



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)

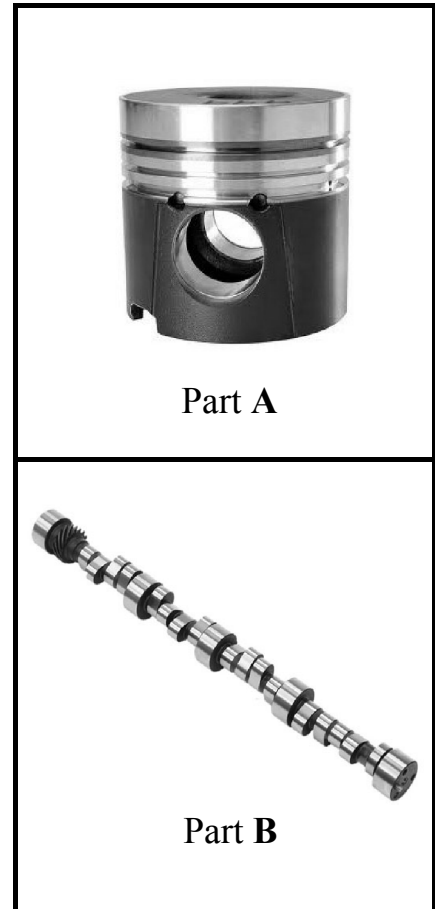
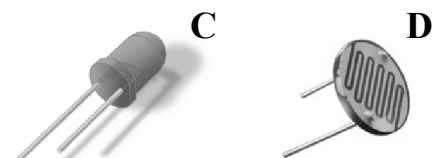


Figure 1



Metal trophy

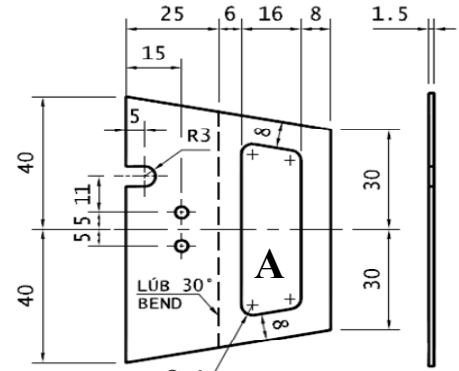


Electronic components

SECTION B – 20 Marks
COMPULSORY

Answer **any five** questions.

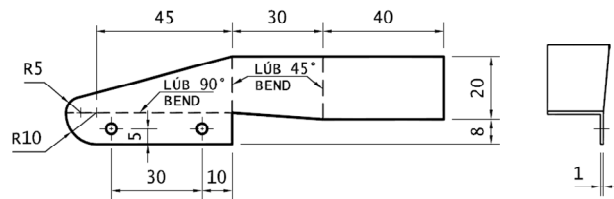
The drawings show the Windscreen, Right Mudguard, Electric Circuit and an assembly drawing of the 2015 Metalwork Higher Level Project, Model Stock Car. An image of a perpendicular motor and gearbox is also shown.



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.

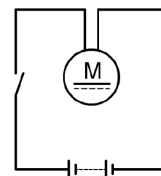
(4 marks)



Perpendicular Motor and Gearbox

- (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)



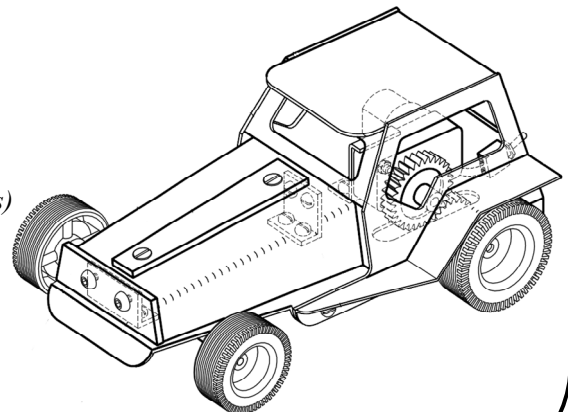
Electric Circuit

- (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)

- (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)

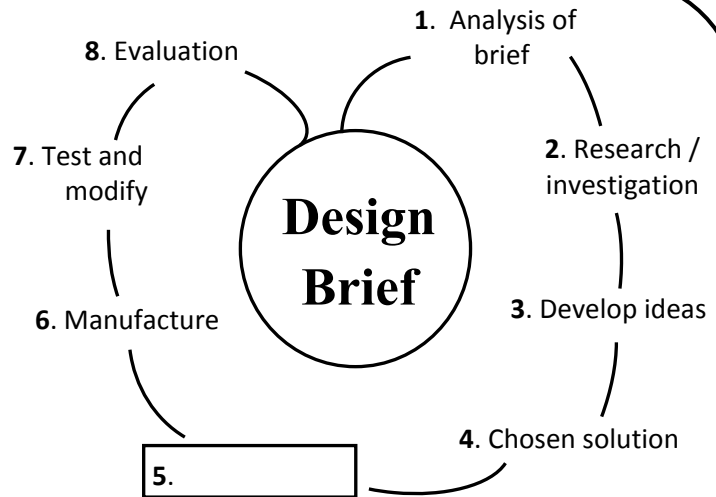


Model Stock Car

- (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 Ø9 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)

