Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION, 2009

MATERIALS AND TECHNOLOGY

METALWORK – HIGHER LEVEL

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100 Marks

Tuesday 16 June, Afternoon 2:00 – 4:00

INSTRUCTIONS

1. Answer Question 1, Sections 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.

Question 1

40 Marks

SECTION A – 20 MARKS
COMPULSORY

Answer **any five** questions.

The diagram, Fig. 1, shows some of the main parts of a basic two-stroke engine.
Questions (a) to (d) relate to this diagram.

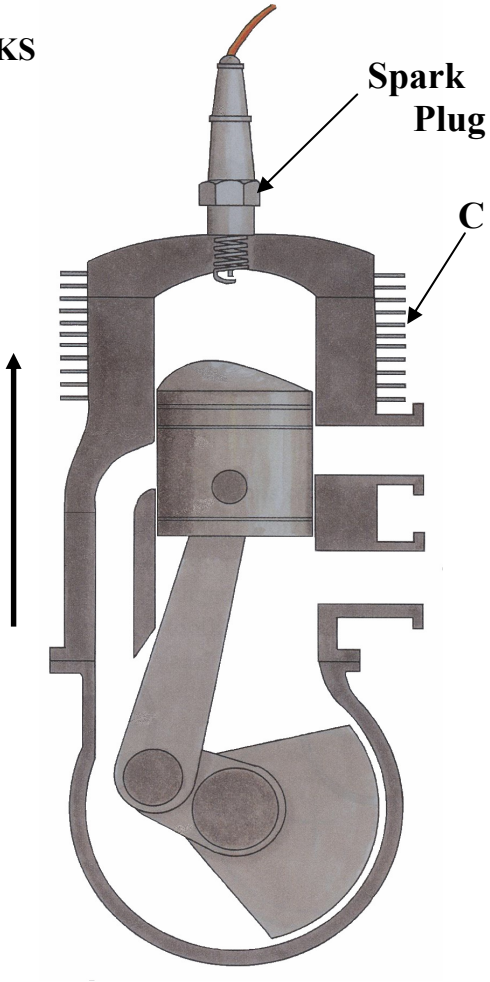


Fig. 1

(a) Describe the function of the Spark Plug.
(4 marks)

(b) **(i)** Identify part 'C' of the engine.
(ii) Explain the purpose of the part 'C'.
(4 marks)

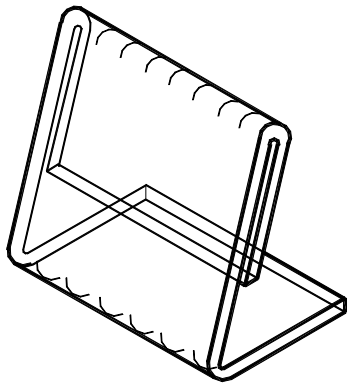
(c) Outline the operation of the engine during upward stroke.
(4 marks)

(d) Suggest **any two** suitable applications for a two-stroke engine.
(4 marks)

(e) Briefly describe the contribution made to technology by **one** of the following people:

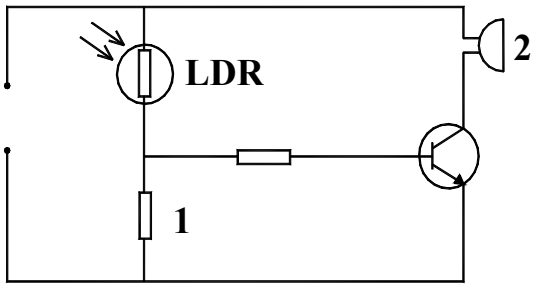
(i) Thomas Edison, or
(ii) Henry Maudslay, or
(iii) Frank Whittle.
(4 marks)

(f) **(i)** Name **one** suitable plastic material which could be used to make the photo frame shown.



(ii) Describe how the photo frame shown is bent to shape.
(4 marks)

(g) **(i)** Identify components **1** and **2** from the electronic circuit shown.

