Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION, 2013

METALWORK
MATERIALS AND TECHNOLOGY

Higher Level - 100 Marks

Tuesday, 18 June Afternoon 2:00 – 4:00

INSTRUCTIONS

1. Answer Question 1, Section A and 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.

Fig. 1 shows some of the main parts of a basic four-stroke engine.
Questions (a) to (c) relate to this diagram.

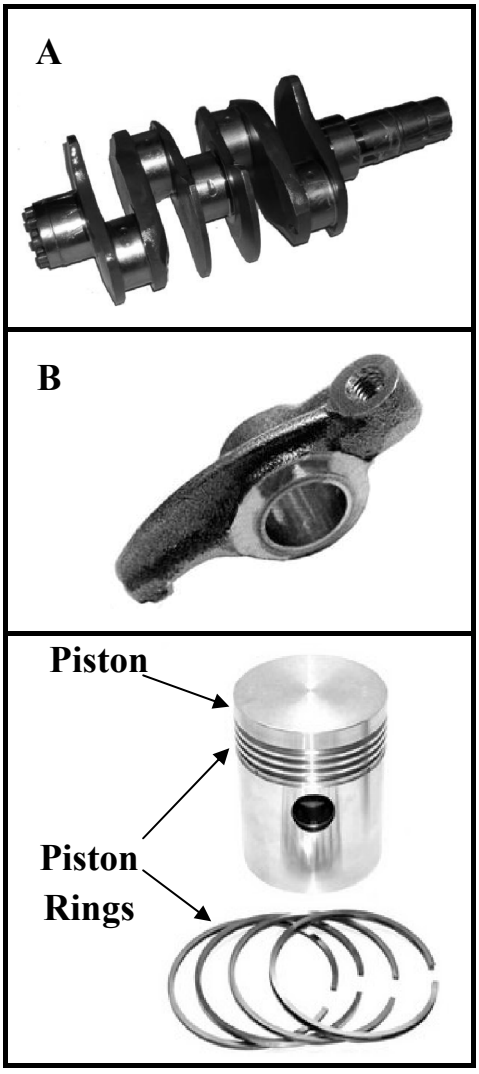


Fig. 1

(a) **(i)** Identify part **A**.
(ii) Explain the purpose of part **A**.

(4 marks)

(b) **(i)** Name part **B**.
(ii) Describe how part **B** activates the Inlet / Exhaust Valves.

(4 marks)

(c) **(i)** Suggest a suitable material for the Piston shown.
(ii) Explain the purpose of the Piston Rings shown.

(4 marks)

(d) **(i)** Outline **any two** ways in which engines impact negatively on the environment.
(ii) Describe **any one** measure used to reduce the negative environmental impact of engines.

(4 marks)

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

(i) John L. Baird, or
(ii) Steve Jobs, or
(iii) Isaac Singer.

(4 marks)

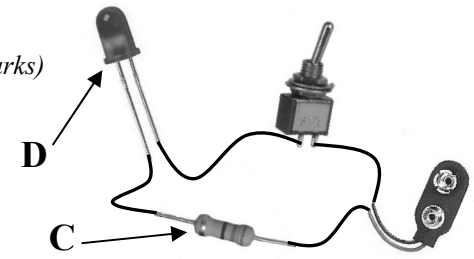
Hot Water Cylinder

(f) **(i)** Explain the term *non-ferrous* metal.
(ii) Name **one** non-ferrous metal suitable for the manufacture of the hot water cylinder shown.

(4 marks)

(g) **(i)** Identify **both** of the electronic components **C** and **D** shown in the electronic circuit.
(ii) Draw, using the correct electronic symbols, a circuit diagram for the circuit shown.

(4 marks)

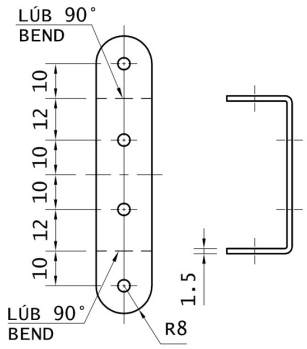


Electronic Circuit

SECTION B – 20 Marks
COMPULSORY

Answer **any five** questions.

The drawings show the Front Axle Support, Side Panel and an assembly drawing of the 2013 Metalwork Higher Level Project, Model Jeep.



Front Axle Support

(a) **(i)** Outline **any two** safety precautions to be taken when drilling the 3.5 mm diameter holes in the Front Axle Support.

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

(4 marks)

(b) **(i)** Describe how the front wheel arch **A** is accurately marked-out on the Side Panel.

