



**Coimisiún na Scrúduithe Stáit  
State Examinations Commission**

**JUNIOR CERTIFICATE EXAMINATION, 2018**

**METALWORK  
MATERIALS AND TECHNOLOGY**

**Higher Level – 100 Marks**

**Tuesday, 19<sup>th</sup> 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 basic four-stroke engine.

Questions (a) to (c) relate to this diagram.

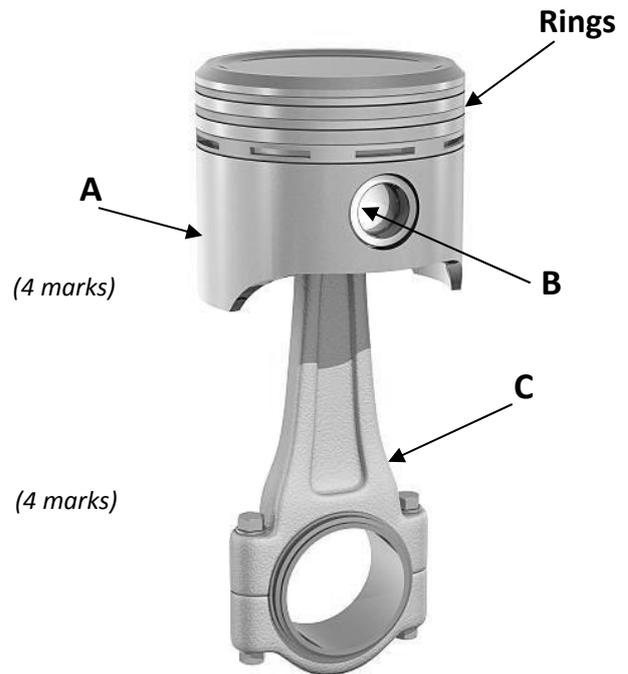


Figure 1

- (a) (i) Identify engine part **A** shown.  
(ii) Outline the function of the rings on part **A**. (4 marks)
- (b) (i) Name engine part **B** and name engine part **C** shown.  
(ii) Explain the purpose of part **B**. (4 marks)
- (c) (i) Describe the compression stroke of the four-stroke engine cycle.  
(ii) Explain how a four-stroke engine is lubricated. (4 marks)
- (d) Describe **any two** ways in which electric cars are helping to reduce the environmental impact of pollution caused by engines. (4 marks)
- (e) Describe briefly the contribution made to technology by **one** of the following people:  
(i) Harry Ferguson,  
(ii) James Dyson,  
(iii) Neil Papworth. (4 marks)
- (f) (i) Name **one** suitable plastic material which could be used to make the phone case shown.  
(ii) Explain **one** main difference between thermoplastics and thermosetting plastics. (4 marks)
- (g) (i) An LED TV is shown. Explain the meaning of the term LED.  
(ii) Draw the electronic symbol for a LED, as used in circuit diagrams. (4 marks)



Electric Car



Plastic phone case



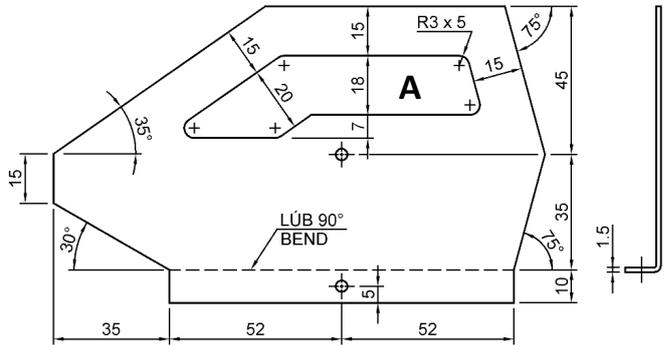
LED TV

**SECTION B – 20 Marks**  
**COMPULSORY**

Answer **any five** questions.

The drawings and the diagrams shown are taken from the **2018 Metalwork Higher Level Project, Model Snowcat**.

- (a) (i) Explain how the window labelled **A** is accurately marked-out on the side panel.
- (ii) Describe **any two** steps required to accurately shape the window labelled **A**.

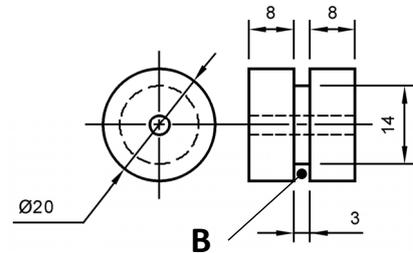


(4 marks)

**Side panel**

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

(4 marks)



**Track wheel**

- (c) (i) Describe **any two** stages required to produce the 3mm undercut, labelled **B**, in the track wheel.
- (ii) Explain the purpose of the undercut, labelled **B**, in the operation of the track wheel.

