



Coimisiún na Scrúduithe Stáit State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION, 2019

METALWORK MATERIALS AND TECHNOLOGY

Higher Level – 100 Marks

Tuesday, 18th 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 four-stroke engine.

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

- (a) (i) Identify part **A** shown.
 (ii) Outline how a seal is created between part **A** and the engine cylinder. (4 marks)
- (b) (i) Explain the function of the spark plug.
 (ii) Describe, making reference to part **B**, the exhaust stroke of the four-stroke engine cycle. (4 marks)
- (c) (i) Identify part **C**, and describe the type of motion of part **C**.
 (ii) Explain how a four-stroke engine is lubricated. (4 marks)
- (d) Describe briefly the contribution made to technology by **one** of the following people:
 (i) Nikolaus Otto,
 (ii) Guglielmo Marconi,
 (iii) Tim Berners-Lee. (4 marks)

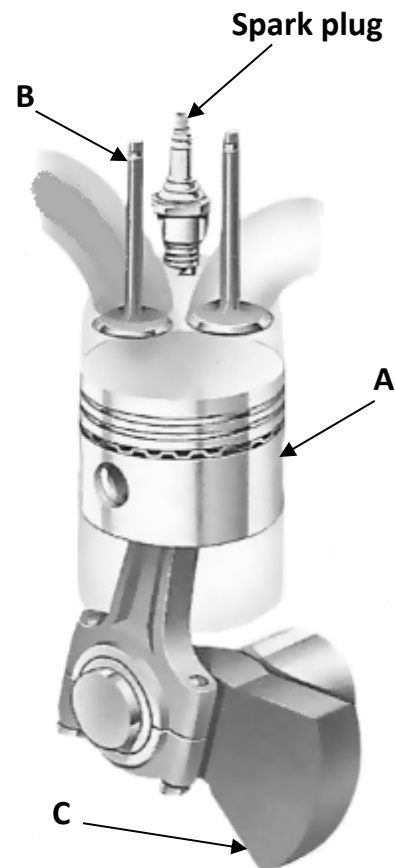


Figure 1

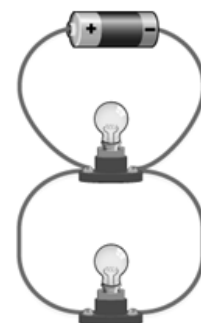
- (e) (i) The music speaker shown is a *smart technology* device. Explain the term *smart technology*.
 (ii) Name **any two** other smart technology devices. (4 marks)
- (f) (i) Explain the term *non-ferrous* metal.
 (ii) Name **one** non-ferrous metal suitable for the manufacture of the *Arm* of the selfie stick shown and give **one** reason for your selection. (4 marks)
- (g) (i) Is circuit **D** shown connected in parallel or connected in series?
 (ii) State **one** suitable application for circuit **D** shown. (4 marks)



Music speaker



Selfie stick arm

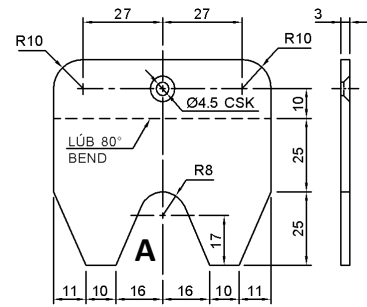


Circuit D

COMPULSORY

Answer **any five** questions.

The drawings and the diagrams shown are taken from the 2019 Metalwork Higher Level Project, Model Roadster.



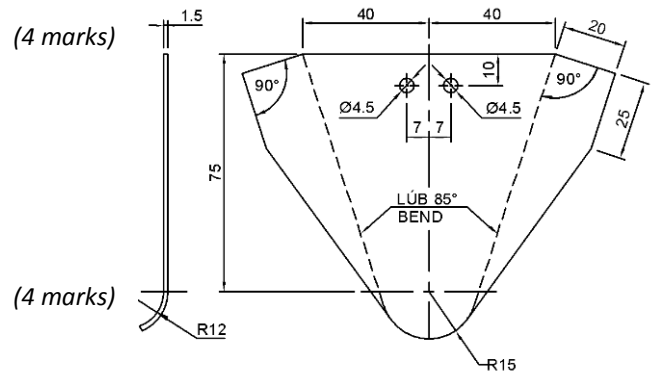
Seat

- (a) (i) Describe **any two** steps required to accurately shape the section labelled **A** of the seat.
- (ii) Outline how a high quality finish is produced on the edge profile of the seat.

