Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2012

Marking Scheme

ENGINEERING – MATERIALS AND TECHNOLOGY

Higher Level

LEAVING CERTIFICATE 2012

MARKING SCHEME

Written Examination and Practical Examination

ENGINEERING – MATERIALS AND TECHNOLOGY

HIGHER LEVEL

LEAVING CERTIFICATE

ENGINEERING - Materials and Technology

(Higher Level – 300 marks)

Written Examination Marking Scheme 2012

Answer Question 1, Sections A and B and **Four other questions.**

Question 1 Section A – 50 marks
Any ten @ 5 marks each.

(a) 5
(b) 5
(c) **Any two @** 3 + 2
(d) 3 + 2
(e) 5
(f) 3 + 2
(g) 3 + 2
(h) 5
(i) 3 + 2
(j) **Any two** @ 3 + 2
(k) **Any one** @ 5
(l) 5
(m) 5

Question 1 Section B – 50 marks
Answer **all** of the following.

(n) 5 + 5

(o) (i) 1 + 1 + 1
(ii) 5
(iii) 1 + 1

(p) **Any two** @ 5 + 5

(q) (i) 3 + 2
(ii) 3 + 2

(r) **Any two** @ 5 + 5

Question 2 – 50 marks

(a) (i) 8
(ii) 10

(b) (i) 3 + 3 + 3
(ii) 5

(c) (i) 2 + 2 + 2 + 2
(ii) 10

Question 3 – 50 marks

(a) **Any two** @ 8 + 8

(b) (i) 12
(ii) 4

(c) (i) 2 + 2 + 2 + 2
(ii) 3 + 2
3 + 2

Question 4 – 50 marks

(a) **Any two** @ 8 + 8

(b) (i) 10
(ii) 5 + 5
(iii) 2

(c) (i) 4 + 4
(ii) 4

Question 5 – 50 marks

(a) (i) 12
(ii) 4

(b) **Any three** @ 6 + 6 + 6

(c) **Any one** @ 16

OR

(c) (i) 8
(ii) 4 + 4

Question 6 – 50 marks

(a) (i) 2 + 6
(ii) 4
(iii) 4

(b) (i) 2 + 2
(ii) 2 + 2
(iii) 2 + 2
(iv) 2 + 2

(c) **Any three** @ 6 + 6 + 6

Question 7 – 50 marks

(a) 6 + 6 + 6

(b) (i) 4 + 4
(ii) 4 + 4

(c) (i) 4 + 4
(ii) 4 + 4

OR

(c) (i) 6
(ii) 5
(iii) 5

Question 8 – 50 marks

(a) **Any one** @ 16

(b) **Any three** @ 6 + 6 + 6

(c) 16

OR

(c) (i) 6
(ii) 5 + 5

Sample Answers *and* Marking Scheme

Note: **The solutions presented are examples only.**
All other valid solutions are acceptable and are marked accordingly.

Question1 (100 Marks)

Section A – 50 marks

(a) **Helmet guard process:**
Bars are fabricated by bending and then welded.

5

(b) **Allotropy:**
Allotropy is the ability of a material to exist in different forms. Allotropy of iron modifies the solubility of carbon which allows some steels to be hardened. The transformation from *alpha iron* (ferrite), which has a bcc crystal structure, to the fcc structure of *gamma iron* (austenite) is the basis for the hardening of steels. Up to 1.7% carbon can be accommodated in gamma iron. When carbon steel is cooled from the austenite state to ferrite, some carbon must come out of solution. A compound of iron and carbon called cementite is formed giving a hardness to carbon steel.

5

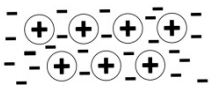
(c) **Safety signs:**
(i) Corrosive substance
(ii) First Aid
(iii) Wear hand protection

(Any two) 3 + 2

(d) **Two issues with disposal of foamed polystyrene:**
- Long life cycle, does not breakdown easily
- Will not recycle
- Toxic gases when burned

(Any two) 3 + 2

(e) **Metallic bond:** the cations are bonded by a 'sea' of electrons giving metals that are usually malleable, ductile and conductive.



5

(f) **Thermal conductors** allow heat to pass through them eg copper
Electrical conductors allow current to flow easily eg aluminium

3 + 2

(g) Silver has an attractive shiny surface, it is malleable, can be shaped by cutting and hammering, it is expensive and holds its value well, etc.

(Any two) 3 + 2

(h) **Factor of safety** is the degree of structural capacity beyond applied loads.

5

(i) **A single acting cylinder** is a pneumatic output device that requires compressed air to make the piston move. If the air is removed the piston will return.
A double acting cylinder needs compressed air to move the piston but will stay in t his position if the air is turned off. It needs air to return the piston to its original position.

3 + 2

(j) **(i)** Internet Service Provider.
(ii) Light Dependent Resistor.
(iii) Random Access Memory.
(iv) Computer Aided Drawing/Drafting/Design.

