



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2023

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, 2023

Marking Scheme

Written Examination and Practical Examination

***ENGINEERING –
Materials and Technology***

ORDINARY LEVEL

Introduction – written examination

In considering the marking scheme, the following should be noted.

1. The solutions presented are examples only. All other valid solutions are acceptable and are marked accordingly.
2. The detail required in any answer is determined by the context and the manner in which the question is asked, and by the number of marks assigned to the answer in the examination paper and, in any instance, therefore, may vary from year to year.
3. Bonus marks at the rate of 5% of the marks obtained will be given to a candidate who answers entirely through Irish and who obtains less than 75% of the total marks. In calculating the bonus to be applied decimals are always rounded down, not up e.g., 4.5 becomes 4; 4.9 becomes 4, etc. The bonus table given on the next page applies to candidates who answer entirely through Irish and who obtain more than 75% of the total marks.
4. The table below contains information about annotations used for marking throughout the exam paper.

Annotation	Meaning
	Blank page
	Page marked by examiner



Coimisiún na Scrúduithe Stáit

Marcanna Breise as ucht freagairt trí Ghaeilge

Léiríonn an tábla thíos an méid marcanna breise ba chóir a bhronnadh ar iarrthóirí a ghnóthaíonn níos mó ná 75% d'iomlán na marcanna.

N.B. Ba chóir marcanna de réir an ghnáthrata a bhronnadh ar iarrthóirí nach ghnóthaíonn níos mó ná 75% d'iomlán na marcanna don scrúdú. Ba chóir freisin an marc bó nais sin **a shlánú síos**.

Tábla 200 @ 5%

Bain úsáid as an tábla seo i gcás na n-ábhar a bhfuil 200 marc san iomlán ag gabháil leo agus inarb é 5% gnáthrata an bhónais.

Bain úsáid as an ngnáthrata i gcás 150 marc agus faoina bhun sin. Os cionn an mharc sin, féach an tábla thíos.

Bunmharc	Marc Bónais
151 - 153	7
154 - 160	6
161 - 166	5
167 - 173	4

Bunmharc	Marc Bónais
174 - 180	3
181 - 186	2
187 - 193	1
194 - 200	0

LEAVING CERTIFICATE
ENGINEERING - Materials and Technology

(Ordinary Level – 200 marks)

Written Examination Marking Scheme 2023

Answer any four questions.

Question 1: 50 marks Any eight parts @ 6 marks each. Award 1 extra mark for each of the first two correctly answered parts.	
Question 2: 50 marks (a) Explain any three @ 5marks (15) (b) Describe @ 12 marks (12) (c) (i) Three materials @ 3 marks (ii) Three reasons @ 2 marks (15) (d) (i) Explain @ 4 marks (ii) Name @ 2 marks Two metals @ 1 mark each (8)	Question 5: 50 marks (a) (i) Name any three @ 3 marks (ii) Describe @ 11 marks (20) (b) Any three parts @ 4 marks (12) (c) Any two parts @ 5 marks (10) (d) Two precautions @ 4 marks (8)
Question 3: 50 marks (a) Explain any two @ 7 marks (14) (b) (i) One part @ 7 marks (ii) Describe @ 7 marks (14) (c) Identify any two @ 5 marks (10) (d) Explain two parts @ 6 marks (12) OR (d) (i) Describe two areas @ 3 marks (ii) Two ways @ 3 marks (12)	Question 6: 50 marks (a) Name any three @ 5 marks (15) (b) Explain any three @ 5 marks (15) (c) (i) Name two processes @ 3 marks (ii) Describe @ 6 marks (iii) Name two items @ 4 marks (20) OR (c) (i) One part @ 6 marks (ii) One part @ 6 marks (iii) Two advs @ 4 marks (20)
Question 4: 50 marks (a) (i) Two names @ 5 marks (ii) Name two flames @ 5 marks (iii) Two precautions @ 5 marks (15) (b) Any three parts @ 4 marks (12) (c) Any three parts @ 5 marks (15) (d) Two precautions @ 4 marks (8)	Question 7: 50 marks (a) Explain any two @ 6 marks (12) (b) (i) One part @ 5 marks (ii) One part @ 5 marks (iii) One part @ 5 marks (iv) One part @ 5 marks (20) (c) Any three parts @ 6 marks (18) OR (c) (i) State @ 6 marks (ii) One part @ 6 marks (iii) One part @ 6 marks (18)

Sample Answers *and* Marking Scheme

Note: The solutions presented are examples only.

All other valid solutions are acceptable and are marked accordingly.

Question 1

(50 Marks)

Any eight parts @ 6 marks each.

Award 1 extra mark for each of the first two question parts answered correctly. (Max: +2 marks)

- (a) **State one application of remote-control technology.**
- Controlling construction equipment like cranes, diggers and drills.
- (b) **Explain the term brittleness:**
- Brittleness describes the property of a material that breaks when subjected to stress.
- (c) **State two reasons why pilot holes are used when drilling:**
- Helps to guide a larger drill through the material providing a more accurate and better located hole.
 - Can help provide a better cutting action for larger drills.
- (d) **List one advantage of using thumbscrews when assembling parts:**
- The large, knurled head, provides easy grip, and this helps to loosen or tighten the thumbscrew without tools.

large knurled head



thumbscrew

- (e) **Give one application of a strip heater when working with plastics:**
- A strip heater allows for plastics such as acrylic to be heated up and bent into shape.