(4 marks)

- (b)** Describe how the rear cover is accurately bent to shape making reference to:

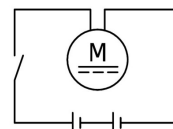
- (i) the 85° bends;
- (ii) the R12 bend.



Rear cover

- (c) (i)** Outline the operation of the electric circuit shown, used to power the model roadster.

- (ii)** Modify and redraw the electric circuit to include an LED to be fitted to the model roadster.



Electric circuit

(4 marks)

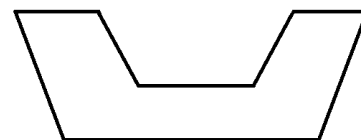
- (d) (i)** List **any two** advantages of the motorised gearbox as the drive mechanism for the model roadster.
- (ii)** Suggest **any two** other drive mechanisms which could be used for the model roadster.



Motorised gearbox

(4 marks)

- (e) (i)** A simple design for a side panel is shown. Describe, using a diagram(s), how you would modify the given side panel to incorporate a step.



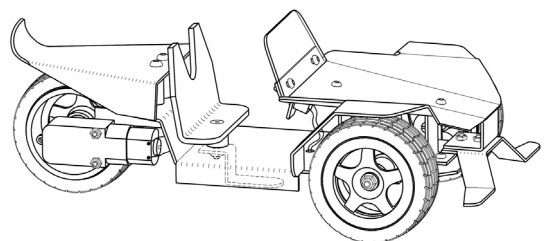
Side panel

- (ii)** Show how the modified side panel is to be attached to the model roadster.

(4 marks)

- (f) (i) Suggest **any two** safety features incorporated in real life roadsters.
- (ii) Outline **any two** safety precautions to be observed when operating a real life roadster.

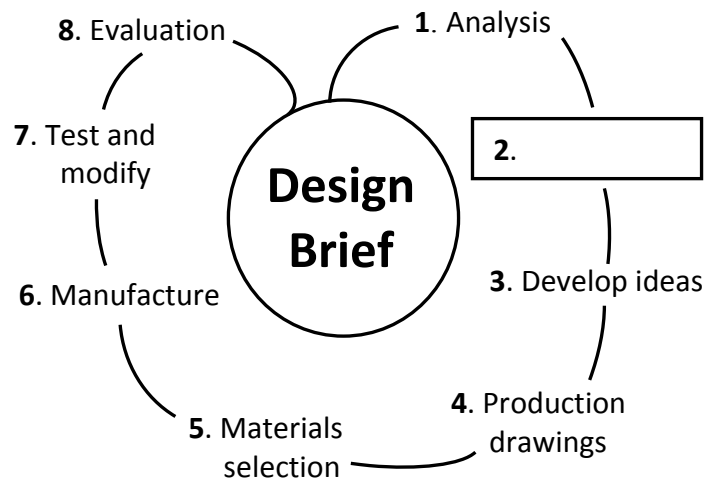
(4 marks)



Model roadster

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

- (a) (i) Suggest **any** suitable name for **stage two** of the design process shown opposite.
- (ii) Outline **any three** items of information which may be contained in the 'Production drawings' stage for the hoverboard shown below.
- (iii) Suggest **any two** factors which may be considered when evaluating the design of the hoverboard shown.

