



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Junior Certificate 2019

Marking Scheme

METALWORK
MATERIALS AND TECHNOLOGY

Higher Level

Note to teachers and students on the use of published marking schemes

Marking schemes published by the State Examinations Commission are not intended to be standalone documents. They are an essential resource for examiners who receive training in the correct interpretation and application of the scheme. This training involves, among other things, marking samples of student work and discussing the marks awarded, so as to clarify the correct application of the scheme. The work of examiners is subsequently monitored by Advising Examiners to ensure consistent and accurate application of the marking scheme. This process is overseen by the Chief Examiner, usually assisted by a Chief Advising Examiner. The Chief Examiner is the final authority regarding whether or not the marking scheme has been correctly applied to any piece of candidate work.

Marking schemes are working documents. While a draft marking scheme is prepared in advance of the examination, the scheme is not finalised until examiners have applied it to candidates' work and the feedback from all examiners has been collated and considered in light of the full range of responses of candidates, the overall level of difficulty of the examination and the need to maintain consistency in standards from year to year. This published document contains the finalised scheme, as it was applied to all candidates' work.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with their Advising Examiners when in doubt.

Future Marking Schemes

Assumptions about future marking schemes on the basis of past schemes should be avoided. While the underlying assessment principles remain the same, the details of the marking of a particular type of question may change in the context of the contribution of that question to the overall examination in a given year. The Chief Examiner in any given year has the responsibility to determine how best to ensure the fair and accurate assessment of candidates' work and to ensure consistency in the standard of the assessment from year to year. Accordingly, aspects of the structure, detail and application of the marking scheme for a particular examination are subject to change from one year to the next without notice.



**Coimisiún na Scrúduithe Stáit
State Examinations Commission**

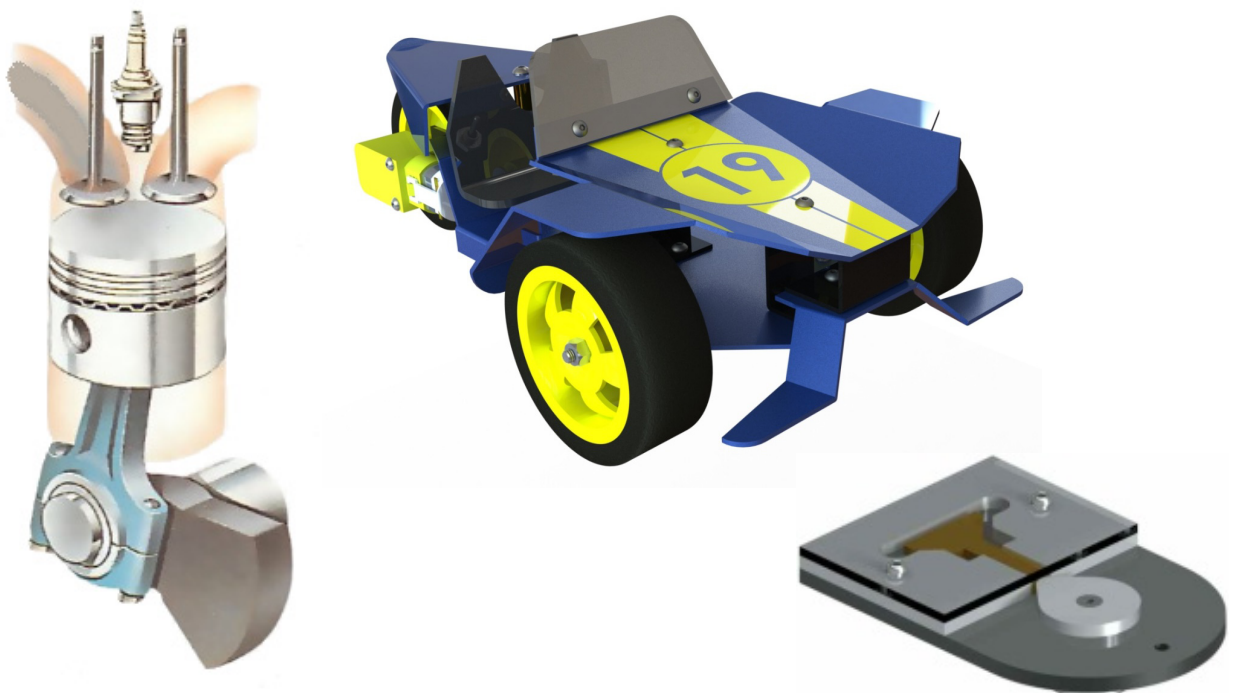
JUNIOR CERTIFICATE EXAMINATION, 2019

**METALWORK
*MATERIALS AND TECHNOLOGY***

HIGHER LEVEL

MARKING SCHEME

Written Examination, Practical Examination and Project



Written Examination - Answer Question 1, Section A and B, and three other questions.

Note: The solutions presented are examples only.

All other valid solutions are acceptable and are marked accordingly.

