Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2014

Marking Scheme

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.

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Leaving Certificate Examination, 2014

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The descriptions, methods and definitions in the scheme are not exhaustive and alternative valid answers are acceptable. If you are unsure of the validity of an alternative answer, contact your advising examiner.

Section A - Core *(72 marks)*

*Answer **any nine** questions in the spaces provided.*
All questions in Section A carry 8 marks.

Section A. Answer **any nine** questions. All questions carry 8 marks.

1. The image shows workers laying a pipeline on the Shell project in the West of Ireland.

Suggest **one** disadvantage of this project.

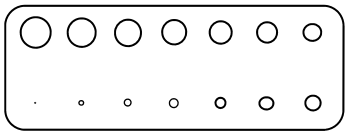
Danger of pollution/danger of gas leaks and explosions/unsightly to rural landscape, etc.

Suggest **one** advantage of this project.

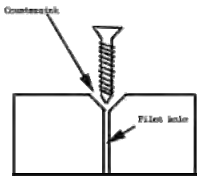
Economic benefit to local community/employment, etc.

2. Drilling is an essential task in project manufacture. In the boxes provided, draw well proportioned freehand sketches to explain the following terms associated with drilling.

Drill gauge:



Countersunk Hole:



3. A student has downloaded from the internet the image of the safety sign shown.

(i) State the meaning of the safety sign shown.

Fire hazard/flammable, etc.

(ii) The image is to be printed at A4 size for display in the Technology room. Outline the main steps required to print this image at A4 size.

Source image/edit image/resize image/print preview and print, etc.

4. The Stone Cutters bridge in Hong Kong is illuminated by 60,000 light emitting diodes (LEDs).

Give **two** reasons for using LEDs instead of filament bulbs.

More economical/energy efficient/ last longer/ size, etc.

5. Polyethylene terephthalate (PET) is a plastic used in the manufacture of water bottles. PET is an example of a *thermoplastic* material.

(i) Explain what is meant by a thermoplastic material.

A plastic that can be reformed repeatedly with heat without damaging the materials properties, etc.

(ii) Name **one** other thermoplastic material.

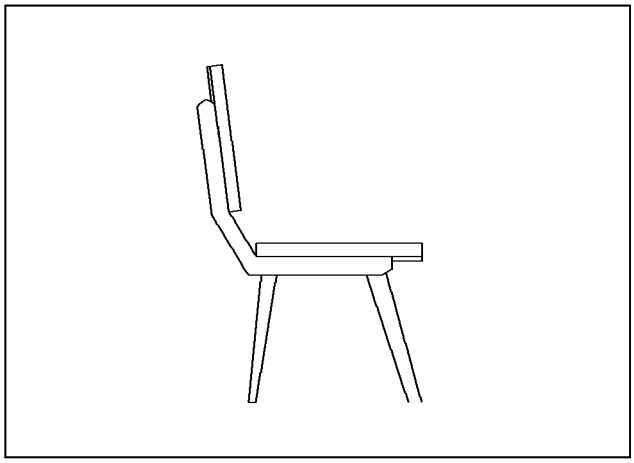
Acrylic/Nylon/PVC/polythene, etc.

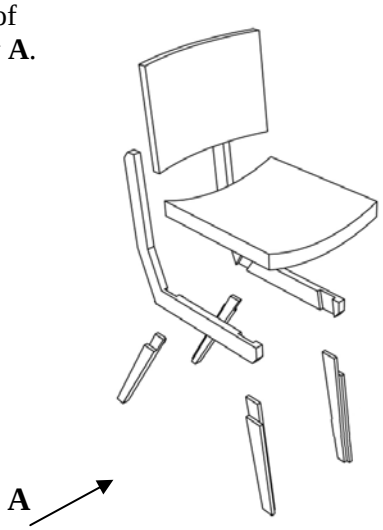
6. The *electronic signature* capture device shown allows individuals to sign, send and store documents electronically.