(4 marks)

- (d) (i) Identify **both** electronic components, labelled **X** and **Y**, used in the electric circuit for the model snowcat.
- (ii) Outline the function of **each** of the components, labelled **X** and **Y**, in the operation of the model snowcat.

(4 marks)



**Component X**



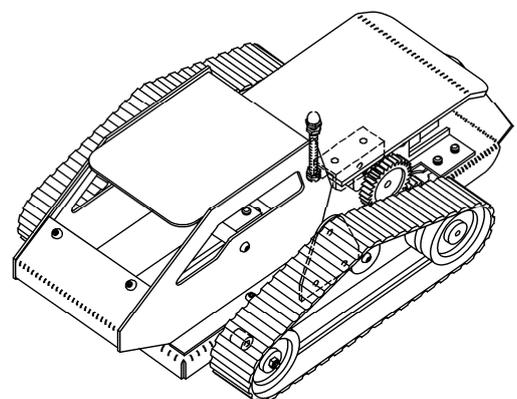
**Component Y**

- (e) Design, using a diagram(s), an adjustable tensioning system for **each** caterpillar track on the model snowcat.

(4 marks)

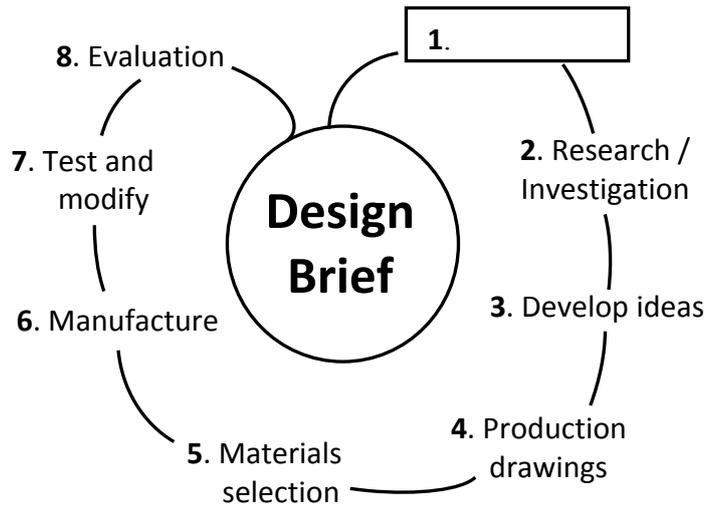
- (f) (i) Suggest **two** advantages for using caterpillar tracks instead of wheels in the model snowcat.
- (ii) The model snowcat includes two rear axles. Explain **one** reason for having two rear axles on the model.

(4 marks)



**Model snowcat**

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



- (a) (i) Suggest **any** suitable name for **stage one** of the design process shown opposite.
- (ii) Outline **any two** factors which may be considered at the “Evaluation” stage.
- (iii) Suggest **any three** factors which may be considered when selecting materials for the toy car shown.

(7 marks)



Toy car

A newly developed sports field is shown below.

- (b) (i) Design, using a diagram(s), a dugout shelter suitable for players and management. The dugout shelter should include:
- Protection from the elements for the players
  - A design that allows for full vision of the playing area.
- (ii) Design, using a diagram(s), seating for the dugout to accommodate up to *five* people and outline how the seating is to be fixed in the dugout.
- (iii) Select suitable materials for the dugout and seating.
- (iv) Suggest **one** suitable finish for **each** material selected in part (iii).



Newly developed sports field

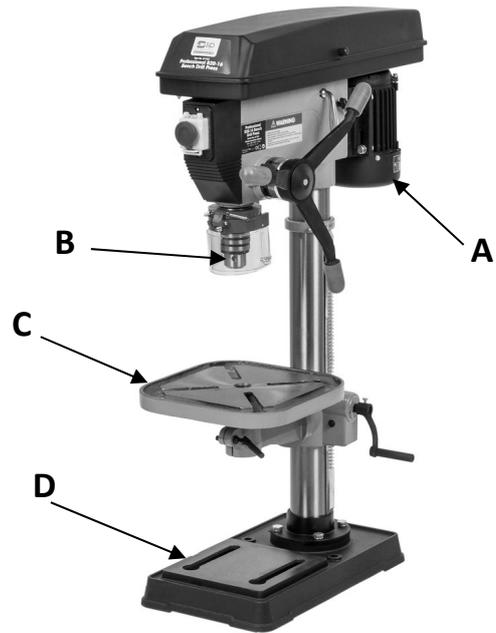
(13 marks)

### Question 3

20 Marks

- (a) (i) Name parts **A**, **B**, **C** and **D** of the pillar drilling machine shown.
- (ii) Name and describe a suitable mechanism used to adjust the height of part **C**.
- (iii) Identify **any two** integrated safety features on the pillar drilling machine shown.
- (iv) Name an alloy steel used to make drill bits and explain why this material is suitable for drill bits.

