefit of using hydraulics for a power press rather than pneumatics.

....

.... **[1]**

(c) (i) State the name of the unit used to measure pressure of a liquid.

.... **[1]**

(ii) The press in Fig. 4 uses a piston with a radius of 30 mm and the pressure in the cylinder is

0.5 N/mm^2.

Calculate the force output from the cylinder.

Use the formula: Force = pressure × area

Area of the piston

....

.... **[1]**

Force

....

.... **[2]**

Turn over

3 Fig. 5 shows an incomplete lighting circuit.

component **A**

12 V

components **B** and **C**

6 W

6 W
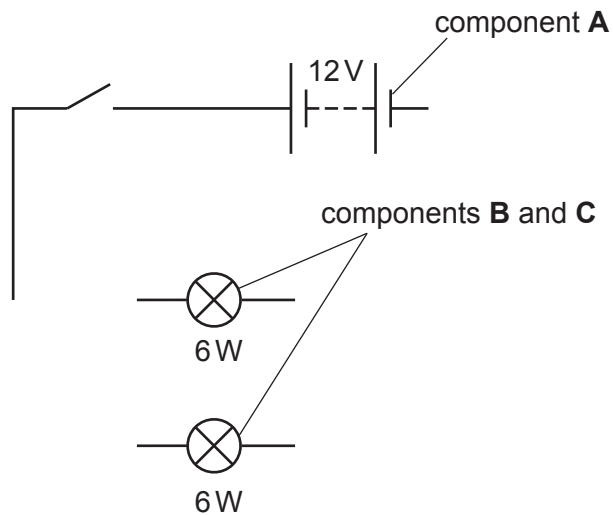
Fig. 5

(a) (i) Name component **A**.

.... [1]

(ii) Name components **B** and **C**.

.... [1]

(iii) Complete the circuit diagram in Fig. 5 so that:

- Components **B** and **C** are connected in **parallel**. **[3]**

- A circuit symbol for an ammeter is added to the circuit to allow the total current to be measured. **[2]**

(b) (i) Calculate the total current flowing through the completed circuit when the switch is closed.

....

....

.... **[2]**

(ii) State **one** effect of increasing the voltage supply to the circuit.

.... **[1]**

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Turn over for the next question

4 (a) (i) Give **one** example of a spring held under tension used to create movement.

.... **[1]**

(ii) State the type of energy that is represented by a spring held under tension.

.... **[1]**

(b) Fig. 6 shows the symbol for a fluid power component.
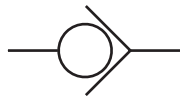
Fig. 6

(i) Name the component shown in Fig. 6.

.... **[1]**

(ii) Describe the operation of the component shown in Fig. 6, when it is used in a fluid power system.

....

....

....

....

....

.... **[3]**

(c) Fig. 7 shows the principle of a hydraulic vehicle lift.
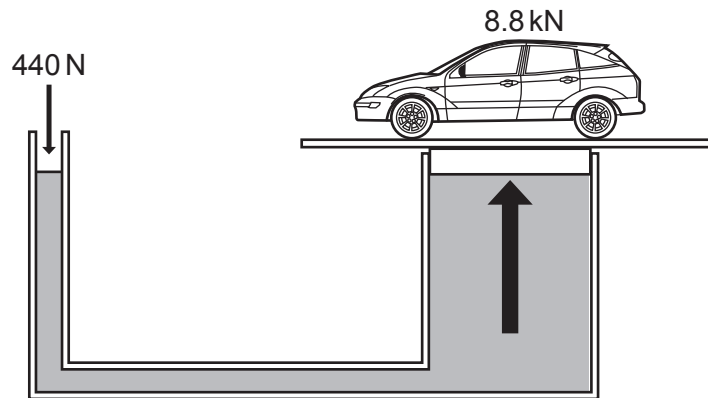
Fig. 7

(i) Complete the statement below to describe how the input force is used to lift the vehicle.

Because the increase in pressure is the .... on both sides, a small

force on the left side produces a much .... force on the right. **[2]**

(ii) Give **two** other hydraulic applications used to lift heavy loads.

1 ....

2 ....

[2]

5 Fig. 8 shows a vehicle braking servo that uses a vacuum to assist in the application of the vehicle brakes.

engine vacuum   diaphragm

pushes cylinder
piston to control
braking system

brake
applied
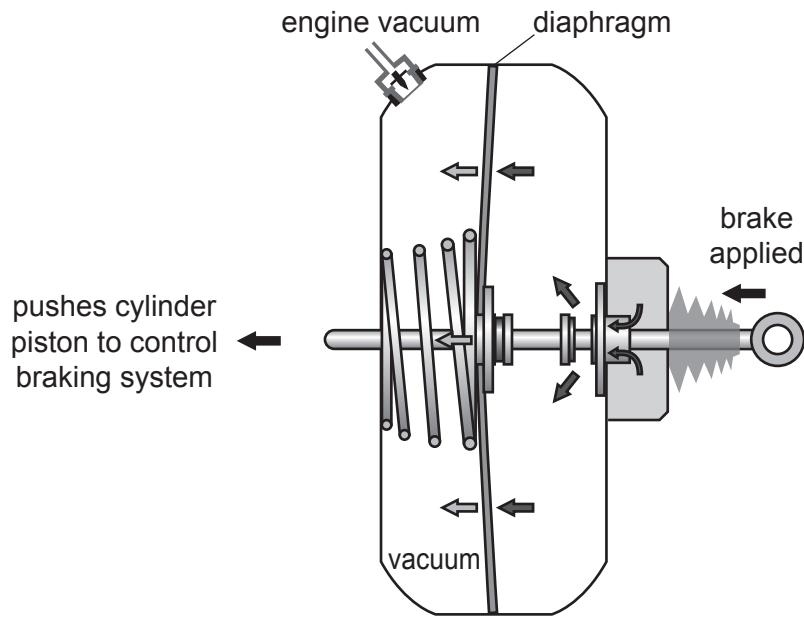
vacuum

Fig. 8

(a) (i) Add a **label** to Fig. 8 to show the atmospheric intake side of the servo. **[1]**

(ii) Describe how the vacuum is used to connect the pressure applied by the vehicle driver with the hydraulic cylinder.

....

....

....

....

....

.... **[3]**

(iii) Name **one** other application that uses a vacuum.

.... **[1]**

(b) (i) The braking system uses a fluid held in a reservoir.

State how the use of the reservoir in a hydraulic system is different to the storing of air in a pneumatic system.

....

....

....

.... **[2]**

(ii) Describe the mechanical effects of a leak in the hydraulic braking system.

....

....

....

.... **[2]**

(c) The brake pedal works as a Class 1 lever. The driver uses a force of 200 N on the pedal to produce an output of 600 N.

Calculate the mechanical advantage of the brake.

....

.... **[1]**

Turn over

6 Fig. 9 shows a system used to raise and lower a garage door.

Fig. 9

(a) Using the terms below, describe an electro-mechanical system to raise and lower the door.

electric motor	AC power supply	pulley
reversing current	mechanical door	gearbox

....

....

....

....

....

....

....

.... **[4]**

(b)* Discuss how the choice of energy forms could be influenced by availability for a large scale manufacturing operation.

....

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....

....

....

....

....

....

....

....

....

....

.... **[6]**

END OF QUESTION PAPER

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).

16

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