Application:

Total (6) Marks

Explain:

Total (6) Marks

Two reasons:

(Award 3 + 3)

Total (6) Marks

Advantage:

Total (6) Marks

Application:

Total (6) Marks

- (f) **Tool A:**
- Tool A is a socket ratchet.
 - The socket ratchet is used with a socket head to open or close fittings like nuts.



- (g) **Give one reason why it is important to wear ear protection when working in a workshop.**

- Being exposed to loud noises for a period of time can cause damage to your hearing.

- (h) **Any one:**

(i) CAD Modelling:

CAD (computer-aided design) modelling is the use of computer-based software to aid in design processes. CAD software can be used to create two-dimensional (2-D) drawings or three dimensional (3-D) models which allows designers to test, refine and manipulate virtual products prior to production. These high-quality 3D designs are identical in dimension and detail to the desired finished product, ensuring quality and accuracy for production.

(ii) Artificial Intelligence:

Artificial intelligence (AI) refers to the simulation of human intelligence in machines that are programmed to think like humans and mimic their actions. The term may also be applied to any machine that exhibits traits associated with a human mind such as learning and problem solving.

(iii) Electrical vehicle:

An electric vehicle is essentially a vehicle with an electric motor powering it rather than a combustible engine. A fully electric vehicle does not run on or have a petrol or diesel engine.



Identify Tool A:
Award 3 Marks
One application:
Award 3 Marks
Total (6) Marks

Reason:
Total (6) Marks

Explain any one:
Total (6) Marks

(i) **Explain the term *upcycling*:**

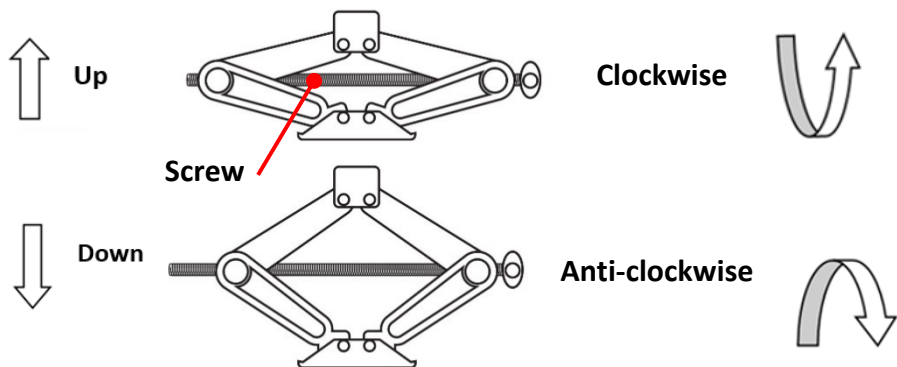
- Upcycling is the process of reusing old materials to create something more valuable or of a higher quality. An example of upcycling is using reclaimed skateboards to make quality furniture, as shown.



(j) **Any one:**

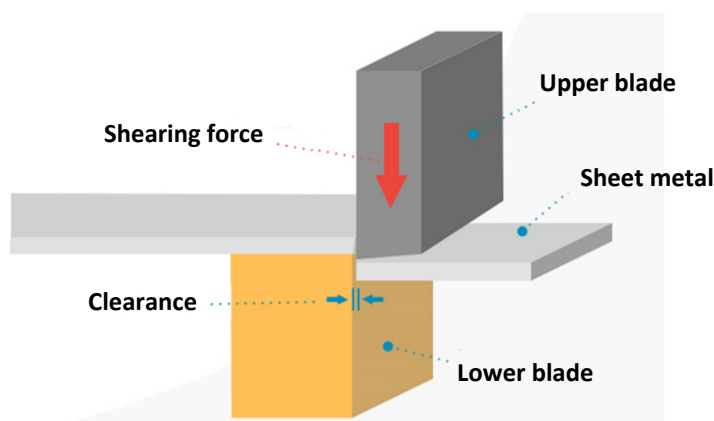
(i) **Scissor jack**

A scissor jack is operated by turning a small crank that is connected to one end of the scissor jack. This crank is usually "Z" shaped. When this crank is turned, the screw turns, and this raises or lowers the jack.



(ii) **Foot shears**

A foot shears has two straight-edged blades which pass closely together to generate the force on the material necessary to shear. Just before the blade makes contact with the material, the material is held in place with pressure preventing it from slipping. When the foot pedal is pressed, the top blade lowers at an angle creating a scissor effect shearing the material.



Explain:

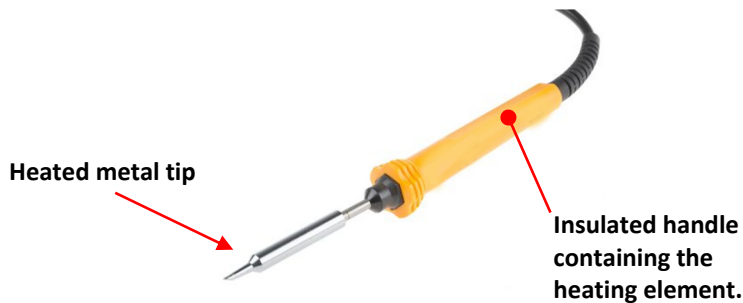
Total (6) Marks

Describe any one:

Total (6) Marks

(iii) Soldering iron

A soldering iron is a hand tool used to join electronic components and other materials using solder. It supplies heat to the components and materials so that melted solder can flow into the joint between the two workpieces. A soldering iron has a heated metal tip and an insulated handle. Heating is achieved by passing an electric current through a heating element.



