Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate Examination, 2018

Technology

Higher Level

Wednesday, 20 June
Afternoon, 2:00 - 4:00

Section B and Section C

Section B - 50 marks

Section C - 50 marks

Instructions:

1. Answer either **(a) or (b)** from each question in **Section B**.
2. Answer **one** question from **Section C**.
3. Hand up **Section A** with your answer sheets to this paper.

Section B - 50 Marks **Question 1. Answer either (a) OR (b) from this question.**

1 (a) The graphic shows a lever micro switch.

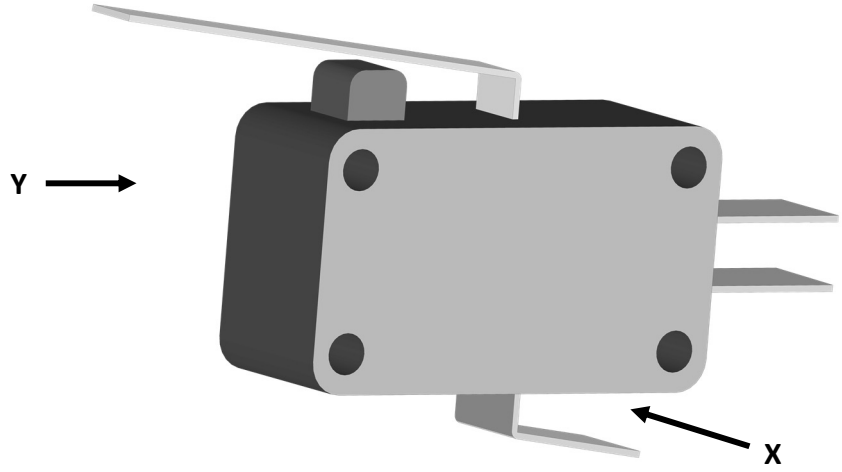
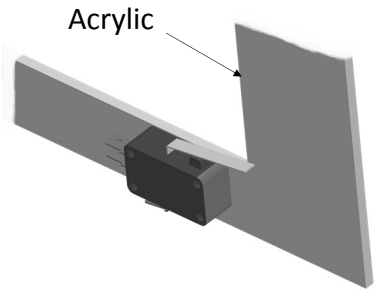


Fig. 1



(i) Make well-proportioned sketches of the following views:

1. An **elevation** in the direction of arrow **X**.
2. An **end view** in the direction of arrow **Y**.

(10 marks)

(ii) The micro switch, acting as a limit switch, will be mounted on acrylic in a student project as shown in **Fig. 1**.

1. Explain the function of a **limit switch** in a project.
2. Explain the advantage of the lever in a micro switch.
3. Explain how the micro switch should be mounted on the acrylic shown. *Name any tools required and state the processes used.*

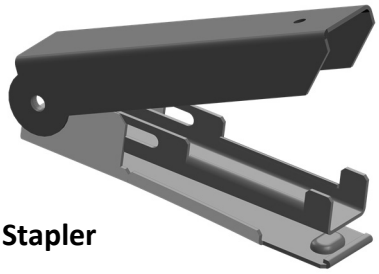
(10 marks)

(iii) The electrical contacts on the micro switch are labelled: NO, NC and COM. Explain the meaning of **each** of these abbreviations.

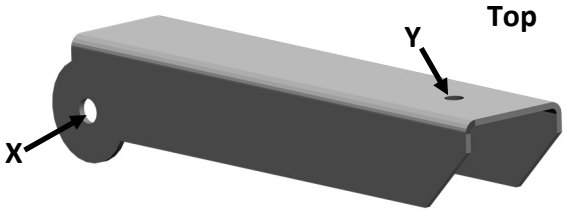
(5 marks)

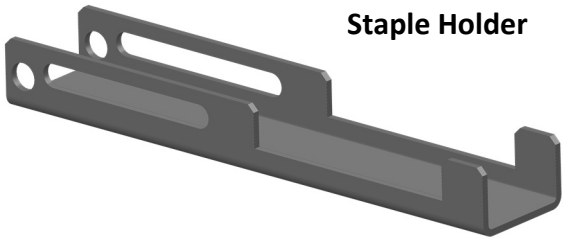
- OR -

1 (b) The graphics show a design for parts of an office stapler.
The top is to be manufactured from 3 mm acrylic.
The staple holder and base are to be manufactured from steel.