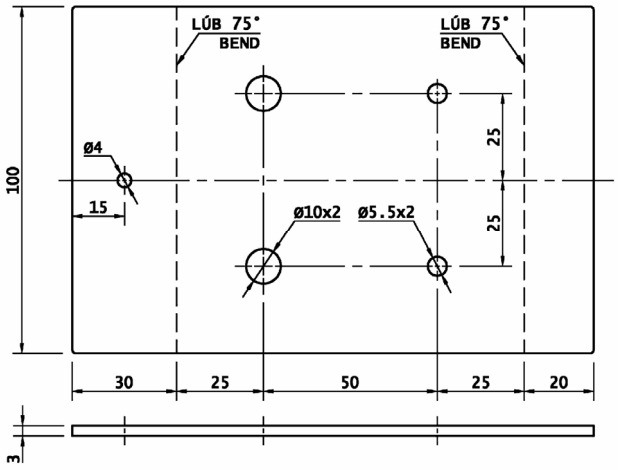


(ii) Outline the function of the **LDR** in the electronic circuit.
(4 marks)

SECTION B – 20 MARKS
COMPULSORY

Answer **any five** questions.

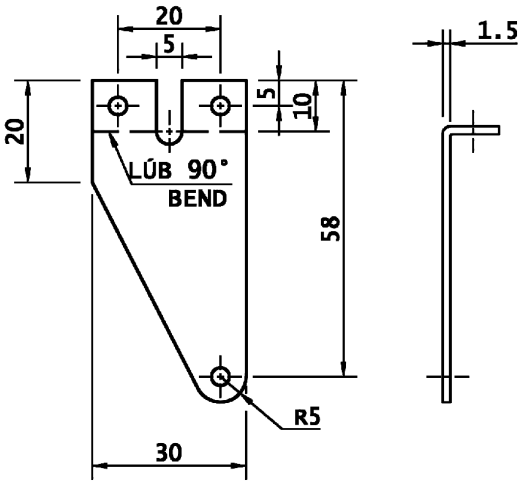
The drawings show the Control Panel, Left Undercarriage and an assembly drawing of the 2009 Metalwork Higher Level Project, Model Aircraft.



Acrylic Control Panel

(a) Suggest **any two** steps which should be taken, when drilling the Ø10 holes in the Control Panel, to prevent any damage to the acrylic.

(4 marks)



Left Undercarriage

(b) **(i)** Calculate the overall dimensions of the Left Undercarriage.

(ii) Describe how the Left Undercarriage is bent to shape.

(4 marks)

(c) Outline the procedures required to obtain a high quality finish on all surfaces of:

(i) the Control Panel made from acrylic;
(ii) the Left Undercarriage made from aluminium.

(4 marks)

(d) Describe how the model may be controlled and steered by the operation of the electronic circuit.

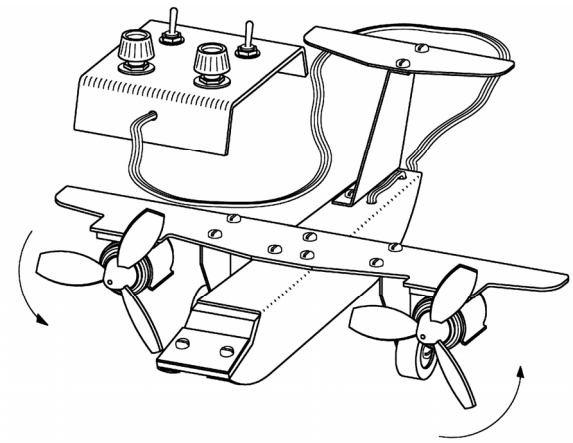
(4 marks)

(e) Design, using a diagram, a Castored Nose-wheel and Battery Holder as an integrated unit for the model.

(4 marks)

(f) State **any two** advantages for having a remote control panel to operate the Model Aircraft.