(k) Define electrical conductor in relation to the properties of metals and name one metal which is used as an electrical conductor.

- Definition: An electrical conductor is a material that allows electricity to flow through it.
- Example: Copper

Definition:

Award 3 Marks

One example:

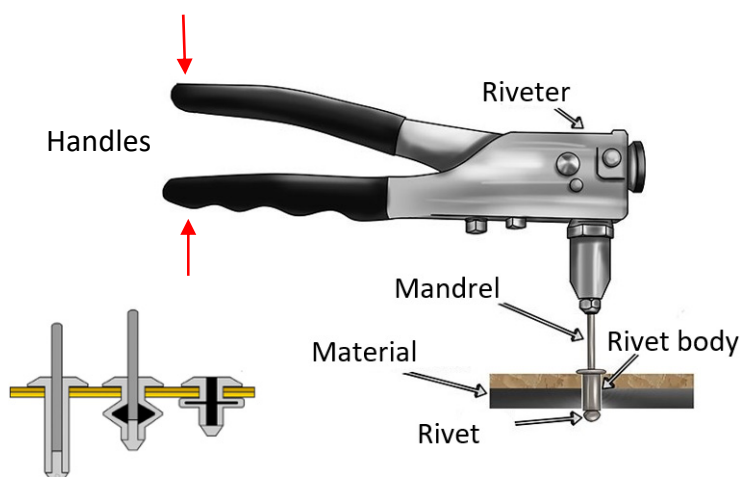
Award 3 Marks

Total (6) Marks

(l) Any one:

(i) Pop riveting

Pop rivets are typically used to join sheet metals together. The rivet body is inserted into a pre-drilled hole in the material being joined and the mandrel is held in the riveter. When the handles are squeezed, the mandrel snaps, and the body of the rivet holds the pieces together.

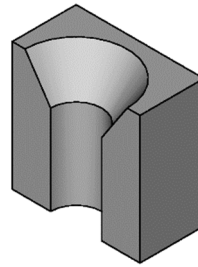


Explain any one:

Total (6) Marks

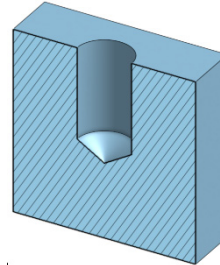
(ii) Countersinking

Countersinking is a process that creates a V-shaped edge near the surface of a hole. It is often used to allow the head of a countersunk-head screw, sit flush or below the surface of the material.



(iii) Blind hole

A blind hole refers to a hole that is reamed, drilled or milled to a specific depth without breaking through to the other side of the workpiece.



(m) List two benefits of using cutting fluids when machining.

- Provides a better finish on the workpiece being cut.
- Reduces the temperature of the workpiece and cutting tool being used.

Two benefits:
(Award 3 + 3 Marks)
Total (6) Marks



(a) Any three**(i) Water cooled oxygen lance:**

The water-cooled oxygen lance is used to blow oxygen over the hot metal in the Basic Oxygen Furnace during the steel making process. The oxygen ignites the carbon dissolved in the steel, and converts it into carbon dioxide and carbon monoxide, which in turn raises the temperature of the furnace to 1700°C. This helps in melting the steel and reducing the carbon content and impurities in the steel. The lance is kept cool by water passing through the walls of the lance.

(ii) Pig iron:

Pig iron is produced when iron ore is smelted in the 'Blast Furnace'. Pig iron has a high carbon content, making it very brittle.

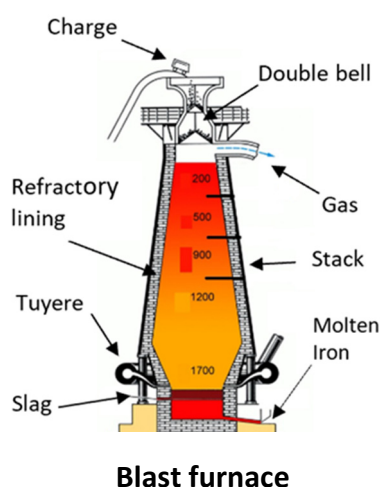
(iii) Carbon electrodes:

Carbon electrodes are used in the 'Electric Arc Furnace' to produce heat. The heat is generated by means of an electric arc produced between the charge and the electrodes.

(iv) Iron ore:

Iron ore is mined and is used as the raw material to make pig iron.

Explain

(Award 3 @ 5 Marks)**Total (15) Marks****(b) Any one****(i) Labelled diagram & operation:**

Iron ore, coke and limestone provide the charge and are fed in through the top of the furnace. As the coke burns, carbon monoxide is produced, and combines with the oxygen in the ore, leaving iron. The limestone combines with impurities to form slag. The molten iron falls to the bottom of the furnace where it is tapped off from time to time. The slag floats on top of the molten iron and is tapped off when necessary.

