Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION, 2014

METALWORK
MATERIALS AND TECHNOLOGY

Higher level - 100 marks

Tuesday, 17 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 two types of engine, labelled A and B.
Questions (a) to (d) relate to these.

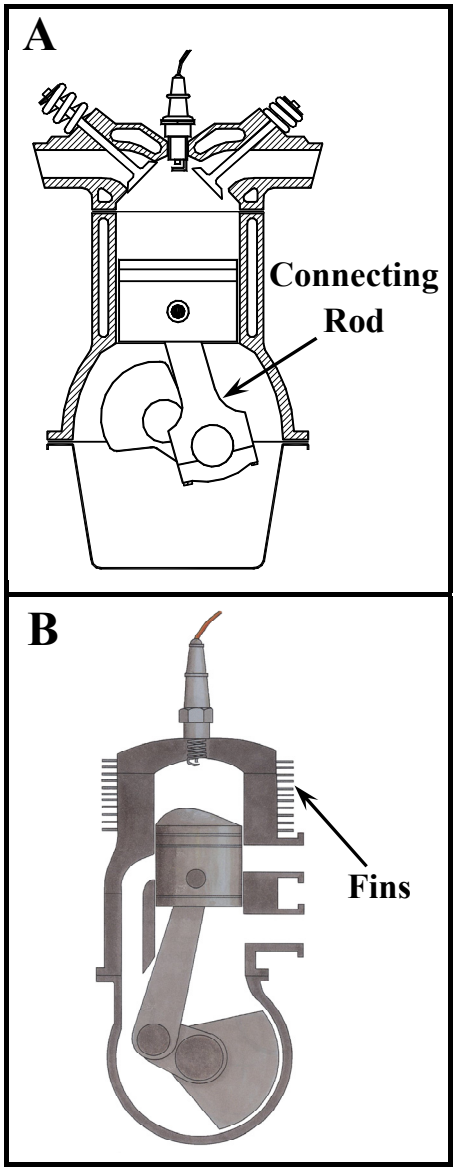


Figure 1

(a) **(i)** Name engine **A**.
(ii) Explain the purpose of the Connecting Rod in engine **A**.

(4 marks)

(b) **(i)** Name engine **B**.
(ii) Outline the purpose of the Fins in engine **B**.

(4 marks)

(c) **(i)** Compare how the fuel/air mixture is taken into **each** of the engines.
(ii) Explain how the fuel/air mixture is ignited in these engines.

(4 marks)

(d) **(i)** Suggest **one** suitable application for engine **A** and **one** suitable application for engine **B**.
(ii) Outline **one** environmental effect of engines.

(4 marks)

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

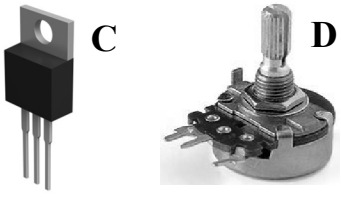
(i) Sir Timothy Berners-Lee
(ii) Guglielmo Marconi
(iii) James Watt.

(4 marks)

Disposable Cup

(f) **(i)** Name **one** suitable plastic material for the manufacture of the disposable cup shown.
(ii) Suggest **one** property which makes the chosen material suitable for the cup.

(4 marks)



Electronic Components

(g) **(i)** Identify **both** of the electronic components **C** and **D** shown.
(ii) Outline the function of **one** of the electronic components shown.

(4 marks)

SECTION B – 20 MARKS
COMPULSORY

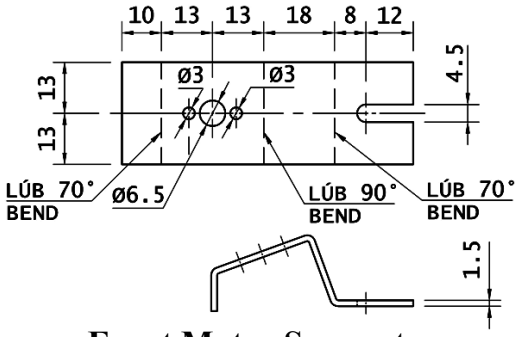
Answer **any five** questions.

The drawings show the Front Motor Support, Lower Left Panel, Electric Circuit and an assembly drawing of the 2014 Metalwork Higher Level Project, Model Chinook Helicopter.

(a) (i) Outline how a high quality finish is produced on the edge profile of the Front Motor Support.

