



**Coimisiún na Scrúduithe Stáit  
State Examinations Commission**

**JUNIOR CERTIFICATE EXAMINATION, 2007**

**MATERIALS AND TECHNOLOGY**

**METALWORK – HIGHER LEVEL**

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**100 Marks**

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**Tuesday, 19 June – 2.00 – 4.00**

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**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.

The diagram, Fig. 1, 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) Heinrich Focke, or
- (ii) Henry Ford, or
- (iii) Nicholas Otto.

(4 marks)

- (b) (i) Name part 'B'.  
(ii) Explain the purpose of part 'B'.

(4 marks)

- (c) Explain the function of the piston rings.

(4 marks)

- (d) Describe **one** of the following engine strokes:

- (i) Induction;
- (ii) Ignition.

(4 marks)

- (e) (i) Outline **one** environmental effect of engines.

- (ii) Suggest how this effect could be reduced.

(4 marks)

- (f) (i) Name a suitable plastic, which could be used to make the guttering shown.

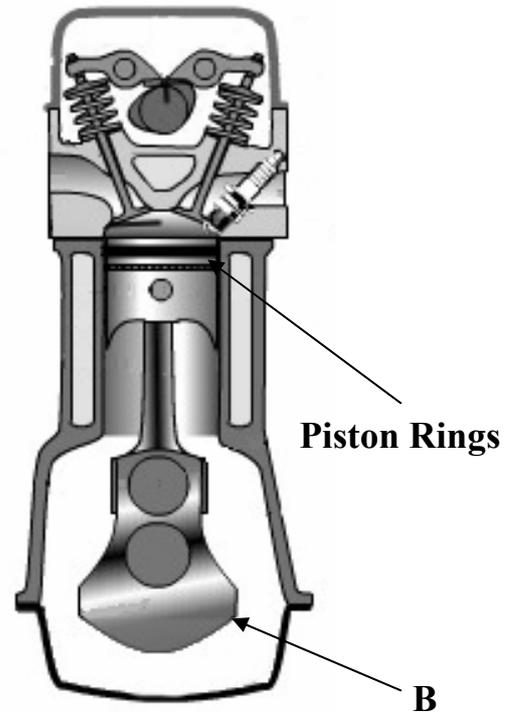
- (ii) Is the plastic named a Thermoset or a Thermoplastic?

(4 marks)

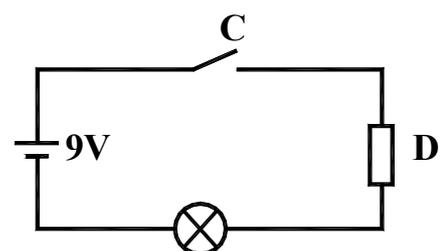
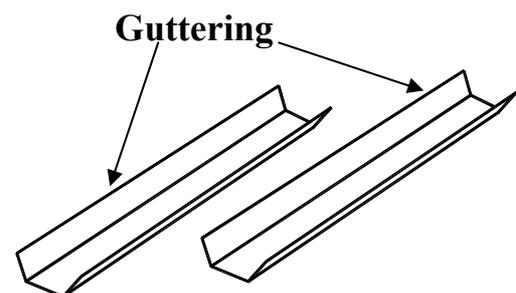
- (g) (i) Identify components 'C' and 'D' in the electronic circuit shown.

- (ii) The circuit is connected to a cell marked 9V. Explain the meaning of 9V.

(4 marks)



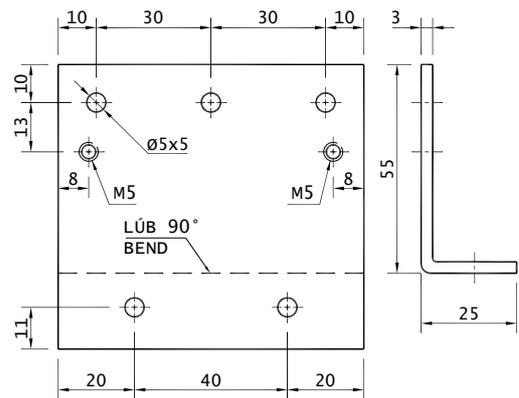
**Fig.1**



**SECTION B – 20 MARKS  
COMPULSORY**

Answer **any five** questions.