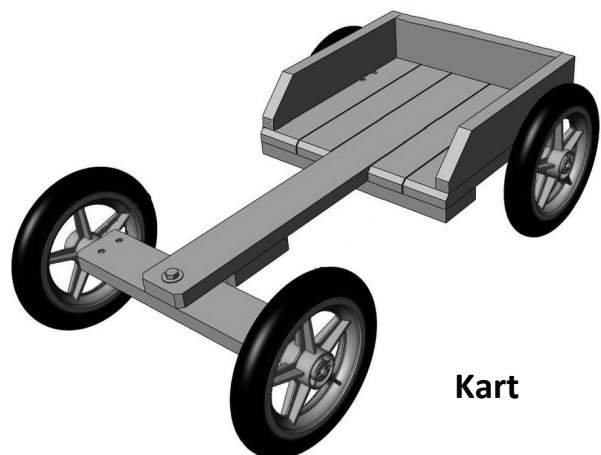


(7 marks)

Hoverboard

A kart is shown opposite.

- (b) (i) Design, using a diagram(s), a suitable steering system for the front wheels of the kart.
- (ii) Design, using a diagram(s), a single seat for the kart.
- (iii) Design, using a diagram(s), a simple hand-braking mechanism to slow down the kart.



Kart

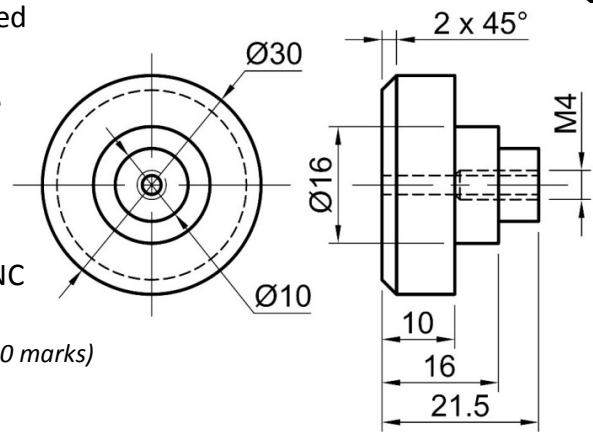
(13 marks)

Question 3

20 Marks

- (a) (i) Name **any three** turning operations required to produce the lathe component shown.
- (ii) Identify **any three** safety precautions to be observed when operating a lathe.
- (iii) State **any two** reasons why a lathe is designed to run at different speeds (RPM).
- (iv) Describe **any two** advantages of using a CNC lathe to manufacture the component.

(10 marks)



Lathe component

- (b) A Ø12 mm hole is to be drilled in a lathe component. The component has a surface cutting speed of 81 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) Three jaw chuck **and** four jaw chuck;
- (ii) Rake angle **and** clearance angle;
- (iii) Manual lathe **and** CNC lathe.

(6 marks)



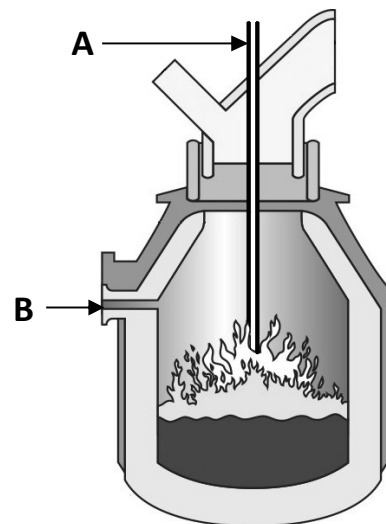
CNC lathe

Question 4

20 Marks

- (a) (i) Identify the type of furnace shown.
- (ii) List the materials in the charge.
- (iii) Name part **A** and explain how it is prevented from melting.
- (iv) Explain the purpose of part **B**.
- (v) Name **one** other furnace used to produce steel.

(10 marks)



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

- (i) Conductivity;
- (ii) Malleability;
- (iii) Elasticity;
- (iv) Brittleness.

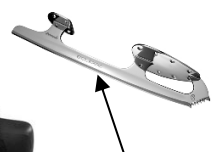
(4 marks)

- (c) (i) Describe the heat treatment process of hardening.
- (ii) Outline **any two** reasons why stainless steel is used to manufacture the skate blade shown.

