



**Coimisiún na Scrúduithe Stáit
State Examinations Commission**

JUNIOR CERTIFICATE EXAMINATION, 2015

**METALWORK
MATERIALS AND TECHNOLOGY**

Higher Level - 100 Marks

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

INSTRUCTIONS

1. Answer Question 1, Section A and Section 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.

Figure 1 shows some of the main parts of a four-stroke engine.

Questions (a) to (c) relate to these.

- (a) (i) Name part A.
(ii) Suggest a suitable material for the manufacture of part A. (4 marks)

- (b) (i) Name part B.
(ii) Explain the purpose of part B. (4 marks)

- (c) (i) Describe the power stroke of the four-stroke engine cycle.
(ii) Suggest how a seal is created between part A and the engine cylinder. (4 marks)

- (d) (i) Outline **any two** types of environmental pollution caused by engines.
(ii) Describe **one** improvement to engines which has made them more environmentally friendly. (4 marks)

- (e) Describe briefly the contribution made to technology by **one** of the following:
(i) Jack Dorsey,
(ii) Henry Ford,
(iii) John Dunlop. (4 marks)

- (f) (i) Name **one** process which may be used to inscribe a winner's name on the metal trophy shown.
(ii) Describe the decorative metalwork process of enamelling. (4 marks)

- (g) (i) Identify **each** of the electronic components C and D shown.
(ii) Draw the electronic symbol for **one** of the components shown. (4 marks)

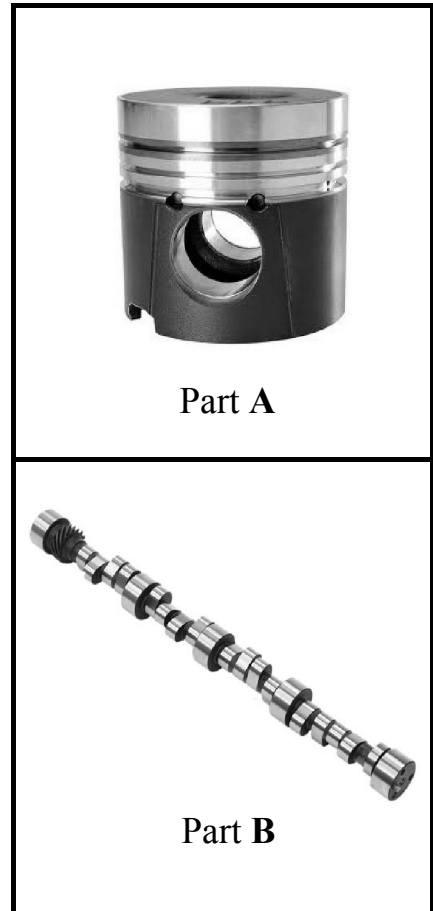
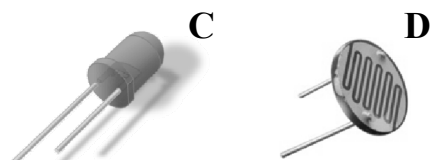


Figure 1



Metal trophy

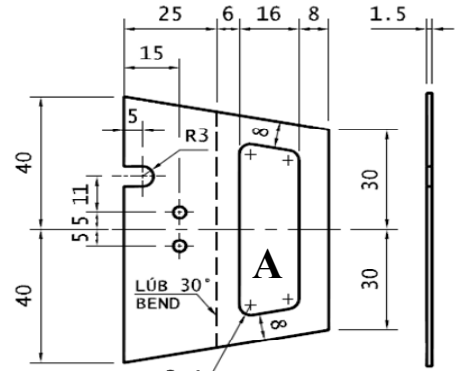


Electronic components

**SECTION B – 20 Marks
COMPULSORY**

Answer **any five** questions.

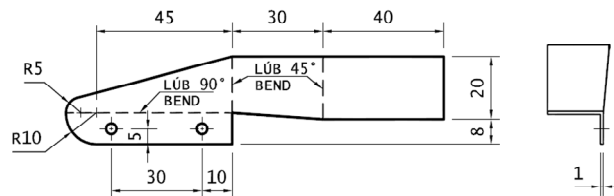
The drawings show the Windscreen, Right Mudguard, Electric Circuit and an assembly drawing of the 2015 Metalwork Higher Level Project, Model Stock Car. An image of a perpendicular motor and gearbox is also shown.



Windscreen

- (a) (i) Describe how the windscreen is marked-out.
(ii) Explain the steps involved in accurately shaping the window labelled A.

