



**Coimisiún na Scrúduithe Stáit
State Examinations Commission**

JUNIOR CERTIFICATE EXAMINATION, 2017

METALWORK

MATERIALS AND TECHNOLOGY

Higher Level - 100 Marks

Tuesday, 20th 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 basic two-stroke engine.

Questions (a) to (d) relate to this diagram.

- (a) (i) Name part A.
- (ii) Explain the purpose of part A. (4 marks)

- (b) (i) Name the parts labelled B and C.
- (ii) Explain the purpose of **one** of these parts. (4 marks)

- (c) (i) Describe the movement of part D as the piston moves up and down.
- (ii) Explain how an engine is lubricated. (4 marks)

- (d) (i) Suggest **any two** suitable applications for a two-stroke engine.
- (ii) Outline **any two** types of environmental pollution caused by engines. (4 marks)

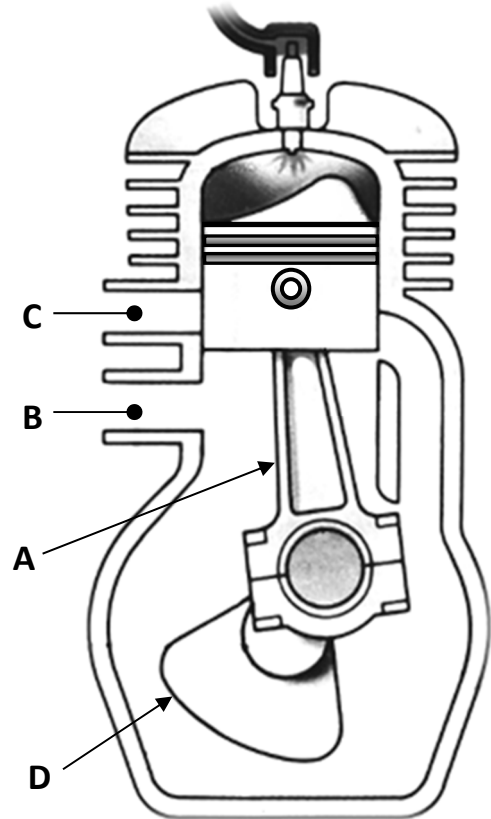


Figure 1

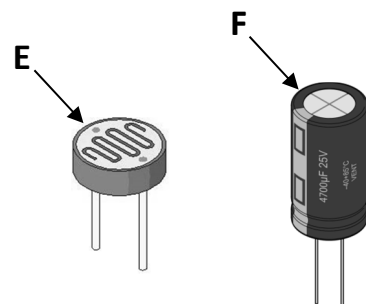
- (e) Describe briefly the contribution made to technology by **one** of the following people:
 - (i) Enzo Ferrari,
 - (ii) Nikola Tesla,
 - (iii) John Logie Baird.(4 marks)



Garden light

- (f) (i) Identify **any** type of renewable energy which may be used to power a garden light.
- (ii) Suggest **any two** other applications for this type of renewable energy. (4 marks)

- (g) (i) Identify **both** of the electronic components E and F shown.
- (ii) Outline the function of **one** of the electronic components shown. (4 marks)



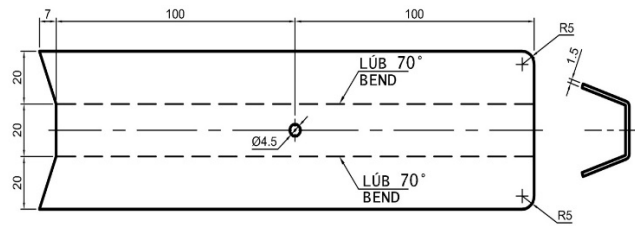
Electronic components

SECTION B – 20 MARKS
COMPULSORY

Answer **any five** questions.

The drawings and diagrams shown are taken from the 2017 Metalwork Higher Level Project, Model Autonomous Search Vehicle.

