



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2018

Marking Scheme

ENGINEERING –
Materials and Technology

Ordinary 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.

LEAVING CERTIFICATE 2018

Marking Scheme

Written Examination and Practical Examination

ENGINEERING –
Materials and Technology

ORDINARY LEVEL

LEAVING CERTIFICATE

ENGINEERING - Materials and Technology

(Ordinary Level – 200 marks)

Written Examination Marking Scheme 2018

Answer Question 1, Sections A and B and Three other questions.

Question 1:

Total - 65 Marks

Section A – 30 Marks

Any six @ 5 marks each

Two part answers 3 + 2

Section B – 35 Marks

Any three parts @ 12 + 12 + 11 marks

Two part answers 6 + 6 or 6 + 5

Question 2: Total - 45 Marks

- (a) Three parts @ 4 each (12)
- (b) One part @ 5
One part @ 3
One part @ 2 (10)
- (c) (i) Three parts @ 3 each
(ii) Three parts @ 2 each (15)
- (d) Two parts @ 4 each (8)

Question 3: Total - 45 Marks

- (a) Two parts @ 5 each
Two parts @ 5 each (20)
 - (b) One part @ 6
One part @ 5 (11)
 - (c) Two parts @ 3 each (6)
 - (d) Two parts @ 4 each (8)
- OR**
- (d) Two parts @ 4 each (8)

Question 4: Total - 45 Marks

- (a) (i) Two parts @ 2 each
(ii) Two parts @ 2 each
(iii) One part @ 4 &
Two parts @ 3 each (18)
- (b) Three parts @ 3 each (9)
- (c) Three parts @ 4 each (12)
- (d) Two parts @ 3 each (6)

Question 5: Total - 45 Marks

- (a) (i) Three parts @ 3 each
(ii) One part @ 9 (18)
- (b) Three parts @ 5 each (15)
- (c) Two parts @ 3 each (6)
- (d) Two parts @ 3 each (6)

Question 6: Total - 45 Marks

- (a) (i) One part @ 4 &
Two parts @ 3 each
(ii) One part @ 4 &
Two parts @ 3 each (20)
 - (b) Two parts @ 5 each (10)
 - (c) Three parts @ 5 each (15)
- OR**
- (c) Three parts @ 5 each (15)

Question 7: Total - 45 Marks

- (a) (i) Two parts @ 3 each
(ii) Two parts @ 2 each (10)
 - (b) Four parts @ 5 each (20)
 - (c) Three parts @ 5 each (15)
- OR**
- (c) Three parts @ 5 each (15)

Sample Answers *and* Marking Scheme

Note: The solutions presented are examples only.

All other valid solutions are acceptable and are marked accordingly.

Question 1

(65 Marks)

SECTION A - 30 MARKS

6 parts @ 5 marks each

For two part answers award 3 + 2

SECTION B - 35 MARKS

2 parts @ 12 marks each

1 part @ 11 marks

Award 6 + 6 or 6 + 5 as appropriate

SECTION A – 30 MARKS		MARKS
(a) (i) Ensure the work piece is secured tightly in the chuck. (ii) Test run the programme.		3 + 2 Marks
(b) Renewable energy source.		5 Marks
(c) (i) A cloths line tensioner. (ii) A ratchet spanner.		3 + 2 Marks
(d) (i) To achieve accuracy/function of the final product. (ii) To allow other people manufacture the same product.		3 + 2 Marks
(e) A temporary joint is one which can be disassembled such as using a machine screw and nut.		5 Marks
(f) The short leg on a LED is connected to the negative side of the battery.		5 Marks
(g) Solder		5 Marks
(h) (i) To connect a phone to a charger. (ii) To connect a printer to a computer.		3 + 2 Marks

SECTION B – 35 MARKS

(i) Any one:

Describe
Award 12 (11) Marks
Total (12, 11) Marks

Four jaw independent chuck

The jaws in this chuck can be moved independently of one another, each being controlled by its own screw. They are also reversible and therefore only one set is required. The four jaw independent chuck is used for eccentric turning and for gripping square, round, rectangular and irregular shapes. The work can be centered more accurately in this chuck than in the self-centering one, but it takes longer. The concentric circles on the face of the chuck serve as a guide when positioning the work.