(4 marks)



Right Mudguard

- (b) (i) Outline how a high quality finish is produced on the edge profile of the right mudguard.
(ii) Describe how the right mudguard is accurately bent to shape.

(4 marks)

- (c) (i) Outline **one** advantage of using a perpendicular motor and gearbox as the drive for the model.
(ii) Suggest **one** alternative drive mechanism suitable for the model.

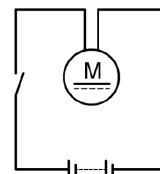
(4 marks)



Perpendicular Motor and Gearbox

- (d) (i) Explain the operation of the electric circuit used with the model.
(ii) Illustrate how a lighting system incorporating two LEDs may be fitted to the model.

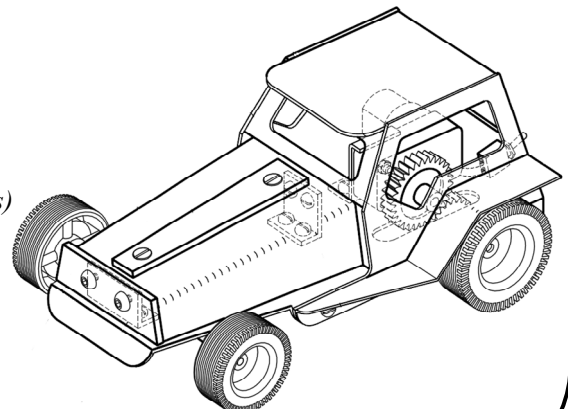
(4 marks)



Electric Circuit

- (e) (i) Design, using a diagram, the front axle support(s) for the model.
(ii) Describe a process to manufacture the front axle support(s) designed by you in (e)(i) above.

(4 marks)

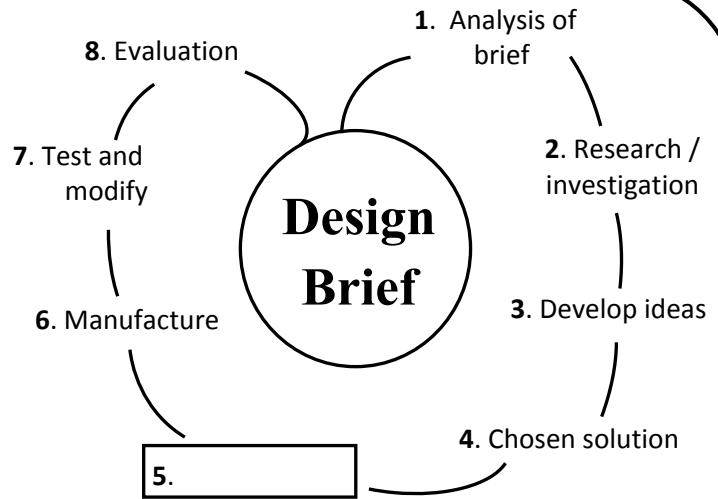


Model Stock Car

- (f) Design, using a diagram, **one** additional feature to enhance the appearance of the model stock car shown.

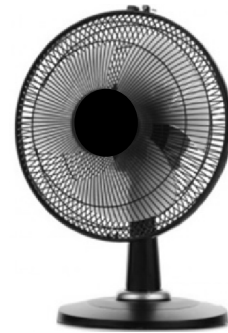
(4 marks)

A simple model, with eight stages of a design process is shown opposite. Stage five is omitted.



- (a) (i) Suggest a suitable name for stage five of the design process shown opposite.
- (ii) Outline any two pieces of information to be included in stage five of the design process.
- (iii) Suggest any three factors which may be considered when evaluating the design of the desk fan shown.

(7 marks)



Desk fan

A metal sign for a hotel is shown below.

- (b) (i) Design, using diagram(s), a metal bracket which will hold the given sign. The bracket is to be fixed at a right angle to a wall and should include:
 - A method to attach the sign to the bracket
 - A means to fix the bracket to the wall
 - A decorative feature for the bracket.



Metal sign for a Hotel

- (ii) Suggest one suitable metal for the bracket and one suitable finish for the chosen metal.
- (iii) Draw an alternative design for the hotel sign shown.

(13 marks)

Question 3

20 Marks

- (a) (i) Name parts **A**, **B**, **C** and **D** of the pillar drilling machine shown.
- (ii) Describe a mechanism used to raise and lower part **B**.
- (iii) Outline **one** method which may be used to accurately drill a blind hole.
- (iv) Explain how the *drill drift*, shown below, can be used to remove part **C** from the spindle.

