



**Coimisiún na Scrúduithe Stáit  
State Examinations Commission**

**JUNIOR CERTIFICATE EXAMINATION, 2004**

**MATERIALS AND TECHNOLOGY**

**METALWORK – HIGHER LEVEL**

---

**100 Marks**

---

**Tuesday, 22 June – 2.00 – 4.00**

---

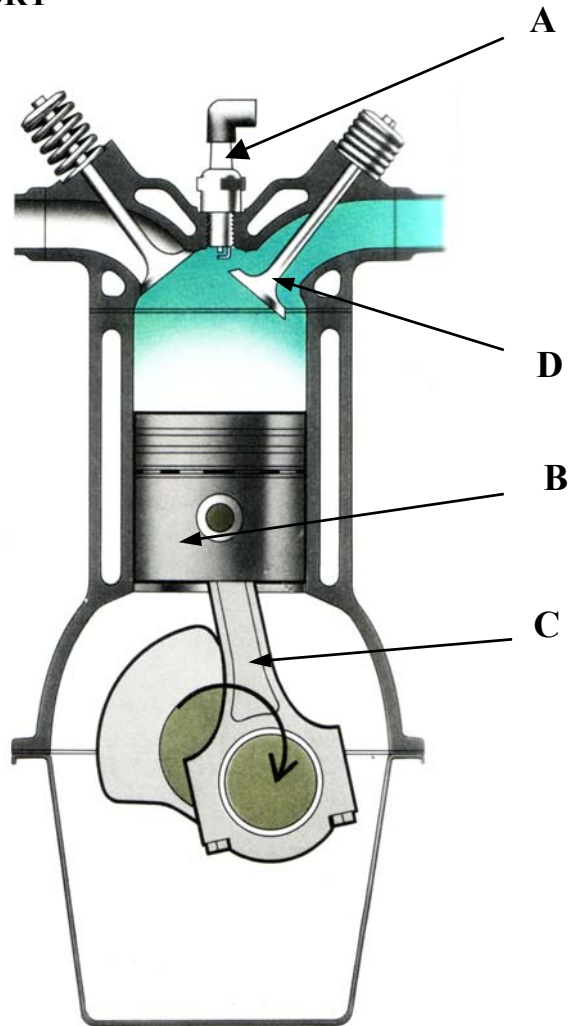
**INSTRUCTIONS**

- 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.**

SECTION A – 20 MARKS  
COMPULSORY

Answer any five questions.

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



- (a) Briefly describe, the contribution made to technology by **one** of the following people:
  - (i) Fr. Nicholas Callan, or
  - (ii) Michael Faraday, or
  - (iii) The Wright brothers.

(4 marks)
- (b) (i) Name Part 'A'.  
 (ii) Explain the purpose of Part 'A'.  

(4 marks)
- (c) (i) Name Part 'B'.  
 (ii) Suggest a suitable material for Part 'B'.  

(4 marks)
- (d) Briefly describe the function of Part 'C'.  

(4 marks)
- (e) Part 'D' shows a valve. What is the purpose of this valve?  

(4 marks)

Fig. 1a

- (f) (i) Name **one** Thermosetting and **one** Thermoplastic material.  
 (ii) State **one** use for each chosen material.  

(4 marks)
- (g) (i) Name and identify by number, any **two** of the four electronic components, shown in Fig. 1b.  
 (ii) Draw the symbol for **one** of the components identified.  

(4 marks)