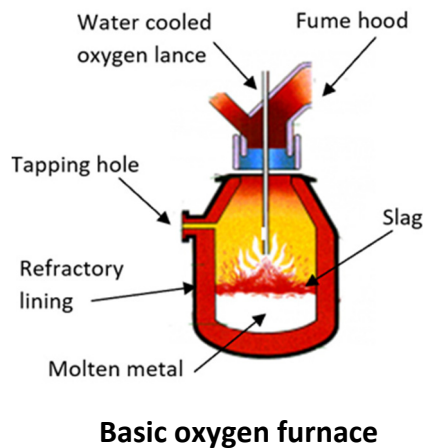
Describe

(Award 6 Marks)

Labelled Diagram

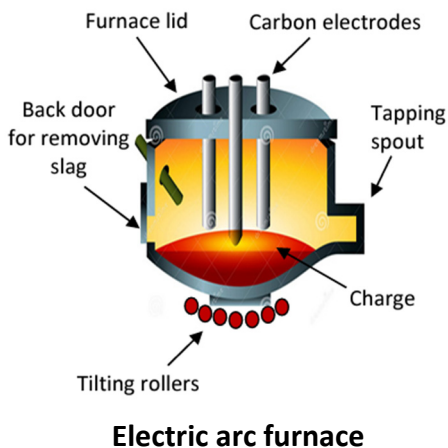
(Award 6 Marks)**Total (12) Marks**

(ii) Labelled diagram & operation:



The charge consists of scrap iron and steel together with lime and molten pig iron. Oxygen is blown at the surface of the molten charge from a water-cooled lance which is lowered through the mouth of the furnace. Impurities in the charge are oxidized and form a slag on the surface. At the end of the blow, the steel is poured off through a tapping hole followed by emptying the slag through the mouth of the furnace.

(iii) Labelled diagram & operation



Cold scrap iron or steel make up most of the charge together with small amounts of lime and carbon. Heat for this furnace is produced by an electric arc created between carbon electrodes and the charge. The lime combines with impurities producing slag. When the correct composition of steel is achieved the slag is removed through the back door. The furnace is then tilted forward on its rollers allowing the molten steel to flow out the tapping spout.

(c) Electric go-kart:

Steering grips:

- (i) Material: Rubber
- (ii) Reason: Increases the grip for the driver when holding the steering wheel.

Back support:

- (i) Material: Plastic
- (ii) Reason: Can be easily moulded into the shape needed.

Chassis:

- (i) Material: Steel tube
- (ii) Reason: Light but strong



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

(d) Alloy:

(i) Explanation:

An alloy is created by mixing metal with either another metal or a nonmetal substance. Metal alloys are generally made by melting the substances, mixing them together, and then letting them cool to room temperature, resulting in a solid material.

(ii)

Alloy: Bronze

Metals: Copper and tin

(i) Explain
(Award 1 @ 4 Marks)

(ii) Alloy name
(Award 1 @ 2 Marks)
Metals used
(Award 1 @ 1 Mark)
(Award 1 @ 1 Mark)
Total (8) Marks

Question 3**(50 Marks)****(a) Any two:****(i) Annealing:**

Annealing is a heat treatment procedure used to soften metals. To anneal steel, it is heated to a cherry red colour, approx. 900° and allowed to cool down as slow as possible. This can be achieved by leaving the metal in a furnace while the furnace is cooling down. Annealing relieves internal stresses, increases ductility and malleability of a metal.

(ii) Case hardening:

Case hardening is a method of making low carbon steel very hard on the outside while leaving its centre tough. Low carbon steel may be case hardened by first increasing the amount of carbon in the outer surface by 'carburising'. Carburising is carried out by heating the steel to a cherry red and allowing it to cool in a carbon rich material. The steel part will now have a skin or 'case' rich in carbon. The part is then heated to a cherry red and quenched, producing a hardened skin with a tough core.

(iii) Quenching:

Quenching is when a hot metal is cooled very quickly i.e., when a cherry red metal is dipped into cold water and moved about.

Explain

(Award 2 @ 7 Marks)**Total (14) Marks****(b)****(i) Hardening:**

Hardening increases the hardness of steel resulting in the steel retaining its cutting edge.

(ii) Tempering:

Tempering removes some of the hardness while increasing the toughness of a metal. It is achieved by heating the metal to a specific temperature which is determined by the colour of the metal. On heating, colours appear and when the correct colour is achieved i.e., light straw appears at approx. 250° - 350°, it is quenched in cold water.

(i) Hardening effect

(Award 1 @ 7 Marks)

(ii) Describe

(Award 1 @ 7 Marks)**Total (14) Marks****(c) Two safety precautions:**

- Wear heat resistant gloves when performing heat treatment of metals.
- Do not leave hot metals lying around in case people accidentally pick up the piece.

Identify

(Award 2 @ 5 Marks)**Total (10) Marks**

(d) **Any two:**

(i) Toughness:

This property enables a material to withstand blows or an impact. The amount of energy it takes to fracture a material is an indicator of its toughness.

(ii) Ductility:

A material is said to be ductile when it can be permanently stretched, without fracture. It must be plastic enough to allow deformation and strong enough not to fracture. A metal must be ductile to enable it to be stretched / drawn into wire.

(iii) Malleability:

The ability to be hammered or rolled into a thin sheet without fracturing.