Strip heater

A strip heater is used to form straight or small curvature bends in thermoplastic sheet material. An electric element or hot wire is enclosed in a channel which has an opening at the top. Thermoplastic sheet is placed across supports above the opening. By adjusting the height of the supports the width of strip to be heated can be altered. The supports are set to a low height for tight bends. If a more gradual bend is required the heated area is widened by setting the supports higher. Different thicknesses of sheet may be formed by thermostatically controlling the heating temperature.

Knurling tool

A knurling tool is used on a centre lathe to apply a grip to the surface of a piece i.e. scribe / centre punch. The knurling tool is fitted to the tool post and set at 90° to work. The knurling tool has two opposing rollers which are pressed into the piece and when moved parallel to the axis of the work will produce a diamond pattern on the surface of the material.

(j) Any two:

Virus

A program or piece of code that operates by attaching itself to some other program or downloaded file. When this program starts the virus code runs, replicates itself and infects other programs or documents on the PC without the user's knowledge. Written with the deliberate intention of corrupting files, a computer virus can seriously damage or completely destroy files or software on a computer.

Explain
Award 6 + 6(5)
Total (12, 11) Marks

CNC laser cutter

A CNC laser cutter uses a laser beam to cut through the work piece. Laser cutters are used to cut materials precisely and are capable of very accurate work. CNC laser cutters can also be used for etching a range of materials such as glass, plastics and woods. A 2D vector drawing needs to be generated which is then sent to the laser cutter. Care needs to be taken with the exhaust fumes, particularly when cutting plastics.

Social networks

Social networks are platforms for individuals to chat over the internet using certain applications on their computers or phones. They provide an opportunity for people

to stay in contact from different parts of the world. Facebook, WhatsApp and Wechat are examples of usable applications.

Web browser

A web browser provides a platform for the user to access the internet for information. It provides an access point to search, gather and store information as required.

(k) Electrical insulator:

An electrical insulator prevents the flow of current (electricity) through it.

Name:

Plastic / Rubber

Definition

Award 6

Example

Award 6(5)

Total (12, 11) Marks

(l) Any two:

Printed circuit board (PCB)

A PCB is a thin board made of fiberglass, composite epoxy, or other insulating material. Conductive pathways are etched or "printed" onto board, connecting different components on the PCB, such as transistors, resistors, and integrated circuits. PCBs are used in both desktop and laptop computers.

Explain

Award 6 + 6 (5)

Total (12, 11) Marks

Rack and pinion

A rack and pinion is a gear mechanism where rotary motion of the pinion moves the rack in a linear motion or linear motion of the rack will rotate the pinion. Can be used to move the table of a drilling machine up or down.

Parting off tool

A parting off tool is a lathe cutting tool which can be used to cut pieces at 90° to their axis on the lathe.

Variable resistor

A variable resistor can be used to adjust the flow of current in a circuit. A dimmer switch (variable resistor) allows the user to adjust the light levels in a room.

(m)

Name:

Countersink drill

Function:

A countersinking drill is a cutter which widens the mouth of a hole to accommodate a CSK screw, the screw fits flush with the surface. Countersinking drills have point angles of either 60° or 90°.

Name

Award 6

Function

Award 6(5)

Total (12, 11) Marks

Question 2

(45 Marks)

- (a) (i) **Name:** Blast furnace
(ii) **Name:** Electrical arc furnace
(iii) **Name:** Basic oxygen furnace

Function: Production of pig iron
Function: Production of steel
Function: Production of steel