(Any two) 3 + 2

(k) **(i)** **George Devol:** Born in 1912, he was an American inventor who was awarded the patent for Unimate, the first industrial robot. Devol's patent for the first digitally operated programmable robotic arm represented the foundation of the modern robotics industry. He died in August, 2011.

(ii) **Theodore Maiman:** From Los Angeles, he invented the first operable laser. Laser beams are extensively used in industry, medicine, electronic data processing and communications.

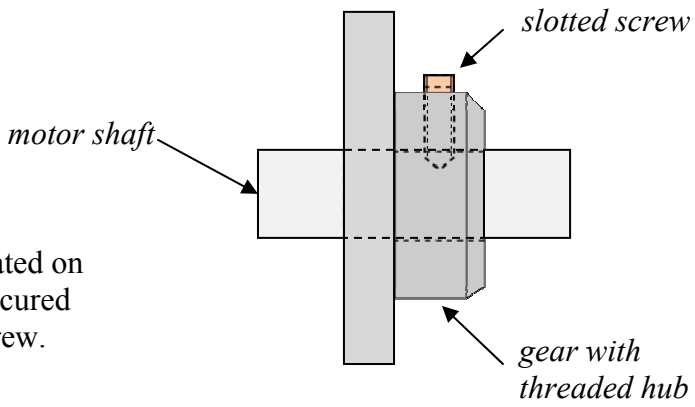
(iii) **Francis Beaufort:** From Navan, Co. Meath, Sir Francis Beaufort (1774 – 1857) was an Irish hydrographer and officer in Britain's Royal Navy. Beaufort was the creator of the Beaufort scale for indicating wind force.

(Any one) 5

(l) **Evaluation in design:** The product is tested to see if it is capable of carrying out the intended function. An evaluation statement can be compiled to assess how well the product works. Among the issues to be considered are safety, aesthetics, choice of materials, machining processes, cost, quality, appropriateness of design and function. The product should meet the original design criteria and modifications can be considered.

5

(m) *suggested solution:*



The gear wheel is located on the motor shaft and secured with a slotted grub screw.

5

Section B – 50 marks

(n) **(i)** **Entertainment**

- Optical disc systems such as CD, DVD and Blu-Ray
- Laser light shows for concerts and other shows.

(ii) **Industry**

- Powerful lasers can cut precise shapes out of thick sheets of acrylic, stainless steel, aluminium, wood, graphite, etc.
- Lasers can be used to accurately determine measurements without contact.
- Printing.
- Scanning barcodes.

5 + 5

(o) **(i)** **A –** Power source / Stimulating medium / Energy pump
B – Fully reflective mirror
C – Partially reflective mirror / Output coupler with laser beam emitted.

1 + 1 + 1

(ii) **Principle of operation:**
The lasing medium is a material with properties that allow it to amplify light by stimulated emission. Light of a specific wavelength that passes through the medium is amplified (increases in power).
For this medium to amplify light, it needs to be supplied with energy (A). This process is called pumping. The energy is typically supplied as an electrical current, or as light at a different wavelength. Pump light may be provided by flash lights or by another laser.
The most common type of laser uses feedback from an optical cavity—a pair of mirrors on either end of the gain medium. Light bounces back and forth between the mirrors, passing through the gain medium and being amplified each time. Typically one of the two mirrors, the output coupler (C), is partially transparent. Some of the light escapes through this mirror. Depending on the design of the cavity (whether the mirrors are flat or curved), the light coming out of the laser may spread out or form a narrow beam.

5

(iii) Gas, light, heat, electromagnetic radiation, semiconductor, etc.

1 + 1

(p) **Monochromatic:** light that contains one wavelength of light. It has one specific colour, ordinary white light is a combination of many colors (or wavelengths) of light.

Coherent: the wavelengths of the laser light are in phase in space and time. Ordinary light can be a mixture of many wavelengths.

Directional: laser light is emitted as a relatively narrow beam in a specific direction. Ordinary light, such as from a light bulb, is emitted in many directions away from the source.

(Any two) 5 + 5

(q) **(i)** Accuracy, precision, versatility of uses, reliability of process and equipment

3 + 2

(ii) **Advantages of laser technology in medicine:**

- Precise control of equipment for eye surgery.
- Allows less invasive and bloodless surgery.
- Laser healing makes recovery much quicker with a reduced chance of infection.
- Neurosurgeons can navigate deep, narrow approaches to brain tumours

3 + 2

(r) **(i)** **Laser vaporisation cutting** is used for non-melting materials such as wood, carbon and thermoset plastics.
Laser fusion cutting is used to cut metals up to 15mm thick.

(ii) **Safety hazards of Class IV laser**
Class IV denotes lasers and laser systems that produce a hazard not only from direct or specular (mirror) reflections, but may also produce significant skin hazards as well as fire hazards.

(iii) **Photon**
One of the basic structures, a photon is an elementary particle and is the unit of light.