Explain

(Award 2 @ 6 Marks)

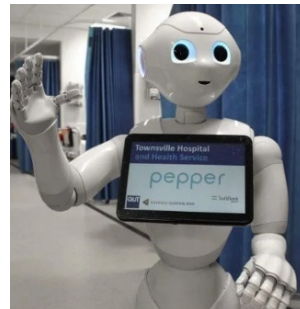
Total (12) Marks

(d)

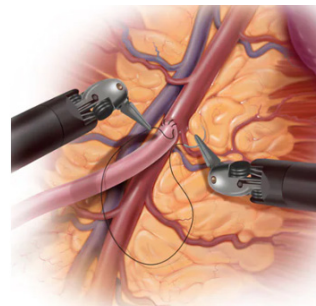
OR

(i)

- Roving robots in emergency rooms can support the evaluation of patients by connecting with a remote specialist who can converse with them, review their records and examine patients with special cameras.



- Surgical robots are beginning to be used for general surgeries. Robotic assisted surgical systems use robotic arms with tiny surgical instruments that are controlled by surgeons, potentially allowing for expert surgeons to operate remotely from anywhere in the world.



**Robot assisted,
heart surgery**

(i) Describe

(Award 2 @ 3 Marks)

(ii)

- Exoskeleton suits can help people with spinal cord injuries gain some mobility, helping to improve cardiovascular health, slow the loss of fat tissue, build lean muscle mass, improve bowel function, and aid in pain management
- Exoskeleton technology can help assist the disabled by helping with personal care functions like dress, shave, scratch and eat by themselves.



(ii) State two ways
(Award 2 @ 3 Marks)
Total (12) Marks

Question 4

(50 Marks)

(a)

(i) Common gases:

- Oxygen
- Acetylene

(ii) Any two flames:

- Oxidising flame
- Neutral flame
- Carburising flame

(iii) Two safety precautions:

- The gas hoses are checked for damage before starting the welding process.
- Correct PPE is worn while welding.

(i) Name common gases

(Award 1 @ 3 Marks)

(Award 1 @ 2 Marks)

(ii) Any two flames

(Award 1 @ 3 Marks)

(Award 1 @ 2 Marks)

(iii) Safety precautions

(Award 1 @ 3 Marks)

(Award 1 @ 2 Marks)

Total (15) Marks

(b)

Function of any three:

(i) Welding plant:

A welding plant is a device used for fusing / welding metals together. The welding plant creates an electrical arc between the welding rod and the metals being joined. The arc generates enough heat to melt the welding rod and metals, fusing the joint between the two pieces of metal. The welding plant can produce temperatures up to 3,600°C needed to melt metals.

Function

(Award 3 @ 4 Marks)

Total (12) Marks

(ii) Chipping hammer:

The chipping hammer is used to remove the slag which forms on top of the welded joint after arc welding.



(iii) Leather apron:

Leather aprons are fireproof and help protect against heat and flames. The leather apron is worn during welding and helps protect the welder against sparks, spatter, slag, and some flames that are often encountered during welding work.

(iv) Electrode holder:

An electrode holder is a device that holds the electrode / welding rod during the welding process. The handle is insulated to protect the user from the current flowing to the electrode.

(c) Any three:

(i) Passive flux when soldering electrical circuits.

A passive flux is an inactive, non-corrosive flux and will not damage / corrode the electrical circuit. Therefore, the passive flux can remain on the electric circuit when finished soldering.

(ii) Permanently join sheet metals.

Resistance / Spot welding.

(iii) Cleaning joints before soldering them together.

The removal of grease and corrosion from joints before soldering ensures that the solder will adhere / join to the surface of the metals when the correct heat is applied. This will aid in a successful soldered joint.

(iv) Name the cutting tool and state a suitable use.

- Thread cutting die.
- The thread cutting die will produce an external thread on a round bar.

(d) Safety Precautions:

Working with adhesives:

- Wear suitable gloves to avoid the adhesives coming in contact with your skin.
- Work in a well-ventilated area as adhesives can produce harmful fumes.

Any three explanations

(i) Explain

(Award 1 @ 5 Marks)

(ii) One process

(Award 1 @ 5 Marks)

(iii) Reason

(Award 1 @ 5 Marks)

(iv) Name

(Award 1 @ 3 Marks)

Suitable use

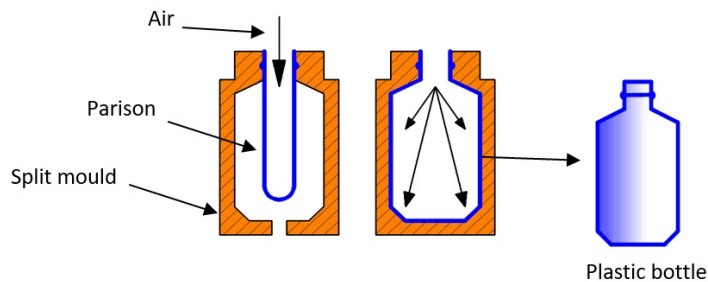
(Award 1 @ 2 Marks)