Stapler





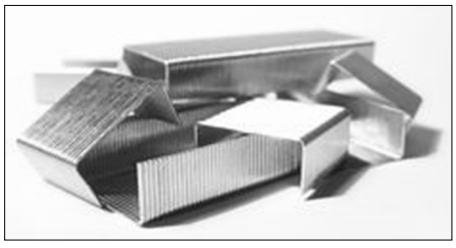
Staple Holder

(i) Make a well-proportioned sketch of the **development** of the **staple holder**
Indicate clearly on your sketch the position of all cutting and bend lines.
(10 marks)

(ii) Explain, using sketches, the steps required to manufacture the **top**
from 3 mm acrylic sheet.
Name any tools required and state the processes used. (5 marks)

(iii) Describe, using sketches, how to produce the holes marked X and Y, in the **top.**
Name any tools required and state the processes used.
(5 marks)

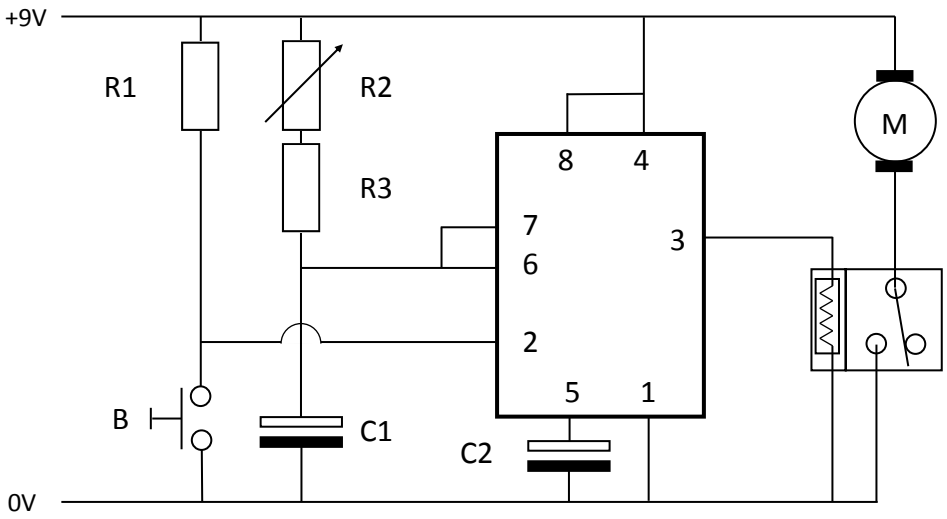
(iv) Staple strips are easily broken if not stored correctly.
Sketch a suitable design for a container to solve this problem.
(5 marks)



Broken staple strips

Section B - 50 Marks **Question 2. Answer either (a) OR (b) from this question**

2 (a) The 555 timing circuit design shown is to be used in a novelty toothbrush holder.
The circuit operates a motor, for a set time, to animate the novelty figure when the switch **B**, connected to pin 2, is pressed.







555 chip

(i) Two switches are available for use at **B**. One is labelled **PTM** and one is labelled **PTB**.
Which one should be used in this situation? Explain the meaning of its label.
(4 marks)

(ii) Using a sketch, indicate how the pins 1 and 5 on the 555 chip are identified.
(4 marks)

(iii) Name the components which can be used to change the time delay in this circuit.
(4 marks)

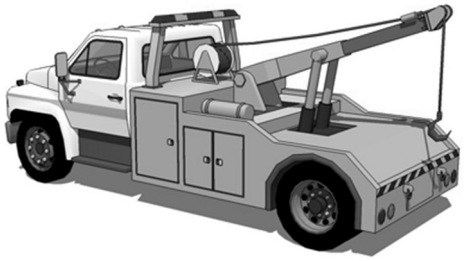
(iv) The relay attached to pin 3 is labelled **SPDT**. Explain this label.
Sketch the pin arrangements for a **DPDT** relay.
(6 marks)

(v) An additional component is normally connected across the coil of the relay to protect the chip. Name, and draw the symbol for this component. (4 marks)

(vi) The resistors used in this circuit have a gold coloured fourth band.
Explain the meaning of this band. (3 marks)

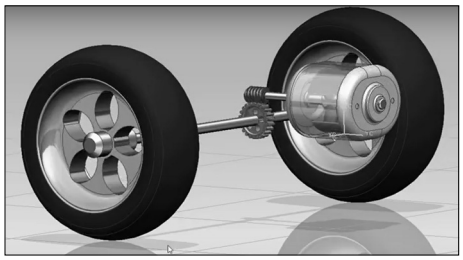
- OR -

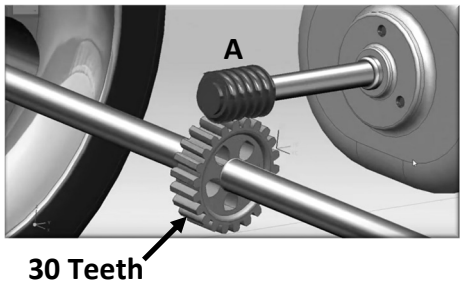
2 (b) The graphics show mechanisms used in a model recovery truck.