Suggest **two** benefits of such devices for a business.

No use of paper/instant verification/electronic storage does not require as much physical space, etc.

7. In the box provided, make a well proportioned 2D sketch of the *assembled* chair when viewed in the direction of arrow **A**.





8. The blade of the jig saw shown *reciprocates* when in use.

(i) Describe what is meant by 'reciprocating' motion.

Moving backwards and forwards (or up and down) in a straight line, etc.

(ii) Outline **one** safety precaution that should be observed when operating a jig saw.

Wear safety goggles/keep the cable out of the way of the cutting blade/ dust mask, etc.

9. The graphics below show a resistor colour code table and a resistor **R**.

(i) Calculate the value of the resistor **R**.

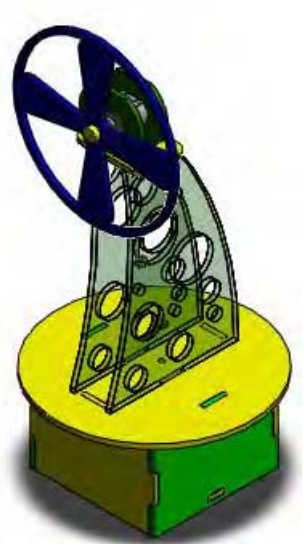
R - brown, black, red, gold. **Value** = **1000 ohms (1kΩ)**

(ii) Using Ohm's law, calculate the current passing through the resistor **R** when connected to a **9V** source.

V= I × R

Current (I) = **V/R = 9/1000 = 0.009A (9mA)**

10. The *heat sensor fan* shown is to be manufactured from acrylic and includes a printed circuit board (PCB).



List **four** main steps required to manufacture this item.

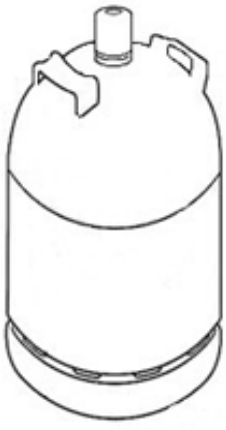
Design parts on CAD
Cut parts out (manually/CNC/Laser cutter)
Design circuit on Circuit Wizard
Produce PCB on CNC router and populate and solder PCB
Assemble /Test, etc.

11. The image shows a *high quality* reusable food container. The container is mass-produced.

Describe **two** costs associated with mass-producing high quality products.

Materials/machinery/skilled labour, etc.

12. Use **two** graphic techniques to enhance the representation of the gas container shown.



Rendering/colour/shading/ shadow/hatching, etc.

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Section B - Core *(48 marks)*

*Answer **both** questions.*
Each question in Section B carries 24 marks.

Section C - Options *(80 marks)*

*Answer **two** of the five options presented.*
All questions in Section C carry 40 marks.

Section B - Core *Answer Question 2 **and** Question 3.*

Question 2** - Answer 2(a) **and** 2(b)* ***(a) - 10 marks, (b) - 8 marks, (c) OR (d) - 6 marks

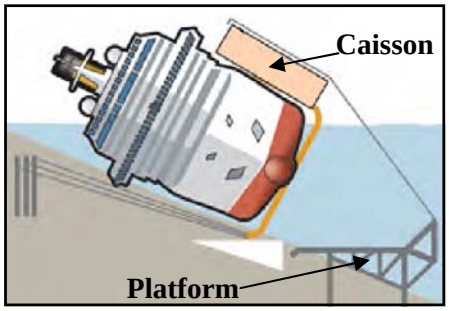
2(a) The cruise ship *Costa Concordia* ran aground off the coast of Italy. A hydraulic pulley system was used by the rescue team when salvaging the ship.

(i) Outline **two** advantages of using a pulley system to lift very heavy objects like the Costa Concordia.
Mechanical advantage generated/relatively quiet/less lubrication required/mobile use from a tug boat, etc.