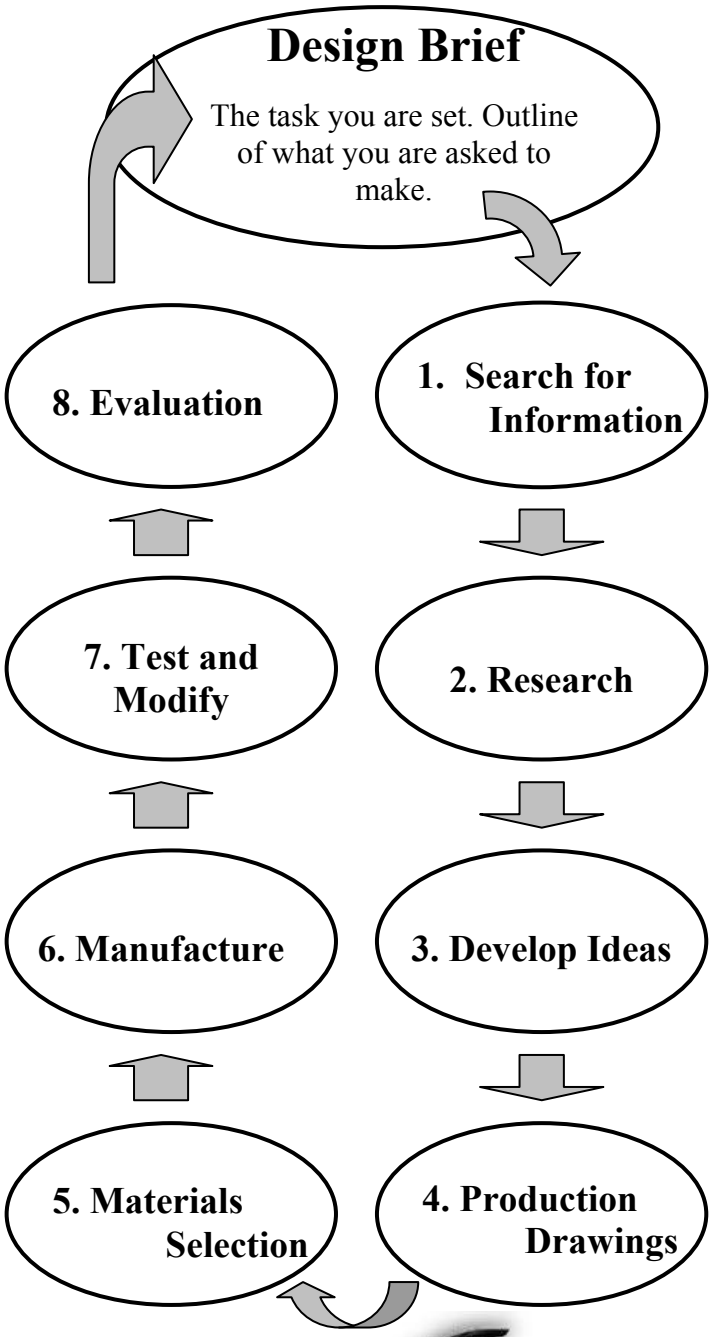
(4 marks)



Model Aircraft

Question 2 — 20 Marks

A simple model of a design process is shown opposite.



(a) **(i)** List **any three** pieces of information which may be contained in the "production drawings".

(ii) Outline **any two** safety precautions to be taken at the "manufacture" stage.

(7 marks)

A fire extinguisher to be located in the Metalwork room is shown.

(b) **(i)** Draw the elevation of the fire extinguisher as shown.

(ii) Design a suitable metal wall bracket to hold the fire extinguisher.

(iii) Describe, using a diagram, how the bracket may be secured to the wall.

(iv) List **one** other fire extinguishing device which could be found in the Metalwork room.

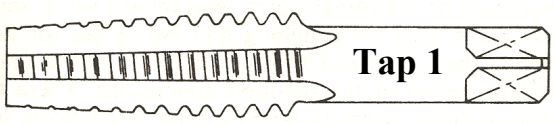
(13 marks)

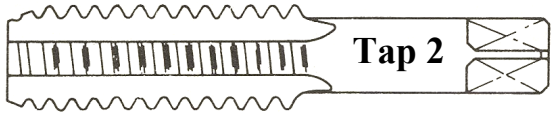
Question 3

20 Marks

(a) **(i)** Identify **each** of the taps shown.
(ii) Suggest **one** use for **each** of the taps shown.
(iii) Identify parts 'A', 'B' and 'C' of the screw thread shown.