Model Recovery Truck

Tyre circumference = 50 × 3.14 mm





(i) Name the gear shown at **A**.
State **two** advantages of using this type of gear to move the truck.

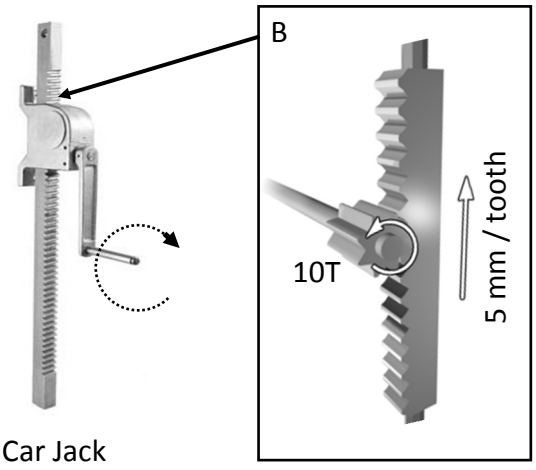
(6 marks)

(ii) If the motor, attached to gear **A**, turns at 420 RPM and the tyres have a circumference of 50 × 3.14 mm, calculate the distance travelled by the truck in 1 minute.

(6 marks)

(iii) Name the mechanism **B** used in the car jack shown.

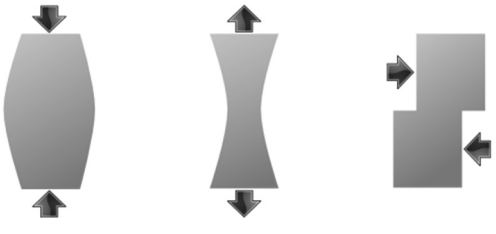
If the mechanism rises by 5 mm per tooth, calculate how many rotations of the handle is required to lift a car by 400 mm.



Car Jack

(8 marks)

(iv) Name the forces, labelled X, Y and Z, which can be applied to mechanisms.



(5 marks)

Section C - 50 Marks

Answer **one** question from this section – all questions carry equal marks.

This section relates to **Technology & Society**, **Control Systems** and **Design & Manufacture**.

3. Technology & Society



(a) (i) Outline **two** reasons why car manufacturers are phasing out engines which run on fossil fuel.

(ii) Outline **two** technologies to replace fossil fuel engines and briefly describe how they operate.

(20 marks)



(b) (i) Name **two** technologies required for the convenient and efficient operation of 'bike rental' schemes in large cities.

(ii) Outline how these **two** technologies operate.

(15 marks)

(c) The way in which we interact with computers has changed over time.
We have changed from using keyboards (typed commands) ***to*** computer mice (point and click) ***to*** touch screens (multi-touch gestures) ***to*** voice command (Alexa/Echo).

(i) Name **two** household systems which can be controlled by voice command.

(ii) Outline **two** advantages of using this new technology in the home.

(15 marks)



4. **Control Systems** and **Technology & Society**



(a) (i) Outline **two** reasons why robotic devices are now commonly used in industrial manufacture.

(ii) Outline **two** ways in which robotic devices are particularly suitable for space and planetary exploration.

(20 marks)

(b) Robotic devices require:

- mechanical components
- sensing components
- an operating programme.

Explain, using a suitable example, why **each** item listed above is required.

(15 marks)

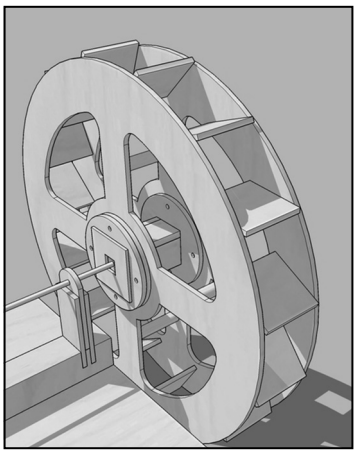
(c) Driverless cars are complex robotic devices requiring a form of artificial intelligence (AI).

(i) Outline **two** advantages of driverless cars.

(ii) Explain why driverless cars are more complex than other robotic devices.

(15 marks)

5. Design & Manufacture



A student intends to manufacture a water wheel generator based on the design shown.

(a) (i) Describe, with the aid of sketches, the steps required to manufacture the water wheel from a suitable material.
Name any tools required and state the processes used.

(ii) Describe, with the aid of sketches, how the turning wheel could be supported with a suitable frame.
Name any additional components required.

(25 marks)

(b) A motor, two different sized pulley wheels, and a pulley belt are available.

(i) Describe, with the aid of sketches, how the turning water wheel could be used to generate electric current.