(ii) Briefly describe why it would be important for the engineers to work as a *team* in order to salvage the ship.
Share ideas to solve problems/complete the task on time/distribute the work/ ensure the safety of workers, etc.

2(b)

(i) Suggest **two** reasons for the use of caissons.



The caissons are initially pumped with water to allow the ship to move into an upright position. The water is then pumped out of the caissons allowing them to be used for buoyancy purposes/the floatation of the ship, etc.

(ii) Name a suitable material for the manufacture of the platform. Outline **one** property of your chosen material that makes it suitable for the manufacture of the platform.

A suitable material and property, e.g., galvanised steel– very strong, etc.

(iii) *Triangulation* is used in the construction of the platform. Discuss the importance of triangulating the platform.
Required for rigidity/strength/safety, etc.

*Answer 2(c) **or** 2(d)*

2(c) Technological developments such as the use of *global positioning systems* (GPS) have greatly enhanced the transport industry.

(i) Outline **two** reasons why cruise ships use GPS when navigating the seas.
Accuracy/safety/works in all weather/coverage all over the planet, etc.

(ii) Name **two** other devices in which GPS is used.
Car Sat Nav's/smart phones, etc.

OR

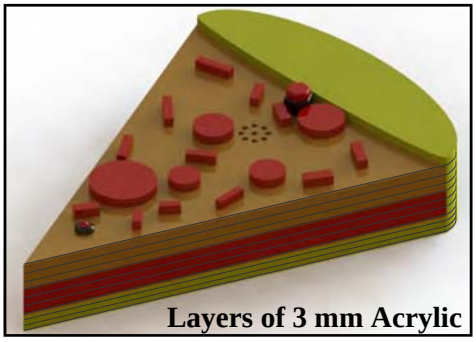
2(d) Cruise ships like the Costa Concordia can carry up to 5,000 passengers and crew.

(i) Outline **two** environmental disadvantages of cruise holidays.
Sea pollution/damage to coral reefs/carbon footprint/excessive waste generated, etc.

(ii) Outline **one** area where technology has had a positive impact on the environment.
Any relevant example, e.g., fuel efficient engines, etc.

Question 3 - Answer 3(a) and 3(b) *(a) - 10 marks, (b) - 8 marks, (c) OR (d) - 6 marks*

3(a) The graphic shows a student's timer project made from 3 mm acrylic. The student designed this project to ensure the correct timing for the cooking of pizzas.


Layers of 3 mm Acrylic

(i) Outline **two** reasons why acrylic is suitable for the manufacture of this project.
Variety of colours/presentation/easy to process, etc.

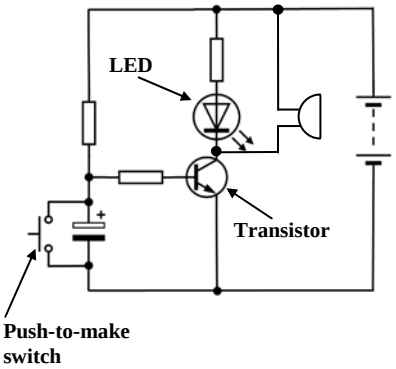
(ii) The project was designed to allow the battery be changed when necessary. Describe, using notes and sketches, a suitable method to allow access to the battery inside this project.
Sliding access panel/screw fixed panel, etc.

3(b) The circuit shown uses a *push-to-make switch*, a *transistor* and a *light emitting diode (LED).*

(i) Redraw the circuit in your answerbook and label the electronic components referred to above.

(ii) The LED is a *polarised* component. Explain what is meant by the term 'polarised'.
The long leg is positive/short leg is negative/ current flows from positive to negative, etc.

(iii) Show how a buzzer could be included in the circuit so that the LED and buzzer are activated at the same time.