(11 marks)

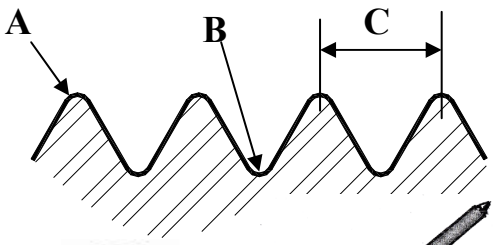




(b) A 9 mm hole is to be drilled in a material which has a surface cutting speed of 54 m/min. Using the given formula calculate the speed in RPM. (Take π as 3)

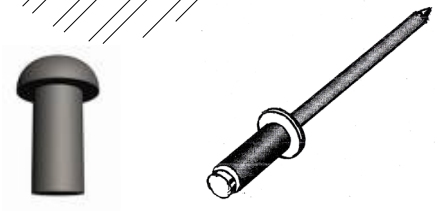
$$N = \frac{S \times 1000}{\pi \times D}$$

(4 marks)



(c) **(i)** Identify **each** of the rivets shown opposite.
(ii) Describe how a joint may be completed using **one** of the rivets shown.

(5 marks)



Rivet A **Rivet B**

Question 4

20 Marks

(a) Name the type of furnace shown. *(1 mark)*

(b) List the materials in the charge. *(3 marks)*

(c) Briefly outline the operation of the furnace. *(2 marks)*

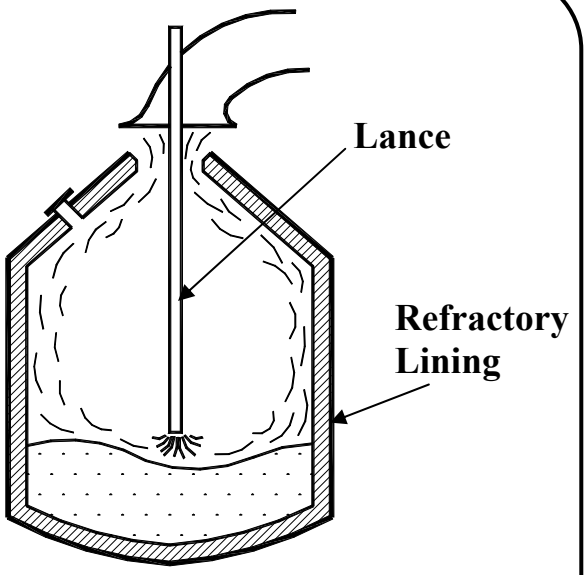
(d) Explain what prevents the Lance from melting. *(1 mark)*

(e) Outline the purpose of the Refractory Lining. *(2 marks)*

(f) Describe, using diagrams, how **each** of the following is removed from the furnace:

(i) Steel;
(ii) Slag.

(4 marks)



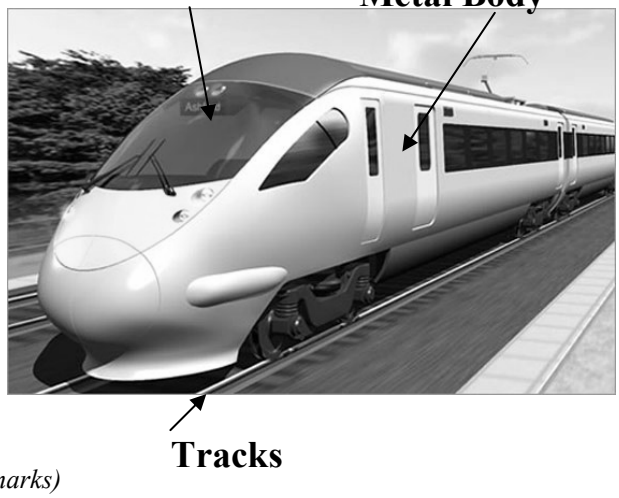
(g) Redraw the given table into your answer book. Complete the table by naming the alloys and listing **one** important property of **each**.

(7 marks)

Composition	Alloy	Property
Copper + Zinc		
Iron + Carbon		
Lead + Tin		

Question 5 — 20 Marks

A train on tracks is shown opposite.



(a) **(i)** Name **one** suitable material for **each** part labelled.

(ii) State **one** reason for the selection of **each** material.