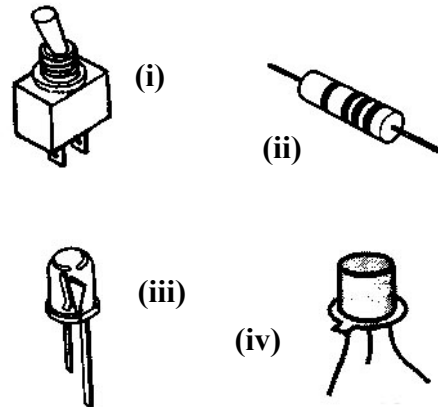


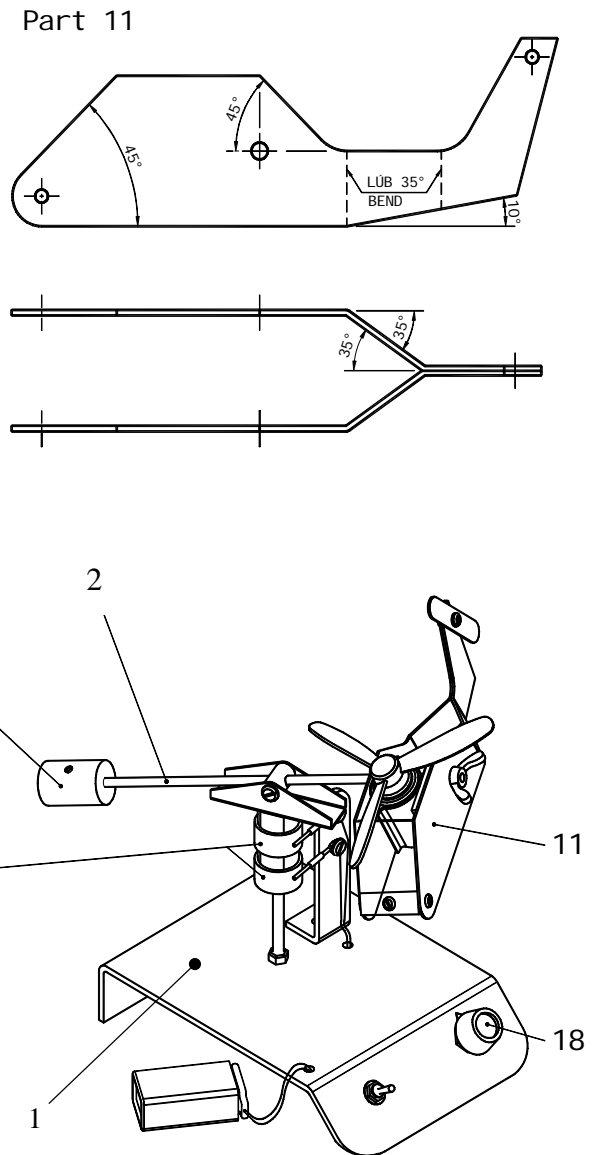
Fig. 1b

**SECTION B – 20 MARKS  
COMPULSORY**

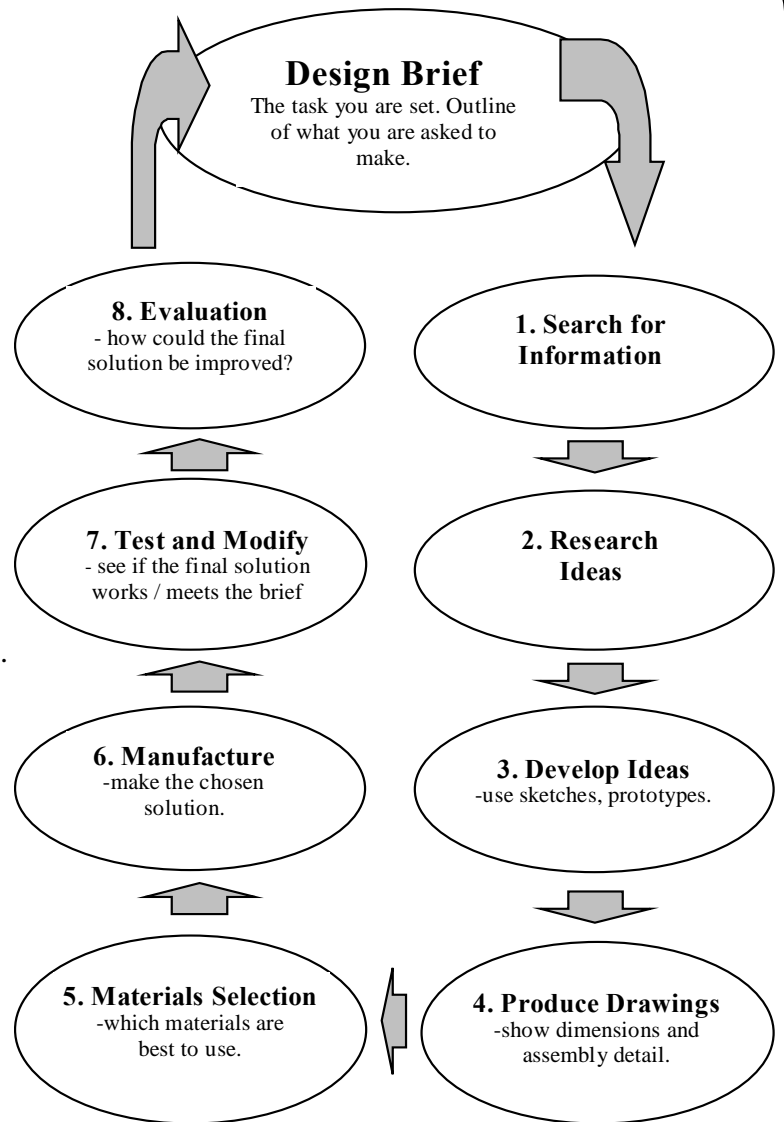
Answer any five questions

The drawings in Fig. 1c show Part 11 and an assembly drawing of the 2004 Metalwork Higher Level Project, Model Helicopter.