Name and function
Award 3 @ 4 Marks
Total (12) Marks

- (b) **Selected Furnace**
(i) **Diagram & parts**

Blast furnace

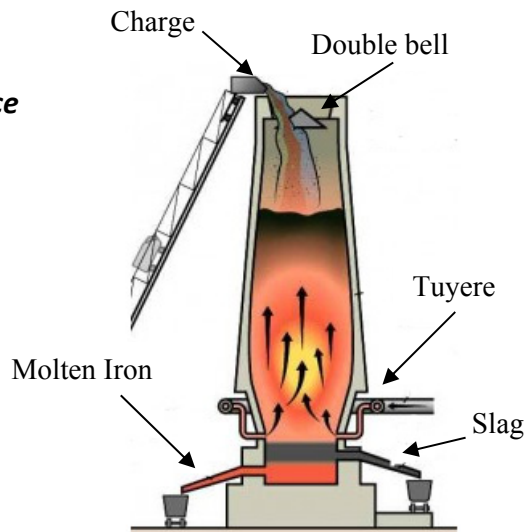
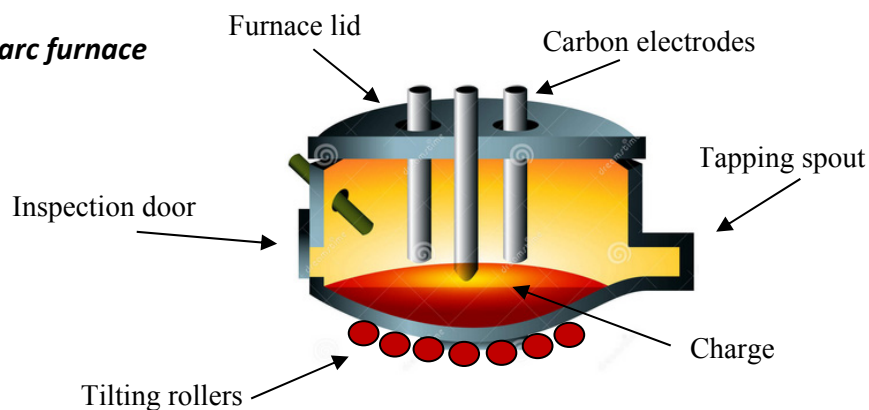
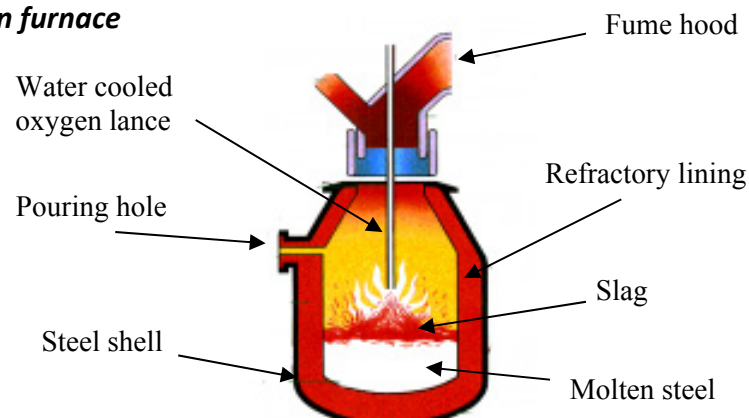


Diagram and parts
Award 5 Marks
Total (5) Marks

Electric arc furnace



Basic oxygen furnace



(ii) Materials in the charge

Blast furnace - Iron ore, Coke, Limestone
Electrical arc furnace - Molten iron / scrap metal, lime, carbon
Basic oxygen furnace - Molten iron / scrap metal, lime, carbon

Materials
Award 3 Marks
Total (3) Marks

(iii) Metal removal

Blast furnace - Both tapped from the bottom, slag on top, iron on bottom.
Electrical arc furnace - Furnace is tilted on rollers and both are poured off.
Basic oxygen furnace - Furnace is rotated and the steel is poured out through a pouring hole, the furnace is then rotated in the opposite direction and the slag emptied out.

Describe
Award 2 Marks
Total (2) Marks

(c) (i) Material:

(ii) Reason:

Lathe cutting tool: Tungsten carbide

Can cut at high temperatures without losing its edge.

Musical instrument: Brass

Will not rust / easy to solder.
Helps to produce a good sound.

Lathe bed way: Cast iron

Strong in compression / wears well
and has good dampening properties

(i) Material
Award 3 @ 3 Marks
(ii) Reason
Award 3 @ 2 Marks
Total (15) Marks

(d) Ferrous & Non-ferrous Metals, any two:

Aluminium: Non-Ferrous
Copper: Non-ferrous
Cast iron: Ferrous

Ferrous / Non-ferrous
Award 2 @ 4 Marks
Total (8) Marks

Question 3

(45 Marks)

(a) (i) **Cooled quickly** - Hardening

Property - Very hard and brittle, will break / shatter easily.