(ii) Describe how the Front Motor Support is accurately bent to shape.

(4 marks)

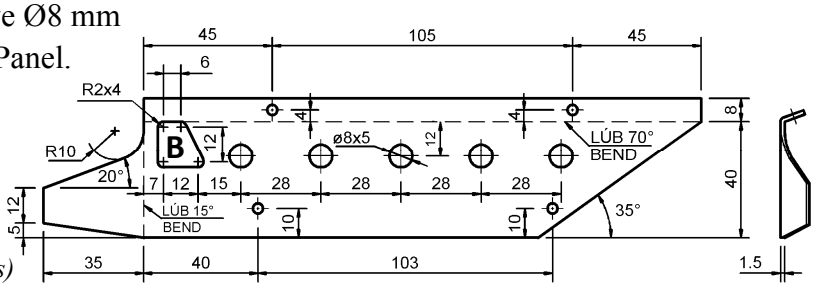


Front Motor Support

(b) (i) Describe a correct procedure to accurately drill the five Ø8 mm holes in the Lower Left Panel.

(ii) Describe how the front window **B** is accurately marked-out on the Lower Left Panel.

(4 marks)

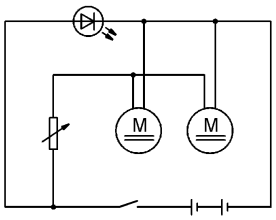


Lower Left Panel

(c) (i) Explain the operation of the Electric Circuit used with the model.

(ii) Outline **one** advantage of using ribbon cable to connect a control console to the model.

(4 marks)



Electric Circuit

(d) (i) Describe a procedure for soldering the Electric Circuit shown.

(ii) Outline **any two** safety precautions to be observed when soldering the circuit.

(4 marks)

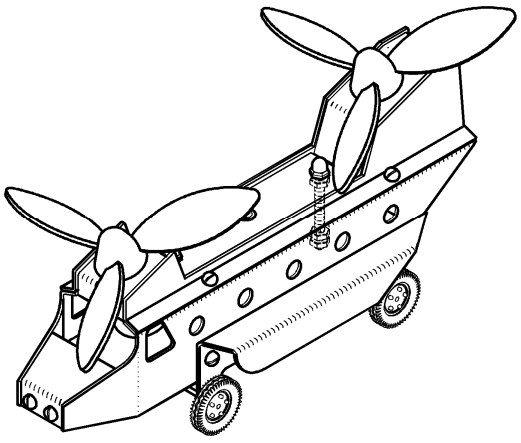
(e) Design, using a diagram, a hand-held control console to operate the model.
The console must include a 9 volt battery with holder, an on/off switch and a potentiometer.

(4 marks)

(f) (i) Suggest **any two** advantages of a Chinook Helicopter over a Single Rotor Helicopter.

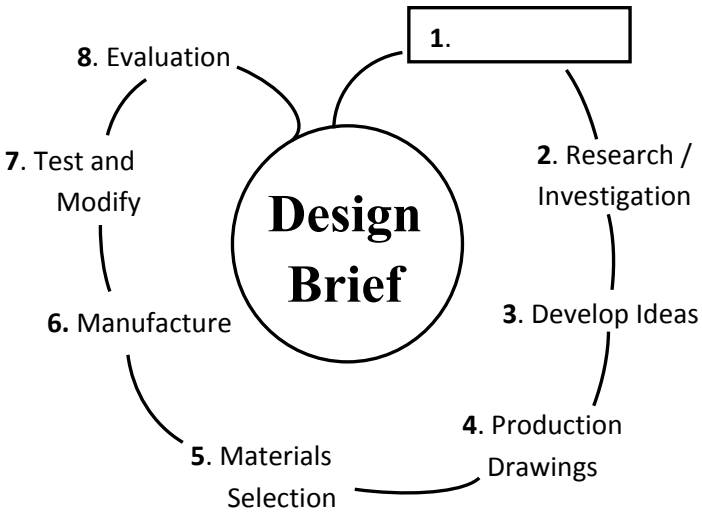
(ii) Outline **any two** suitable applications for a Chinook Helicopter.

(4 marks)



Model Chinook Helicopter

A simple model, showing eight stages of a design process is shown opposite. Stage one is incomplete.



(a) (i) Name and briefly describe **stage one** of the design process shown opposite.