(10 marks)

- (b) A $\varnothing 9$ mm hole is to be drilled in a material which has a surface cutting speed of 81 m/min. Using the given formula, calculate the speed in RPM. (Take π as 3)

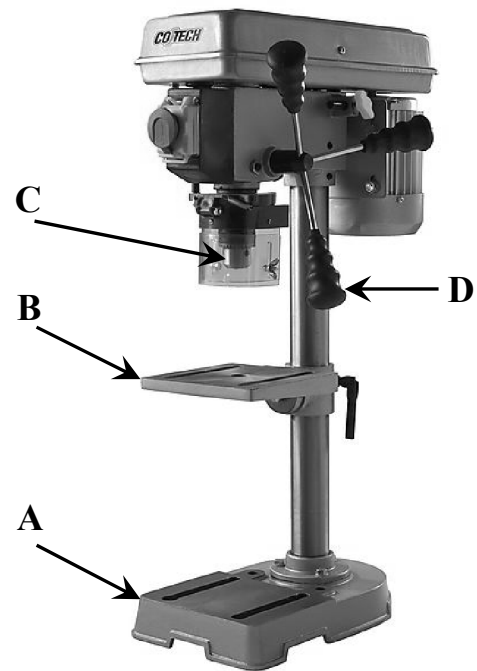
$$N = \frac{S \times 1000}{\pi \times D}$$

(4 marks)

- (c) Select **any two** from (i), (ii) or (iii) below and explain the difference between the terms in each:

- (i) Countersunk screw **and** Grub screw;
- (ii) Circular split die **and** Die nut;
- (iii) Snap head rivet **and** Pop rivet.

(6 marks)



Pillar drilling machine



Drill drift

Question 4

20 Marks

- (a) (i) Name the type of furnace shown.
- (ii) List the materials in the charge.
- (iii) With reference to part **A**, describe how the charge is melted.
- (iv) Explain the purpose of part **B**.

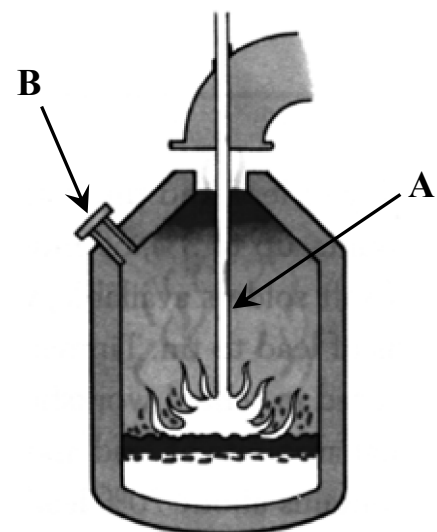
(10 marks)

- (b) (i) Name **any two** alloy steels and suggest a suitable application for **each**.
- (ii) Outline **any two** reasons why different materials are alloyed with steel.

(6 marks)

- (c) (i) Name **any two** heat treatment processes which may be applied to steel.
- (ii) Describe how **one** of the named heat treatment processes is carried out.

(4 marks)

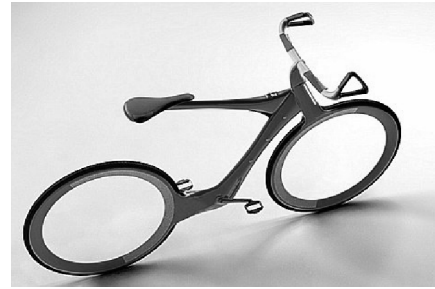


Question 5

20 Marks

A design for a modern bicycle is shown.

- (a) (i) Compare the wheel design of the modern bicycle shown with the wheel design of a traditional bicycle.
- (ii) Describe **any two** design features (other than wheel design) which are incorporated in the design of the modern bicycle shown.
- (iii) Outline **two** safety features which could be included in the design of the bicycle shown.
- (iv) State **two** advantages of a bicycle as a mode of transport. (10 marks)



Modern bicycle

- (b) (i) Identify the drive mechanism shown.
- (ii) Suggest **any two** suitable applications for the drive mechanism shown.
- (iii) Suggest **one** safety risk associated with the drive mechanism shown and describe **one** design feature that would minimise the risk.
- (iv) Describe **one** method to reduce wear in the drive mechanism shown. (10 marks)