Question 1 – Section A (5 parts only) (a) (i) Name part A @ 2 marks (ii) Explain @ 2 marks 4 MARKS (b) (i) Explain @ 2 marks (ii) Describe @ 2 marks 4 MARKS (c) (i) Name @ 1 mark, Describe @ 1 mark (ii) Explain @ 2 marks 4 MARKS (d) Any one @ 4 marks 4 MARKS (e) Explain @ 2 marks Name two @ 1 mark each 4 MARKS (f) (i) Explain @ 2 marks (ii) Name @ 1 mark, Reason @ 1 mark 4 MARKS (g) (i) Identify @ 2 marks (ii) Application @ 2 marks 4 MARKS	Question 1 – Section B (5 parts only) (a) (i) Describe any two @ 1 mark each (ii) Two steps @ 1 mark each 4 MARKS (b) (i) Description @ 2 marks (ii) Description @ 2 marks 4 MARKS (c) (i) Operation @ 2 marks (ii) Modify @ 1 mark, Redraw @ 1 mark 4 MARKS (d) (i) Any Two @ 1 mark each (ii) Any Two @ 1 mark each 4 MARKS (e) (i) Design @ 2 marks, Diagram @ 1 mark (ii) Attach @ 1 mark 4 MARKS (f) (i) Any Two @ 1 mark each (ii) Any Two @ 1 mark each 4 MARKS
Question 2 (a) (i) Name @ 2 marks (ii) Any three factors @ 1 mark each (iii) Any two factors @ 1 mark each 7 MARKS (b) (i) Design of steering @ 3 marks Diagram @ 2 marks (ii) Design of seat @ 2 marks Diagram @ 2 marks (iii) Design hand-break @ 2 marks Diagram @ 2 marks 13 MARKS	Question 3 (a) (i) Name three @ 1 mark each (ii) Identify three @ 1 mark each (iii) Any two @ 1 mark each (iv) Describe any two @ 1 mark each 10 MARKS (b) Substitution @ 2 marks, Calculation @ 2 marks 4 MARKS (c) (i) 2 + 1 marks (ii) 2 + 1 marks (iii) 2 + 1 marks (Any TWO) 6 MARKS
Question 4 (a) (i) Identify @ 1 marks (ii) Name three @ 1 mark each (iii) Name A @ 1 mark, Explain @ 2 marks (iv) Purpose B @ 2 marks (v) Name @ 1 mark 10 MARKS (b) (i)-(iv) Define any two @ 2 marks each 4 MARKS (c) (i) Description @ 4 marks (ii) Any two @ 1 mark each 6 MARKS	Question 5 (a) (i) Material @ 1 + 1 mark, reason 1 + 1 mark (ii) Name any two @ 1 mark each (iii) Any two @ 1 mark each (iv) Any two advantages @ 1 mark each 10 MARKS (b) (i) Two drives @ 1 + 1 mark (ii) Two applications @ 1 + 1 mark (iii) Two reasons @ 2 marks each (iv) One hazard @ 2 marks 10 MARKS
Question 6 (a) (i) Description @ 3 marks (ii) Explain @ 2 marks (iii) Any two @ 1 mark each (iv) Describe @ 3 marks, 10 MARKS (b) (i) Two elements @ 1 mark each (ii) Any two @ 1 mark each (iii) Name @ 2 marks, two @ 1 mark each (iv) Any two @ 1 mark each 10 MARKS	Question 7 (a) (i) Identify three functions @ 1 mark each (ii) Explain @ 3 marks (iii) Positive @ 1 mark, negative @ 1 mark (iv) Any two @ 2 marks each 12 MARKS (b) (i) 2 marks (ii) Name @ 2 marks (iii) Any two @ 1 mark each (iv) One @ 2 marks 8 MARKS

Question 1, Section A - Compulsory

20 Marks

Five parts only to be counted

- (a) (i) Part **A** is the Piston *Name @ 2 marks*
 (ii) Piston rings provide a seal between the piston (part A) and the cylinder. The rings prevent lubricating oil passing into the combustion chamber. *Explain @ 2 marks*



4 marks

- (b) (i) The spark plug is used to ignite the compressed fuel-air mixture during the ignition stroke. *Explain @ 2 marks*
 (ii) During the exhaust stroke, the piston moves up while the exhaust valve is open. This action expels the spent fuel-air mixture through the exhaust valve. *Description @ 2 marks*



4 marks

- (c) (i) Part **C** is the Crankshaft. *Name @ 1 mark*
 Rotary (circular) motion takes place at the crankshaft. *Describe @ 1 mark*
 (ii) Four-stroke engines are lubricated by oil held in an oil sump. The oil is distributed through the engine by splash lubrication or a pressurised pump system. *Explain @ 2 marks*



- (d) (i) **Nikolaus Otto**; was a German engineer who successfully developed the compressed charge internal combustion engine which ran on petroleum gas and led to the modern internal combustion engine.
 (ii) **Guglielmo Marconi**; was an Italian inventor and electrical engineer, known for his pioneering work on long-distance radio transmission, development of Marconi's law, and a radio telegraph system. He is credited as the inventor of radio.
 (iii) **Tim Berners Lee**; is an English engineer and computer scientist, best known as the inventor of the World Wide Web. He implemented the first successful communication between a Hypertext Transfer Protocol (HTTP) client and server via the internet in mid-November 1989.