Answer 3(c) or 3(d)

3(c)

(i) When manufacturing the pizza timer project, all of the acrylic layers should be exactly the same size and shape. Outline how best this could be achieved.
CNC router/laser cutter or use of a template if manually processed, etc.

(ii) Suggest a suitable adhesive to join the acrylic layers together.
Liquid solvent cement/Tensol cement, etc.

OR

3(d) The graphics show a printed circuit board (PCB) and a copper stripboard.

(i) Outline the benefits of using a PCB rather than copper stripboard for the manufacture of the timer circuit.
Components are labelled on the PCB/soldering pads are pre-fluxed/visually easier to understand compared to a stripboard, etc.

(ii) State **two** safety precautions a student should observe when soldering a circuit.
Place soldering iron in its stand when not in use/ventilation required to extract fumes/ never touch the soldering tip when it is hot, etc.


PCB


Copper Stripboard

Section C - Options - *Answer **any two** of the Options*

Option 1 - Applied Control Systems - *Answer 1(a) **and** 1(b)*

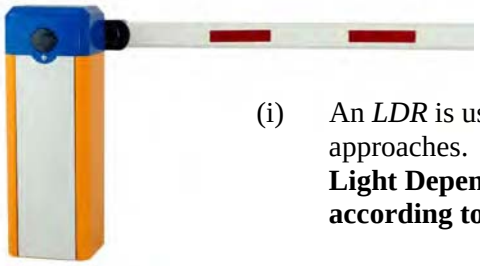
(a) - 10 marks, (b) - 20 marks, (c) OR (d) - 10 marks

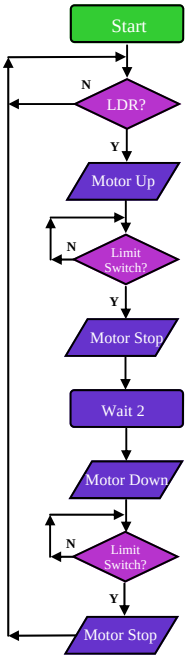
1(a) Some modern toys are both intelligent and *interactive*.

(i) Explain what is meant by the term 'interactive' in this context.
A child is able to control the outputs of the toy directly by using a console or by activating buttons on the toy itself, etc.

(ii) Peripheral interface control circuits (PICs) can be used to control various inputs and outputs in toys.
Suggest **three** outputs suitable for use in a toy such as the robotic dog shown.
LEDs/motors/speakers/piezo sounder, etc.

1(b) A student has produced a simple flowchart to control an automatic vehicle barrier, similar to the one shown in the image.





(i) An *LDR* is used to trigger the barrier to raise as a vehicle approaches. Explain the abbreviation 'LDR'.
Light Dependent Resistor– The value of resistance changes according to the level of light, etc.

(ii) Suggest a reason for including two limit switches in the control program as shown in the flowchart.
The limit switches stop the motor when the barrier is fully opened and fully closed.

(iii) The flowchart currently allows the barrier to open and close *once*.
Describe how a loop could be included in the flowchart to allow the barrier to reset and be used repeatedly.

*Answer 1(c) **or** 1(d)*

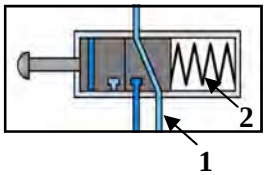
1(c) Unmanned aerial vehicles known as *Drones* are operated by means of an automatic programmable system or by a remote operator. There is no pilot on board.

(i) Suggest **two** possible uses of such aircraft.
Military warfare/geographical surveillance/policing/search and rescue, etc.

(ii) Suggest **one** advantage and **one** disadvantage of the use of such aircraft.
Advantage: Remotely operated/travel large distances/reprogrammable to perform different tasks, etc.
Disadvantage: Can cause civilian losses of life during air strikes/Unethical, etc.

OR

1(d) (i) Give **one** advantage and **one** disadvantage of using pneumatics in industrial workshops.
Advantage: Limitless supply of air/ wide range of applications, etc.
Disadvantage: Set up cost/potential noise pollution, etc.