**The drawings show the Valve Chest, Flywheel, Electric Circuit and an assembly drawing of the 2007 Metalwork Higher Level Project, Model Steam Engine.**



**Valve Chest**

- (a) List **four** safety precautions to be observed while making the model.

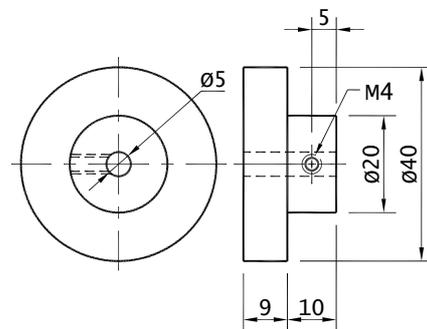
*(4 marks)*

- (b) Describe **any two** processes used to manufacture the valve chest.

*(4 marks)*

- (c) List **three** lathe processes used to make the flywheel.

*(4 marks)*



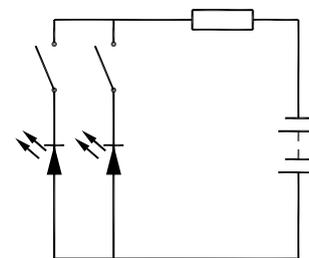
**Flywheel**

- (d) Describe briefly the operation of the electric circuit.

*(4 marks)*

- (e) Design, using a diagram, a suitable support for the flywheel.