4 marks

- (e) (i) Smart technology (Self-Monitoring, Analysis, and Reporting Technology) is where a smart device (electronic device), generally connected to other devices or networks via different wireless protocols such as Bluetooth, NFC, Wi-Fi, LiFi, 3G, etc., that can operate to some extent interactively and autonomously. *Explain @ 2 marks*
 (ii) Examples of smart devices include smartphones, smart cars, smart thermostats, smart doorbells, smart locks, smart refrigerators, tablets, smartwatches, smart bands, smart key chains and smart speakers. *Name any two @ 1 mark each*



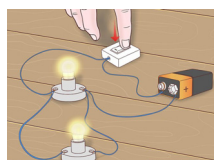
4 marks

- (f) (i) A non-ferrous metal is a metal, including alloys, that does not contain iron (ferrite) in appreciable amounts. *Explain @ 2 marks*
 (ii) One suitable non-ferrous material for the selfie stick arm is aluminium. *One suitable metal @ 1 mark*
 Aluminium is used due to its strength-to-weight ratio, corrosion resistance and attractive appearance. *One reason @ 1 mark*



4 marks

- (g) (i) Circuit **D** is connected in parallel *Identify @ 2 marks*
 (ii) Parallel circuits are used in car headlights, wiring of speaker systems in professional venues, streetlamps, house lighting and alarm systems. *One application @ 2 marks*



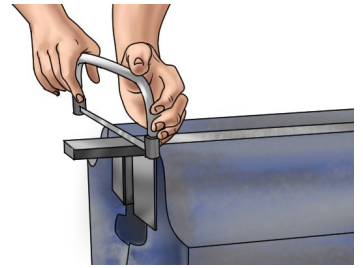
4 marks

Question 1, Section B - Compulsory
Five parts only to be counted

20 Marks

(a) (i) The section labelled **A** may be produces as follows: –

- mark-out and drill a series of pilot holes and finish with $\varnothing 16\text{mm}$ hole
- draw lines tangential to the hole to complete the outline of the shape
- cut-out the sections to the R8 hole
- file to the marked shape
- smooth file to finish the shape



Describe any two @ 1 mark each

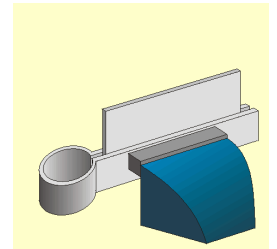
(ii) A high quality finish is achieved on the edge profile of the seat by smooth filing (draw filing) and ensuring that all rough edges are removed using a smooth file. A polish may then be applied to achieve a high quality finish.

Two steps @ 1 mark each

4 marks

(b) (i) The 85° bend on the rear cover may be completed by holding the work in a folding bar and striking the work with a mallet. Alternatively the support can be bent to shape using a folding machine. The accuracy of the finished bend can be checked using an engineers protractor.

Describe @2 marks



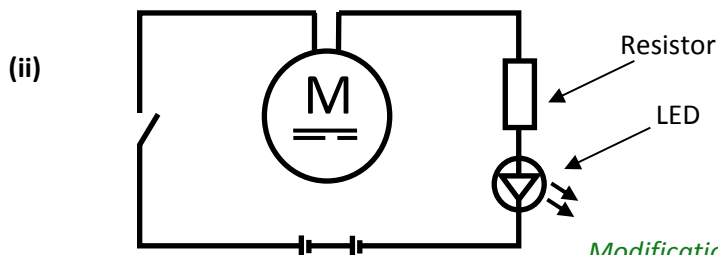
(ii) The R12 bend on the rear cover may be completed by holding the work in place against a $\varnothing 24$ former in a vice. A mallet is used to strike the work and form it to the required shape. The accuracy of the finished bend can be checked using the $\varnothing 24$ former.

Describe @ 2 marks

4 marks

(c) (i) The motor is activated to drive the model roadster by closing the toggle switch. The voltage from the power supply (battery) drives current around the circuit resulting in the motor rotating.