(Any two) 5 + 5

Question 2 (50 Marks)

(a) (i) Impact testing will determine the toughness of the material.
Test pieces are notched and held in the vice associated with the machine. A pendulum strikes the test piece and determines the energy absorbed in breaking the piece. This gives a numerical value for the toughness of the material.
The izod impact test (Impact test B) shown has a striking energy of 167 joules and a vertical test specimen notched on the front face.

8

(ii)

Impact test A	**Impact test B**
Charpy Test	Izod Test
300 joules striking energy	167 joules striking energy
Test specimen held horizontally	Test specimen held vertically
Test specimen is clamped at both ends	Test specimen is clamped at one end
Notch on test specimen faces away from striker	Notch on test specimen faces striker

10

(b) (i) **Brass:** brittle metal with no ductility
Copper: not brittle but is a ductile metal
Mild Steel: not a brittle metal

3 + 3 + 3

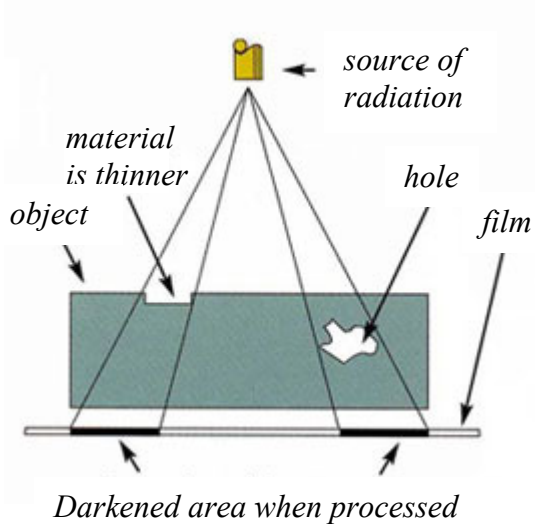
(ii) During the **elastic** extension stage, the specimen extends proportionately with applied load and will return to the original state if the load is removed.
The **plastic** stage gives an increase in specimen length with a relatively small increase in load. The specimen is subjected to work hardening and will 'neck' and then fracture.

5

(c) (i) **Surface imperfections:** visual inspection, penetrant test
Internal flaws: radiography (x-ray) test, ultrasonics

2 + 2 + 2 + 2

(ii) X-ray / Radiography testing:



Radiation from an x-ray tube is passed through the weld. If no defects are present, the amount of absorption is uniform across the area exposed to the x-ray beam. If a defect is present in the weld, a smaller amount of rays is absorbed giving a variation in the intensity of the emergent beam. This can be detected by placing a photographic film on the side of the material opposite the radiation source. On a negative film, the defect shows as a dark spot.

Ultrasonic testing is another suitable method to check for internal faults in welded joints.

10

Question 3 (50 Marks)

(a) (i) Annealing

Annealing is carried out to a metal as soft as possible, it also improves ductility, refines grain size and minimises internal stresses. Annealing essentially involves:

- heating slowly to the required temperature,
- holding at that temperature for long enough to enable the internal changes to take place and
- cooling slowly.

When the temperature is reached the steel is "soaked" to ensure uniform heating and cooling is controlled by reducing the temperature of the furnace gradually. If possible, the object to be annealed is allowed to cool by turning off the furnace making it as soft as possible.

(ii) Normalising

Heating steel to about 40^{o}C above upper critical temperature, holding at this temperature and cooling in air. Grain structure and size refined, internal stresses are relieved and improved mechanical properties are consequences of normalising.

(iii) Carburising

Carburising is a surface hardening process that increases the carbon content of the surface layers.

In **pack carburising**, the object is placed in a furnace surrounded with a carbon-rich compound. The carbon will diffuse into the surface layers at a temperature above the upper critical point. The depth of penetration of carbon into the surface depends on the temperature and length of time in the furnace.

The pack carburising process is time consuming and makes some objects prone to cracking. Grain refining is necessary. After pack carburising, the component may be immersed in a salt bath to allow for uniform surface heating.

(Any two) 8 + 8

(b) (i) Flame hardening

The surface of the steel object is heated to 850^{o}C with an oxy-acetylene flame and quenched quickly. This creates a hard outside layer as the heated austenite structure changes to hard martensite. The depth of hardening depends on the rate of heating.

12

(ii) Lathe slideways, machine beds.

4

(c) (i) A - Austenite
B - Ferrite and Pearlite
C - Liquid
D - Austenite and Cementite

2 + 2 + 2 + 2

(ii) X - Eutectoid point: a reaction that occurs in the solid state when solid austenite changes to solid pearlite. It happens at 723^{o}C for the iron carbon alloy with 0.83% carbon.

(Name and Describe) 3 + 2

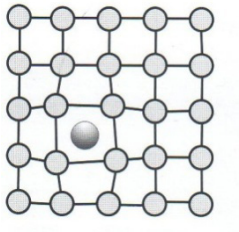
Y - Eutectic point: A liquid to solid change occurs at this point. It happens at 1140^{o}C for the iron carbon alloy with 4.3% carbon. Liquid steel changes to solid austenite and cementite.