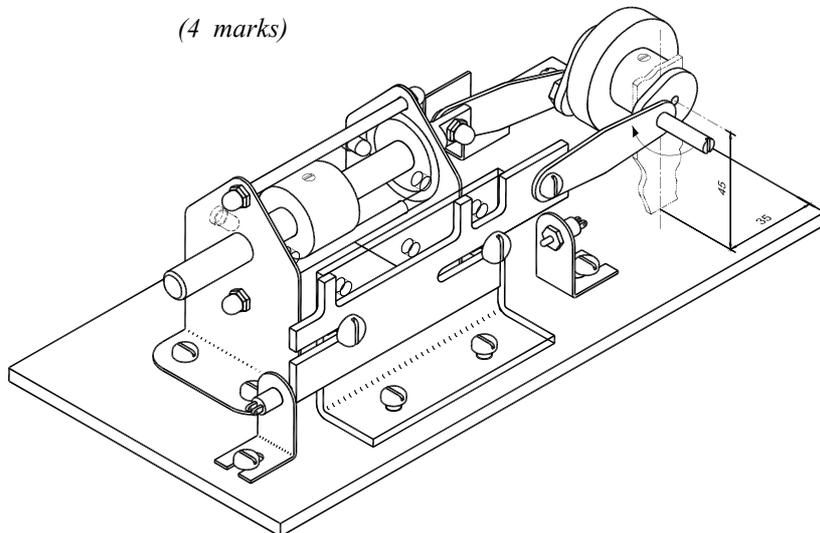
*(4 marks)*



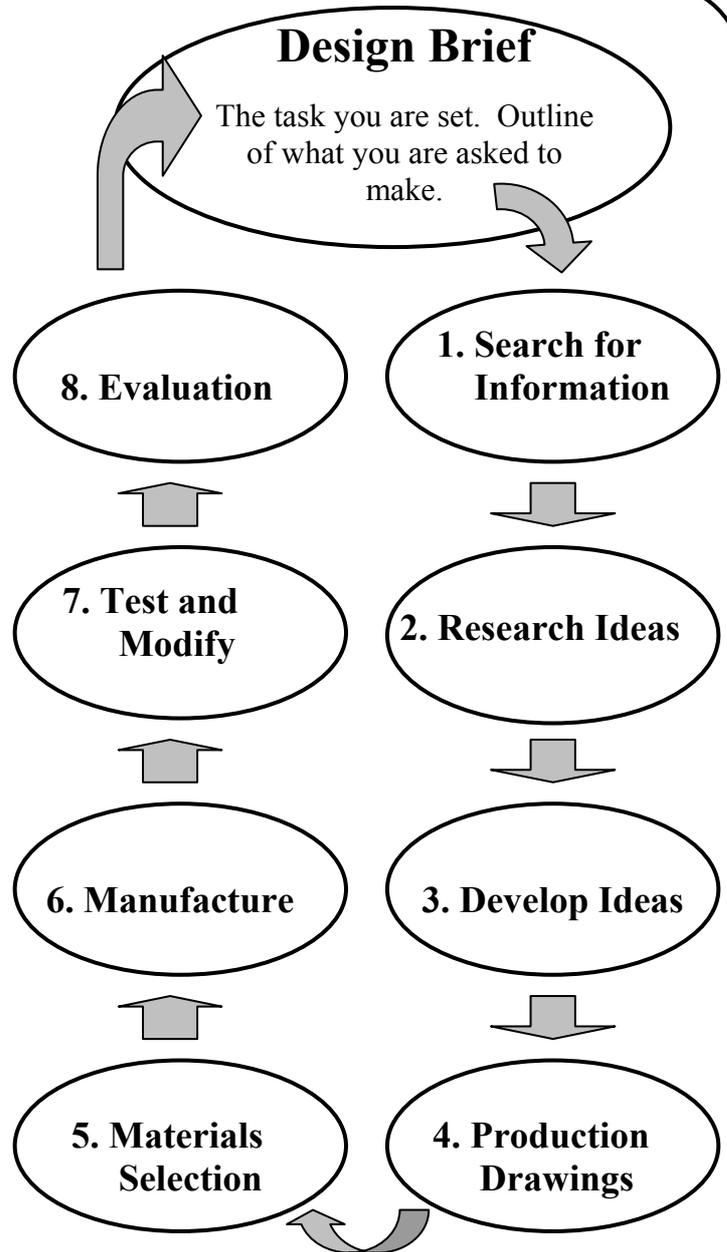
**Electric Circuit**

- (f) Suggest **two** suitable applications for a steam engine.

*(4 marks)*

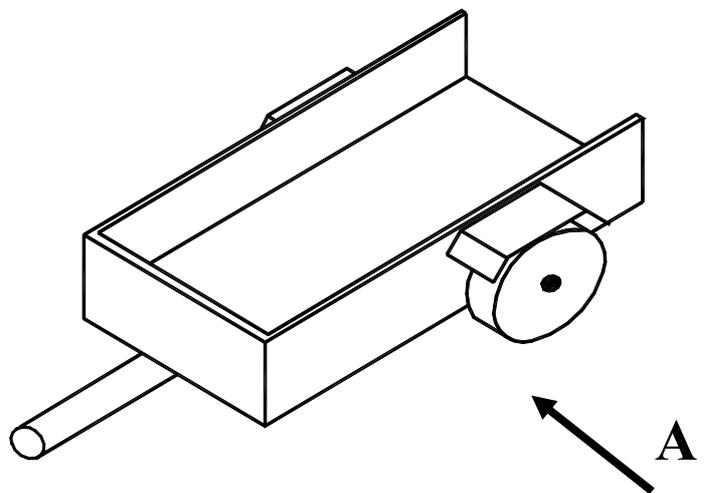


A simple model of a design process is shown opposite.



