



**Coimisiún na Scrúduithe Stáit
State Examinations Commission**

JUNIOR CERTIFICATE EXAMINATION, 2016

**METALWORK
MATERIALS AND TECHNOLOGY**

Higher Level - 100 Marks

Tuesday, 21 June Afternoon, 2:00 – 4:00

INSTRUCTIONS

1. Answer Question 1, Section A and Section B, and three other questions.
2. All answers must be written in ink on the answer book supplied.
Diagrams should be drawn in pencil.
3. Squared paper is supplied for diagrams as required.
4. Please label and number carefully each question attempted.

SECTION A – 20 Marks
COMPULSORY

Answer **any five** questions.

Figure 1 shows some of the main parts of a two-stroke engine.

Questions (a) to (d) relate to these.

- (a) (i) Name part A.
(ii) Describe the function of part A.

(4 marks)

- (b) (i) Name part B.
(ii) Describe how the cooling fins cool the engine.

(4 marks)

- (c) (i) Describe the operation of the engine during the downward stroke.
(ii) Outline **one** environmental effect of engine exhaust fumes.

(4 marks)

- (d) (i) Suggest **any two** applications for two-stroke engines.
(ii) Name **one** other type of engine.

(4 marks)

- (e) Describe briefly the contribution made to technology by **one** of the following:

- (i) Thomas Edison,
(ii) Steve Jobs,
(iii) Eileen Gray.

(4 marks)

- (f) (i) Identify **any two** properties of the plastic material used to make the plastic water bottle shown opposite.
(ii) Outline **one** way in which the plastic bottle may be ‘up-cycled’.

(4 marks)

- (g) (i) Identify the electronic component labelled C and identify the electronic component labelled D.
(ii) Draw, using the correct electronic symbols, a circuit diagram for the circuit shown opposite.

(4 marks)

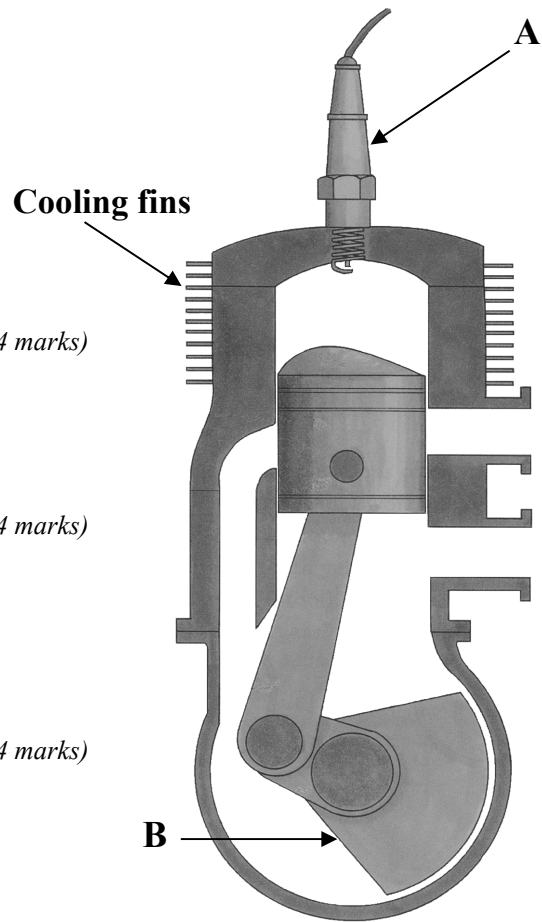
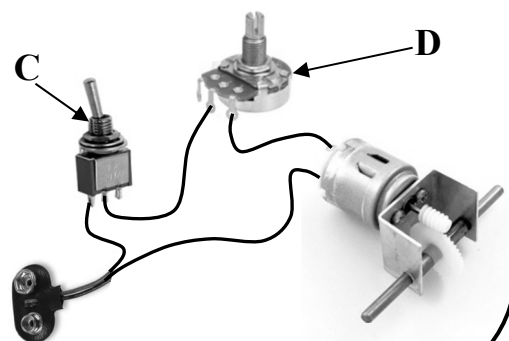


Figure 1



Plastic water bottle



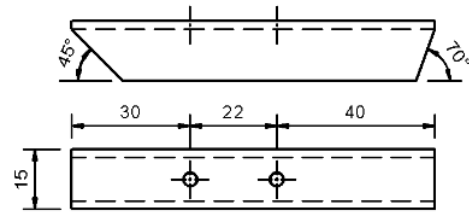
Electronic circuit

**SECTION B – 20 Marks
COMPULSORY**

Answer **any five** questions.