Name
Award 5 Marks
Property
Award 5 Marks
Total (10)

(ii) **Cooled slowly** - Annealing

Property - Very soft and malleable, easy to bend / shape.

Name
Award 5 Marks
Property
Award 5 Marks
Total (10)

(b) **Heat treatment processes**

(i) & (ii) Describe
Award 1 @ 6 Marks
Award 1 @ 5 Marks
Total (11)

(i) **To temper the point of a scriber:**

The point is cleaned and polished with emery paper. It is then heated away from the point to allow the colours to appear and run to the point. When the correct colour, light straw, appears at approx. 250° to 350°C the point is quenched in cold water. This removes some of the hardness and increases toughness.

(ii) **To case harden the point of a screwdriver:**

The tip of the screwdriver is heated to approx. 900° C and placed in a carbon rich powder for a period of time. This will absorb carbon into the steel and it can then be hardened by heating and quenching.

(c) **Two safety precautions:**

- Wear protective clothing to protect from hot water splashes or rising steam.
- Use a tongs or pliers to hold the hot material.

Safety precautions
Award 2 @ 3 Marks
Total (6) Marks

(d) **Any two metal properties:**

(i) **Conductivity:**

Conductivity is the ability of a material to allow heat or current to pass through it.

(ii) **Brittleness:**

Brittleness is the inability of a material to withstand impact i.e. a brittle material will fracture if subjected to an impact or blow.

(iii) **Toughness:**

Toughness is the ability of a material to withstand a blow or an impact.

Explain
Award 2 @ 4 Marks
Total (8)

OR

(d) **Two applications for robotics:**

- Welding metal parts on car assembly lines.
- Pick and place electronic components on PCB's.

Applications
Award 2 @ 4 Marks
Total (8) Marks

Question 4

(45 Marks)

(a) (i) **Name of gases**

Oxygen & Acetylene

Name

Award 2 @ 2 Marks

Total (4) Marks

(ii) **Colour of cylinders**

Oxygen cylinder - Black

Acetylene cylinder - Maroon (red)

Colour

Award 2 @ 2 Marks

Total (4) Marks

(iii) **Types of flame**

Oxidising flame

Neutral flame

Carburising flame

Types of flame

Award 1 @ 4 Marks

Award 2 @ 3 Marks

Total (10) Marks

(b) **Function of any three:**

Function

Award any 3 @ 3 Marks

Total (9) Marks

(i) **Welding mask**

A welding mask is required to protect the user from the bright light and heat of the welding process affecting both the eyes and the skin on the face.

(ii) **Generator**

A generator is used to produce the electricity required by the manual metal arc welding process when a mains electricity supply is not available.

(iii) **Electrode holder**

Electrode holder is used to hold the electrode when welding.
The handle is insulated.

(iv) **Leather gloves**

Leather gloves are used to protect the user from burns due to the arc, molten splatter or when handling hot metals.

(c) Any three:

Award 3 @ 4 Marks
Total (12) Marks

(i) Advantages of spot welding:

- Does not require a high level of skill to use
- Portable.

(ii) Permanent joint between electronic components

Soldering.

(iii) Reason for using a locknut:

Locknuts are used in assemblies because they do not loosen due to vibrations.

(iv) Health Hazards:

- Fumes from the burning gases
- High temperatures produced by the gases.

(d) Two safety precautions:

- Keep the hot soldering iron in its stand when not in use
- Do not touch the point of the hot soldering iron.

Safety precautions
Award 2 @ 3 Marks
Total (6) Marks

Question 5

(45 Marks)

(a) (i) Processes:

Safety hat - Injection molding

Baby bottle - Blow molding

Toy car - Vacuum forming

Name

Award 3 @ 3 Marks

Total (9) Marks

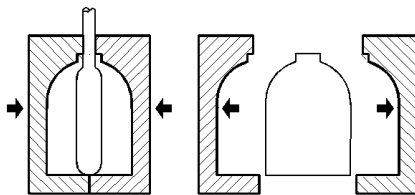
(ii) Any one process from 5(a)(i):

Describe

Award 9 Marks

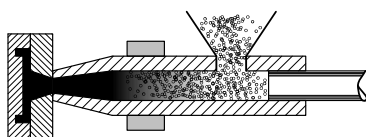
Total (9) Marks

Blow Moulding



Used to produce articles from a heated thermoplastic tube called a parison. The article is moulded by the internal shape of a split mould. The mould closes around the extruded parison and air is blown inside forcing the parison out against the wall of the mould. The component is allowed to cool before being removed from the opened mould.

