



**Coimisiún na Scrúduithe Stáit
State Examinations Commission**

JUNIOR CERTIFICATE EXAMINATION, 2006

MATERIALS AND TECHNOLOGY

METALWORK – HIGHER LEVEL

100 Marks

Tuesday, 20 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. 1, shows some of the main parts of a basic two-stroke engine.
Questions (b) to (e) relate to this diagram.

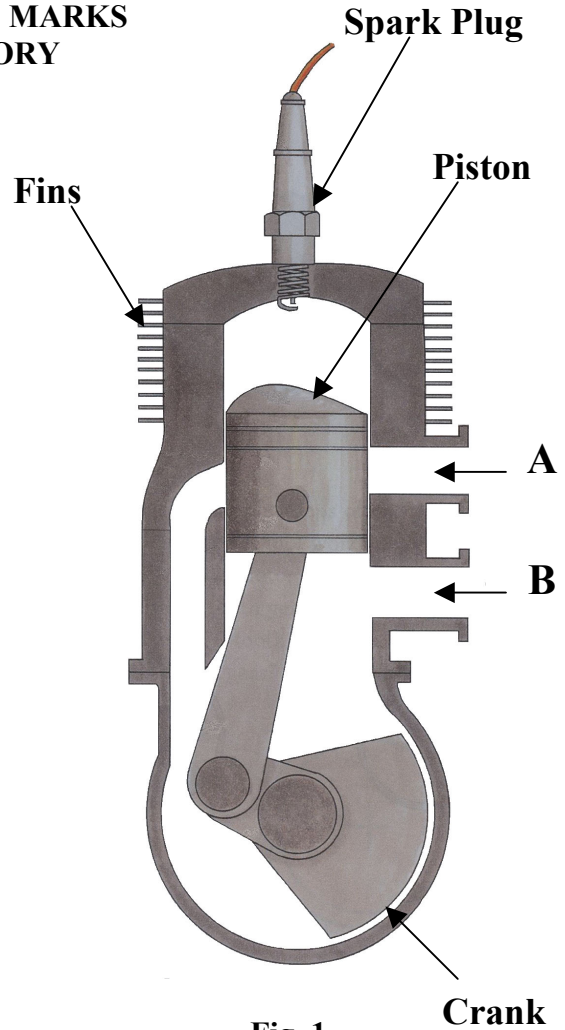


Fig. 1

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

- (i) Dugald Clerk, or
- (ii) Michael Faraday, or
- (iii) William Siemens.

(4 marks)

(b) (i) Name the parts marked 'A' and 'B'.
(ii) Explain the purpose of **one** of these parts.

(4 marks)

(c) Briefly describe the function of the Spark Plug.

(4 marks)

(d) Explain the purpose of the Fins.

(4 marks)

(e) Describe the type of motion, which occurs at:

- (i) The Crankshaft;
- (ii) The Piston.

(4 marks)

(f) (i) List the metals used to make Brass.
(ii) State **two** properties of Brass.

(4 marks)

(g) (i) Select the correct electronic symbol for **each of the two** components shown in Fig. 1a.

- (ii) Outline the function of **one** of the components.

(4 marks)



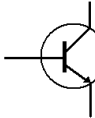
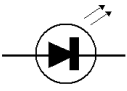

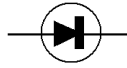
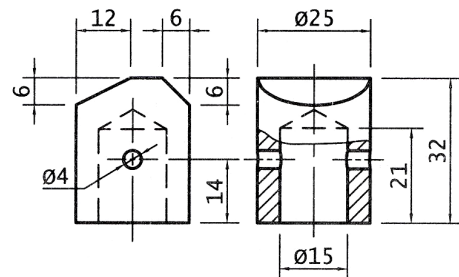
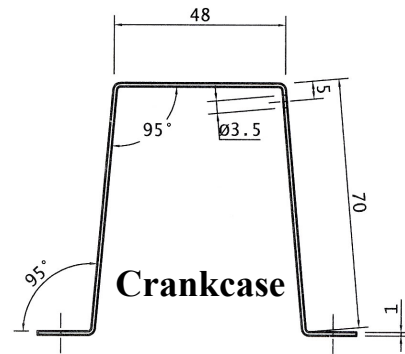
Components	
A	
B	
Symbols	
1	
2	
3	
4	

Fig. 1a

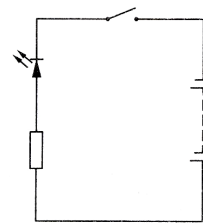
**SECTION B – 20 MARKS
COMPULSORY**

Answer any five questions

The drawings in Fig. 1b show the Crankcase, Piston, Electric Circuit and an assembly drawing of the 2006 Metalwork Higher Level Project, Model 2-Stroke Engine.