The drawings show the Centre Support, Side Panel, Electric Circuit and an assembly drawing of the 2016 Metalwork Higher Level Project, Model Remote Control Trike.

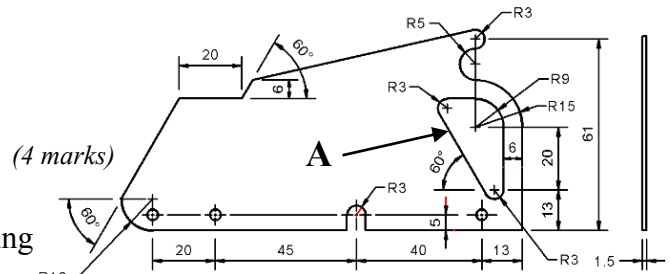
- (a) (i) Suggest **one** reason why U-Aluminium is suitable for the centre support.
- (ii) Describe how the 45° and 70° angles are marked-out and shaped on the centre support.



Centre Support

(4 marks)

- (b) (i) Explain how the window labelled **A** is accurately shaped in the side panel.
- (ii) Outline how a high quality finish is produced on the edge profile of the side panel.



Side Panel

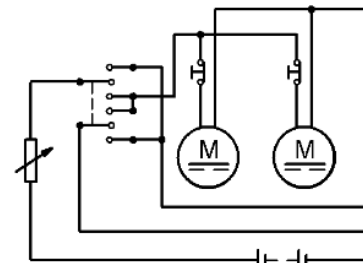
(4 marks)

- (c) Explain the function of **each** of the following switches, shown in the electric circuit, in the operation of the model remote control trike:

- (i) the DPDT switch;
- (ii) the push to break switch.

(4 marks)

- (d) (i) Design, using a diagram, a control console for the model. The control console must be capable of controlling the model from both handheld and desk-mounted positions.
- (ii) Describe briefly how you would manufacture the control console designed by you in (d)(i) above.



Electric Circuit

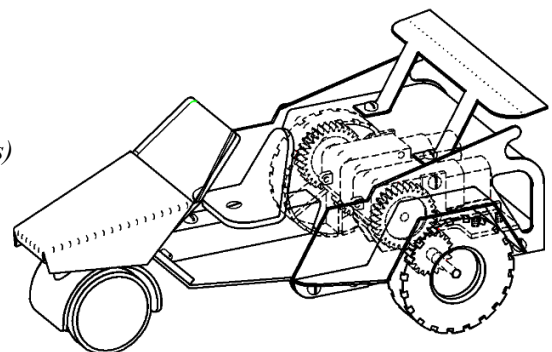
(4 marks)

- (e) (i) Outline **one** advantage of using ribbon cable to connect a control console to the model.
- (ii) Outline **any two** steps to be taken to produce a good quality soldered circuit.

(4 marks)

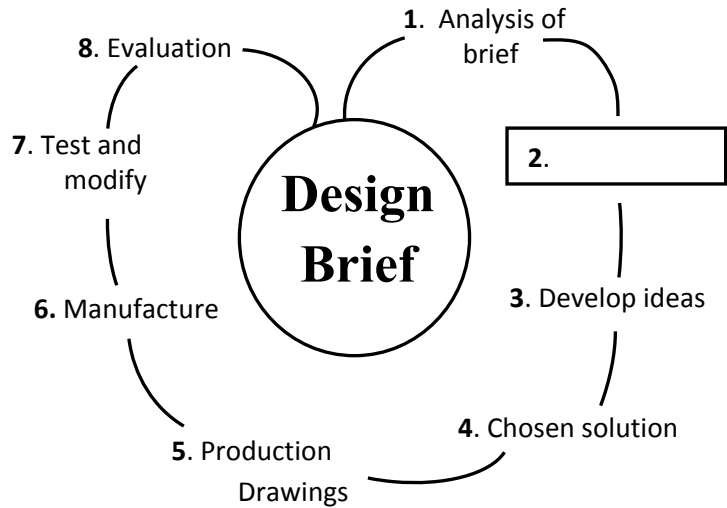
- (f) (i) Describe, using a diagram, any additional feature that could be added to the trike.
- (ii) Suggest **any two** suitable applications for a trike.