- (a) Name the tool used to mark-out and measure the angles on Part 11.  
(4 marks)
- (b) Describe how the base, Part 1, made from acrylic, is bent to shape.  
(4 marks)
- (c) (i) Suggest a suitable material for the counterweight, Part 3. Give **one** reason for your choice.  
(4 marks)
- (ii) Describe briefly, how the counterweight, Part 3, is attached to the rotating arm, Part 2.  
(4 marks)
- (d) Describe the function of the potentiometer, Part 18.  
(4 marks)
- (e) The slip rings, Parts 5, form part of the electronic circuit. Explain the purpose of these rings.  
(4 marks)
- (f) Sketch a suitable design for a landing pad for the helicopter and describe its main components.  
(4 marks)



A simple model of a design process is shown opposite.



- (a) (i) List **three** sources of information you might use at the “Search for Information” stage.
- (ii) List any **three** important points, which should be considered, at the “Materials Selection” stage.

(6 marks)

- (b) The diagram in Fig. 2 shows a metallic bracket and wooden sign to be fixed to a wall outside a *Bed and Breakfast*.

- (i) Suggest a suitable metal for the bracket and give **two** reasons for your choice.
- (ii) Using simple sketches and notes show how the bracket may be improved to give extra support to the sign.
- (iii) Suggest a suitable finish for the bracket.

(14 marks)

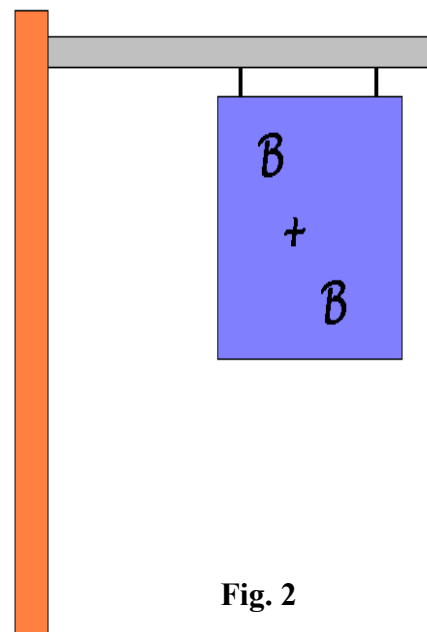


Fig. 2

Fig. 3 shows four lathe-turning operations A, B, C and D.

- (a) (i) Name any **three** operations shown.
- (ii) Explain the **three** operations named. (9 marks)
- (b) State **two** reasons why centre lathes are designed to run at different speeds (RPM). (3 marks)
- (c) A 12mm diameter bar is to be turned on the lathe. The material has a surface cutting speed of 54m/min. Using the given formula, calculate the speed in RPM. (Take  $\pi$  as 3)

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

(4 marks)

- (d) Fig. 3 shows two tools X and Y, used on the lathe.
  - (i) Name **both** tools shown.
  - (ii) Explain the purpose of **one** tool shown. (4 marks)