(ii) The graphic shows a 3/2 control valve used in pneumatics.
Describe the purpose of parts **1** and **2** as identified in the graphic.
1: Exhaust port- Releases air out of the pneumatic circuit
2: Spring– return the valve to its depressed position.

Option 2 - Electronics and Control - *Answer 2(a) **and** 2(b)*

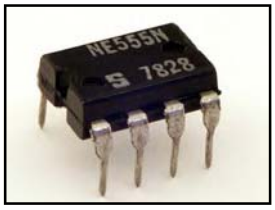
(a) - 10 marks, (b) - 20 marks, (c) OR (d) - 10 marks

2(a) Integrated circuits (ICs) have many individual components such as transistors, diodes and capacitors etched on a tiny silicon chip. Silicon is a *semiconductor*.

(i) Explain what is meant by the term 'semiconductor'.
A material that has conductivity between that of a conductor like metal and that of an insulator like glass. A substance that can act as a conductor or insulator depending on chemical or external conditions. Examples Germanium /Silicon Carbide, etc.

(ii) Outline **two** advantages of using ICs in electronic devices such as mobile phones.
Processing speed/small in size/low cost, etc.

2(b) The image shows a 555 timer chip. Two uses of the 555 are as a *monostable* circuit or as an *astable* circuit.



(i) Explain the terms 'monostable' and 'astable'.
Monostable: **In a monostable circuit the IC is timed to pulse just once. The circuit must be reset to use it again.**
Astable: **In an astable circuit the IC is timed to pulse continuously until the power is removed.**

(ii) Give **one** everyday use of a monostable circuit and **one** everyday use of an astable circuit.
Monostable: LEDs come on for a period of time and then go off, etc.
Astable: A circuit using LEDs that flash repeatedly, etc.

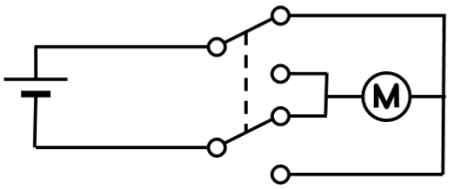
(iii) ICs can be damaged by overheating while being soldered. Describe how this damage can be prevented.
Use a heat sink/solder IC sockets and mount the ICs into the sockets afterwards, etc.

*Answer 2(c) **or** 2(d)*

2(c) The image shows a low-cost *DC* gearbox motor widely used by students in project work.

(i) Explain what is meant by the term 'DC'.
Direct Current– current flows in one direction only through the circuit, etc.

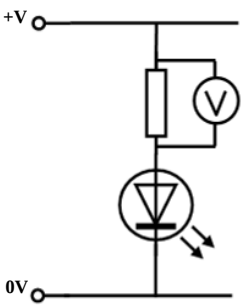
(ii) Sketch a typical motor reversal circuit that uses a double-pole double-throw (DPDT) switch to control the direction of a motor.



OR

2(d) *Multimeters* are commonly used in electronics.

(i) Outline **two** uses of a 'multimeter' in a Technology room.
Continuity tester/measure voltage, current, resistance, temperature, etc.



(ii) The diagram shows a resistor and a light emitting diode (LED) connected in a circuit.

Using a line diagram, show how a multimeter would be connected to measure the voltage drop across the resistor in this circuit.

Option 3 - Information and Communications Technology - Answer 3(a) and 3(b)

(a) - 10 marks, (b) - 20 marks, (c) OR (d) - 10 marks

3(a) The use of *computer simulation* software has many applications such as analysing weather patterns and projecting weather forecasts for the future.

(i) Explain what is meant by the term 'computer simulation'.
A computer simulation is an application/program designed to imitate a real life situation.

(ii) Suggest **two** other applications of computer simulation software in industry.
Flight simulation/electronic circuit design/fluid dynamics, etc.