Injection Moulding:

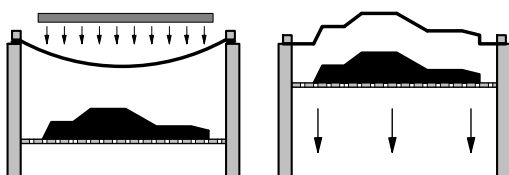


Thermoplastic is softened by heating it inside an injection nozzle.

The softened plastic is forced by a plunger into a cold mould where it hardens rapidly and is then ejected.

Injection moulding is used for the rapid moulding of components

Vacuum forming:



Vacuum forming is used to make articles from thermoplastic sheet. The sheet is clamped and a heater raises the temperature of the sheet until it becomes soft and flexible. The mould table is raised and air is removed from beneath the sheet allowing atmospheric pressure to push down, forcing the sheet to take up the shape of the mould. When the mould table is lowered the vacuumed formed sheet can be removed for finishing.

(b) Plastic technology:

- (i) Thermosetting plastic
- (ii) Thermoplastic
- (iii) Recycling.

Award 3 @ 5 Marks
Total (15) Marks

(c) Suitable plastic:

- (i) Plastic bag: Polyethylene
- (ii) Garden hose pipe: Polyvinylchloride (PVC)
- (iii) Fast food container: Polystyrene

Name
Award 2 @ 3 Marks
Total (6) Marks

(d) Safety precautions:

- Do not touch hot parts of the strip heater when in use
- Use gloves when handling the hot plastic.

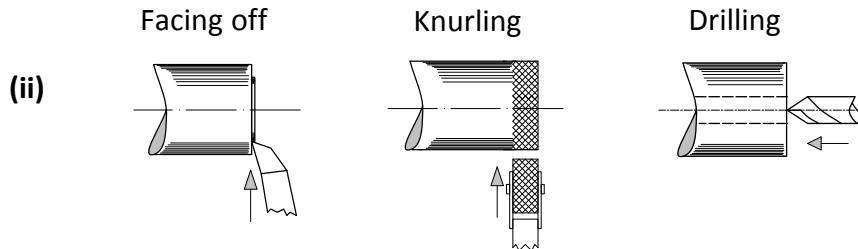
Safety precautions
Award 2 @ 3 Marks
Total (6) Marks

Question 6

(45 Marks)

(a) Steering wheel:

(i) Taper turning, drilling, parallel turning, facing off, knurling...



(i) Name

Award 1 @ 4 Marks

Award 2 @ 3 Marks

(ii) Describe

Award 1 @ 4 Marks

Award 2 @ 3 Marks

Total (20) Marks

(b) Lathe work holding methods:

(i) Self centering 3 jaw chuck

A self-centering 3 jaw chuck is used to hold round or hexagonal bars on a centre lathe when turning or drilling. Because of the 120° between each jaw, the chuck will only hold round or hexagonal bars on centre.

(ii) Using a centre

A centre can be fitted to the spindle of the tailstock and used to provide support when machining long bars on the lathe.

(b) (i) & (ii) Describe

Award 2 @ 5 Marks

Total (10) Marks

(c) Centre lathe part:

(i) **Name:** Four-way toolpost

(ii) **Function:**

Holds up to 4 tools and allows each to be used as needed by rotating the tool post through 90° .

(iii) **Safety precautions:**

- Make sure the cutting tool is secured correctly before use
- Make sure all tools are on centre when setting up in the tool post.

(i) Name

Award 5 Marks

Total (5) Marks

(ii) Describe

Award 5 Marks

Total (5) Marks

(iii) Safety Precautions

Award 5 Marks

Total (5) Marks

OR

(c) Any three CNC lathe terms:

Describe Award 3 @ 5 Marks Total (15) Marks

(i) Safety guard

The safety guard encloses the working area of a CNC lathe, if it is opened the lathe will turn off. The guard is see through to allow the user to watch what is happening.