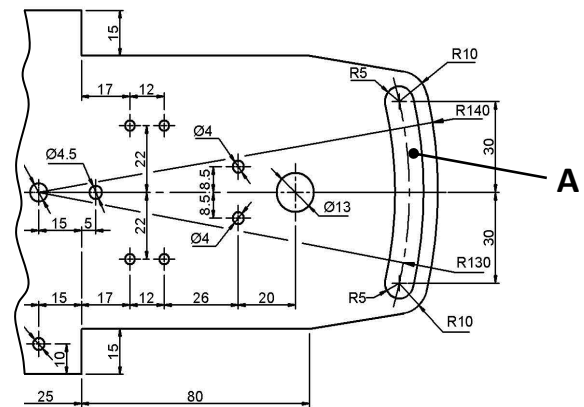
- (a) (i) Describe how the 70° angles are accurately bent to shape on the Central Cover.
- (ii) Explain **one** suitable method to check the accuracy of the 70° bends.



Central Cover

- (b) (i) Outline **any two** safety precautions to be observed when drilling the Ø13 mm hole in the 1.5 mm aluminium Chassis.
- (ii) Describe how a high quality finish is achieved on the edge profile of the Chassis.

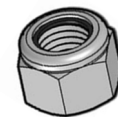
(4 marks)



Part view of Chassis

- (c) (i) Explain how the slot labelled **A** in the Chassis is accurately shaped.
- (ii) An M6 Nylock nut is used in the model assembly. Explain why a Nylock nut is used.

(4 marks)



Nylock nut

- (d) (i) Explain the function of a Micro-switch with roller lever.
- (ii) Describe how the movement of the search light, labelled **B** below, is achieved.

(4 marks)



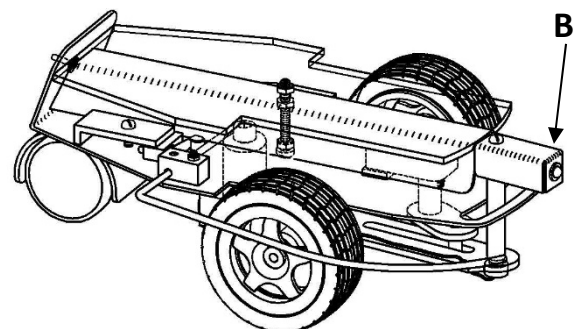
Micro-switch with roller lever

- (e) Design a unit, for the model shown, which will securely hold a battery holder and act as a mudguard for the wheel.

(4 marks)

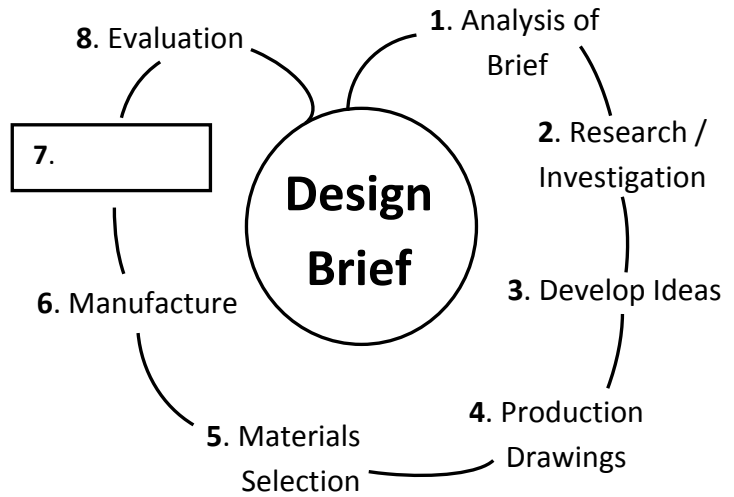
- (f) (i) State **two** reasons for designing autonomous vehicles.
- (ii) Suggest **one** example of where an autonomous search vehicle may be used.

(4 marks)



Model Autonomous Search Vehicle

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



- (a) (i) Suggest **any** suitable name for **stage seven** of the design process shown opposite.
- (ii) Outline **any two** pieces of information which should be considered at **stage seven** of the design process.
- (iii) Suggest **any three** factors which may be considered when selecting materials for manufacturing the trampoline shown.



Trampoline

(7 marks)

A tennis racket, tennis balls and a water bottle are shown.