Total (15) Marks

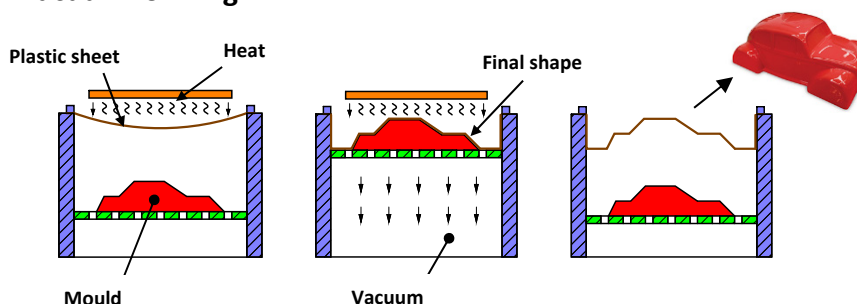
Safety precautions

(Award 2 @ 4 Marks)

Total (8) Marks

(a) Name plastic manufacturing processes:**(i)****A – Blow moulding****B – Vacuum forming****C – Injection moulding****(ii) Describe anyone of the manufacturing process:****Blow Moulding**

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

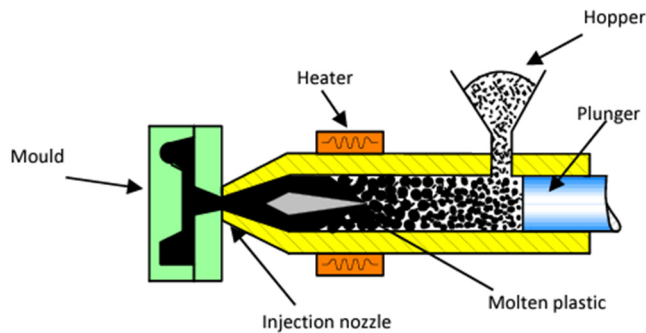
Vacuum forming

A vacuum former is a plastic thermoforming machine that is used to produce parts which are precisely formed on one side. The former contains a heating element, a height adjustable table, which is porous, and an air pump. The heating element is used to heat up and soften a sheet of plastic which has been clamped into a frame. When the plastic sheet begins to sag, a mould, placed on the poyous table, is lifted into the plastic

(i) Name**(Award 3 @ 3 Marks)****(ii) Describe****(Award 1 @ 11 Marks)****Total (20) Marks**

sheet. The air pump is then turned on creating a vacuum below the mould. This causes the plastic sheet to pull against the mould, forming the final shape. After cooling, the mould is lowered, and the plastic part is removed.

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.

(b) Any three:

(i) Elastic memory:

This describes the ability of a plastic to return to its original shape after being formed. The plastic remembers its original shape and will return to this shape if heated.

(ii) Thermosetting plastics:

Thermosetting plastic is a plastic which remains hard when heated.

(iii) Plastic dip coating:

Pre-heated items for coating are dipped into a tank of plastic powder which fuses and sticks to the product. The item is removed and allowed to cool causing the plastic to form a protective coating around the product.

(iv) Thermoplastic:

Thermoplastic is a plastic which softens when heated. Thermoplastics can be recycled and used again.

Describe

(Award 3 @ 4 Marks)

Total (12) Marks

(c) Any two:

- (i) Toy racing car:** Polystyrene (HIPS) / PVC / ABS
- (ii) Bevel gears:** Nylon
- (iii) Electric socket:** Bakelite / Melamine-Formaldehyde (MF)
Urea-Formaldehyde (UF)
- (iv) Food container:** Polystyrene

Name
(Award 2 @ 5 Marks)
Total (10) Marks

(d) Safety Precautions:

- Do not leave pieces of hot plastic unattended on the bench / work area.
- Wear protective gloves if handling hot sheets of plastic.

Safety precautions
(Award 2 @ 4 Marks)
Total (8) Marks

Question 6**(50 Marks)****(a) Any three:**

- A – Four jaw chuck
- B – Tailstock
- C – Emergency stop button
- D – Revolving dead centre

Name
(Award 3 @ 5 Marks)

Total (15) Marks

(b) Any three:**(i) Clearance angle:**

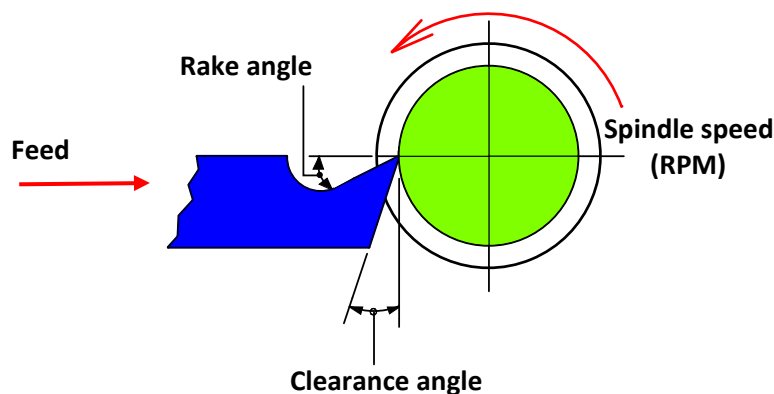
Without a clearance angle, no cutting would take place. The clearance angle ensures that only the cutting edge of a tool contacts the material. It provides clearance between the cutting tool face and the workpiece. This ensures a reduction in friction and heat build-up, while providing longer tool life and better surface finish.

(ii) Spindle speed:

This is the speed at which the chuck rotates in RPM. This speed can be adjusted by selecting different gear train settings within the gear box.

(iii) Rake angle:

The rake angle is ground on a cutting tool to provide a sharp edge for cutting. The rake angle allows the swarf to pass over the cutting tool and away from the cutting area.