Piston



Electric Circuit

- (a) Describe how the Crankcase is bent to shape. (4 marks)
- (b) List **four** processes used to manufacture the piston. (4 marks)
- (c) (i) Suggest a suitable drill size for the M4 holes in the base. (4 marks)
- (ii) Name the type of hole, which should be drilled before the $\text{Ø}10\text{mm}$ hole in the Sideplate. (4 marks)
- (d) (i) Explain the operation of the Electric Circuit shown. (4 marks)
- (ii) Explain the purpose of the resistor in the Electric Circuit. (4 marks)
- (e) Design, using a diagram, a suitable switch bracket to hold the push to make switch used in the Electric Circuit. (4 marks)
- (f) Suggest **two** suitable applications for a 2-Stroke Engine. (4 marks)

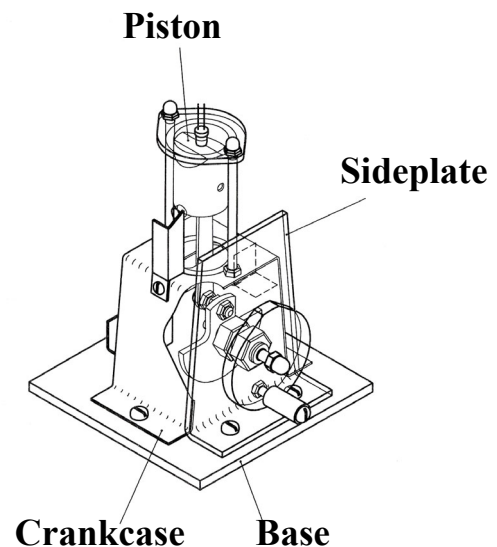
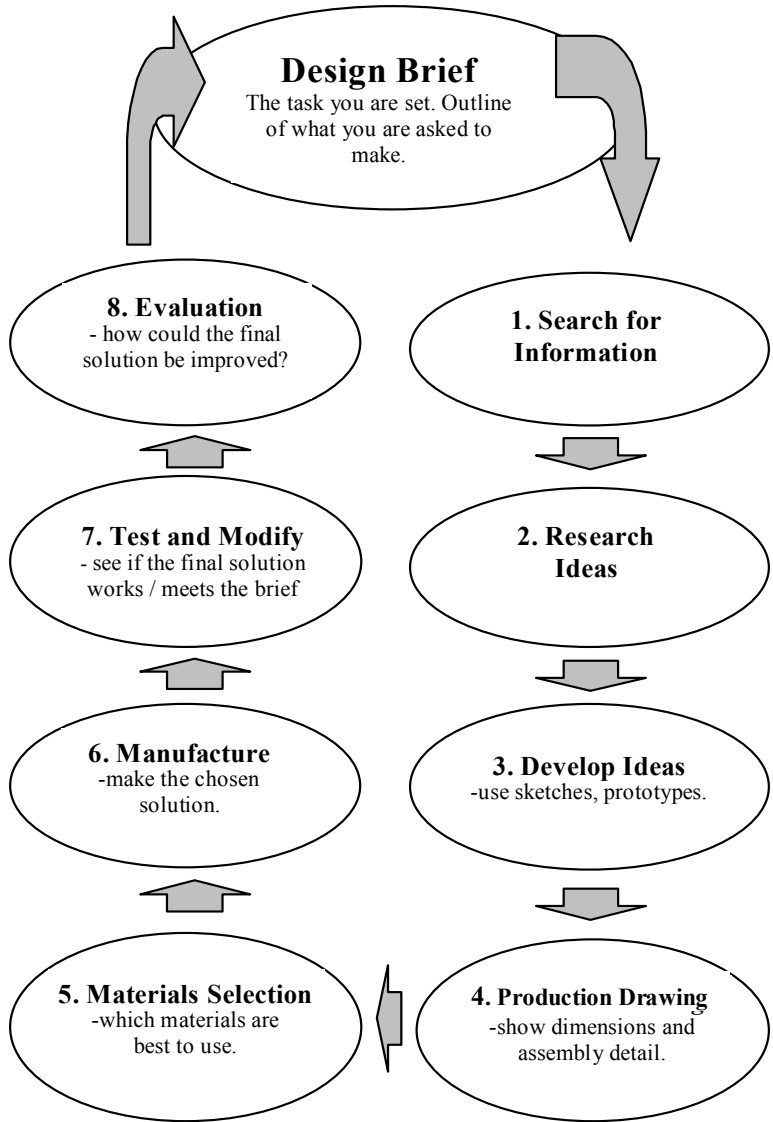


Fig. 1b

A simple model of a design process is shown opposite.