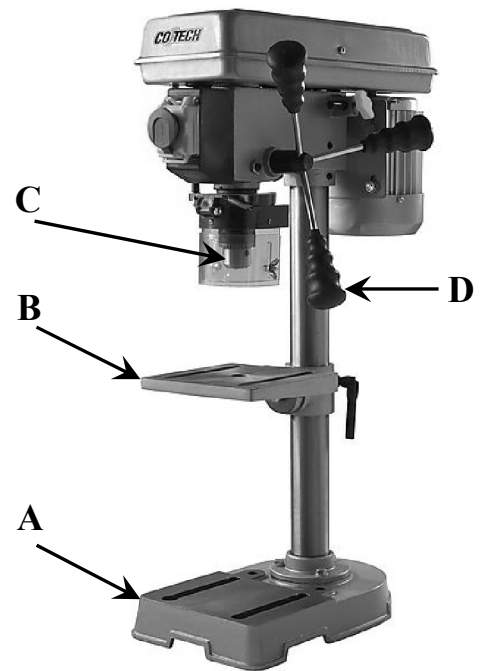
$$N = \frac{S \times 1000}{\pi \times D}$$

(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**.

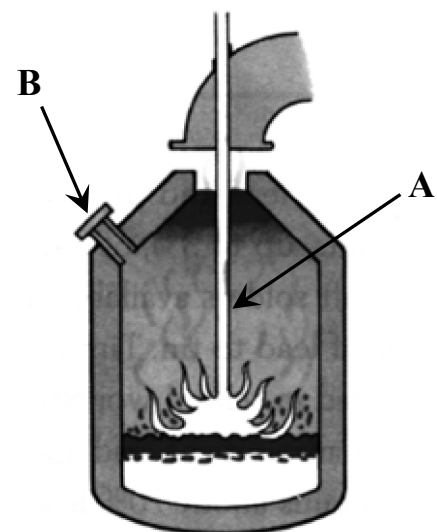
(10 marks)

- (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)

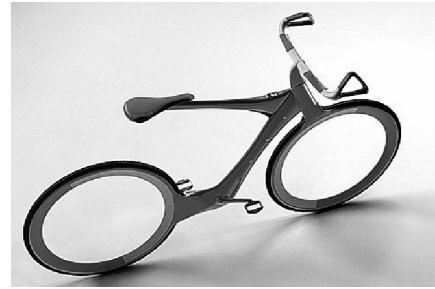


Question 5

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)

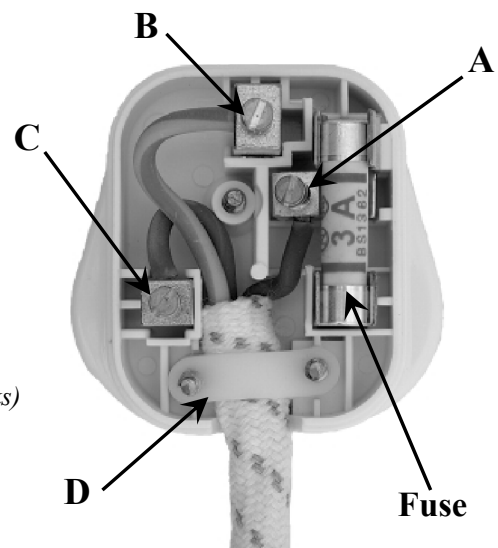


Drive mechanism

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.

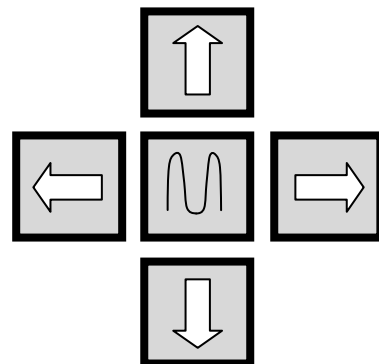
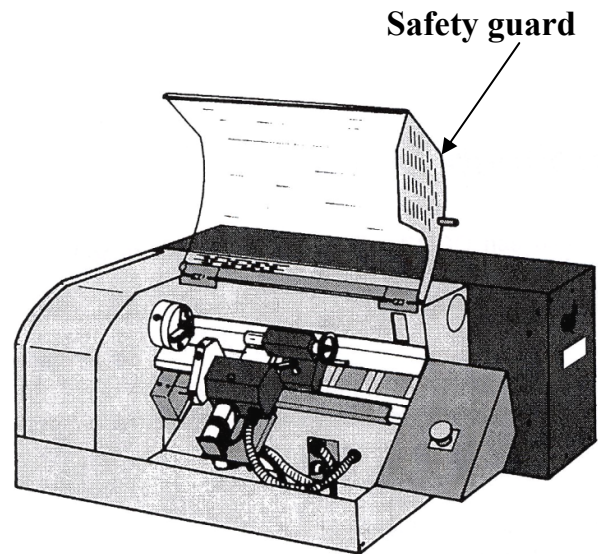
(iii) From the list below, select the polymer which is most suitable for making the safety guard shown, and explain **one** reason for this selection:

- 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)



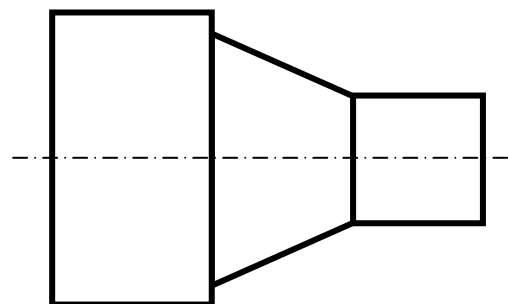
Jog keys

(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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Coimisiún na Scrúduithe Stáit
State Examinations Commission

JUNIOR CERTIFICATE EXAMINATION, 2015

METALWORK
TECHNIQUES AND DESIGN – PRACTICAL EXAMINATION

Higher Level – 150 Marks

27th April - 8th May, 9:30 - 12:30 or 2:00 - 5:00

PLEASE READ CAREFULLY

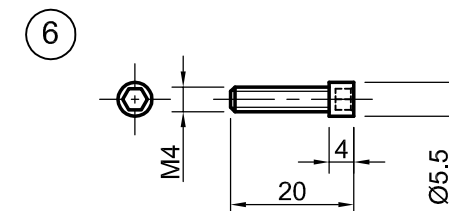
INSTRUCTIONS

- (a) The Examination Number must be clearly stamped or engraved by the **teacher** on the test-piece in the position indicated on the drawing. If the test-piece is not assembled, the Examination Number must be indicated on each separate part of the test-piece.
- (b) Candidates are not permitted to communicate with or assist one another.
- (c) Where applicable, completed **mild steel** parts **only** must be lightly sprayed with a clear rust preventive aerosol.

From the materials supplied, make the **Mechanism** shown on the drawing to the shape and dimensions specified.

PART	MATERIAL	PROCESS
1	Coloured Acrylic	Mark out, drill and shape.
3	Coloured Acrylic	Mark out, drill, tap and shape.
4	Aluminium	Mark out, drill, tap and shape.
5	Aluminium	Mark out, drill and shape.

Note: (i) Parts 2 and 6 have been made prior to examination day. Parts 3 and 4 have been part-prepared. Using the screws and nuts supplied, assemble the Mechanism as detailed on the assembly drawing.
(ii) **Accuracy, finish and function are important.**

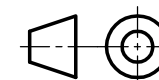


Tá tábhacht ag baint le cruinneas,
le bailchríoch agus le hoibriú.

Accuracy, finish and function are important.

SONRAÍ CÓIMEÁLA

ASSEMBLY DETAILS





Coimisiún na Scrúduithe Stáit

SCRÚDÚ AN TEASTAIS SHÓISEARAIGH, 2015

MIOTALÓIREACHT
TEICNÍOCHTAÍ AGUS DEARADH – SCRÚDÚ PRAITICIÚIL

Ardleibhéal – 150 Marc

27 Aibreán - 8 Bealtaine, 9:30 - 12:30 nó 2:00 - 5:00

LÉIGH NA TREORACHA SEO GO CÚRAMACH IAD LE DO THOIL

TREORACHA

- (a) Ba chóir don **mhúinteoir** Scrúduimhir an Iarrthóra a ghreanadh nó a scríobadh san ionad a thaispeántar ar an líníocht. Mura bhfuil an triailphíosa curtha le chéile, ní mór an Scrúduimhir a thaispeáint ar gach píosa ar leith den triailphíosa.
- (b) Níl sé de chead ag iarrthóirí caidreamh a bheith acu lena chéile ná cúnamh a thabhairt dá chéile.
- (c) Áit a mbaintear úsáid as **cruach bhog** ní mór na páirteanna críochnaithe a spraeáil le haerasól trédhearcadh chun meirg a chosc.

As na hábhair a sholáthraítear, an **Mheicníocht** a thaispeántar sa líníocht a dhéanamh sa chruth agus de réir na dtoisí a shonraítear.

PÁIRT	ÁBHAR	PRÓISEAS
1	Aicrileach daite	A mharcáil amach, a dhruileáil agus a dheilbhiú.
3	Aicrileach daite	A mharcáil amach, a dhruileáil, a tapa agus a dheilbhiú.
4	Alúmanam	A mharcáil amach, a dhruileáil, a tapa agus a dheilbhiú.
5	Alúmanam	A mharcáil amach, a dhruileáil agus a dheilbhiú.

- Nóta:** (i) Rinneadh páirteanna 2 agus 6 roimh lá an scrúdaithe. Tá na páirteanna 3 agus 4 páirtdeánta. Ag baint úsáid as na scriúna agus as na cnónna a sholáthraítear, cóimeáil an mheicníocht faoi mar atá sa líníocht chóimeála.
- (ii) Tá tábhacht ag baint le cruinneas, le bailchríoch agus le hoibriú.