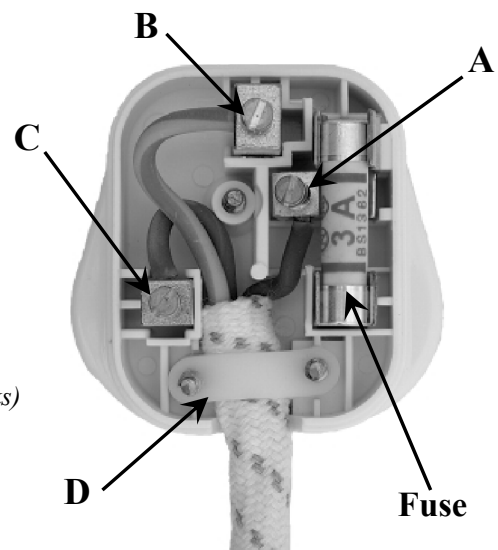


Drive mechanism

Question 6

20 Marks

- (a) (i) Name **each** of the terminals **A**, **B** and **C** in the plug shown.
- (ii) State which colour wire should be connected to **each** terminal.
- (iii) Describe the purpose of part **D** shown.
- (iv) Explain the function of the 3A fuse shown.
- (v) Outline **any two** safety precautions to be observed when using electrical appliances. (10 marks)
- (b) (i) List **any two** properties of soft solder that make it suitable for joining electronic components.
- (ii) Outline the main differences between a passive flux **and** an active flux.
- (iii) Describe, using a diagram, the soldering process of *sweating*.
- (iv) What is silver solder? (10 marks)



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

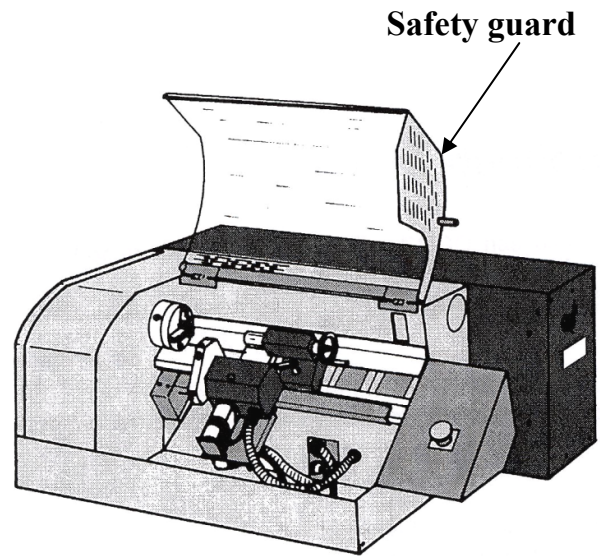
(ii) State **any two** advantages for using the lathe shown over a conventional lathe.

(iii) From the list below, select the polymer which is most suitable for making the safety guard shown, and explain **one** reason for this selection:

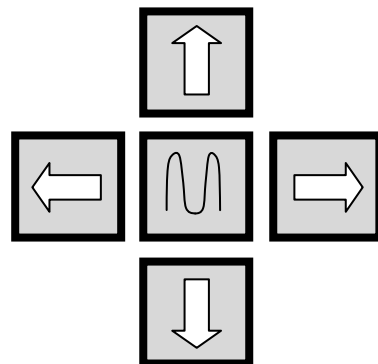
- Polystyrene
- Acrylic
- Polyurethane.

(iv) State if the polymer selected to make the safety guard is either Thermosetting or Thermoplastic **and** give **one** advantage of using this polymer type.

(v) Describe **one** environmental problem caused by the careless disposal of plastic materials.



(10 marks)



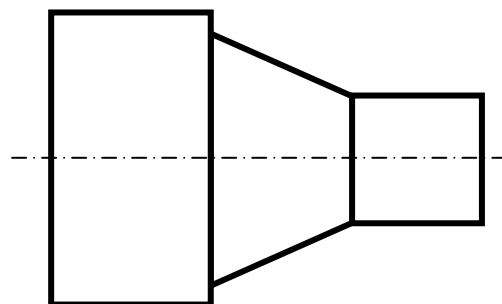
Jog keys

(b) (i) Redraw the jog keys shown and label the correct directions **-X**, **+X**, **-Z** and **+Z**.

(ii) Redraw the lathe component shown. Illustrate how the component may be dimensioned using incremental dimensioning.

(iii) Explain **any two** of the following terms:

- RAM
- CAM
- Canned cycle
- CAD.



Lathe component

(10 marks)

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