- (a) (i) List any **three** important safety points, which should be considered, at the “Manufacture” stage.
- (ii) Outline **three** factors to be considered at the “Evaluation” stage.

(6 marks)

- (b) The diagram in Fig. 2 shows a pair of gates which open separately.
- (i) Describe **one** improvement, which could be made, to the gates to make them more rigid.
- (ii) Show, using diagrams, how the gates may be locked to enable:
- One side only to lock;
 - Both sides to lock.
- (iii) Name a suitable material from which the gates may be manufactured.
- (iv) Suggest a suitable finish for the gates.

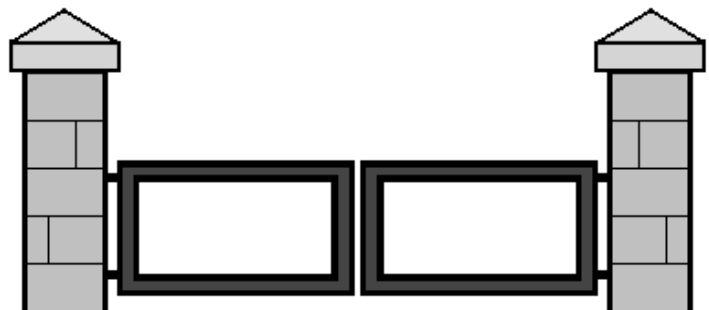
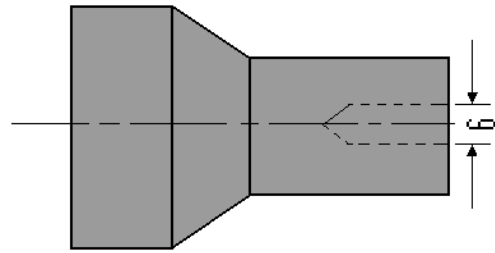


Fig. 2

(14 marks)

Fig. 3 shows a component produced on the lathe, and two tools A and B.

- (a) (i) List **three** turning operations required to produce the component shown.
 (ii) Outline **two** stages needed to drill the 6mm hole.
 (iii) State **two** safety precautions to be taken while making the component on the lathe.
 (12 marks)



Component

- (b) For the 6mm diameter hole to be drilled the component has a cutting speed of 45m/min. Using the given formula calculate the speed in RPM. (Take π as 3)

$$N = \frac{S \times 1000}{\pi \times D} \quad (4 \text{ marks})$$

- (c) (i) Name **both** tools shown.
 (ii) Explain the purpose of **one** of the tools shown.
 (4 marks)

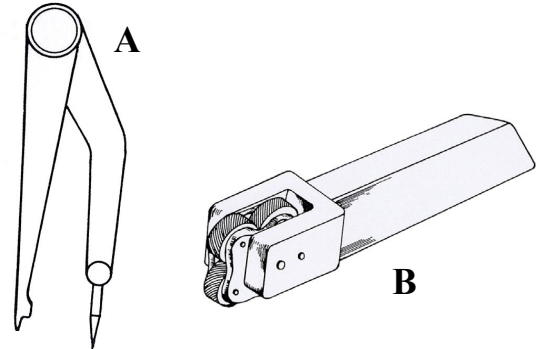
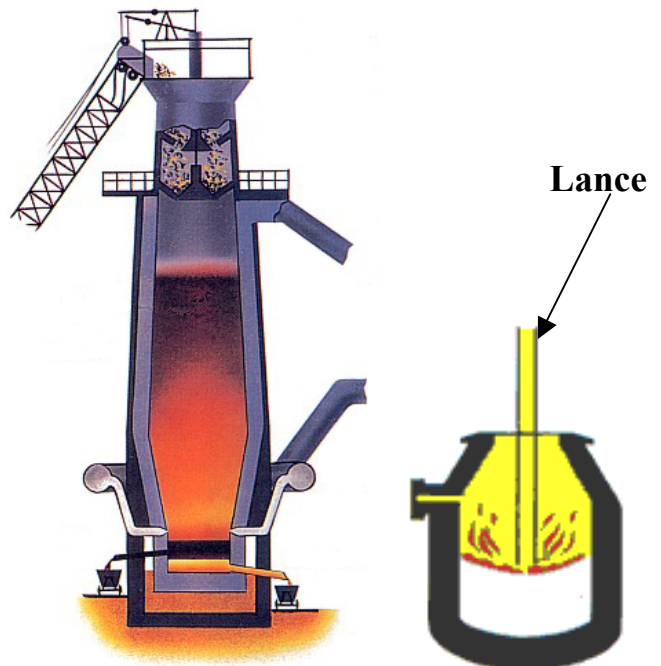