3(b) Hackers continuously try to access information about individuals and companies for their own personal gain.
One method of making personal data more secure and of limiting fraudulent activity is through the use of *biometrics*, such as fingerprint recognition when accessing this data.

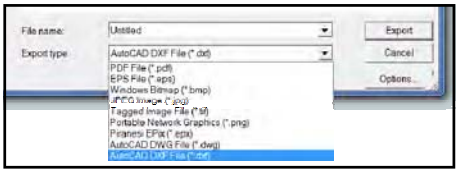
(i) Outline, using examples, what is meant by the term 'biometrics'.
Biometrics refers to the identification of human beings by using their characteristics, e.g., using fingerprint, facial, voice, retina or signature recognition, etc.

(ii) Give **two** benefits for individuals or companies who use biometrics to protect their personal data.
More secure/safe/no need to remember passwords, etc.

(iii) Describe how personal data given in handwritten format could be converted to electronic format.
Optical Character Recognition/scanned/digital image/typed, etc.

Answer 3(c) or 3(d)

3(c) The graphic shows the *export* command used in a computer aided design (CAD) program. This command offers users many different file formats. Some of these file formats include *.jpg* and *.dxf.*



(i) Briefly describe what is meant by the term 'export' in relation to computer files.
Exporting allows files to be saved in different file formats so that they can then be opened in specific software applications such as photo editing software, CNC machine software, etc.

(ii) Give **one** example of where a '.jpg' file format and **one** example of where a '.dxf' file format could be used in project work.
.jpg- digital photographs of the project realisation.
.dxf– allowing CAD files to be used in CNC manufacture, etc.

OR

3(d) In recent years *wireless* technology has become increasingly popular amongst home users, allowing electronic devices to communicate with one another without the use of cables.

(i) Name **two** wireless devices commonly used in the home.
Tablets/laptop computers/smart phones, etc.

(ii) Using notes and sketches, describe how wireless devices interact with each other in a home network.

A wireless router allows electronic devices to communicate with each other. A modem is required to connect to the internet, etc.

Option 4 - Manufacturing Systems - *Answer 4(a) **and** 4(b)*

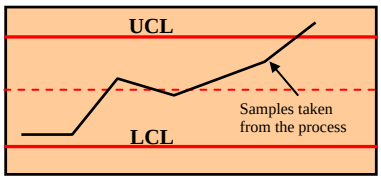
(a) - 10 marks, (b) - 20 marks, (c) OR (d) - 10 marks

4(a) The image shows a water sports harness. A *prototype* of the harness was made by the manufacturer prior to mass production.

(i) Explain what is meant by the term 'prototype'.
A prototype is an example of a product that serves as a basis for future models, etc.

(ii) Suggest **two** benefits for a manufacturer who makes a prototype before undertaking volume production.
Improve the functionality and design of a product, reduce manufacturing costs through the elimination of faults, etc.

4(b) The graph below shows a control chart used to monitor the quality of the assembly process for a sample of water sports harnesses.



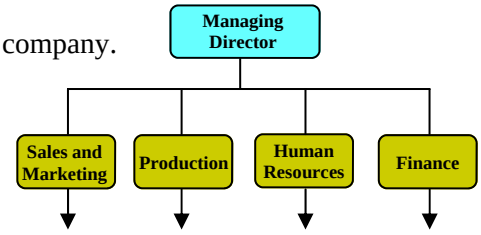
(i) Outline the role of the *upper control limit* (UCL) and the *lower control limit* (LCL) lines on the graph shown.
The UCL and LCL indicate if the process is in control, etc.

(ii) Briefly describe what the graph suggests about the quality of assembly in the harnesses sampled.
The process is out of control.

(iii) Give **one** benefit for manufacturers who collect data about the quality of their manufacturing processes.
In collecting data manufacturers can improve or change manufacturing processes so that the quality of products can be enhanced, etc.

