Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2009

Technology and Design

Assessment Unit AS 3

assessing

Unit 3 – Systems and Control: Industrial and Commercial Practices

[ASV31]

FRIDAY 12 JUNE, MORNING

ASV31

TIME

1 hour 30 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number on the Answer Booklet provided and on the A3 pro forma answer pages provided.
Answer **all three** questions.
Answers to questions **3(b), (c)** and **(d)** should be made on the A3 pro forma answer pages provided.

INFORMATION FOR CANDIDATES

The total mark for this paper is 60, including a maximum of 3 marks for quality of written communication.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
At the conclusion of the examination, attach the A3 pro forma answer pages securely to the Answer Booklet with the treasury tag supplied.

1 **(a)** A voltage divider circuit is shown in **Fig. 1(a)**.

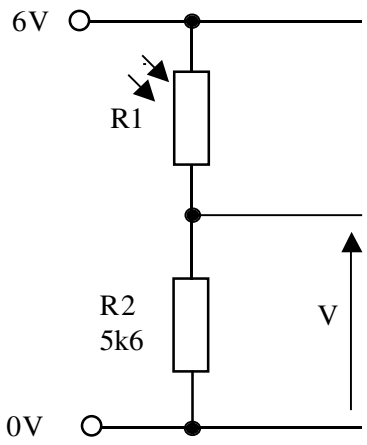


Fig. 1(a)

(i) State the name of the component R1 in **Fig. 1(a)**. [1]

(ii) The resistance of component R1 in **Fig. 1(a)** is 20 kΩ in low level light conditions and 2 kΩ in high level light conditions. Calculate the value of the voltage V for both lighting conditions. [4]

(iii) The voltage divider circuit shown in **Fig. 1(a)** could be used in conjunction with a comparator to make a light level warning device.

Using a comparator based system, draw a complete circuit that will switch on a buzzer when light levels are low. [5]

(b) **Fig. 1(b)** shows an electronic timing circuit.

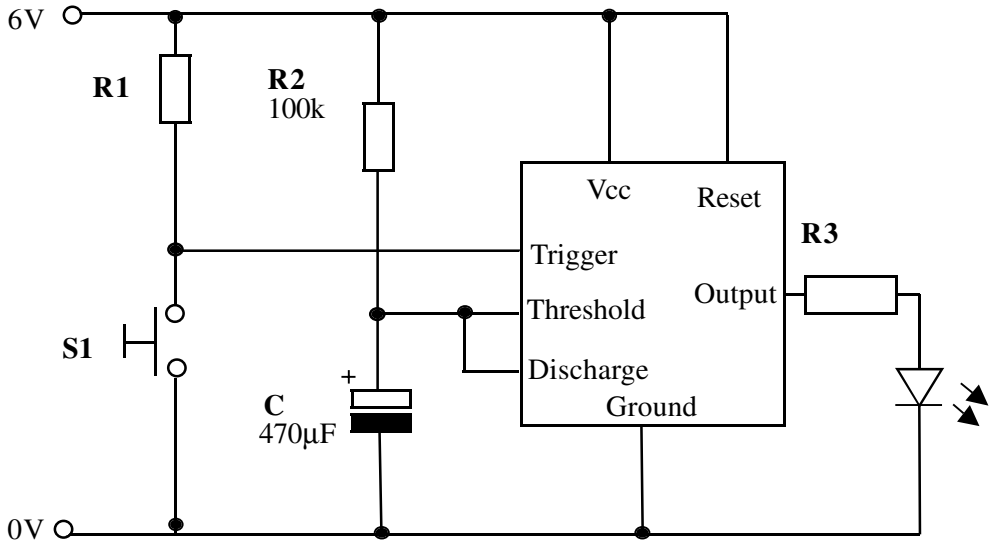


Fig. 1(b)

(i) Describe the operation of the circuit shown in **Fig. 1(b)** after switch S1 has been pressed momentarily. [3]

(ii) Sketch and label the output waveform for the circuit in **Fig. 1(b)** given that $T = 1.1C \times R2$, where T is the time period, in seconds, of the output waveform. [4]

(iii) The timing action produced by the circuit in **Fig. 1(b)** could be produced using a programmable system. State **one** advantage and **one** disadvantage of using a programmable system for this application. [2]

2 **Fig. 2(a)** shows a prototype wheelbarrow.