(Name and Describe) 3 + 2

Question 4 (50 Marks)

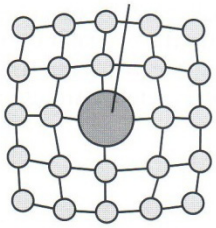
(a) (i) **Interstitial solid solution**

An atom from another element moves into the space between the atoms of the parent metal lattice. This causes compression of the surrounding atoms and will strengthen the material as it takes a higher stress to cause deformation.

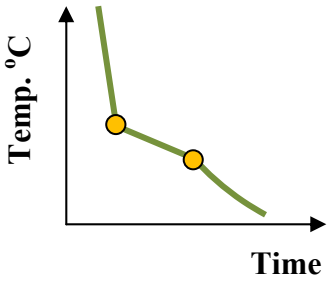


Substitutional solid solution

An atom of another element is present in the crystal lattice. Distortion occurs if this atom is larger or smaller than the parent element. When atoms of similar size are present one type of crystal is may be formed and the mixture looks like a pure metal.
The copper-nickel alloy is an example.



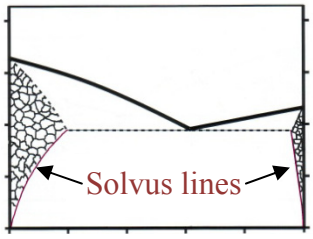
(ii) **Cooling curve for an alloy**



The cooling curve for a combination of metals highlights the start and end of solidification for that particular alloy.

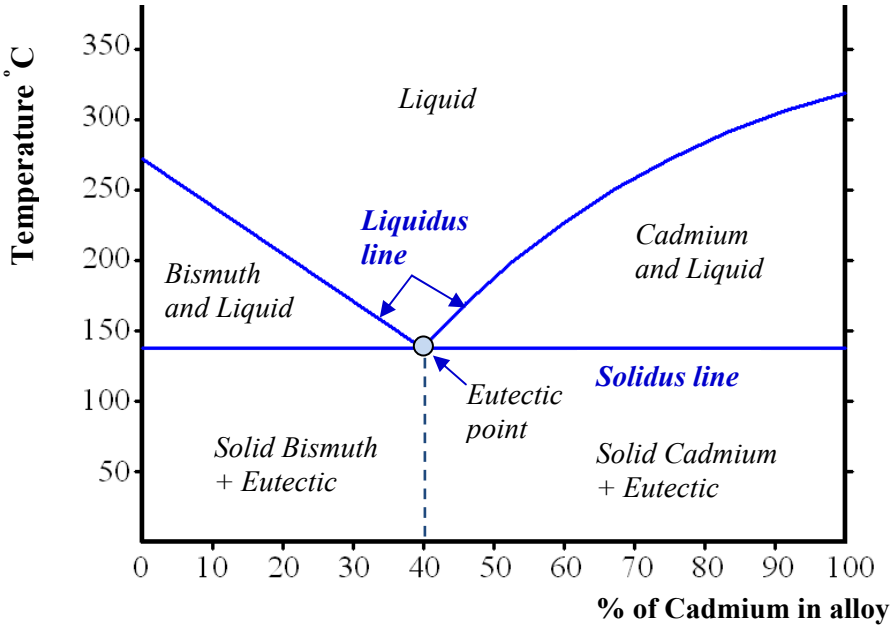
(iii) Lead and zinc mining at Tara Mines in Co. Meath.
Aluminium refining on Shannon estuary.

(iv) **Solvus:** The transition from one solid form to another solid form of an alloy is called the solvus line. On the lead-tin diagram shown, the solvus lines indicate the maximum amount of lead that can be dissolved in tin and the maximum amount of tin that will dissolve in lead.



(Any two) 8 + 8

(b) (i) Draw the thermal equilibrium diagram



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(ii) **Liquid:** the two metals are soluble in each other in the liquid state.

Liquidus line: the change from fully liquid to pasty state. Above the liquidus line, the alloy is liquid. This is the beginning of solidification.

Liquid and bismuth: solid bismuth and liquid.

Liquid and cadmium: solid cadmium and liquid.

Solidus line: the change from pasty to solid. Below the solidus line, the alloy is cooling and solid. This is the end of solidification.

Solid Cadmium + eutectic: at 100% Cadmium there is a large amount of solid Cadmium while this decreases in the alloys found nearer to the eutectic. The same applies for Bismuth.

Eutectic point: a change point in which the alloy changes from liquid to solid without going through a pasty phase.

5 + 5

(iii) **Eutectic alloy**
A mixture of metals that is completely soluble in the liquid state but insoluble in the solid state. The cadmium and bismuth combination is an example.