**(iv) Feed:**

Feed is the amount per revolution at which the cutting tool moves into the material being machined.

Explanation
(Award 3 @ 5 Marks)

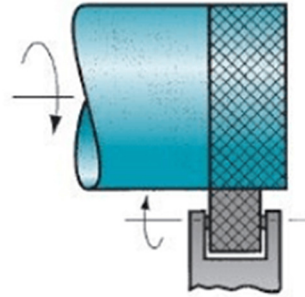
Total (15) Marks

(c)

(i) Knurling / Parting off.

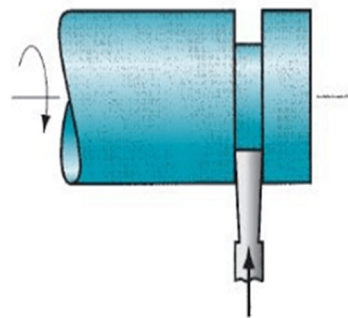
(ii) Knurling

A knurling tool is set on centre and at 90° against a piece of round section bar. The lathe is set so that the chuck revolves at a low speed. The knurling tool is then pressed against the rotating steel bar and pressure is slowly increased until the tool produces a pattern on the bar.



Parting off

Secure the parting off tool in the tool post, square to the workpiece. Check that the tool tip is in line with the centre of the workpiece. Align the tool tip outside of the line where you require to cut. Select a suitable cutting speed and direction and turn on the lathe. Engage the tool tip into the turning workpiece and cut in a continuous motion.



(iii)

- Safety glasses or shield.
- A lab coat / overall to ensure no loose clothing can get caught in the spinning chuck.

(i) Name
(Award 2 @ 3 Marks)

(ii) Describe
(Award 1 @ 6 Marks)

(iii) Safety precautions
(Award 2 @ 4 Marks)
Total (20) Marks

OR

(c)

3D Printing:

(i) **CNC** - Computer Numerical Control.

(ii) A CNC lathe / Lazer machine / Milling machine.

(iii) Advantages:

- CNC machines can manufacture complicated products.
- CNC machines support the automation of mass production.

(i) CNC
(Award 1 @ 6 Marks)
(ii) Identify
(Award 1 @ 6 Marks)
(iii) Two advantages
(Award 2 @ 4 Marks)
Total (20) Marks

Question 7**(50 Marks)****(a) Any two:****(i) Clearance fit:**

The shaft is always smaller than the hole.

(ii) Upper limit:

The largest dimension a piece can be manufactured to.

(iii) Transition fit:

The shaft can be larger or smaller than the hole.

Explanation

(Award 2 @ 6 Marks)**Total (12) Marks****(b) Calculations:**

(i) Largest diameter of the hole in the copper fitting: 16.03 mm

(ii) Nominal diameter of the shaft: 16.00 mm

(iii) Smallest diameter of the shaft: 15.95 mm

(iv) Tolerance of the hole in the copper fitting: 0.06 mm

Calculations

(Award 4 @ 5 Marks)**Total (20) Marks****(c) Any three:****Name:****Application:****(i) Digital vernier calliper**

- Used for accurately measuring the diameter of round bars or the internal diameter of holes. The measurement can be read directly from a digital display.

(ii) Spring divider

- Spring dividers are used for marking out work. Sharp points can be used to scribe the workpiece, creating arcs and circles. They can also be used to gauge the distance between two points.

Name

(Award 3 @ 3 Marks)

Application

(Award 3 @ 3 Marks)**Total (18) Marks**

(iii) Vernier height gauge



- A height gauge is a measuring device used for determining the height of objects or for transferring measurements to a workpiece when marking out.

(iv) Engineers square:



- An engineer square is used to check the squareness of two edges and to help mark lines at 90° to an edge.

OR

(c) Answer all:

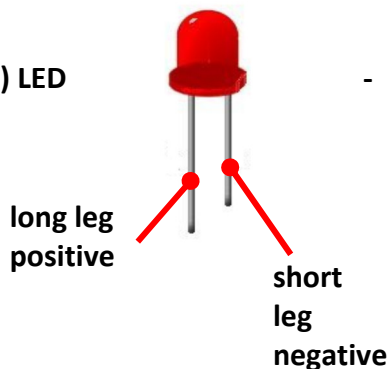
(i) Use for a solenoid



Plunger moves in and out.

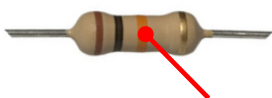
- A solenoid is an electromagnet, used to convert electrical energy into mechanical work. It can be used to open and close pneumatic valves / turn on or off an electrical switch / operate as a locking mechanism....

(ii) LED



- The LED shown has one long leg and one short leg to ensure it is connected into a circuit the correct way i.e. The long leg is connected to the positive and the short leg to the negative connection.