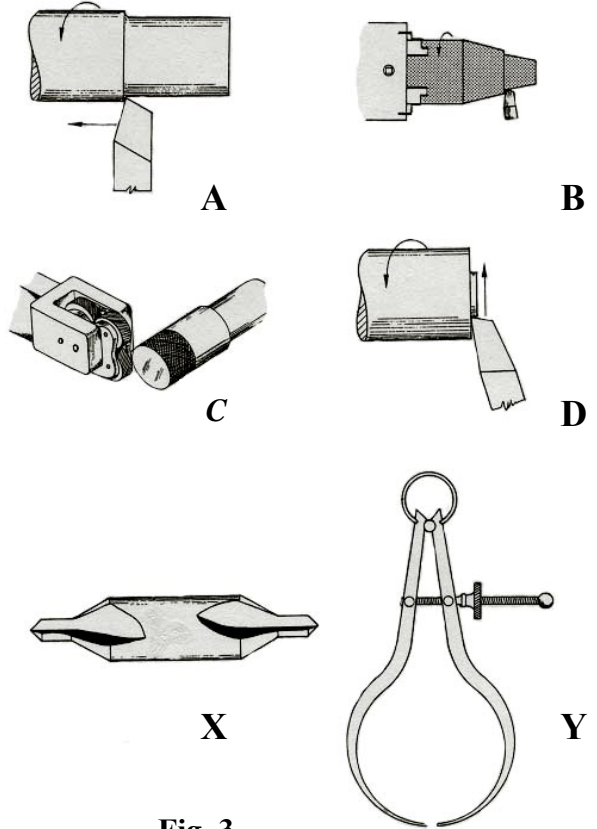


Fig. 3

- (a) Name the type of furnace shown in Fig. 4. (1 mark)
- (b) List the materials in the charge. (3 marks)
- (c) (i) Name Parts 'A' and 'B'.
- (ii) Explain the function of **both** Parts. (4 marks)
- (d) Explain what prevents Part 'B' from being melted by the heat? (1 mark)
- (e) Describe briefly how this furnace is emptied. (2marks)
- (f) (i) Name the metal produced in this furnace.
- (ii) Name **one** other furnace used to produce this metal. (2 marks)
- (g) Redraw the table into your answer book. Complete the table, naming the alloys, and listing **one** important property of each. (7 marks)

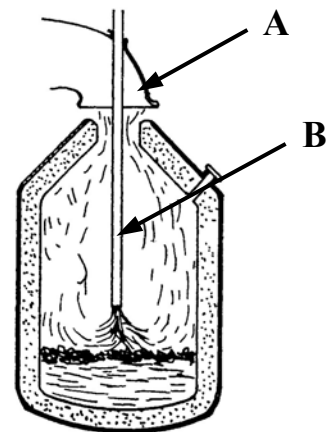


Fig. 4

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

A bicycle and drive mechanism are shown in Fig. 5.

- (a) (i) Name suitable materials for Parts 'A', 'B' and 'C'.  
 (ii) List **one** reason for your choice of material in each case. (6 marks)
- (b) (i) If the driving sprocket has 60 teeth, and the driven sprocket, attached to the rear axle, has 15 teeth, what is the gear ratio?  
 (ii) If the driving sprocket turns at 40 RPM, how fast does the rear wheel turn in RPM? (6 marks)
- (c) (i) Name the process used to join the links of the chain as shown.  
 (ii) State **one** other example of where this process is used. (4 marks)
- (d) (i) The bicycle has pneumatic tyres. What are pneumatic tyres?  
 (ii) Name the Irishman who invented the pneumatic tyre. (4 marks)

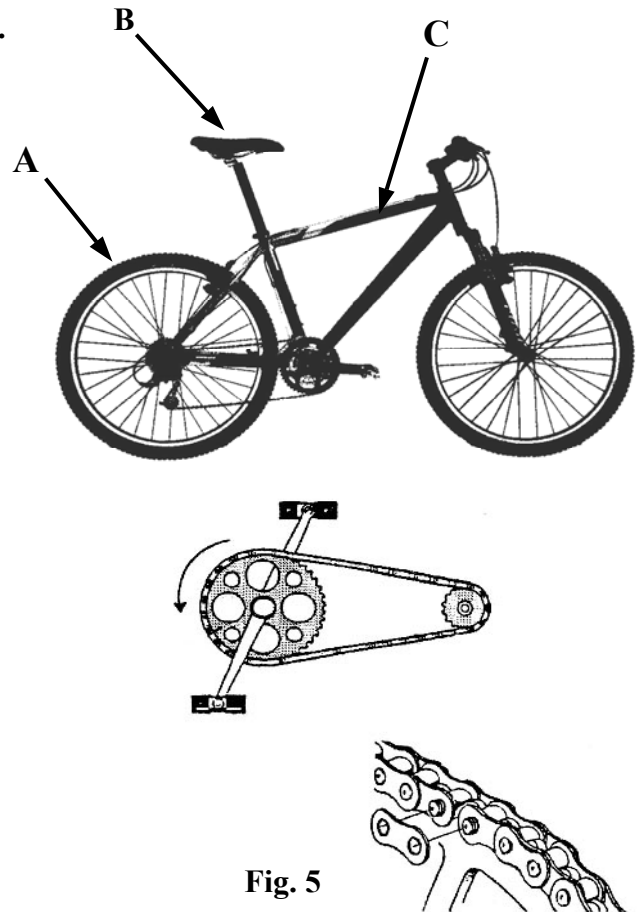


Fig. 5

An electric soldering iron and circuit to be soldered are shown in Fig. 6.