(ii) Suggest **any three** tests which could be carried-out when designing the vacuum cleaner shown.

(7 marks)

Vacuum Cleaner

An entrance door to a house is shown.

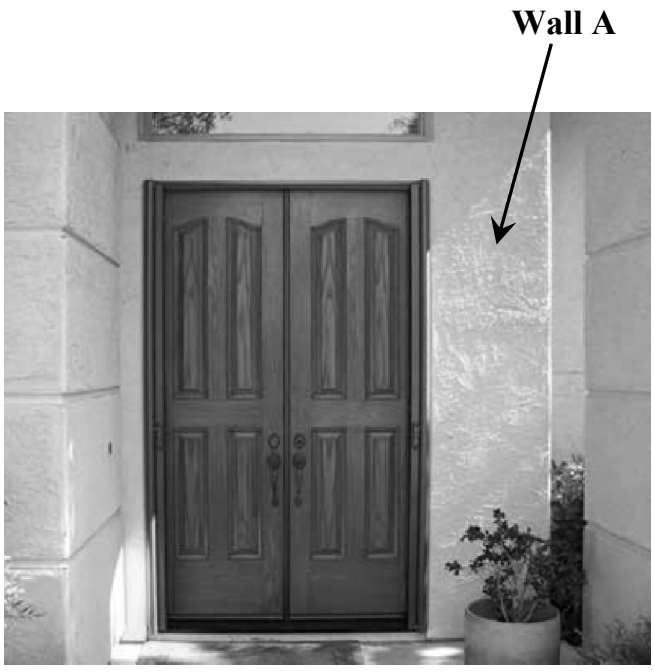
(b) (i) Describe, using a diagram, a modification to the design of the door shown to make it suitable for use by a person in a wheelchair.

(ii) Design, using a diagram, a metal post box to be fixed to wall **A**.
The box should include:

- A slot for letters
- A means of attaching the box to the wall
- A decorative feature.

(iii) Suggest **one** suitable metal for the post box and **one** suitable finish for the metal.

(13 marks)



House Entrance Door

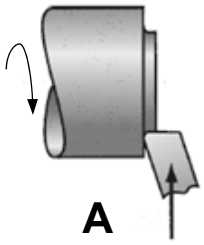
Question 3 — 20 Marks

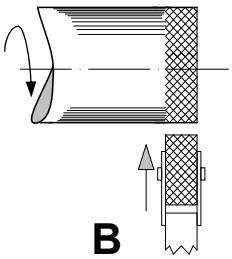
(a) **(i)** Name the turning operations **A**, **B** and **C** shown.

(ii) Describe briefly **any two** of the turning operations **A**, **B** and **C**.

(iii) List **any two** safety precautions to be observed when carrying-out a turning operation on a lathe.

(iv) Outline **any two** factors which may impact on the quality of finish when carrying-out a turning operation on a lathe. *(10 marks)*

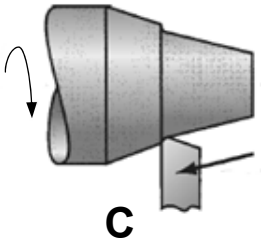




(b) An 18 mm diameter bar is to be turned on a lathe. The material has a surface cutting speed of 135 m/min. Using the given formula, calculate the speed in RPM. (Take π as 3)

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

(4 marks)



(c) Select **any two** of the following and explain the difference between the terms:

(i) Headstock and Tailstock;

(ii) Outside Calipers and Odd-leg Calipers;

(iii) Rake Angle and Clearance Angle.

(6 marks)

Question 4 — 20 Marks

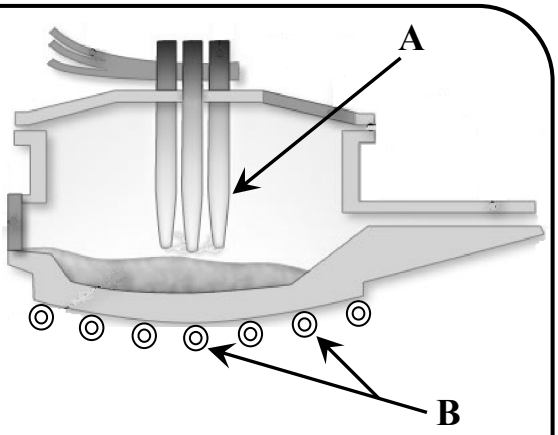
(a) **(i)** Name the type of furnace shown.