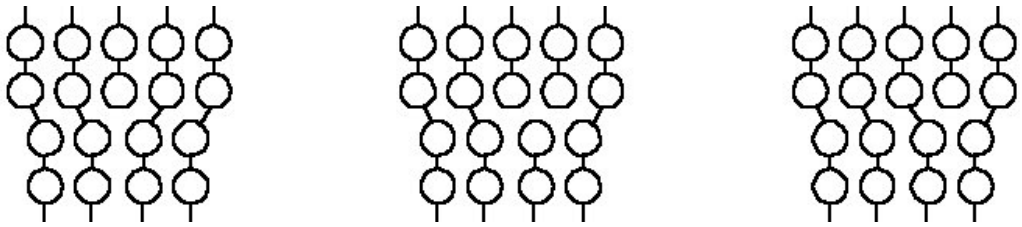
2

(c) **(i)** **Dislocation defect**

This line defect results from an incomplete layer of atoms in a crystal structure. Dislocations can cause a weakening of the structure as the application of a stress will move the dislocation and result in early failure.

4 + 4

(ii) **Movement of dislocation due to shear force**



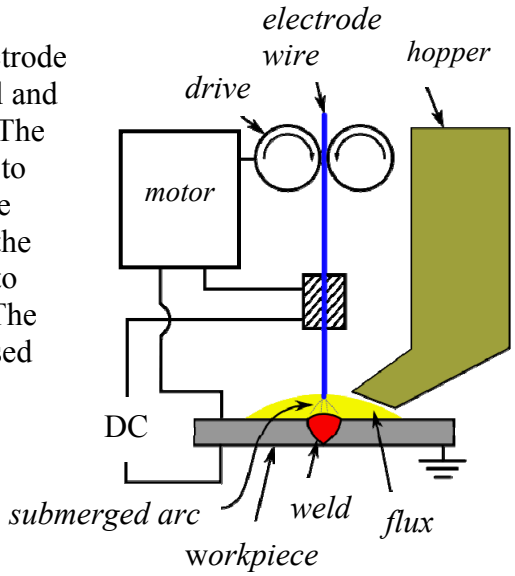
As the shear force is exerted, the fault moves to the next line and may move to the grain boundary. Slip in metals is largely due to the presence of dislocations and will influence material properties.

4

Question 5 (50 Marks)

(a) **(i)** **SAW welding**

In submerged arc welding, a bare wire electrode is used. It is fed automatically from a spool and generates an electric arc to heat the metal. The flux, in powder form, is fed from a hopper to completely cover the joint and the tip of the electrode. The arc creates the heat to melt the joint, flux and electrode. A slag is formed to provide a protective coating for the weld. The excess flux powder can be collected and used again. Submerged arc welding is a fully automated process.



12

(ii) **Applications:** used for large scale straight line welds such as steel reinforcing beams, shipbuilding and bridge construction.

4

(b) **(i)** **Colour coding in oxyacetylene equipment:** Oxygen cylinder is black and acetylene is maroon, hoses and regulators are colour coded with oxygen as blue and acetylene as red.

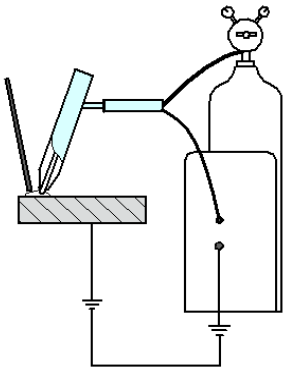
(ii) **Safety precautions in preparation of equipment and materials for oxyacetylene welding:**
Oil and grease needs to be removed to minimise reaction with welding process
Torch must be thoroughly cleaned before starting weld
Flashback arrestors need to be in place on fuel and oxygen line
Correct colour coding of cylinders and hoses must be observed

(iii) **Multi-run welds:** A series of welds are run across the metals to be joined in multi-run welding. A superior weld is produced as each weld has a post heating effect on the previous run. The finished weld is stronger and more refined in structure than single run welds.

(iv) Resistance (spot) welding, MIG welding,

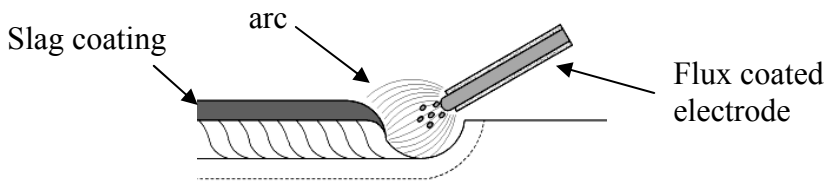
(Any three) 6 + 6 + 6

(c) **(i)** **Tungsten Inert Gas (TIG) welding:**



An arc is formed between the non-consumable electrode and the metal being welded.
The inert gas shielded arc is used to flux the joint, Argon is often used to prevent oxygen getting to the joint area. A filler metal is added manually to the weld pool when necessary. A high frequency generator provides a path for the welding current.

(ii) **Manual metal arc (MMA) welding:**



Electricity is passed through an electrode which jumps between the electrode and the work piece. This causes an arc which produces great heat melting the consumable electrode and the work piece causing the edges to fuse together. The weld pool is protected from oxidation by the gasses produced by melting the chemicals on the electrode coating. This wire electrode also acts as a filler material to fill the gap between the two parts being joined. A slag is formed which protects the weld area from oxidation and minimises cracking of the weld as it allows the joint cool slowly.