- (a) (i) Name Part 'A' and state a material from which it is made.  
 (ii) Name the **two** metals used to make solder.  
 (iii) Describe **three** steps required to solder any two components shown.  
 (iv) List **three** safety precautions to be observed while soldering. (12 marks)
- (b) Discuss briefly the main differences between passive and active flux, as used in soldering. (4 marks)
- (c) Explain the meaning of any **two** of the following terms associated with soldering:  
 (i) Conductivity;  
 (ii) Melting point;  
 (iii) States of matter;  
 (iv) Transformer. (4 marks)

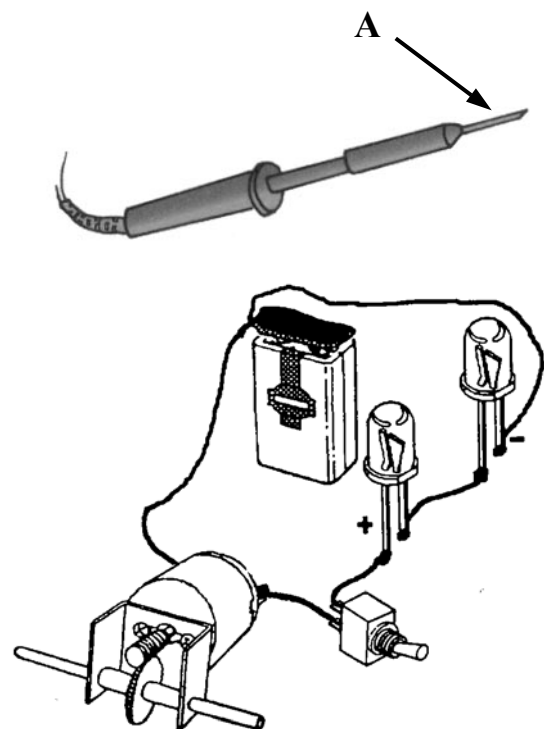


Fig. 6

- (a) (i) Name the type of lathe shown in Fig. 7.
- (ii) List **three** safety features included in this type of lathe.
- (iii) Redraw the jog keys, Fig. 7a, into your answer book. Label the correct direction **-X**, **+X**, **-Z** and **+Z** on each key.

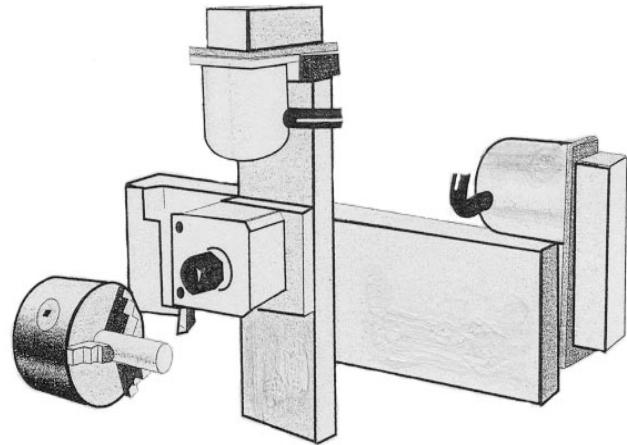


Fig. 7

- (iv) Explain any **two** of the following associated terms:
- Canned cycle;
  - G-codes;
  - Menu;
  - Test run.

- (v) State **two** advantages of this type of lathe over a conventional lathe.

(13 marks)

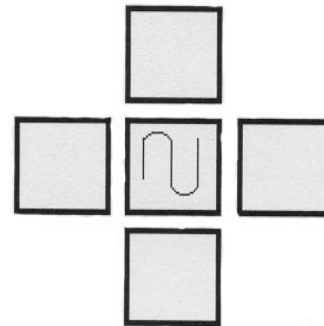


Fig.7a Jog Keys

- (b) Redraw the component, Fig. 7b, to be produced on the lathe. Illustrate using diagrams how it may be dimensioned using:

- (i) Absolute dimensioning;
- (ii) Incremental dimensioning.

(7 marks)

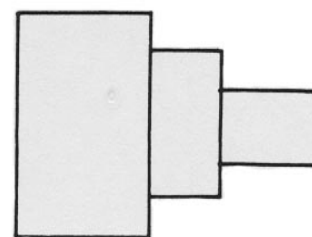


Fig.7b Component