(ii) Stepper motor

A stepper motor turns in steps. A full rotation might require 200 steps, a half rotation 100 steps. The number of steps will determine how many rotations the motor will achieve. If a computer is used to control the number of steps, very accurate control of movement is achieved making it suitable for a CNC lathe.

(iii) Part programme

The CNC lathe requires a control programme or code to move the cutting tool and control speeds automatically. The code or control programme must be written before the CNC lathe will machine the part. This programme is used to instruct the CNC lathe how to produce the required part.

(iv) CAM

CAM stands for 'Computer Aided Manufacture'. This is where computers are used to produce drawings and control machines to manufacture a component.

Question 7

(45 Marks)

(a) (i) Any two methods:

- Digital vernier calipers
- Micrometer.

(ii) Two advantages:

- Easy to read
- More accurate as exact measurement is displayed.

(i) Methods

Award 2 @ 3 Marks

(ii) Advantages

Award 2 @ 2 Marks

Total (10)

(b)

- (i) Nominal diameter of the shaft: 20.00 mm
 (ii) Largest diameter of the shaft: 20.08 mm
 (iii) Smallest diameter of the hole: 19.95 mm
 (iv) Type of fit. Interference fit

Calculations & fit

Award 4 @ 5 Marks

Total (20)

(c) Any three:

Name & application (3 + 2)

Award 3 @ 5 Marks

Total (15)

(i) **Surface table** - Used with a Vernier height gauge for marking out.

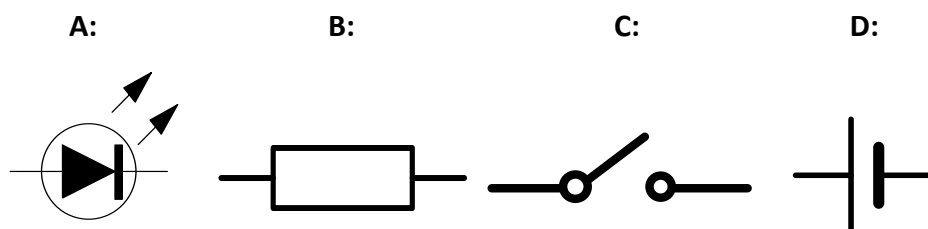
(ii) **Vernier height gauge** - Used for accurately marking out pieces.

(iii) **Gap gauge** - Used for checking linear measurements.

(iv) **Engineer's protractor** - Used to accurately measure angles.

OR

(c) (i) Any three circuit symbols:



(c) (i) & (ii)

Draw & function (3 + 2)

Award 3 @ 5 Marks

Total (15)

(ii) Function:

A: LED, will light up indicating current flow.

B: Fixed resistor, protects the LED slowing down the current flow.

C: Toggle switch, turns on or off the flow of current in the circuit.

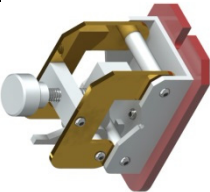
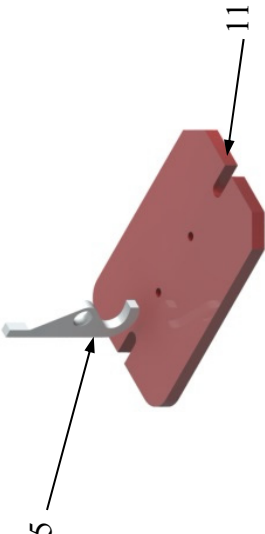
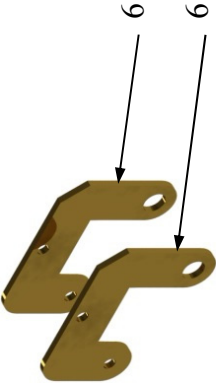
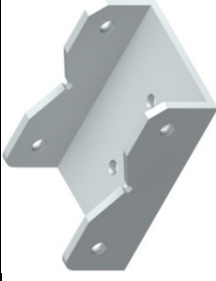
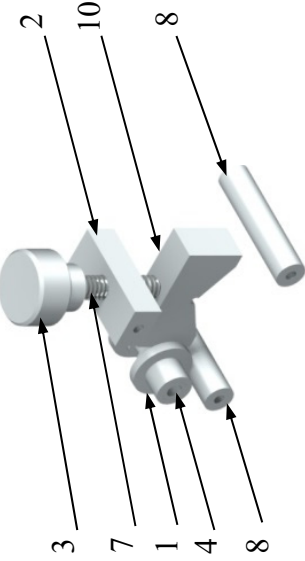
D: Battery, provides electricity energy to the circuit.