(a) **(i)** State the class of lever employed in a wheelbarrow. [1]

(ii) Calculate the effort required to move a 300 N load if the mechanical advantage is 3. [2]

(iii) Calculate the velocity ratio of the wheelbarrow if the distance moved by the load is 120 mm and effort moves 360 mm. [2]

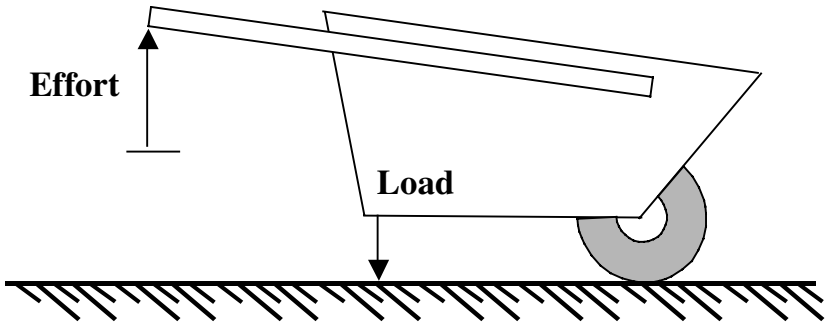


Fig. 2(a)

(b) **Fig. 2(b)** shows various mechanical components assembled for testing.

(i) State the direction of rotation at **G** if **A** rotates in an anticlockwise direction. [2]

(ii) Calculate the velocity ratio between pulleys **A** and **G**. [4]

(iii) Name and draw a suitable system that will link the motor shaft **Y** and shaft **X**. [4]

(iv) Using an annotated sketch describe how a pulley could be attached to a shaft using a key and keyway. [3]

(v) Shaft **M** is to be attached to a crank and slider mechanism to produce a reciprocating output. State **one** other method used to convert rotary motion to reciprocating. [1]