Fig. 3

- (a) (i) Identify Furnace A.
 (ii) List the materials used to charge Furnace A.
 (iii) Explain how heat loss is prevented when charging Furnace A.
 (iv) Describe how the Slag and Iron are removed from Furnace A.
 (9 marks)
- (b) (i) Identify Furnace B.
 (ii) Explain the purpose of the Lance shown.
 (iii) Name the metal produced by Furnace B.
 (5 marks)
- (c) List **one** application and **one** property of the following alloy steels:
 (i) Stainless Steel;
 (ii) High Speed Steel.
 (6 marks)

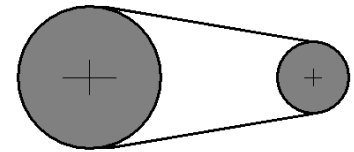
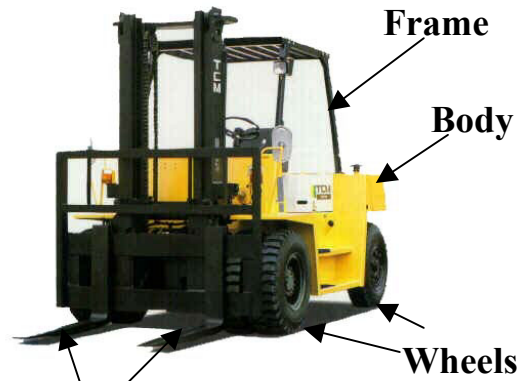


Furnace A

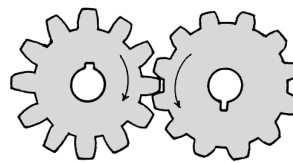
Furnace B

A Forklift and two transmission mechanisms are shown.

- (a) (i) Name **one** suitable material for **each** part identified on the Forklift.
- (ii) Outline **two** safety features incorporated in the design of the Forklift. (6 marks)
- (b) The Forklift uses a chain and sprocket lift mechanism. If the driving sprocket has 18 teeth and the driven sprocket, attached to the forks, has 54 teeth, what is the gear ratio? (4 marks)
- (c) (i) Identify **both** Mechanisms shown.
- (ii) Outline **one** advantage and **one** disadvantage of **each** Mechanism.
- (iii) Suggest **one** application for **each** Mechanism.
- (iv) Describe how Mechanism 2 may be modified to reverse the direction of rotation. (10 marks)



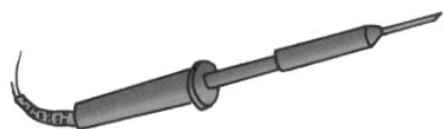
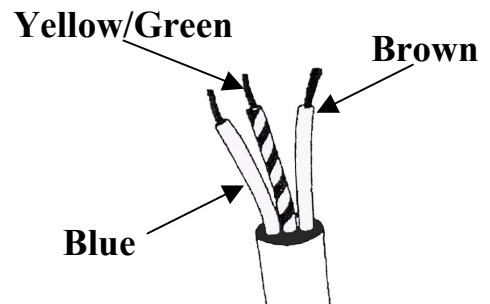
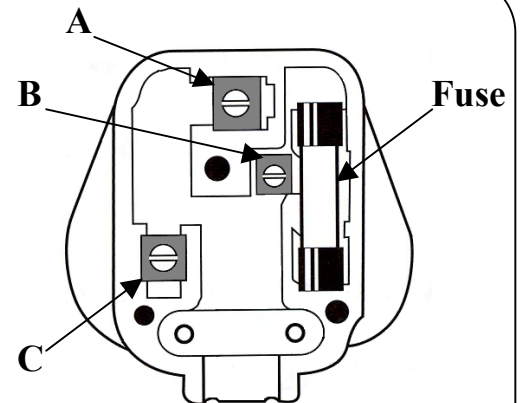
Mechanism 1