(ii) List the materials in the charge.

(iii) With reference to part **A**, describe how the charge is melted.

(iv) Explain the function of part **B**.

(10 marks)



(b) **(i)** Outline **any two** properties of steel which can be improved by alloying.

(ii) Identify the alloy steel used to manufacture the objects shown at **C** and the alloy steel used to manufacture the objects shown at **D**.

(6 marks)

(c) **(i)** State **any two** properties of cast iron.

(ii) Name **one** product manufactured from cast iron. *(4 marks)*

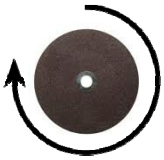
Question 5 — 20 Marks

A vintage train, a modern train, types of motion and a drive mechanism are shown.

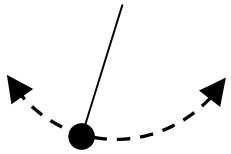
Vintage Train

Modern Train

(a) Compare the vintage train and modern train with reference to each of the following:
- **(i)** Design features;
- **(ii)** Method of propulsion;
- **(iii)** Safety features;
- **(iv)** Environmental impact. *(10 marks)*

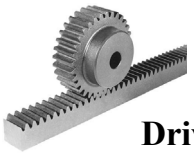


Motion A



Motion B

(b) **(i)** Identify **each** of the types of motion **A** and **B** shown opposite.
- **(ii)** Suggest **one** example where motion **A** occurs and **one** example where motion **B** occurs.
- **(iii)** Identify the drive mechanism shown opposite.
- **(iv)** List **any two** examples where this drive mechanism is used. *(10 marks)*



Drive Mechanism

Question 6 — 20 Marks

(a) **(i)** Outline **any two** reasons for applying a decorative finish to metal.
- **(ii)** Explain, using a diagram, how to apply a plastic coating to the handle of the pliers shown.
- **(iii)** Describe briefly **one** of the following decorative metal finishes:
  - Repoussé
  - Mottling
  - Engraving. *(10 marks)*

Pliers

(b) **(i)** Outline **any two** reasons for the heat treatment of metals.
- **(ii)** Suggest **one** heat treatment to be applied to produce the scriber and **one** heat treatment to be applied to produce the copper bowl.
- **(iii)** Explain why **each** of the heat treatments, suggested by you above, are suitable.
- **(iv)** State **any two** safety precautions to be observed when heat treating metals. *(10 marks)*

Scriber

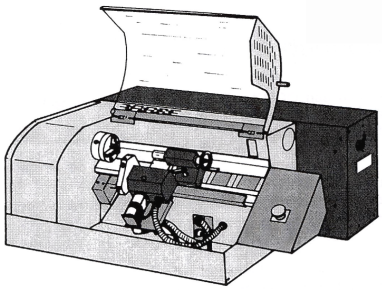
Copper Bowl

Question 7 — 20 Marks

(a) (i) Four computer devices are shown. Outline the purpose of **each** device.

Printer

Scanner



CNC Lathe

Mouse

(ii) Classify **each** device as input or output.

(iii) Explain why it is necessary to backup a computer file. Outline **one** method used to backup a computer file.

(iv) Explain **any two** of the following computer terms:

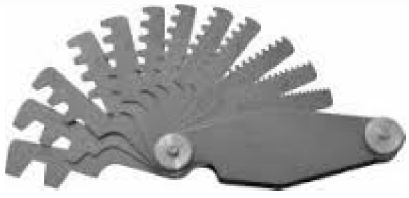
- Modem;
- Webcam;
- ROM;
- Virus.

(v) What is CAD/CAM?

(14 marks)

(b) (i) Name **each** of the measuring instruments labelled **A** and **B** opposite.

Instrument A

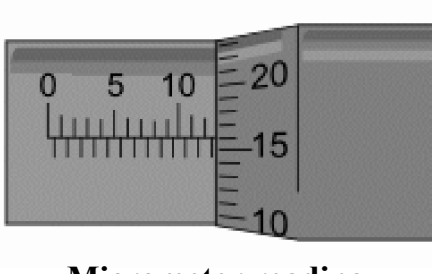


Instrument B

(ii) Suggest a suitable application for **one** of the instruments **A** or **B**.

(iii) What is the value of the micrometer reading shown opposite?

(6 marks)



Micrometer reading

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