- (b) (i) Design, using diagram(s), a metal storage rack which will neatly store the tennis equipment shown. The rack you design should include:

- A means of storing up to four tennis rackets and six tennis balls
- A suitable area to store a water bottle
- A means to attach the rack to a wall.



Tennis racket, tennis balls and water bottle

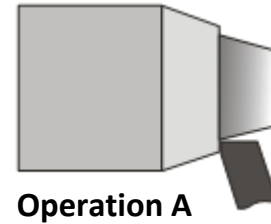
- (ii) Name **one** suitable metal for the storage rack and outline **one** reason for your selection.
- (iii) Suggest **one** suitable finish for the metal storage rack.

(13 marks)

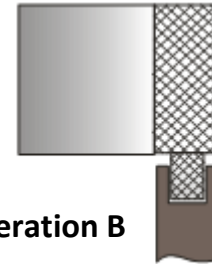
Question 3

20 Marks

- (a) (i) Name **and** describe the lathe operation **A**, shown opposite.
- (ii) Name **and** describe the lathe operation **B**, shown opposite.
- (iii) Name tool **C** and explain the purpose of this tool.
- (iv) Outline **any two** factors which may impact on the quality of finish when machining a workpiece on the lathe.



Operation A



Operation B

(10 marks)

- (b) A $\varnothing 12$ mm bar is to be turned on the lathe. The material has a surface cutting speed of 108 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)

- (c) Select **any two** from (i), (ii) or (iii) below and explain the difference between the terms in **each**:
- (i) Grub screw **and** countersunk screw;
- (ii) Cap nut **and** wing nut;
- (iii) Centre square **and** engineers protractor.



Tool C

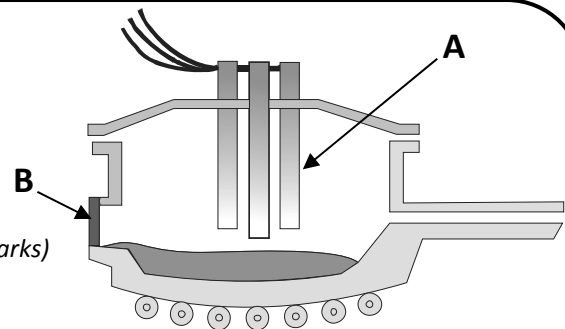
(6 marks)

Question 4

20 Marks

- (a) (i) Identify the type of furnace shown.
- (ii) Name the material produced in this furnace.
- (iii) Name part **A** and describe how the charge is melted.
- (iv) Explain the purpose of part **B**.

(10 marks)



- (b) (i) Name **one** suitable metal used to manufacture the medical equipment shown.
- (ii) Outline **any two** reasons why the chosen metal is suitable.

(4 marks)

- (c) (i) Name **any three** heat treatment processes which may be applied to metals.
- (ii) Describe how **one** of the named heat treatment processes is carried out.

(6 marks)



Medical Equipment

Question 5

20 Marks

A design for a concept motor racing car is shown.

- (a) (i) Describe **any two** design features which enhance this concept racing car.
- (ii) Suggest **any two** properties required of the material used to make the body of a racing car.
- (iii) State **any two** environmental impacts of motor racing technology.

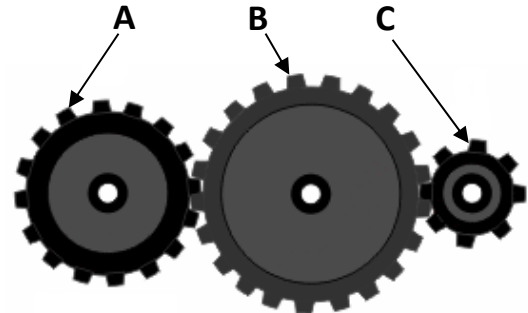


Concept motor racing car

(10 marks)

(b) Gear wheels A, B and C, shown opposite, are part of a drive mechanism.

- (i) If gear A is turning clockwise, in what direction will gear C turn?
- (ii) Calculate the gear ratio if the driving gear A has 16 teeth and the driven gear C has 8 teeth.
- (iii) If gear A is turning at 240 RPM, what is the speed of gear C?
- (iv) Name gear B and explain its function.