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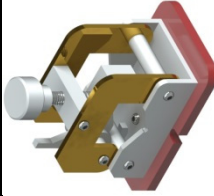
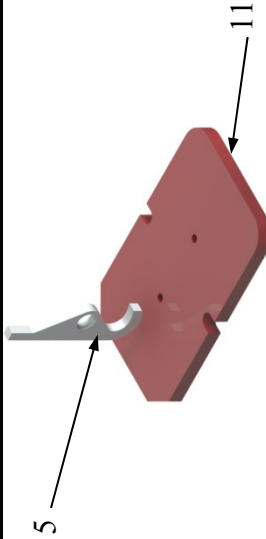
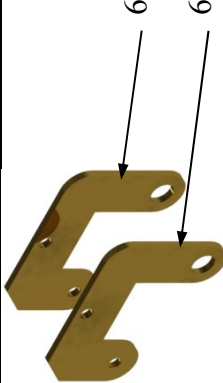
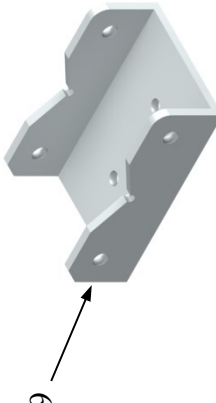
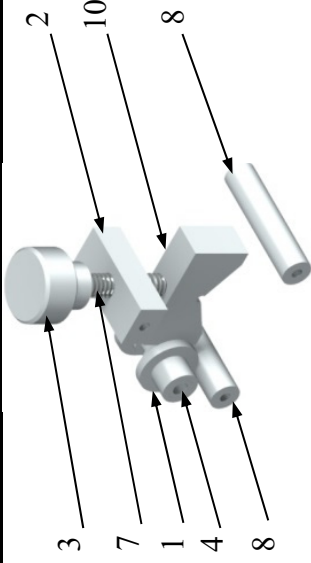


Day 1 - Leaving Certificate Engineering - Practical Marking Scheme 2018

Subjective Marking 1 - 20										17 - 20 Excellent										13 - 16 Very Good										9 - 12 Good										5 – 8 Poor										1 - 4 Very Poor									
Section	Part Number		Pictorial Sketch / Description										Concept																				Mark	Mark																									
1	All Parts of Test-piece												Assembly Function Finish Subjective Mark 1 – 20										5 10 5										20										20																
2	Parts 5 and 11												Part 5 10 Marks Part 11 10 Marks										Marking Out Ø8.1 mm Hole External Profile Marking Out 2 × 6 mm Slots 2 × M5 Holes 10 mm Radii and Chamfers										4 1 5 2 2 2 4										20										20						
3	Parts 6												Parts 6 20 Marks										Marking Out External Profiles Internal Profiles 4 × Ø5.5 mm Holes 2 × Ø10 mm Holes										6 4 4 4 2										20										20						
4	Part 9												Part 9 20 Marks										Marking Out 6 × Ø5.5 mm Holes Vee Slots 5 mm Radii and Chamfers										4 6 6 4										20										20						
5	Parts 1, 2, 3, 4, 7, 8 and 10												Parts 1, 3, 4, 7 & 8 10 Marks Parts 2 & 10 10 Marks										Lathe Work Marking Out and Bench Work Marking Out, Lengths & Profile 6 × M5 Holes & 1 × M8 Hole Ø3, 6 & 8 mm Holes										6 4 6 2 2										20										20						