(iii) Outline **any two** safety features of a rail system.

(iv) Describe **any two** types of motion which occur in the wheel mechanism of the train.

(v) Outline **any two** environmental advantages of train travel compared to other forms of transport.

(12 marks)

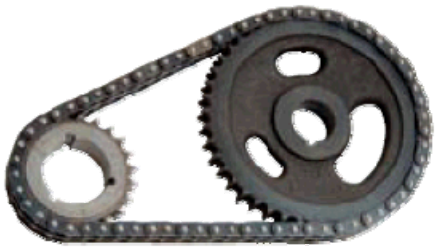
(b) **(i)** Identify the drive mechanism shown opposite.

(ii) Suggest **one** suitable application for this mechanism.

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

(iv) If the driver turns at 25 RPM, how fast does the driven turn in RPM?

(8 marks)



Drive Mechanism

Question 6 — 20 Marks

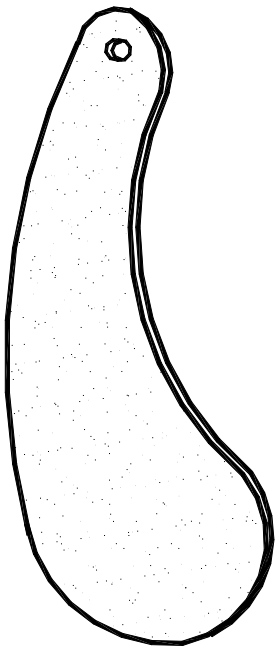
(a) **(i)** Describe how the pendant shown may be shaped from 1mm copper sheet.

(ii) Explain, using diagrams, how the pendant may be finished by enamelling.

(iii) Briefly describe **one** of the following decorative metal finishes:

- Engraving;
- Lacquering;
- Mottling.

(10 marks)



Copper Pendant

(b) **(i)** Name **any two** heat treatment processes.

(ii) Describe **one** of the processes named.

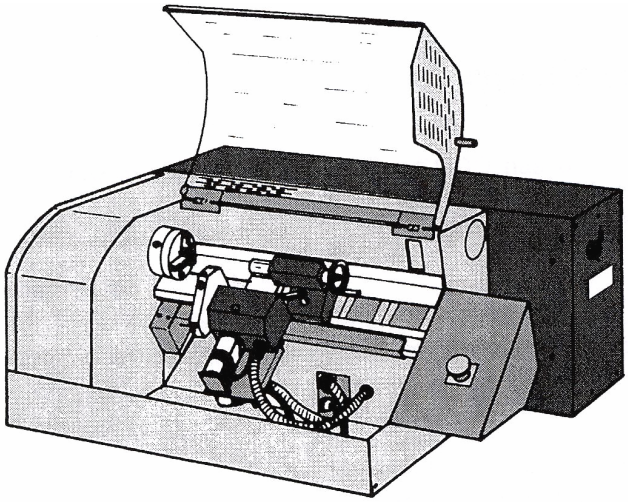
(iii) Suggest **any two** reasons for heat treatment of metals.

(iv) List **any two** safety precautions to be taken when heat treating metals.

(10 marks)

Question 7 — 20 Marks

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

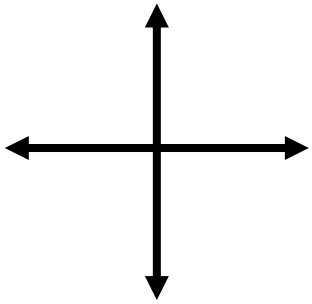


Lathe

(ii) Explain **any two** of the following lathe terms:

- Test run;
- G-codes;
- Tool offsets;
- Tool park position.

(iii) Redraw, in your answer book, the lathe axes shown and label the correct direction **–X**, **+X**, **–Z** and **+Z**.



Lathe axes

(iv) List **any two** advantages of this lathe over a conventional lathe.

(v) Outline **any three** safety features associated with the lathe shown.

(14 marks)

(b) **(i)** Identify **both** portable memory storage devices shown.

Storage Devices

(ii) What is CAD/CAM?

(iii) List **any two** advantages of a CAD/CAM system.

(6 marks)

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