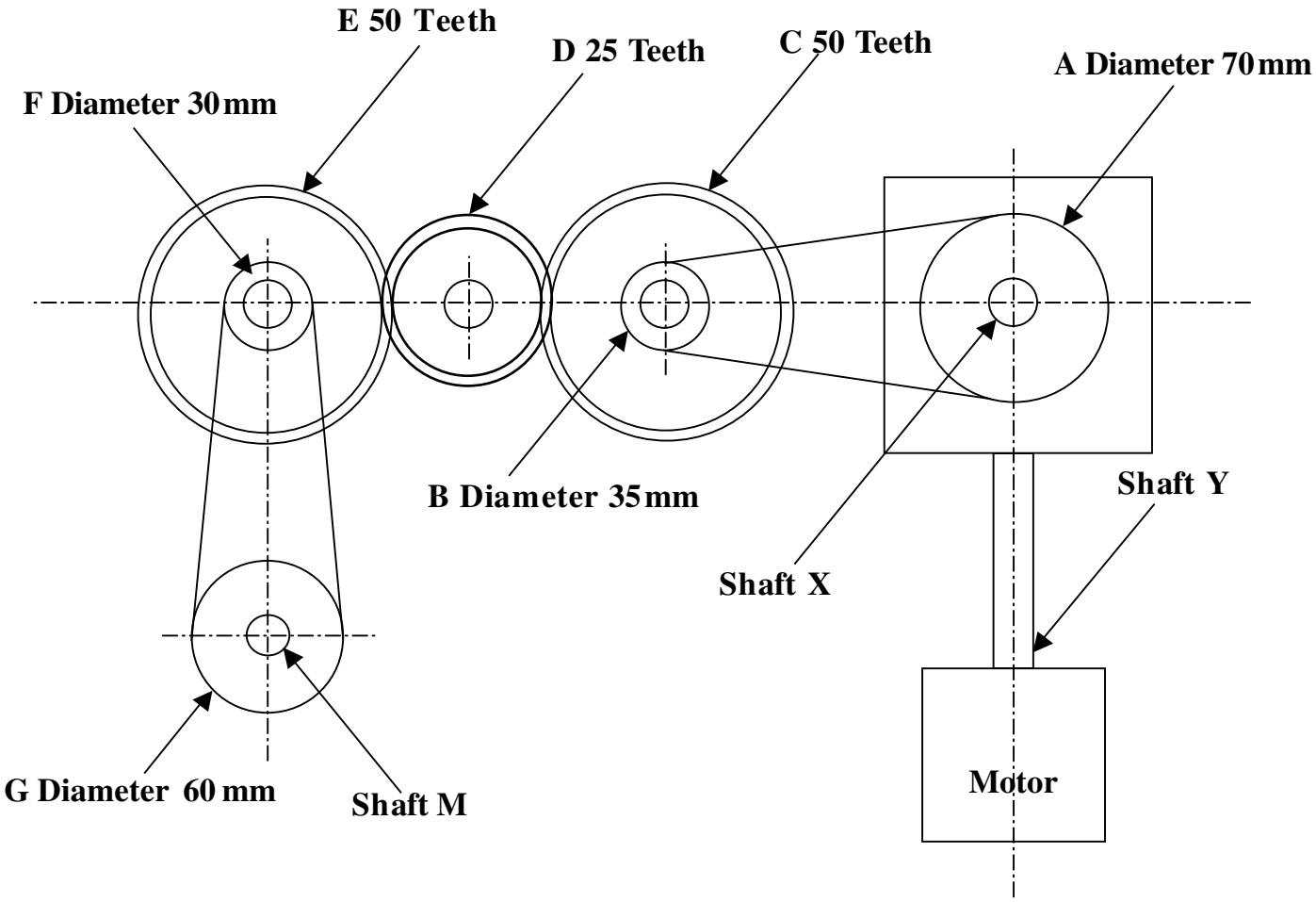


Fig. 2(b)

3 **Fig. 3** shows part of an incomplete pneumatic system.

(a) **(i)** Name the activation method at **A**. [1]

(ii) Name the activation method at **B**. [1]

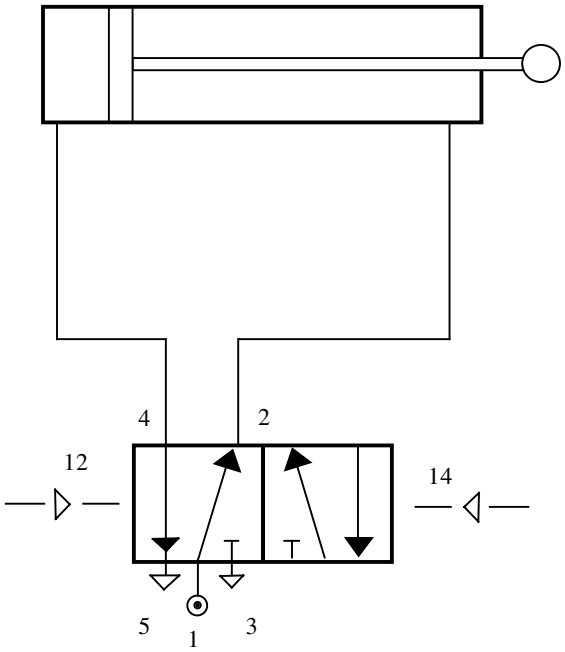
(iii) Briefly outline **one** main difference between activating a diaphragm operated valve and a pilot operated valve. [2]

(b) On the pro forma provided (answer number **3(b)**, **(c)** and **(d)**), complete the circuit enabling **B** and **C** to outstroke the double acting cylinder. [3]

(c) On the pro forma provided (answer number **3(b)**, **(c)** and **(d)**), complete the circuit enabling the double acting cylinder to automatically instroke, slowly, following an outstroke. [4]

(d) On the pro forma provided (answer number **3(b)**, **(c)** and **(d)**), complete the circuit enabling the double acting cylinder to outstroke following a delay in time after **A** is activated. [5]

(e) The double acting cylinder is supplied with an air pressure of 0.4 N/mm^2, has a piston diameter of 60 mm and a piston rod diameter of 6 mm. Calculate the force produced by the cylinder during the instroke. Please assume $\pi = 3.14$. [3]



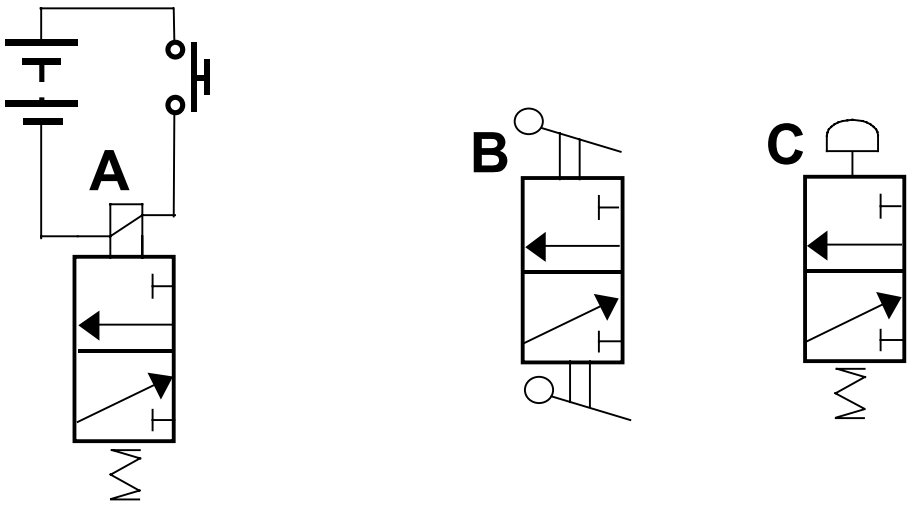


Fig. 3