- (a) (i) List **three** elements which should be included in the 'production drawings'.
- (ii) Discuss **two** factors which could be considered at the 'test' stage. (6 marks)

- (b) (i) Draw an elevation of the trailer looking in the direction of arrow 'A'.
- (ii) Describe how the trailer may be attached to a car for towing.
- (iii) Design, using suitable diagrams, a ramp that could be attached to the trailer allowing a ride-on lawnmower to be loaded.
- (iv) Suggest a suitable metal and a suitable finish for your ramp. (14 marks)



3

20 Marks

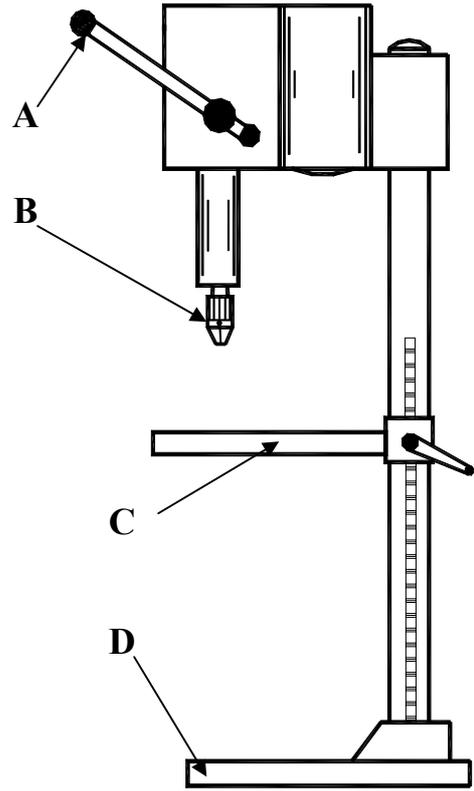
- (a) (i) Name parts 'A', 'B', 'C' and 'D' of the pillar drilling machine shown.
- (ii) Describe the mechanism used to raise and lower part 'C'.
- (iii) List **two** safety precautions to be observed when working on this drill. (8 marks)
- (b) An 8 mm hole is to be drilled in a material which has a surface cutting speed of 36 m/min. Using the given formula calculate the speed in RPM. (Take  $\pi$  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) Countersinking and Counterboring;
- (ii) Clearance hole and Tapping hole;
- (iii) Taper tap and Plug tap.

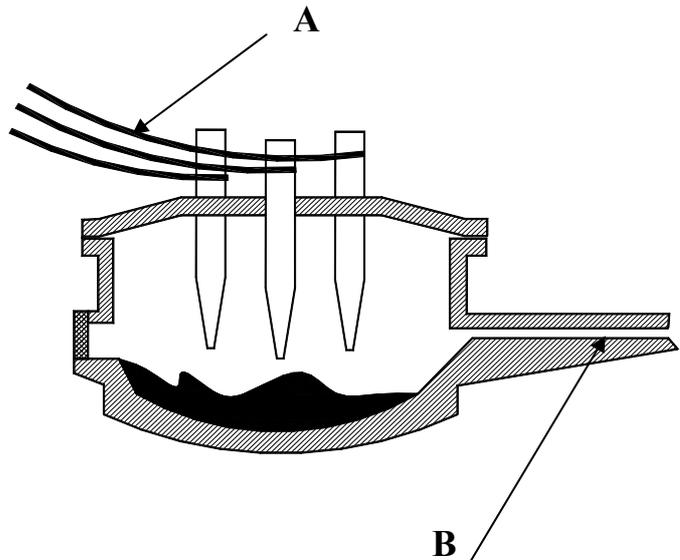
(8 marks)



4

20 Marks

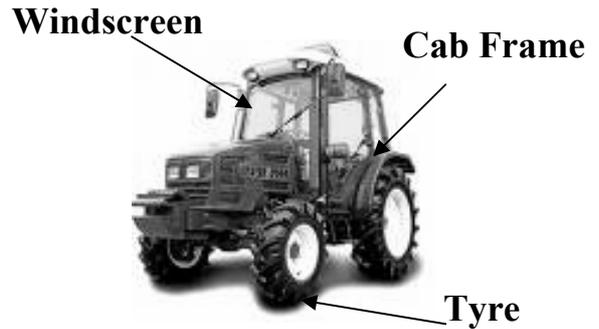
- (a) Name the type of furnace shown. (1 mark)
- (b) List the materials in the charge. (3 marks)
- (c) Describe briefly how the charge is melted. (2 marks)
- (d) Explain the function of parts 'A' and 'B' shown. (2 marks)
- (e) (i) Name the metal produced by this furnace.
- (ii) List **two** properties of this metal. (3 marks)
- (f) (i) List the **two** metals used to make **each** of the following alloys:
- Brass;
  - Solder;
  - Steel.
- (ii) Suggest **one** application for **each** of the alloys listed. (9 marks)