(10 marks)



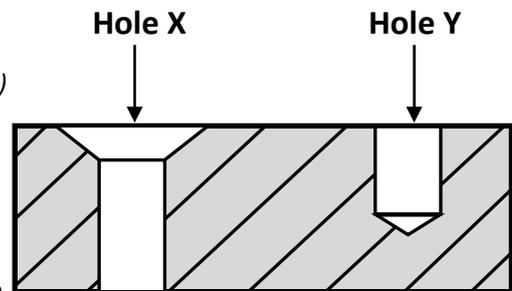
- (b) A  $\varnothing 16$  mm hole is to be drilled in a material which has a surface cutting speed of 120 m/min. Using the given formula, calculate the speed in RPM. (Take  $\pi$  as 3).

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

(4 marks)

- (c) (i) Name **each** of drilled holes **X** and **Y** shown opposite.
- (ii) Describe the stages required to fully thread hole **Y** using M4 taps.

(6 marks)



### Question 4

20 Marks

- (a) (i) Identify the type of furnace shown.
- (ii) List the materials in the charge.
- (iii) Describe, with the aid of a diagram(s), how heat loss from this furnace is prevented.
- (iv) Name part **A** and explain its function.
- (v) Outline the function of chute **B**.

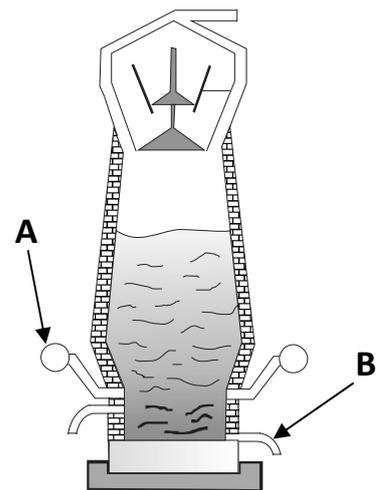
(10 marks)

- (b) (i) Explain why it is sometimes necessary for heat treatments to be applied to metal.
- (ii) Describe **any one** heat treatment process applied to a metal.

(6 marks)

- (c) (i) Name **one** suitable metal used to manufacture the disposable tray shown.
- (ii) Outline **any two** properties of the chosen metal which makes it suitable for the manufacture of the disposable tray.

(4 marks)



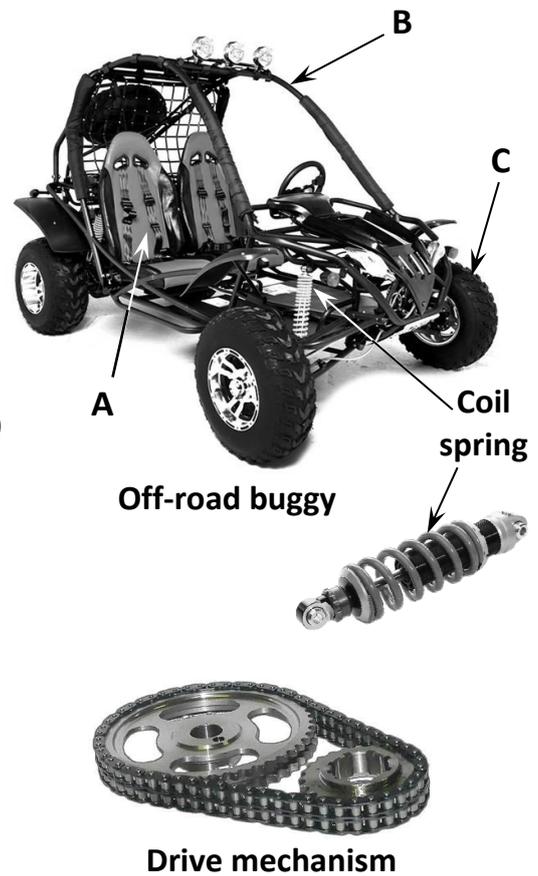
Disposable tray

### Question 5

20 Marks

An off-road buggy and drive mechanism are shown.