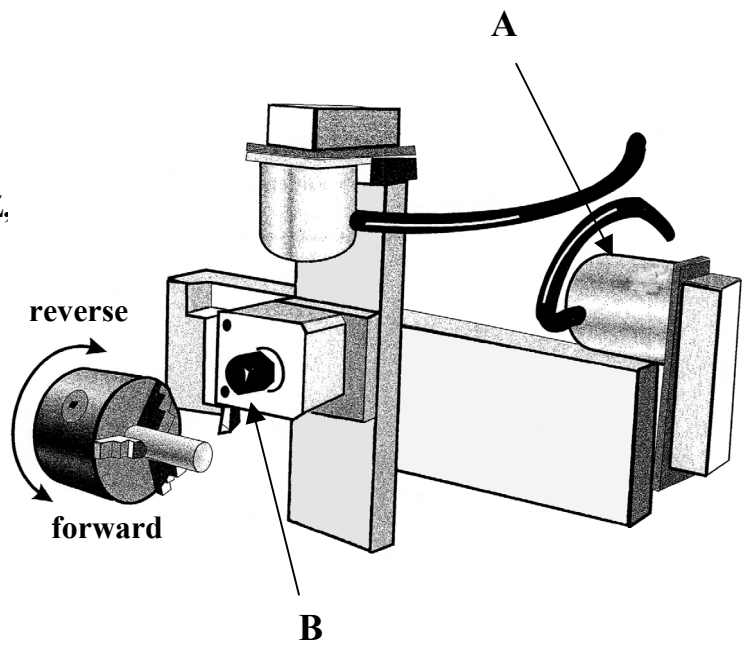
Mechanism 2

An electric plug, wiring cable and an electric soldering iron are shown.

- (a) (i) Name the **three** plug terminals marked 'A', 'B' and 'C'.
- (ii) State which colour cable wire should be connected to each terminal.
- (iii) What is the purpose of the fuse shown? (8 marks)
- (b) (i) Explain the main difference between Thermosetting and Thermoplastic materials.
- (ii) Name a suitable material for the plug casing. (6 marks)
- (c) (i) Outline **two** safety precautions to be observed when using an electric soldering iron.
- (ii) Explain any **two** of the following terms associated with soldering:
 - (a) Tinning the bit;
 - (b) Active flux;
 - (c) Transformer;
 - (d) Sweating.(6 marks)

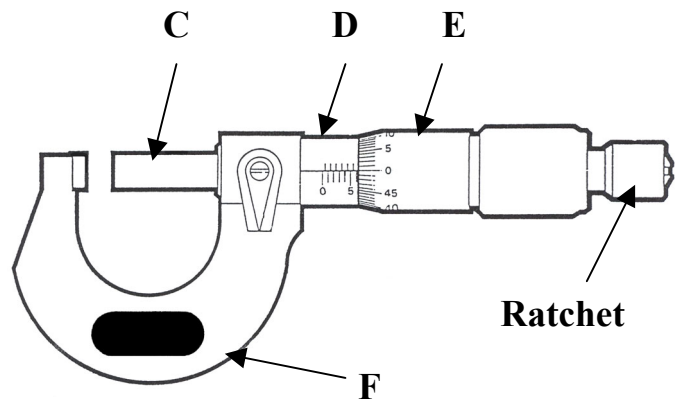


- (a) (i) Identify the parts 'A' and 'B' of the CNC Lathe shown.
- (ii) Draw a diagram, showing the directions $-X$, $+X$, $-Z$ and $+Z$, represented by the CNC jog keys.
- (iii) When turning on the CNC Lathe should the chuck rotate reverse or forward?
- (iv) Outline **two** safety features found on the CNC Lathe.
- (v) Explain the meaning of any **two** of the following computer terms:



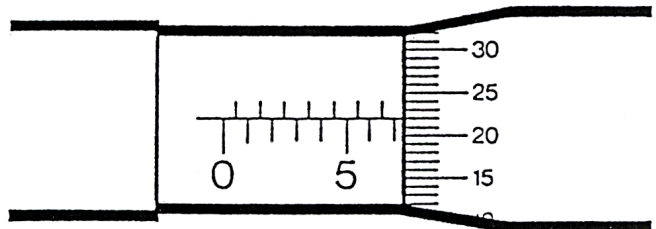
- Menu;
- ROM;
- Virus;
- Removable disk.

(12 marks)



- (b) (i) Name the parts of the micrometer 'C', 'D', 'E' and 'F'.
- (ii) Explain the function of the Ratchet shown.
- (iii) What is the value of the micrometer reading shown opposite?

(8 marks)



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