Operation @ 2 marks



Modification of circuit @ 1 mark
Redraw of circuit @ 1 mark

4 marks

(d) (i) The advantages of the motorised gearbox include:

- it is compact
- it increases the torque generated by the motor
- it is relatively cheap
- easy to assemble

Any two @ 1 mark each

(ii) Alternative drive mechanisms that could be used to drive the model may include:

- belt and pulley drive
- chain and sprocket drive
- meshing gears drive
- simple gearbox drive



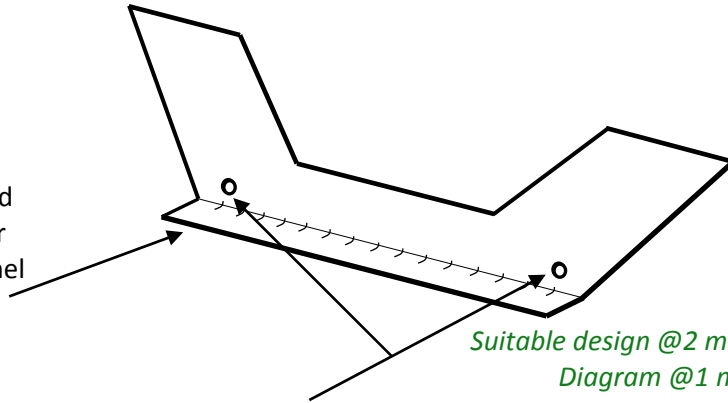
Any **two** @ 1 mark each



4 marks

(e) (i)

A step may be created by bending the lower section of the side panel outward as shown



Suitable design @2 marks
Diagram @1 mark

(ii)

Drilled holes in the side panel allow for it to be attached to the model roadster with screw fasteners

Attach @1 mark

4 marks

(f) (i) Safety features of a real life roadster include:

- warning lights
- breaking system
- rear view mirror



Any **two** @ 1 mark each

(ii) Safety precautions to be observed when riding a real life roadster include:

- wearing protective clothing
- wearing a helmet
- obeying the rules of the road



Any **two** @ 1 mark each

4 marks



Question 2

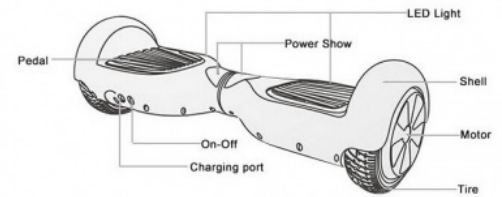
20 Marks

(a) (i) Stage **two** is the 'Research and Investigation'.

Name @ 2 marks

(ii) Information to be contained in the 'Production Drawings' stage include:

- dimensioning details
- wiring diagram
- parts and materials list
- assembly detail



Any three @ 1 mark each

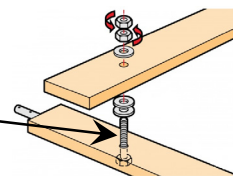
(iii) Factors to be considered when evaluating the hoverboard design include:

- the suitability of the material for the hoverboard, e.g. child-friendly plastic, strong non-corrosive materials, no sharp edges.
- is the design cost effective?
- is the finished product compliant with required safety standards?
- weight of the final product

7 marks

Any two @ 1 mark each

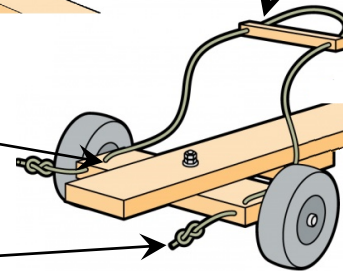
(b) (i) The front steering cross-member is pivoted to the frame. A self-locking nylon nut could be used to prevent loosening due to vibration.



Fit a short wooden plank to the top part of the rope to stop it from cutting into the driver's hands.

Drill two holes for the steering rope at the right and left sides of the front steering cross-member.

Fix the steering rope using two eye bolts or by knotting the end of the rope to stop the rope from passing through the holes.

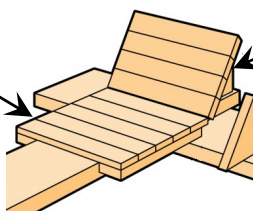


Any suitable steering design @ 3 marks

Suitable diagram @ 2 marks

(ii)

Wooden planks attached to the main frame using screws.



60° triangular wedges to provide a suitable angle for the back rest.

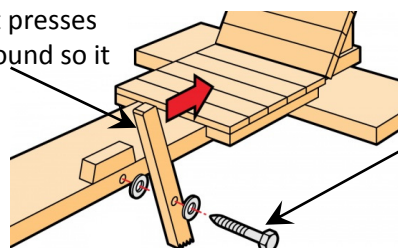
Foam cushioning to minimise vibration.



Any suitable seat design @ 2 marks

Any suitable diagram @ 2 marks

(iii) Pull the brake lever backwards; it presses against the ground so it



Screw the brake lever securely to the frame, either the left or the right side.

Saw grooves or fix a piece of car tyre to the end, so the braking lever doesn't wear so quickly.