*Answer 4(c) **or** 4(d)*

4(c) The graphic shows the organisational structure of a manufacturing company.



(i) Suggest **two** leadership qualities a managing director should possess to lead a company effectively.
Able to make decisions/supportive to colleagues/ provide direction, etc.

(ii) This company has four main departments:
sales and marketing, production, human resources and *finance*.

Briefly describe the work carried out in any **two** departments listed above.
Sales and marketing– identify customer needs/meeting customers/promotions, etc.
Production– manufacturing the products from raw materials/quality control, etc.
Human resources– recruitment/working conditions/staff training/retention, etc.
Finance– Investment/payroll/pay suppliers/maintenance costs, etc.

OR

4(d) *Concurrent engineering* involves bringing a group of professionals together to work collectively on the design and manufacture of a product.

(i) Suggest **two** benefits for a company that takes this approach when designing and manufacturing a product.
Share ideas/critically analyse aspects of design and manufacture/ delegate the workload/improved productivity, etc.

(ii) Companies often use *benchmarking* when designing a new product.
Outline what is meant by the term 'benchmarking'.
Compare a new product against rival products identifying strengths and weaknesses, etc.

Option 5 - Materials Technology - Answer 5(a) and 5(b)

(a) - 10 marks, (b) - 20 marks, (c) OR (d) - 10 marks

5(a) The graphics show various uses of *manufactured boards* produced in Ireland.

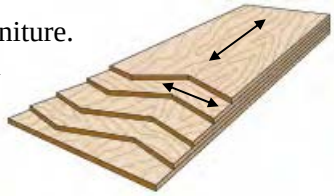
Engineered Wood - door panels

Medium Density Fibreboard - (MDF) furniture panels

Oriented Strand Board - (OSB) flooring panels

(i) Outline **two** advantages of using manufactured boards.
Wide board format/stable/multiple applications/cheaper to solid wood panels, etc.

(ii) *Plywood* is a wood product commonly used in the making of flat-pack furniture. Describe using notes and sketches, how 'laminates' or 'veneers' are glued together to make this board.
Veneers are glued at 90° to each other to improve the strength and rigidity of the board, etc.



5(b) The image shows a child's scooter for outdoor use.

(i) Suggest a suitable material for the production of base **A** and justify your choice.
Any valid material and justification, e.g., ABS/steel/aluminium
Strong/durable/easy to mould/press into shape, etc.

(ii) Both *permanent* and *semi-permanent* joints are used in the assembly of the scooter.
Outline why both 'permanent' and 'semi-permanent' joints are necessary in the assembly of the scooter.
Permanent joints are useful where strength is required, e.g., welded flanges etc.
Semi-permanent joints are useful where parts can be folded so that the scooter can be put away out of use, etc.

(iii) Describe **one** way in which a manufacturer could minimise environmental impact at the design stage and at the manufacture stage of the scooter.
Use recycled materials/energy efficient processes and machinery, etc.

*Answer 5(c) **or** 5(d)*

5(c)

(i) The metal parts of the scooter have been *spray-painted.*
Suggest **two** reasons why this process might be carried out on the metal parts of the scooter.
Protect the metal against corrosion/enhance or change the appearance, etc.

(ii) Outline **two** safety precautions that should be observed when applying paint to materials.
Wear protective equipment- mask, goggles, workshop jacket/ventilate the spray room/ awareness of fire hazards, etc.

OR

5(d) Many products on the market display the *Forest Stewardship Council* (FSC) logo as shown. The mission of this council is to manage the world's forests in a way that is appropriate to the environment and is beneficial to society.

(i) Outline **two** benefits for society arising from the proper management of the world's forests.
Greater supply of oxygen/protect wildlife/recreational benefits, etc.

(ii) Explain what is meant by the term *carbon footprint.*
The amount of CO2 released into the atmosphere due to the activities of an individual, organisation or community, etc.

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