(6 marks)



Ice hockey skates



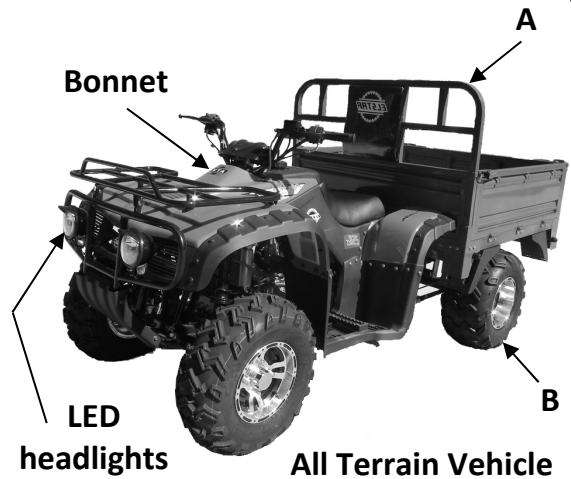
Skate blade

Question 5

20 Marks

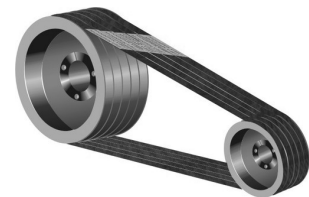
An All Terrain Vehicle (ATV) and drive mechanisms are shown.

- (a) (i) Name **one** suitable material for part **A** and **one** suitable material for part **B** of the ATV shown. State **one** reason for your choice of **each** chosen material.
- (ii) The bonnet shown is made from the thermoplastic material polypropylene. Name **any two** other thermoplastic materials.
- (iii) The ATV has pneumatic tyres. Outline **any two** reasons for using pneumatic tyres on the ATV.
- (iv) State **any two** advantages of using LED headlights.



(10 marks)

- (b) (i) Identify **both** drive mechanisms shown opposite.
- (ii) Suggest **one** application for mechanism 1 and **one** different application for mechanism 2.
- (iii) List **any two** reasons why it is necessary to lubricate mechanism 2.
- (iv) Identify **one** safety hazard associated with **any one** of the drive mechanisms shown.



Drive mechanism 1



Drive mechanism 2

(10 marks)

Question 6

20 Marks

Enamelled pendants and a bronze trophy are shown.

- (a) (i) Describe how the pendants shown may be shaped from 1 mm copper sheet.
- (ii) Explain, using diagrams, how the pendants may be finished by enamelling.
- (iii) Suggest **any two** safety precautions to be taken when heating metals.
- (iv) Describe briefly **any one** of the following decorative metal finishing processes:
- Mottling
 - Etching
 - Engraving.



Enamelled pendants

(10 marks)

- (b) (i) List the metals used to make bronze.
- (ii) Suggest **any two** reasons why bronze is used to manufacture trophies and statues.
- (iii) Name **one** other alloy and list the metals used to make your chosen alloy.
- (iv) Suggest **any two** reasons for alloying metals.



Bronze trophy

(10 marks)

Question 7

20 Marks

- (a) (i) Classify the primary function, as input or output, for **each** of the following devices:

- Motion sensor
- Visualiser
- Headphones.



Motion sensor



Visualiser

- (ii) The USB memory stick shown is 32GB. Explain the meaning of the term 32GB.



USB memory stick



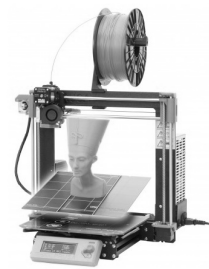
Headphones

- (iii) Suggest **one** positive impact and **one** negative impact of social media on society.

- (iv) Laser cutting and 3D printing are examples of modern manufacturing processes. Outline **any two** advantages of modern manufacturing process over traditional manufacturing processes.



Laser cutter

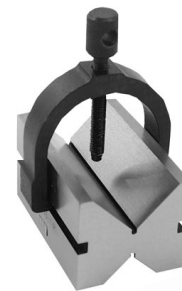


3D Printer

(12 marks)

- (b) (i) Suggest **one** suitable application for the V-block and clamp shown.

- (ii) Name the measuring instrument shown below.



V-block and clamp

- (iii) Identify **any two** ways in which the measuring instrument shown may be used to obtain measurements from a component.

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



Measuring Instrument

(8 marks)

Junior Certificate – Higher Level

Metalwork – *Materials and Technology*

Tuesday 18th June

Afternoon 2:00 – 4:00