Any suitable hand-break design @ 2 marks

Any suitable diagram @ 2 marks



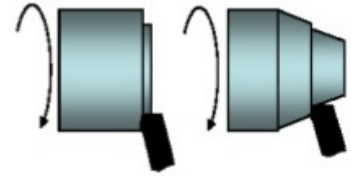
13 marks

Question 3

20 Marks

(a) (i) Lathe turning operations include:

- facing-off
- parallel turning
- taper turning
- parting-off
- centre drilling
- drilling
- threading



Name **three** @ 1 mark each

(ii) Safety precautions to be observed when operating a lathe include:

- wear eye protection
- remove chuck key
- ensure chuck guard is in place
- no loose clothing near moving parts



Identify **three** @ 1 mark each

(iii) Reasons why lathes run at different speeds include:

- turning of different materials (hard or soft)
- different turning operations (drilling, knurling)
- use of different cutting tools
- turning of different diameters of work

Cutting Tool	Mild Steel	Carbon Steel Annealed	Aluminum	Soft Brass	Cast Iron	Annealed Stainless
HSS	100	80	250 to 350	175	100	80 to 100
Carbide	300	200	750 to 1000	500	250	200 to 250

Any **two** @ 1 mark each

(iv) Advantages of using CNC for lathe work include:

- repeatability - identical parts can be made to high levels of accuracy
- increased rate of production of components
- increased accuracy of components produced
- safer working environment

Describe any **two** @ 1 mark each

10 marks

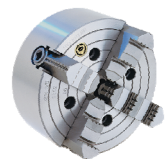
(b) The speed is 2250 rpm.

Correct substitution @ 2 marks

Correct calculation @ 2 marks

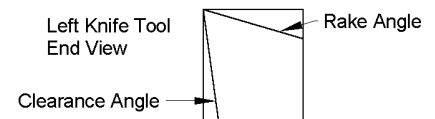
4 marks

(c) (i) The **three jaw chuck** is usually self-centering and hold the rotating work in a centre lathe.
The **four jaw chuck** is used to hold rotation work in the lathe.
The jaws are usually moved independently.



(ii) A **rake angle** facilitates the removal of the chip during the cutting operation.

A **clearance angle** ensures that only the cutting edge of the tool comes into contact with the work.



(iii) A **manual lathe** is used to turn a workpiece to shape. The operator controls the lathe movements to produce the desired finished product.

A **CNC lathe** also turns a workpiece to produce a shape. A series of codes are programmed into a computer which is then used to control the lathe movements, thus producing the finished product.



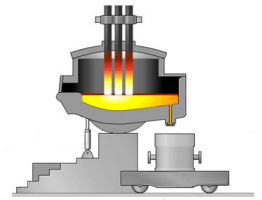
Any **two** parts @ 2 marks +1 mark

6 marks

Question 4

20 Marks

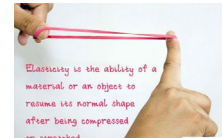
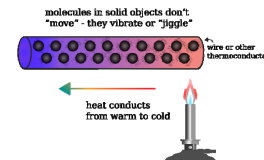
- (a) (i) The furnace shown is a Basic Oxygen Furnace. 1 mark
- (ii) The charge is made up of pig iron, scrap metal, lime, alloying elements. 3 elements @ 1 mark each
- (iii) Part A is the oxygen lance.
Name of part A @ 1 mark
 The oxygen lance is water cooled to prevent it from melting.
Explanation @ 2 marks
- (iv) Part B is the tapping spout. When the furnace is tilted, the molten steel is poured out spout B.
Purpose of part B @ 2 marks
- (v) Steel is also produced by the Electric Arc Furnace.
Furnace name @ 1 mark



Electric arc furnace

10 marks

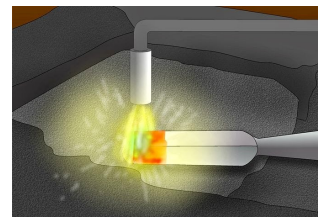
- (b) (i) *Conductivity* is the ability of a material to allow heat or electricity to flow through it.
- (ii) *Malleability* is the ability of a material to be shaped by hammering or pressing.
- (iii) *Elasticity* is the ability of an object or material to resume its normal shape after being stretched or compressed.
- (iv) *Brittleness* is the opposite of toughness. A brittle material can easily be fractured by an impact.



Define any **two** @ 2 marks each

4 marks

- (c) (i) *Hardening* – a piece of high carbon steel is heated to a cherry red. It is then quenched rapidly in water or oil to make the steel hard. The hard steel will also be brittle and may need to be tempered to make it suitable for use.
Description @ 4 marks
- (ii) Reasons why stainless steel is used for the skate blade include:
- Stainless steel has excellent resistance to corrosion
 - it can be sharpened and maintain a sharp edge
 - it is a strong, hard wearing metal



Any **two** @ 1 mark each

6 marks

Question 5

20 Marks

(a) (i) Suitable materials for ATV parts are:

- Part **A** - Rectangular section steel –
Reason - it has a high strength-to-weight ratio.
- Part **B**: Rubber
Reason - to provide good grip and allow a smoother ride over rough surfaces.



Suitable material @ 1 mark each
Suitable reason @ 1 mark each

(ii) Thermoplastic materials include:

- Poly Vinyl Chloride (PVC)
- Acrylic
- Nylon



Name any two @ 1 mark each

(iii) Reasons for using pneumatic tyres on the ATV include:

- Excellent grip on difficult terrain.
- Safe to use.
- Cost.