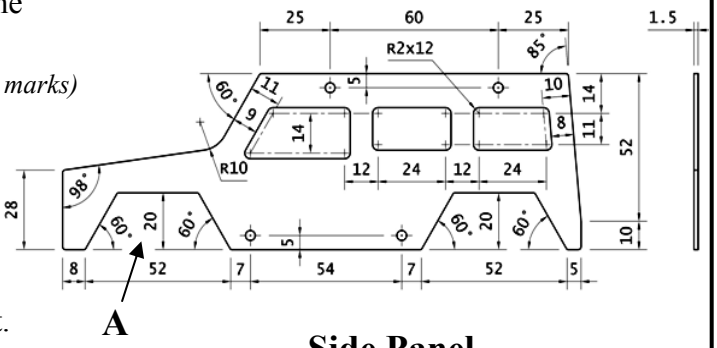
(ii) Outline **any two** methods used to produce a high quality finish on the edge profile of the Side Panel.

(4 marks)

(c) **(i)** Explain how the front window of the Side Panel is marked-out.

(ii) List **any two** steps required to produce the front window of the Side Panel following marking-out.

(4 marks)



Side Panel

(d) **(i)** Design, using a diagram, a Rear Bumper for the model.

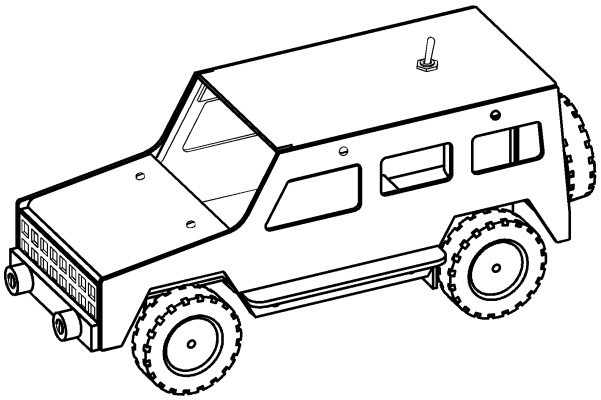
(ii) Show how the Rear Bumper is to be attached to the Chassis of the model.

(4 marks)

(e) Design, using a diagram, a Rear Door which is to be hinged to the model. The Rear Door must have:

(i) a window;

(ii) a spare wheel attached. *(4 marks)*



Model Jeep

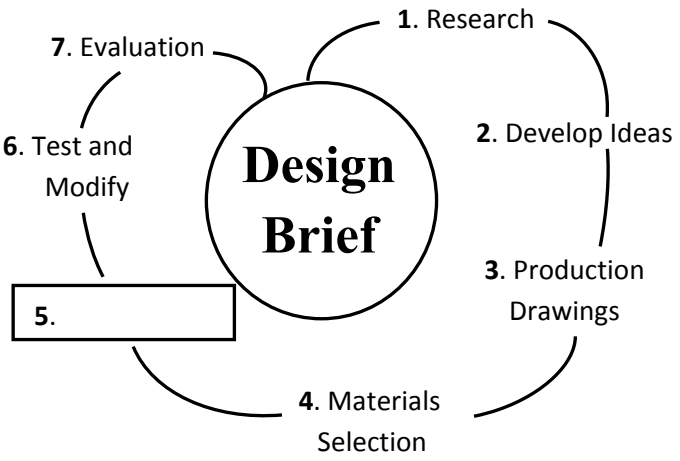
(f) **(i)** List **any two** situations where a Jeep is the most suitable vehicle to use.

(ii) Suggest why the Jeep is most suitable for **each** situation listed.

(4 marks)

Question 2 — 20 Marks

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



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

(ii) Suggest **any three** factors which may be considered in the evaluation of the design for the toaster shown.

(7 marks)

Toaster

A Basketball Hoop and Backboard are shown.

(b) (i) Show, using a diagram, a suitable method to attach the basketball hoop to the backboard.

(ii) Design, using a diagram, a metal structure to support the hoop and backboard in the basketball court.

(iii) Describe, using a diagram, how the hoop and backboard unit is attached to the metal structure.

(iv) Suggest **one** suitable metal for the structure and **one** suitable finish for the metal.

(13 marks)

Basketball Hoop and Backboard

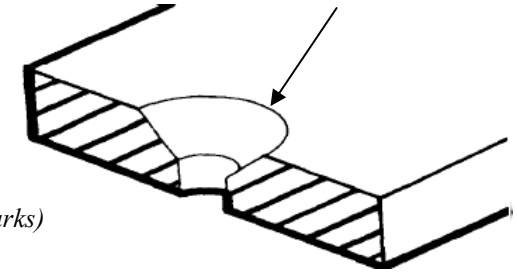
Question 3 — 20 Marks

(a) **(i)** Explain the meaning of the term *spindle speed* in relation to the drilling machine.

(ii) Outline **any two** reasons why the spindle speed of a drilling machine may need to be changed.

(iii) Identify the type of drilled hole shown opposite.