(iii) Resistor colour bands



Brown, Black, Orange

- The colour bands on a fixed resistor are used to calculate the resistance in ohms, of a fixed resistor.

$$(1 \quad 0) \times 1000 = 10000 \text{ Ohms or } 10 \text{ K}\Omega$$

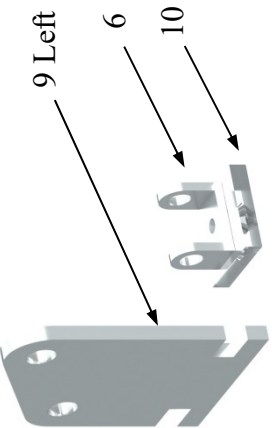
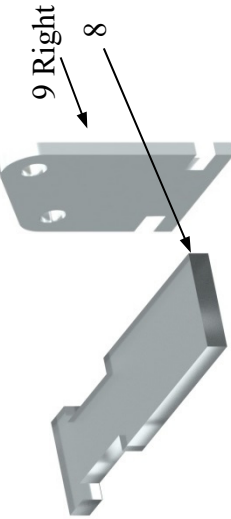
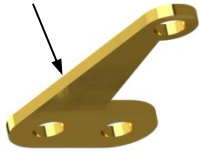
**(i) Solenoid use
(Award 1 @ 6 Marks)**

**(ii) Reason
(Award 1 @ 6 Marks)**

**(iii) Function
(Award 1 @ 6 Marks)
Total (18) Marks**



2023 Leaving Certificate Engineering Practical - Marking Scheme Day 1

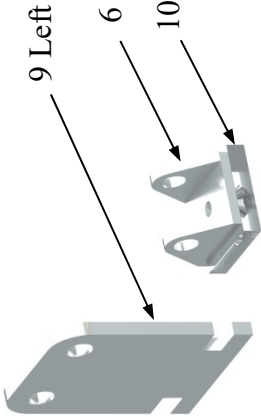
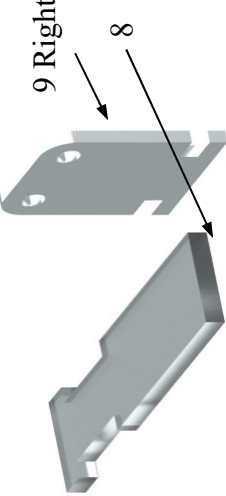
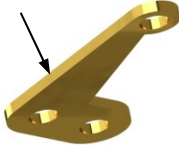
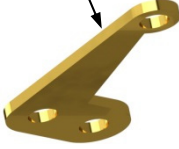
Section	Part Number	Pictorial Sketch / Description	Concept	Mark	Mark
1	All Parts of Test-piece		Assembly (5) Function (10) Finish (5)	20	20
2	Parts 6, 9 Left and 10		Part 6 8 Marks	4	20
			External Profile	4	
			Part 9 Left 10 Marks	4	
			6 mm x 10 mm Slots & External Profile	6	
3	Parts 8 and 9 Right		Part 10 2 Marks	2	20
			Marking Out, $\varnothing 5$ CSK Hole	2	
			Part 8 10 Marks	8	
			5 mm x 30 mm Slots	4	
4	Part 3 Right		Part 9 Right 10 Marks	6	20
			Marking Out, $\varnothing 8$ Holes	4	
			6 mm x 10 mm Slots & External Profile	6	
			Marking Out, $\varnothing 8$ mm Holes	4	
5	Part 3 Left		Part 3 Right 20 Marks	4	20
			7 mm Radius	4	
			10 mm Radii	6	
			Straight Profiles	6	
5	Part 3 Left		Marking Out, $\varnothing 8$ mm Holes	4	20
			7 mm Radii	4	
			10 mm Radii	6	
			Straight Profiles	6	

100 Marks (x 1.5 = 150 Total)



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2023 Leaving Certificate Engineering Practical - Marking Scheme Day 2



Section	Part Number	Pictorial Sketch / Description	Concept	Mark	Mark
1	All Parts of Test-piece		Assembly (5) Function (10) Finish (5)	20	20
2	Parts 6, 9 Left and 10		Part 6 8 Marks Part 9 Left 10 Marks Part 10 2 Marks	4 4 4 6 2	20
3	Parts 8 and 9 Right		Part 8 10 Marks Part 9 Right 10 Marks	2 8 4 6	20
4	Part 3 Right		Part 3 Right 20 Marks	4 4 6 6	20
5	Part 3 Left		Part 3 Left 20 Marks	4 4 6 6	20

100 Marks (× 1.5 = 150 Total)



2023 Leaving Certificate Engineering Practical - Marking Scheme Day 3

Section	Part Number	Pictorial Sketch / Description	Concept	Mark	Mark
1	All Parts of Test-piece		Assembly (5) Function (10) Finish (5)	20	20
2	Parts 6, 9 Left and 10		Part 6 8 Marks	4	20
			External Profile	4	
			Part 9 Left 10 Marks	4	
			6 mm x 10 mm Slots & External Profile	6	
3	Parts 8 and 9 Right		Part 10 2 Marks	2	20
			Part 8 10 Marks	2	
			Marking Out, Length 55 mm	8	
			5 mm x 30 mm Slots	4	
			Marking Out, Ø8 Holes	6	20
			6 mm x 10 mm Slots & External Profile	6	
4	Part 3 Right		Part 3 Right 20 Marks	4	
			Marking Out, Ø8 mm Holes	4	
			7 mm Radius	6	
			10 mm Radii	6	
			Straight Profiles	6	20
5	Part 3 Left		Part 3 Left 20 Marks	4	
			Marking Out, Ø8 mm Holes	4	
			7 mm Radii	6	
			10 mm Radii	6	
			Straight Profiles	6	

100 Marks (× 1.5 = 150 Total)

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