Any two @ 1 mark each

(iv) Advantages of using LED headlights include:

- Lighting Efficiency. LED headlights are built with greater strength and efficiency compared to halogen bulbs of the past.
- LEDs have a lower power consumption.
- LEDs are difficult to damage with external shock, unlike fluorescent and incandescent bulbs which are fragile.
- LEDs can be very small and are easily populated onto printed circuit boards



Any two @ 1 mark each

10 marks

(b) (i) Drive mechanism **1** is a pulley and belt

1 mark

Drive mechanism **2** is a gear train

1 mark

(ii) Applications of drive **1** include car fan belt, vending machine

1 mark

Applications of drive **2** include clocks, toys, printers

1 mark

(iii) The main reasons for lubrication of gear drives include:

- to reduce wear between rotating gears
- to reduce friction and heat build up
- to reduce noise

Any two @ 2 marks each



(iv) The main safety hazard associated with drive mechanism is a risk of getting a body part or clothing caught in such a mechanism

One hazard @ 2 marks

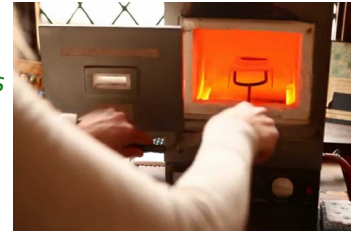
10 marks

Question 6

20 Marks

- (a) (i) The copper pendant is firstly marked-out. The pendant is then cut to shape using a snips / curved snips. A smooth file finish is then applied and edges are made safe.

Description @ 3 marks



- (ii) **Enamelling** is carried out by fusing powdered glass to a metal surface, by firing, usually between 750 and 850 °C. The powder then melts, flows, and hardens to a smooth, durable vitreous coating on metal. This process may also be carried out on glass or ceramics.

Explain @ 2 marks

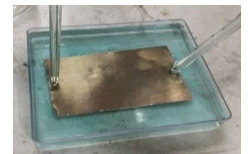
- (iii) Safety precautions to be observed when heating metals include:

- being aware of steam rising from metals cooled in water
- never pick up a piece of metal without being sure it is cold

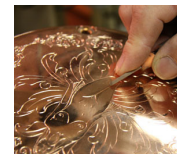


Any two @ 1 mark each

- (iv) **Mottling** – is the creation of overlapping polished circles on the surface of a metal. A dowel with one end coated in carbrundum paste is used to create the mottled effect on metal. One end of the dowel is held in the chuck of a drilling machine. The end with the paste is pressed onto the surface of the metal as it rotates creating the attractive appearance.



Etching - acid is used to bite away portions of a metal surface to produce a desired design.



Engraving –allows designs to be cut into a metal surface with sharp tools.

Describe one @ 3 marks

10 marks

- (b) (i) Copper and tin are the alloying elements used to make bronze.

Two @ 1 mark each



- (ii) Bronze is used to make trophies and statues because:

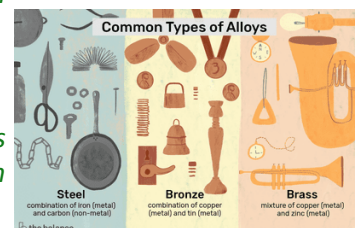
- it can be easily cast and moulded into intricate shapes
- it has high corrosion resistance
- it is a decorative metal
- heavy

Any two @ 1 mark each

- (iii) **Alloy name** – Solder
Alloying elements – Lead and tin

Name any alloy @ 2 marks

Two alloying elements @ 1 mark each



- (iv) Reasons for alloying metals include:

- improving mechanical properties of the metal
- Increasing the range of applications for the metal

Any two @ 1 mark each

10 marks

Question 7

20 Marks

(a) (i) The primary function of each device is classified as follows:

- Motion sensor - input
- Visualiser - input
- Headphones - output

1 mark
1 mark
1 mark



(ii) The term 32GB refers to the amount storage available on the USB memory stick. A GB or Gigabyte is a unit of measure of digital storage.



Explain @ 3 marks

(iii) *Positive impact:* Connect with friends and develop social skills. Social media gives people the chance to expand their social circle and develop new friendships. Other positives include social confidence, heightened literacy in the media, and more social support.



1 mark

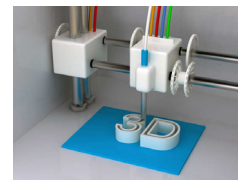
Negative impact: Cyberbullying can be a problem as people can take advantage of the fact that there is no one who can effectively stop the bullying when it happens, due to everything being performed behind a screen. Other negatives include distorted reality and excessive screen time.



1 mark

(iv) Advantages of modern engineering machines:

- repeatability - identical parts can be made to high levels of accuracy
- increased production of components
- increased accuracy of components produced
- safer working environment.