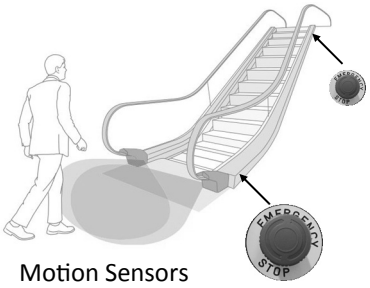
(ii) Describe, with the aid of a suitable circuit diagram, how the generator could power a number of LEDs.

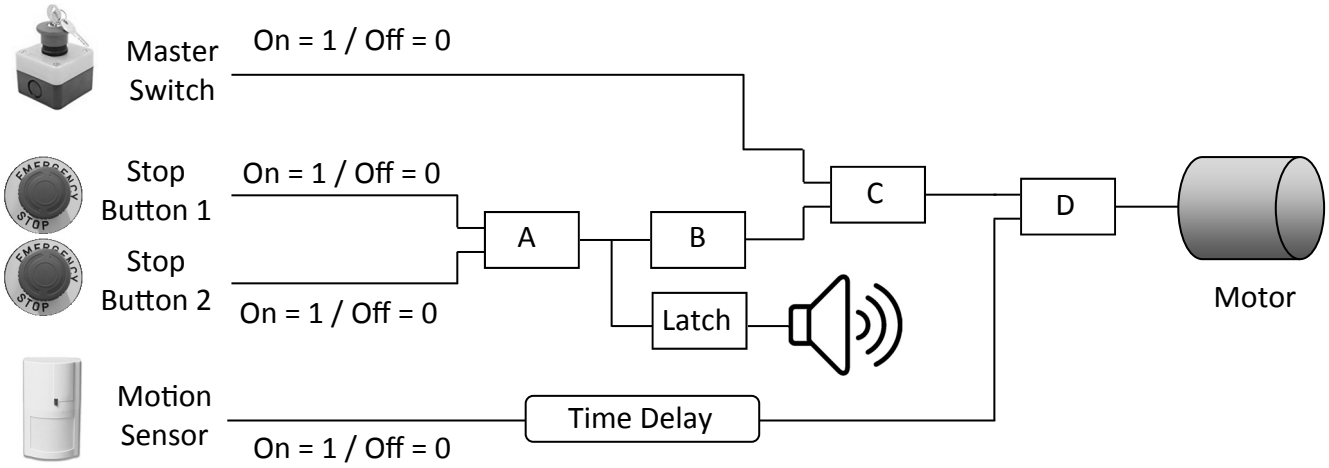
(iii) Describe, with the aid of sketches, **two** other methods of generating electricity using environmentally friendly resources.

(25 marks)

6. Control Systems

(a) A system diagram, to control the operation of an escalator is shown. The system has the following features: *A master on/off switch, two emergency stop buttons and a motion sensor to detect people approaching the escalator.*
Once the motion sensor is activated, a time delay will keep the motor running to allow the person to reach the top of the escalator. The control system will stop the escalator if either of the stop buttons is pressed or if no one is approaching the escalator.





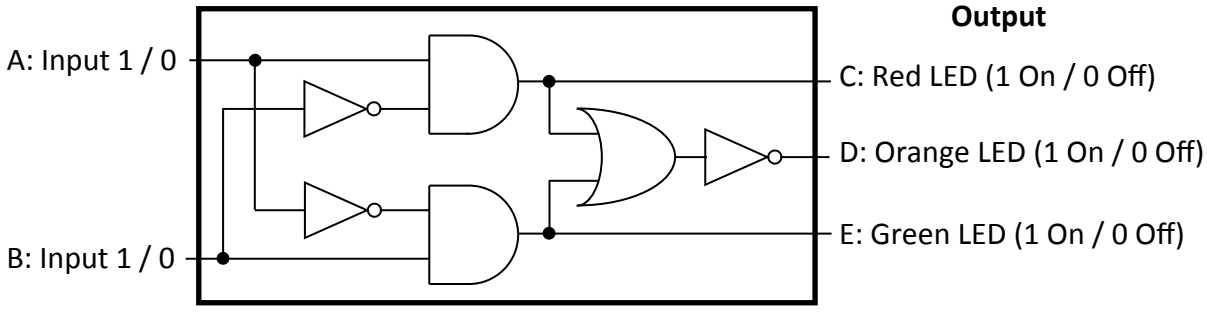
(i) Name the logic gates required at A, B, C and D.
(ii) Draw a truth table for **each** of the logic gates at A and D.
(iii) State the purpose of the 'Latch' in the system.
(iv) Outline a modification to the system which will:
turn on sign X only, when the system is operating correctly,
turn on sign Y only, when the escalator has been switched off or when a stop button has been pressed.

Sign X Sign Y



(34 marks)

(b) Draw a truth table for the system below and hence state which LED (C, D or E) will light if:
(i) the input value of A is greater than B (A > B),
(ii) the input values are the same (A = B).



(16 marks)