(iv) Explain the purpose of the morse taper sleeve shown. *(10 marks)*



Sectional View of Drilled Hole

(b) A 15 mm diameter bar is to be turned on the lathe. The material has a surface cutting speed of 126 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)

Morse Taper Sleeve

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

(i) Chuck Key and Allen Key;

(ii) Drill Gauge and Feeler Gauge;

(iii) Pilot hole and Blind hole. *(6 marks)*

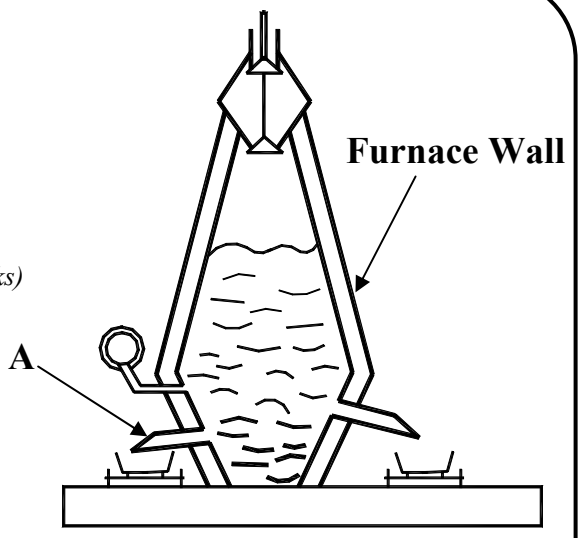
Question 4 — 20 Marks

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

(ii) List the materials in the charge.

(iii) Describe how the furnace wall is protected from melting.

(iv) Identify the material produced at **A** and suggest a suitable application for this material. *(10 marks)*



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

(i) Brittleness;

(ii) Conductivity;

(iii) Elasticity;

(iv) Strength. *(4 marks)*

(c) **(i)** Suggest **any two** reasons why alloys are used to make products.

(ii) Identify **one** suitable alloy used to manufacture the musical instrument shown. *(6 marks)*

Musical Instrument

Question 5 — 20 Marks

A vintage motorcycle, a modern motorcycle and a drive mechanism are shown.

Vintage Motorcycle

Modern Motorcycle

(a) Compare the vintage motorcycle and modern motorcycle with reference to the following:

- **(i)** Design features;
- **(ii)** Materials used to manufacture;
- **(iii)** Safety features;
- **(iv)** Environmental impact.

(10 marks)

(b) **(i)** Identify the drive mechanism shown.

(ii) Suggest **one** suitable application for the drive mechanism shown.

(iii) List **two** reasons why it is necessary to lubricate the drive mechanism.

(iv) If the driver has 40 teeth and the driven has 10 teeth, what is the gear ratio?

(10 marks)

Drive Mechanism

Question 6 — 20 Marks

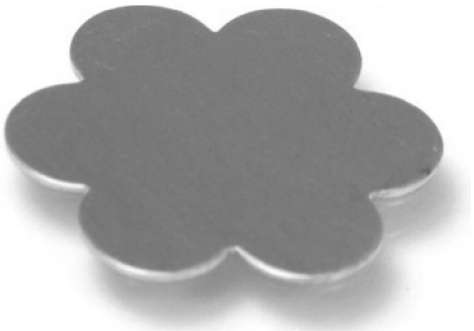
(a) **(i)** Describe how the brooch shown may be shaped from 1mm copper sheet.

(ii) Explain, using diagrams, how the brooch may be finished by Enamelling.

(iii) Describe briefly **one** of the following decorative metal finishes:

- Engraving
- Etching
- Lacquering.

(10 marks)



Copper Brooch

(b) **(i)** Describe how the badge pin shown may be soldered to the copper brooch.

(ii) Outline how oxidisation of the joint may be prevented during the soldering process.

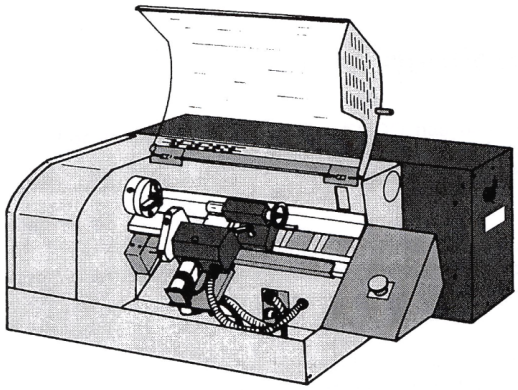
(iii) State **any two** safety precautions to be observed when soldering the badge pin to the brooch.

(10 marks)

Badge Pin

Question 7 — 20 Marks

(a) (i) Identify the type of lathe shown.



Lathe

(ii) Suggest **any two** advantages of this lathe over a conventional lathe.

(iii) Outline **any two** safety features incorporated in the lathe shown.

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

- Byte
- Wi-Fi
- Operating system
- App.

(v) Classify **each** of the following as input or output devices:

- Mouse
- Digital Camera
- Computer Speakers
- Robotic Arm.

(14 marks)

Mouse

Digital Camera

Computer Speakers

Robotic Arm

(b) (i) Explain the meaning of the term thermosetting plastic. List **one** difference between thermoplastics and thermosetting plastics.

(ii) Suggest **one** application for **each** of the following plastics:

- PVC
- Polyurethane
- Polystyrene.

(iii) Outline **one** method used to reduce environmental problems associated with the disposal of plastic materials.

(6 marks)

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