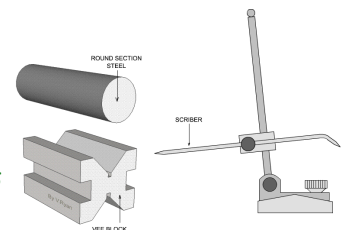


Any two @ 2 marks each

12 marks

(b) (i) V-Blocks are precision metalworking jigs typically used to hold round metal rods or pipes for performing drilling or milling operation.

2 marks



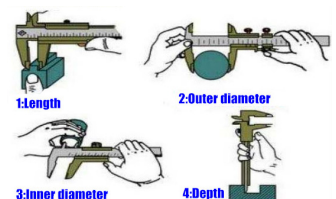
(ii) The measuring instrument is a Vernier Calipers

Name @ 2 marks

(iii) Vernier callipers may be used to measure:

- external diameters and widths
- internal diameters and widths
- depth measurements

Any two @ 1 mark each



(iv) A micrometer is also an engineering measuring instrument.

2 marks

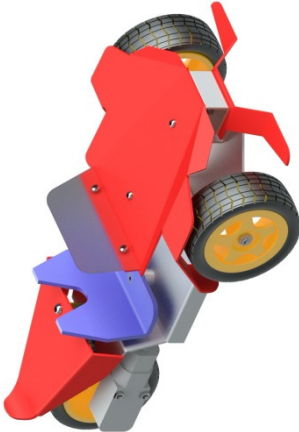
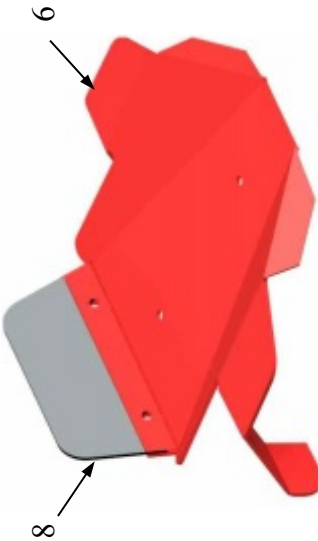
8 marks



Coimisiún na Scrúduithe Stáit
State Examinations Commission



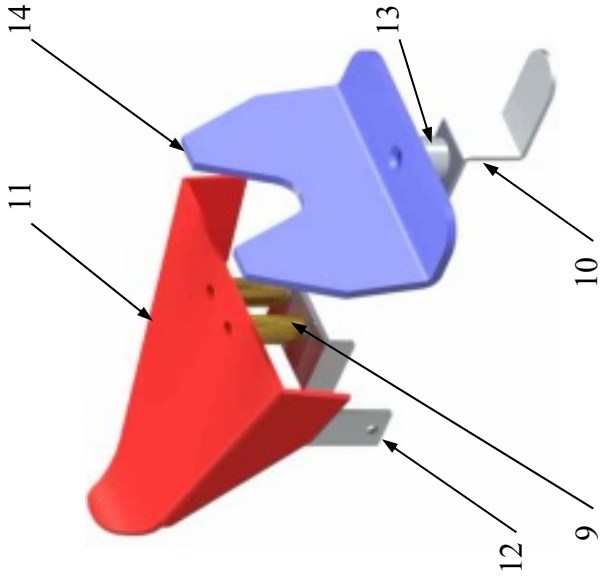
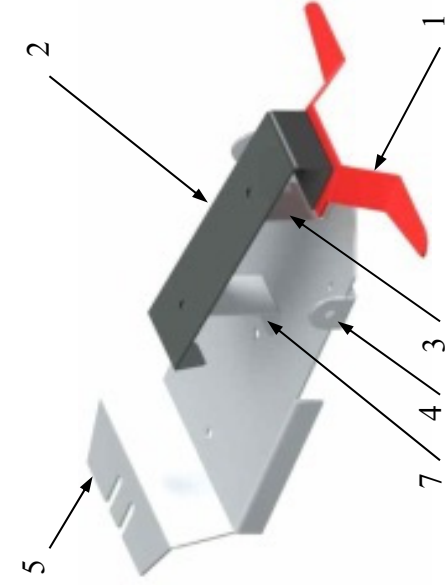
Junior Certificate Metalwork - Higher Level Project - Marking Scheme 2019

Subjective Grading 1/10							9-10 Excellent	7-8 Very Good	5-6 Good	3-4 Poor	1-2 Very Poor
Subjective Grading 1/5							5 Excellent	4 Very Good	3 Good	2 Poor	1 Very Poor
Section	Part Number	Pictorial Sketch/Description							Concept	Mark	Marks
1	Complete Model (Design Element not included)								Assembly	5	20
									Finish		
									Function		
2	Design	Design, make and attach a Left centre side-panel and a Right centre side-panel for the model. Each side panel must incorporate a Step and must add to the overall appearance of the model. Your design solution may include adjustments to already manufactured components. (Note: 20% of the marks will be awarded for this section.)							Left centre side-panel: Subjective Grade 1-10	10	20
							Right centre side-panel: Subjective Grade 1-10	10			
3	Parts 6 & 8								Part 6 Bonnet	16	20
									Part 8 Windscreen	4	