MMA welding is made more effective with the use of an adjustable transformer to allow for different thicknesses of steel to be welded.
MMA welding has many operational uses such as repair work on construction steel.

(Any one) 16

OR

(c) **(i)** Relatively easy to programme and control movements.
Equipment can be light and portable.
Settings can be preset and rarely need adjustment.
Non consumable electrodes.

8

(ii) Painting, circuit assembly, fabrication, placing of parts, component testing

4 + 4

Question 6 (50 Marks)

(a) **(i)** **Name:** Compression moulding.

Operation: This process is suitable for thermosetting plastics. It uses a split mould formed to the shape of the object to be moulded. The combination of heat and pressure allows a measured amount of polymer to be shaped. The polymer can be in powder or 'slug' form. As the mould closes, the application of heat triggers the chemical reaction of 'cross-linking' and the object sets (curing). The mould is opened and the object is removed. These mouldings can have a high quality finish requiring only the removal of 'flash'.

Name 2
Description 6

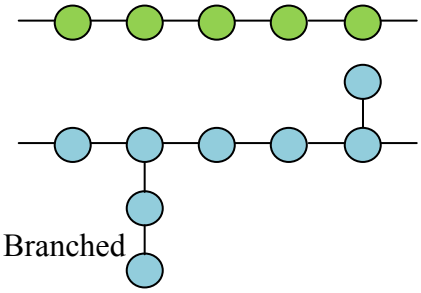
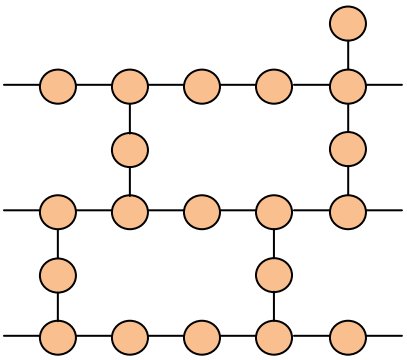
(ii) Thermoset plastic

4

(iii) Socket, plug top

4

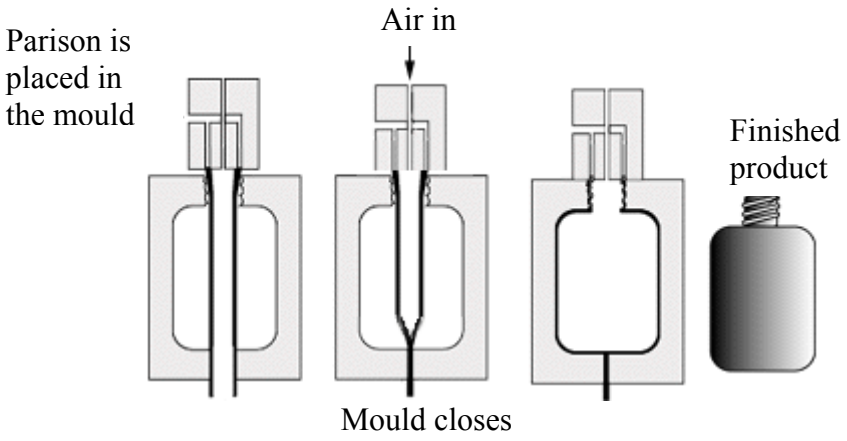
(b)

Thermoplastics	**Thermosetting plastics**
(i) Polymerisation process Addition polymerisation **(ii) Chemical Bonding** Covalent bonding: Secondary bonding with weak van der waals forces. **(iii) Internal structure** Can have linear or branched structure Linear  Branched **(iv) Properties** • Low melting point • Allows for easy moulding • Easily disrupted by heat • Low tensile strength • Branched structures have higher tensile strength than linear • Ideal for recycling	**(i) Polymerisation process** Condensation polymerisation **2 + 2** **(ii) Chemical Bonding** Covalent bonding:Primary bonded strong 3-d structure held together by strong rigid cross-links **2 + 2** **(iii) Internal structure** Have a cross-linked structure  **2 + 2** **(iv) Properties** • High melting point • High tensile strength • Good thermal insulation • Can withstand high temperatures without losing rigidity • Stiff and less flexible **2 + 2**

(c) **(i)** **Elastomers:** A group of polymers consisting of linear chains that are coiled, entangled and are subject to minimal cross-linking. This irregular internal structure and bonding arrangement allows these materials to be very elastic at room temperature

(ii) **Catalyst:** These will speed up or slow down a chemical reaction, they are used to initiate the polymerisation process.

(iii) **Blow moulding:** A moulding process used to create hollow shapes, such as bottles.



An extruded thick-walled tube, called a parison, is placed in the mould. The mould closes and air is blown into the parison. The parison takes the shape of the mould.