5

20 Marks

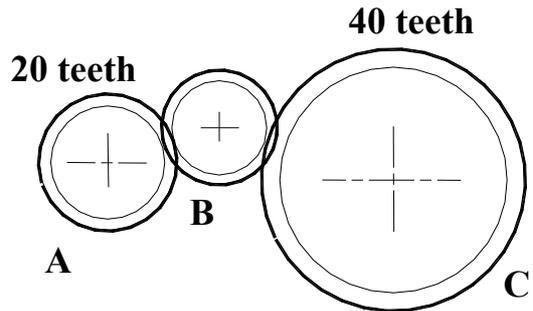
- (a) (i) Name **one** suitable material for **each** tractor part shown.
- (ii) Suggest a suitable method to lubricate the tractor engine.
- (iii) Name a suitable fuel used to power the tractor engine.
- (iv) The tractor has pneumatic tyres. Explain the meaning of 'pneumatic'.
- (v) Describe how power is transmitted from the back of the tractor to attachments, such as mowers and spreaders.



(12 marks)

- (b) Gear wheels 'A', 'B', and 'C' are parts of the transmission system.

- (i) If wheel 'A' is turning clockwise, in what direction will wheel 'C' turn?
- (ii) If the driving wheel 'A' has 20 teeth and driven wheel 'C' has 40 teeth, what is the gear ratio?
- (iii) If wheel 'A' is turning at 500 RPM, what is the speed of wheel 'C'?



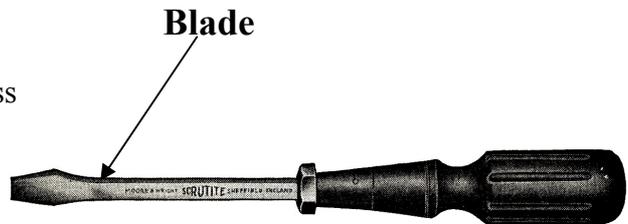
(8 marks)

6

20 Marks

The blade of a screwdriver and material for a bracelet are shown.

- (a) (i) Name a suitable metal which could be used to make the blade.
- (ii) Briefly describe the tempering process applied to the blade following hardening.
- (iii) List **two** safety precautions to be observed when heating metals. (8 marks)



- (b) Explain **any two** of the following terms:
  - (i) Annealing, (ii) Brittleness,
  - (iii) Conductivity, (iv) Ductility. (4 marks)

- (c) (i) Describe, using a diagram, how the bracelet may be bent to shape.
- (ii) Briefly describe **any two** of the following decorative processes which could be used to finish the bracelet:
  - Engraving;
  - Enamelling;
  - Etching.



Bracelet

(8 marks)

### Computer Devices

- (a) (i) Four computer devices are shown. Classify **each** as an input or output device.



**Keyboard**

**Printer**

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

- CPU;
- Monitor;
- RAM;
- WWW.



**Robotic Arm**

**Scanner**

- (iii) Describe briefly how to protect a personal computer (PC) from:

- Electrical surge;
- Virus.

### Storage Devices

- (iv) Name the **three** computer file storage devices shown.

(13 marks)



**A**



**B**



**C**

- (b) (i) Explain the meaning of the term CNC.

- (ii) List **one** similarity and **one** difference between a CNC lathe and a conventional lathe.

- (iii) What is CAD/CAM?

- (iv) List **two** advantages of a CAD/CAM system.

(7 marks)

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