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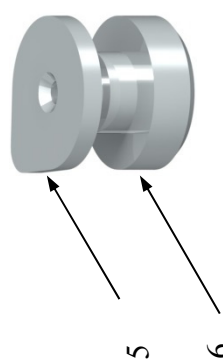
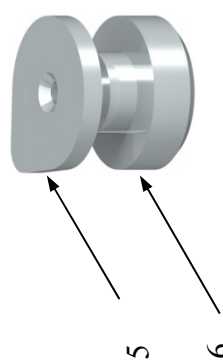
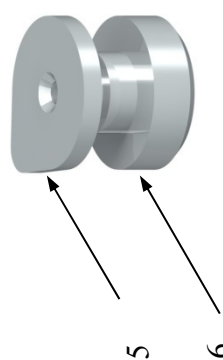
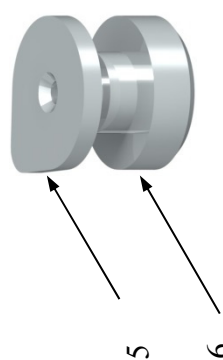
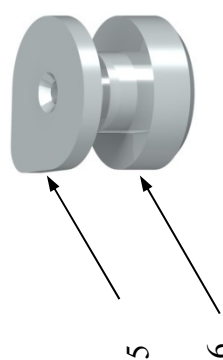
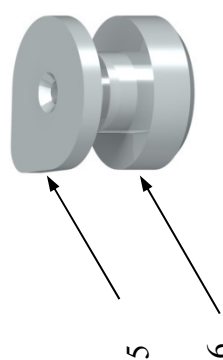
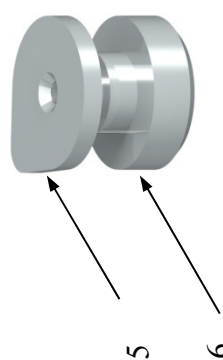
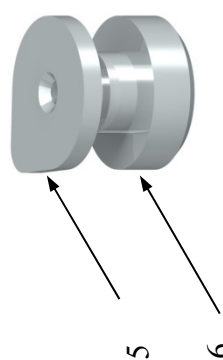
Junior Certificate Metalwork - Higher Level Project - Marking Scheme 2019

4	Parts 13, 14, 9, 11, 12 & 10		Parts 13 & 14 Seat Support & Seat	Mark Out, Turn, Drill, CSK, Shape & Bend	6	20
			Parts 9 & 11 Rear Cover Supports & Rear Cover	Mark Out, Turn, Drill, Shape & Bend	6	
			Part 12 Motor Support	Mark Out, Drill, Tap & Shape	6	
			Part 10 Battery Holder Support	Mark Out, Drill, Shape & Bend	2	
5	Parts 5, 4, 1, 2, 3 & 7		Parts 5 & 4 Chassis & Axle Support	Mark Out, Drill, Shape & Bend	10	20
			Part 1 Spoiler	Mark Out, Drill, Shape & Bend	4	
			Parts 2, 3 & 7 Switch/Spoiler Support, Bonnet Front & Rear Supports	Mark Out, Drill, Shape & Bend	6	

100 Marks (× 1.5 = 150 Total)



Junior Certificate Metalwork - Higher Level Practical Examination - Marking Scheme 2019

Subjective Marking 1-10		9-10 Excellent		7-8 Very Good		5-6 Good		3-4 Poor		1-2 Very Poor	
Subjective Marking 1-5		5 Excellent		4 Very Good		3 Good		2 Poor		1 Very Poor	
Section	Part Number	Pictorial Sketch / Description				Concept		Mark		Marks	
1	Parts 1, 2, 3, 4, 5, & 6					Complete Piece	Assembly: Subjective Marking 1 - 5	5		20	
								5			
								10			
2	Parts 1 & 3					Part 1 Cover	5	1		20	
								2			
								2			
3	Part 2					Part 3 Backplate	15	2		20	
								10			
								3			
4	Part 4					Part 2 Valve Housing	20	5		20	
								10			
								3			
5	Parts 5 & 6					Part 4 Valve	20	2		20	
								10			
								6			
5	Parts 5 & 6					Part 5 Cam	10	3		20	
								5			
								2			
5	Parts 5 & 6					Part 6 Knob	10	2		20	
								4			
								2			
5	Parts 5 & 6					Mark Out	45° Angles (2 × 3)	6		20	
								2			
								3			
5	Parts 5 & 6					Profile	Lengths & Diameters	4		20	
								2			
								2			
5	Parts 5 & 6					Drill & CSK	Mark Out	2		20	
								2			
								2			
5	Parts 5 & 6					Mark Out	Lengths & Diameters	4		20	
								2			
								2			
5	Parts 5 & 6					Drill & Tap	Chamfer	2		20	
								2			
								2			

100 Marks (x 1.5 = 150 Total)