(iv) **GRP:** Glass-reinforced plastics: the addition of glass fibre greatly increases the strength of plastic, commonly polyester resins are used. Boats and storage tanks are commonly made from these materials.

(v) **Laminate:** Thin layers of materials bonded together. High strength plastics can be produced by layers of paper or cloth coated with resin being bonded together. Heat and pressure can be used.

(Any three) 6 + 6 + 6

Question 7 (50 Marks)

(a) **(i)** Tool life is increased as cutting fluids reduce friction.
Machining processes generate less heat as cutting fluids cool tools and materials.
Machining is more efficient.

(ii) The dividing head is used for accurate spacing of cuts on a workpiece, for example, holes on a pitch circle, gear teeth or slots on the periphery of a disk. It is used on a milling machine where the dividing head clamps the workpiece, the milling cutter cuts the desired shape and then the dividing head moves the workpiece to the next position.

(iii) A tolerance is the extent by which a dimension is allowed to deviate from the nominal or basic size. If a nominal size of an object is 20.00mm with a tolerance of 0.15 then the upper limit is 20.15mm and the lower limit is 19.85mm.

(iv) Surface finish is influenced by machine speed, tool feed, machine condition, vibration and type of metal to be cut.

(v) *Advantages:* quick clamping with a firm grip, can accommodate large batches of workpieces, can often accommodate unusual workpiece shapes
Disadvantages: metal needs to be magnetic, the workpiece must have a flat surface and be able to make good contact with the chuck

(Any three) 6 + 6 + 6

(b) **(i)** **Two reasons explained such as:**
Minimising the generation of heat
Reducing wear and noise
Allows metals to slide across each other without damage

4 + 4

(ii) Oil
Grease
Graphite

4 + 4

(c) **(i)** **Loading:** a grinding wheel becomes loaded with small particles when grinding debris becomes trapped in the space between the abrasive grains and the wheel. This will cause overheating of the work piece.
Glazing: the grinding wheel has a shiny appearance as the abrasive particles have lost their edge and failed to break away from the wheel. The grinding wheel not cut effectively.
These faults are caused by inappropriate choice of grinding wheel for the material being ground.

4 + 4

(ii) **Forming** is when the surface produced is a copy of the tool producing it. Contour work and screw cutting are examples of forming.
Generating moves the tool in various directions until the required surface is machined. Facing and taper turning on the lathe are examples of machining by generation.

4 + 4

OR

(c) **(i)** **Research:** use of the internet to gather relevant information, forums to seek expertise and advice **6**

(ii) **Product design:** computer simulation of potential products in use, production of computer drawings, ability to produce realistic drawings and manipulate solid 3D models **5**

(iii) **Production techniques:** use of CNC machines to mass produce objects very efficiently **5**

Question 8 (50 Marks)

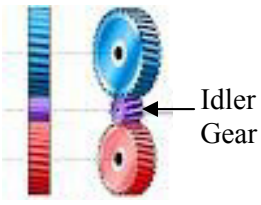
(a) **(i)** **Ball bearing**
Allows a shaft to rotate in the centre of the bearing while it is held in a machine or structure. This reduces friction, promotes free running of the shaft and reduces the build-up of heat.

(ii) **Poly vee belt and pulley**
Motor drives belt to an output pulley which can increase or decrease speeds depending on the size of the pulleys.

(Any one) Name 8
Operation 8

(b) **(i)** **The energy conversation that occurs in a car battery**
Chemical energy to electrical energy

(ii) **Idler gear**
An additional gear that is inserted between two other gears with the purpose of changing the direction of gear rotation. Idler gears do not have an influence on the gear ratio of the system. They allow the input gear and output gear shafts to rotate in the same direction.



(iii) **Ratchet and pawl mechanism**
A ratchet and pawl is used to allow a shaft, axle or pin to rotate in one direction only. The teeth on the ratchet wheel are so shaped that the pawl slides over them in one direction and engages with them so as to restrict movement in the other direction. A ratchet and pawl can be used in ratchet spanners, fishing reels, ratchet screwdrivers, micrometers and winding machines etc.