(4 marks)



Model Remote Control Trike

A simple model, with eight stages of a design process is shown opposite. Stage two is omitted.



- (a) (i) Suggest a suitable name for **stage two** of the design process shown opposite.
- (ii) Outline **any two** sources that could be used at **stage two** of the design process.
- (iii) Suggest **any three** factors which may be considered when choosing the final design of a microwave oven. (7 marks)



Microwave oven

A bus and a bus stop are shown below.

- (b) (i) Design, using a diagram(s), a bus shelter suitable for passengers. The bus shelter should include:
 - Protection from the elements for passengers
 - An area with passenger information
 - A space for advertising.
- (ii) Design, using a diagram(s), seating for the bus shelter to accommodate *four* passengers. Outline how the seating is to be fixed in the bus shelter.
- (iii) Select suitable materials for the bus shelter and seating.
- (iv) Suggest a suitable finish for **each** material selected.



Bus and a bus stop

(13 marks)

Question 3

20 Marks

- (a) (i) State **any two** reasons why lathes are designed to run at different speeds (RPM).
(ii) Describe, using a diagram, how the lathe cutting tool shown is set to the correct height for turning.
(iii) Identify the turning operation shown below and explain how this process is carried out.
(iv) List **any two** safety precautions to be observed when drilling on the lathe.

(10 marks)

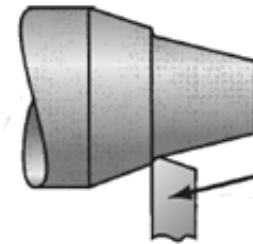


Lathe cutting tool and holder

- (b) A 16 mm diameter bar is to be turned on a lathe. The material has a surface cutting speed of 72 m/min. Using the given formula, calculate the speed in RPM. (Take π as 3)

$$N = \frac{S \times 1000}{\pi \times D}$$

(4 marks)



(a)(iii) Turning operation

- (c) Select **any two** from (i), (ii) or (iii) below and explain the difference between the terms in **each**:

- (i) Three jaw chuck **and** Four jaw chuck;
(ii) Facing **and** Parallel turning;
(iii) Countersinking **and** Counterboring. (6 marks)

Question 4

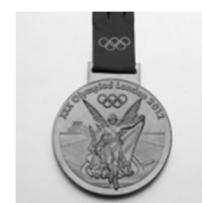
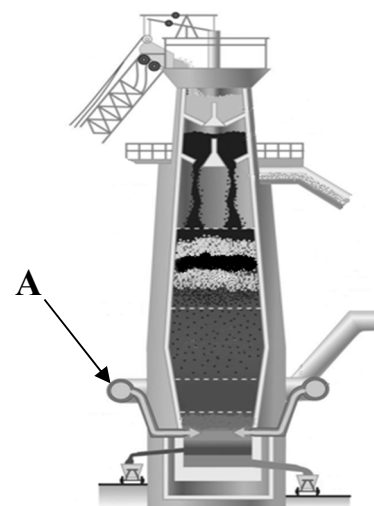
20 Marks

- (a) (i) Name the type of furnace shown.
(ii) List the materials in the charge.
(iii) Explain how heat loss is prevented during the charging of the furnace.
(iv) With reference to part A, describe how the charge is melted. (10 marks)

- (b) Define **any two** of the following material properties:

- (i) Hardness
(ii) Ductility
(iii) Malleability
(iv) Conductivity. (6 marks)

- (c) (i) Identify **any two** metals used to make a bronze Olympic medal.
(ii) Suggest **one** other application for this alloy. (4 marks)



Olympic medal

Question 5

20 Marks

A design for a remote controlled drone is shown.