- (a) (i) Name a suitable material for **each** buggy part labelled **A**, **B** and **C**.
- (ii) State **one** reason for the selection of **each** material.
- (iii) Outline **any two** safety features on the off-road buggy shown.
- (iv) Explain the function of the coil spring on the off-road buggy. (10 marks)
- (b) (i) Identify the drive mechanism shown opposite.
- (ii) If the driver has 90 teeth and the driven has 15 teeth, what is the gear ratio?
- (iii) Identify **one** safety hazard associated with the drive mechanism shown.
- (iv) Describe, with the aid of a suitable diagram, **one** design feature to minimise the hazard identified by you in part **b (iii)**. (10 marks)

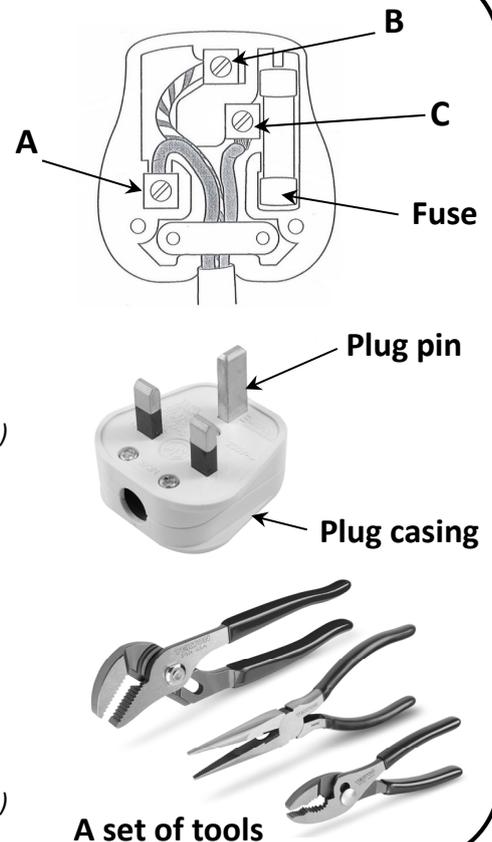


### Question 6

20 Marks

An electrical plug and a set of tools are shown.

- (a) (i) Name **each** of the terminals **A**, **B** and **C** in the plug shown.
- (ii) State the colour of the wire that should be connected to **each** terminal.
- (iii) Explain the function of the fuse shown.
- (iv) Suggest a suitable metal for the plug pin shown and outline **one** reason for your choice.
- (v) Explain why thermosetting plastics are used to manufacture the plug casing. (10 marks)
- (b) The handles of the tools shown are finished by plastic dip coating. Describe, using a diagram(s), the plastic dip coating process making reference to:
- heating the metal;
  - the method of applying a plastic finish;
  - **any two** safety precautions to be observed.
- (10 marks)



(a) (i) Classify the primary function, as input or output, for **each** of the following devices:

- Code scanner
- Drone controller
- Robotic arm
- Virtual reality goggles.



Code scanner



Drone controller



Robotic arm



Virtual reality goggles

(ii) A robotic arm uses stepper motors to control its movements. Describe the benefits of using a stepper motor.

(iii) Explain how the solar charger shown is used to charge a mobile phone.

(iv) Identify **one** other form of renewable energy.

(12 marks)



Solar charger

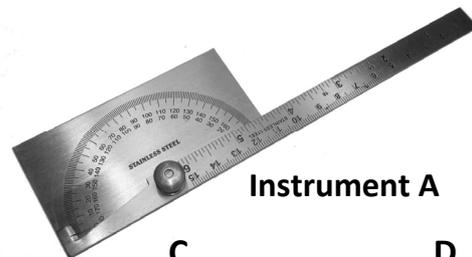
(b) (i) Name measuring instrument **A** and measuring instrument **B** shown.

(ii) Suggest a suitable application for **one** of the measuring instruments shown.

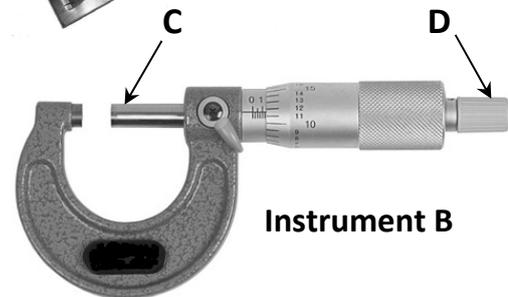
(iii) Identify the parts labelled **C** and **D** on instrument **B**.

(iv) What is the value of the reading shown opposite?

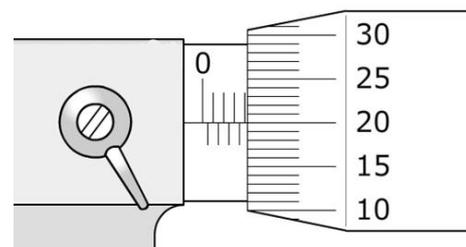
(8 marks)



Instrument A



Instrument B



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