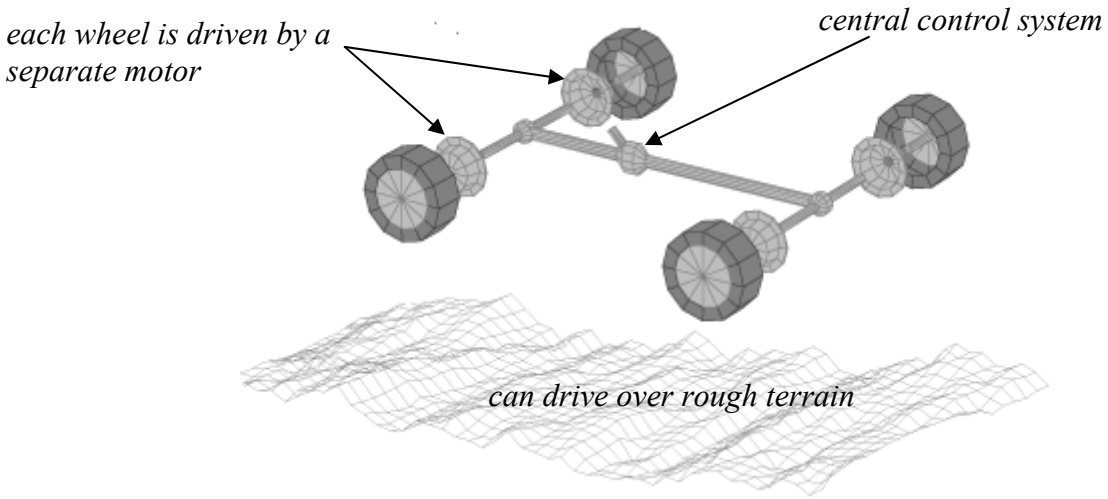
(iv) **Heat sink**
A heat sink is used in electronics to conduct away heat generated by a component. These heat sinks are normally corrugated or finned to dissipate heat to the surrounding air and protect components such as transistors.

(v) **The benefits of using solar panels**
Solar panels are used to harness the free energy from the sun and use it to generate electrical energy or to provide hot water and heating for buildings.

(Any three) 6 + 6 + 6

(c) There are a variety of ways that of providing independent drive to each wheel of an all-terrain vehicle.

Suggested solution is based on the principle of the use of a separate drive to each wheel, other viable solutions are acceptable.



This all terrain surveillance vehicle has the facility to drive each wheel separately as each wheel has a motor control system. These motors are centrally controlled to turn on each motor when required.

16

(c) **(i)** Silicon.

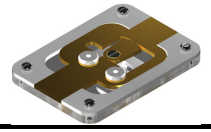
6

(ii) IC's allow more complex circuits to be constructed.
Circuits are more likely to be reliable as digital principles are encouraged.
Circuits will be more reliable.

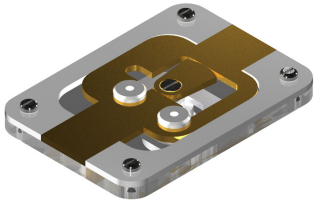
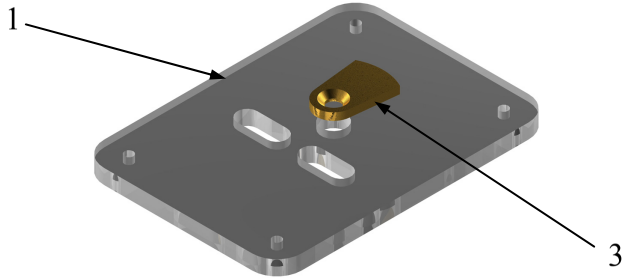
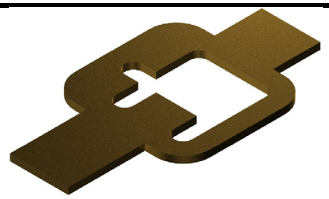
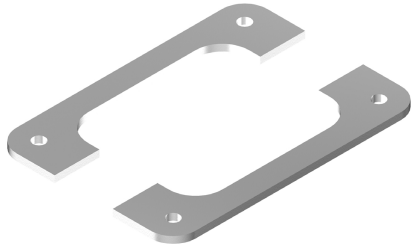
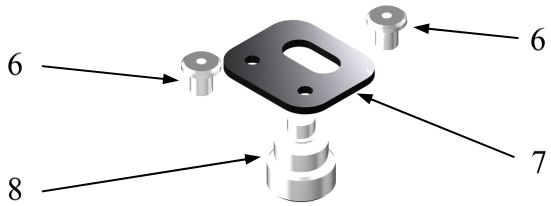
5 + 5

Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate Engineering Practical Marking Scheme 2012



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 Project**		Assembly, Function & Finish Subjective Mark 1 – 20		**20**	20
2	**Parts 1 and 3**		**Part 1** 12 Marks	Marking Out	**2**	20
				10mm Radii	**2**	
				M5 Tapped Holes	**2**	
				Ø10 mm Hole	**2**	
				8 mm Slots	**4**	
			Part 3 8 Marks	Marking Out	**2**	
				Ø5.5 mm CSK	**2**	
				External Profile	**4**	
3	**Part 2**		**Part 2**	Marking Out	**4**	20
				Internal Profile	**6**	
				57 × 60 mm with 12 mm Radii	**4**	
				34 × 26 mm Bolt End	**3**	
				21 × 26 mm Bolt End	**3**	
4	**Parts 4 and 5**		**Parts 4 & 5**	Marking Out	**4**	20
				Ø5.5 mm Holes	**4**	
				10 mm Radii	**4**	
				12 mm Radii	**4**	
				Internal Profile	**4**	
5	**Parts 6, 7 and 8**		**Part 6**	Lathe Work	**8**	20
			Part 7	Bench Work	**8**	
			Part 8	Lathe Work	**4**	

100 Marks (× 1.5 = 150 Total)