Day 2 - Leaving Certificate Engineering - Practical Marking Scheme 2018

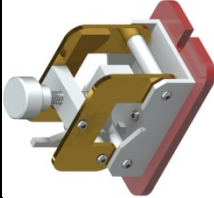
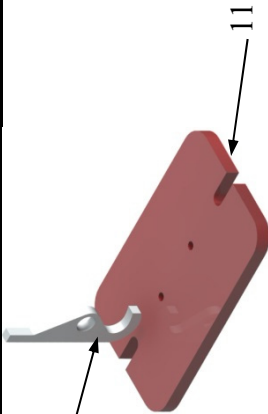
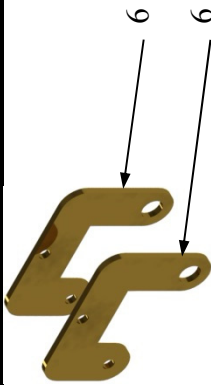
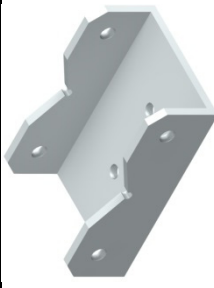
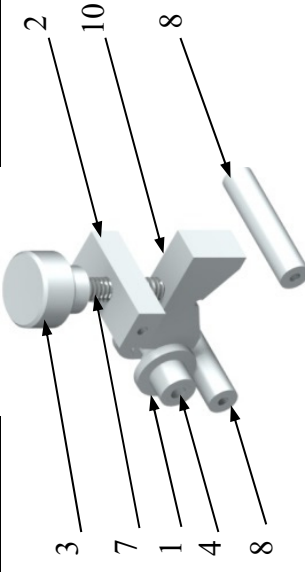
Subjective Marking 1 - 20										17 - 20 Excellent										13 - 16 Very Good										9 - 12 Good										5 - 8 Poor										1 - 4 Very Poor									
Section	Part Number	Pictorial Sketch / Description										Concept										Mark										Mark																											
1	All Parts of Test-piece											Assembly Function Finish										5 10 5										20										20																	
2	Parts 5 and 11											Part 5 10 Marks										Marking Out Ø8.1 mm Hole External Profile										4 1 5										20																	
												Part 11 10 Marks										Marking Out 2 × 6 mm Slots 2 × M5 Holes 10 mm Radii and Chamfers										2 2 2 4																											
3	Parts 6											Parts 6 20 Marks										Marking Out External Profiles Internal Profiles 4 × Ø5.5 mm Holes 2 × Ø10 mm Holes										6 4 4 4 2										20																	
4	Part 9											Part 9 20 Marks										Marking Out 6 × Ø5.5 mm Holes Vee Slots 5 mm Radii and Chamfers										4 6 6 4										20																	
5	Parts 1, 2, 3, 4, 7, 8 and 10											Parts 1, 3, 4, 7 & 8 10 Marks										Lathe Work Marking Out and Bench Work										6 4										20																	
												Parts 2, & 10 10 Marks										Marking Out, Lengths & Profile 6 × M5 Holes & 1 × M8 Hole Ø3, 6 & 8 mm Holes										6 2 2																											



Coimisiún na Scrúduithe Stáit
State Examinations Commission



Day 3 - Leaving Certificate Engineering - Practical Marking Scheme 2018

Subjective Marking 1 - 20										17 - 20 Excellent		13 - 16 Very Good		9 - 12 Good		5 - 8 Poor		1 - 4 Very Poor	
Section	Part Number	Pictorial Sketch / Description										Concept				Mark	Mark		
1	All Parts of Test-piece											Assembly Function Finish	5 10 5		20	20			
2	Parts 5 and 11											Part 5 10 Marks	Marking Out Ø8.1 mm Hole External Profile	4 1 5	20				
3	Parts 6											Part 11 10 Marks	Marking Out 2 × 6 mm Slots 2 × M5 Holes 10 mm Radii	2 2 2 4	20				
4	Part 9											Parts 6 20 Marks	Marking Out External Profiles Internal Profiles 4 × Ø5.5 mm Holes 2 × Ø10 mm Holes	6 4 4 4 2	20				
5	Parts 1, 2, 3, 4, 7, 8 and 10											Part 9 20 Marks	Marking Out 6 × Ø5.5 mm Holes Vee Slots 5 mm Chamfers	4 6 6 4	20				
												Parts 1, 3, 4, 7 & 8 10 Marks	Lathe Work Marking Out & Bench Work	6 4	20				
												Parts 2, & 10 10 Marks	Marking Out, Lengths & Profile 6 × M5 Holes & 1 × M8 Hole Ø3, 6 & 8 mm Holes	6 2 2	20				

100 Marks (×1.5 = 150 Total)

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