- (a) (i) Outline **any two** suitable uses for a drone.
- (ii) Describe **any two** design features which could be incorporated in the design of a drone.
- (iii) Suggest **any one** function, of the drone shown, which can be operated using remote control.
- (iv) State **any two** environmental impacts of using drone technology.

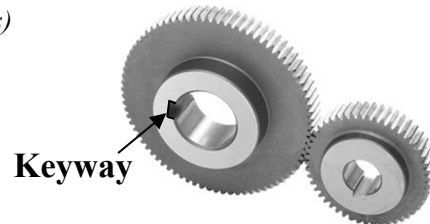
(10 marks)



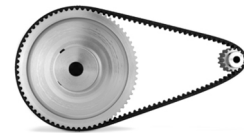
Remote controlled drone

- (b) (i) Identify the drive mechanism **A** shown.
- (ii) Suggest **any two** suitable applications for drive mechanism **A**.
- (iii) Explain the purpose of the keyway shown on drive mechanism **A**.
- (iv) Describe **one** advantage for using a toothed belt drive mechanism.

(10 marks)



Drive mechanism A



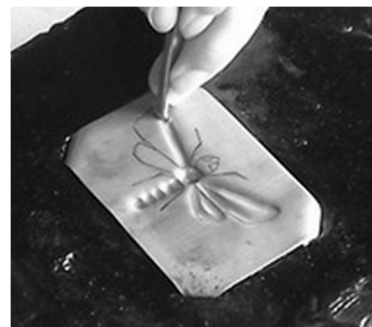
Toothed belt drive

Question 6

20 Marks

- (a) (i) Name the decorative metalwork process applied to copper sheet shown opposite.
- (ii) Describe how this decorative metalwork process is carried out.
- (iii) Identify **any two** other decorative metalwork processes.
- (iv) Outline **any two** reasons for applying a decorative finish to metal.

(10 marks)



- (b) (i) Describe a suitable heat treatment process which should be applied to the copper sheet, before this decorative process can be carried out.
- (ii) Name **any two** other heat treatment processes which can be applied to metal.
- (iii) State **any two** safety precautions to be observed when heat treating metals.

(10 marks)



- (a) (i) Four computer peripheral devices are shown. Outline the purpose of **each** device.
- (ii) Classify **each** device as either input or output.
- (iii) Explain the difference between computer hardware and computer software.
- (iv) Explain **any two** of the following, associated with computer technology:
- Gigabyte
 - VDU
 - 3D printing
 - Dropbox.
- (v) Describe **one** risk associated with online computer activity and outline **one** precaution to be taken to minimise this risk.



Headphone set



Joystick



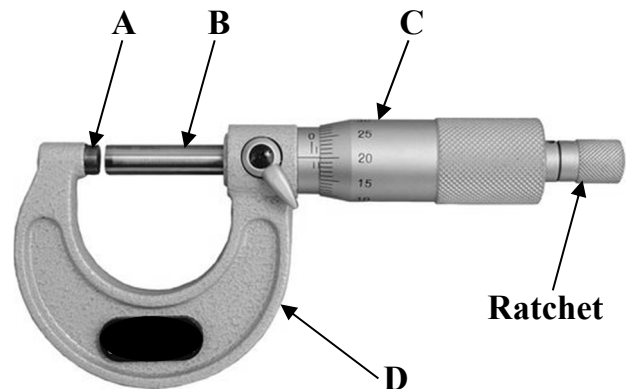
Data projector



Keyboard

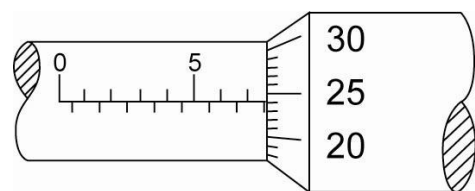
(14 marks)

- (b) (i) Name the parts **A**, **B**, **C** and **D** of the micrometer shown.
- (ii) Explain the function of the Ratchet shown.
- (iii) State the value of the micrometer measurement shown opposite.



Micrometer

(6 marks)



Micrometer measurement

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