Drive mechanism

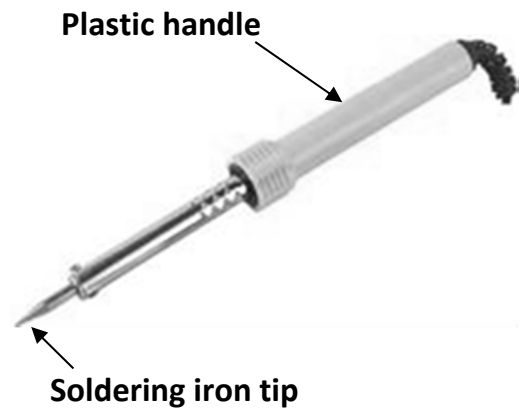
(10 marks)

Question 6

20 Marks

An electric soldering iron is shown.

- (a) (i) Name **one** metal which is suitable to make the tip of the soldering iron and give **one** reason for your choice.
- (ii) The plastic handle is an insulator. Explain the term *insulator*.
- (iii) Which is the most suitable for manufacturing the handle of the soldering iron, thermoplastic or thermosetting plastic?
- (iv) State **one** reason why the plastic chosen at part (iii) above is suitable.



(10 marks)

- (b) (i) Name **any two** metals used to make soft solder.
- (ii) List **any two** properties of solder that make it suitable for joining electronic components.
- (iii) Outline the purpose of flux when soldering.
- (iv) State **any three** safety precautions to be observed when soldering.



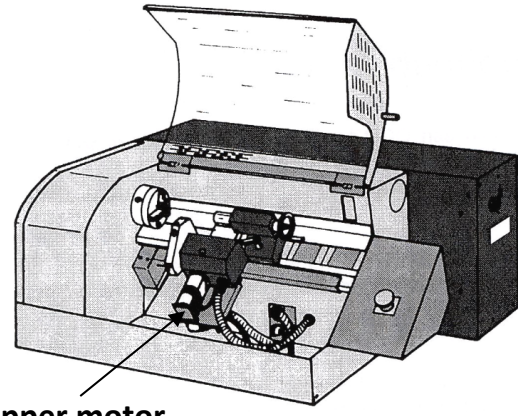
Soft solder



Flux

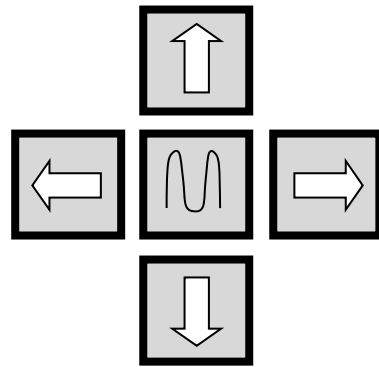
(10 marks)

- (a) (i) Identify the type of lathe shown.
- (ii) Explain the function of the stepper motor on the lathe shown.
- (iii) State **any two** built-in safety features of the lathe shown.
- (iv) Redraw the jog keys shown and label the correct directions -X, +X, -Z and +Z.



Stepper motor

- (v) Explain **any two** of the following computer terms:
 - Cloud Storage
 - URL
 - App
 - CAD.



Jog keys

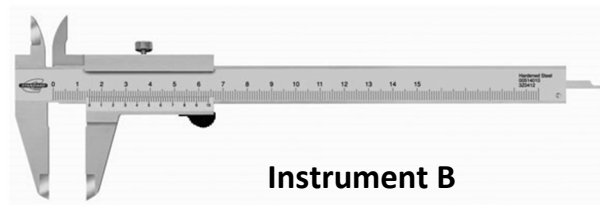
(13 marks)

- (b) (i) Name measuring instrument **A** and measuring instrument **B**, shown opposite.



Instrument A

- (ii) Suggest **one** suitable application for measuring instrument **A**.
- (iii) Describe **any two** measuring functions of instrument **B**.



Instrument B

- (iv) Name **one** other measuring instrument used in engineering.

(7 marks)

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