



Coimisiún na Scrúduithe Stáit
State Examinations Commission

Leaving Certificate 2016

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.



Leaving Certificate Examination, 2016

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Marking Scheme

Section A - Core (72 marks)

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

1. Wearable devices such as the activity tracker shown have become very popular. Some of these devices make use of *GPS* technology.

- (i) Suggest **two** health benefits for a person who uses a smart device such as an activity tracker.

Improve fitness, monitor heart rate, monitor loss in calories, track performance on an ongoing basis, etc.

- (ii) Explain the abbreviation GPS.

Global Positioning System.



(2+2+4 marks)

2.



The image shows is of a unique bike rack in Roanoke, Virginia, USA.

- (i) Name a suitable *wood* for the bike rack.

Wood: **Cedar, Oak, etc.**

- (ii) Describe how the wood chosen above could be treated to help prolong its life outdoors.

A preservative or finish could be applied e.g., paint, varnish, etc. The wood could also be pressured treated.

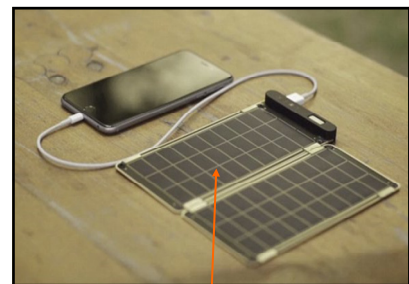
(4+4 marks)

3.

Solar Paper® is one of the thinnest and lightest personal solar chargers in the world. A standard smart phone can be fully charged in two hours using this device.

Give **two** advantages of using Solar Paper.

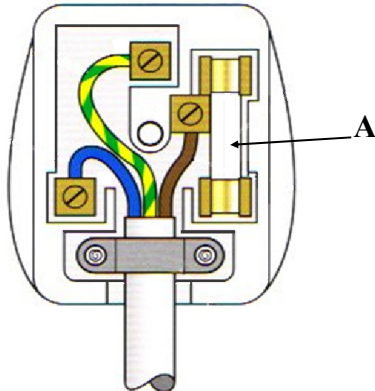
Portable, light, renewable source of energy, etc.



Solar Paper®

(4+4 marks)

4. The graphic shows the wiring of a domestic 3 pin plug.



(i) State the colour coding of the *earth wire* and the *neutral wire*.

Earth wire: Yellow/Green.

Neutral Wire: Blue.

(ii) What is the purpose of fuse A?

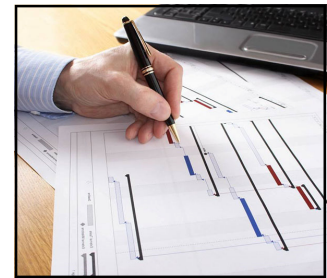
To protect the appliance against a surge of electrical current.

(3+3+2 marks)

5. Students often construct a *Gantt Chart* during the planning stage of a project task.

(i) Explain what is meant by a Gantt chart.

Gantt charts are used by project managers to graphically outline the various tasks of a project. The duration and sequence of each task is represented on the chart.



(ii) Give **one** benefit for a road building company which uses Gantt charts when planning its work.

The use of Gantt charts allow companies to complete projects on time.

(4+4 marks)

6. The image shows a bike frame that has been *prototyped* using a 3D printer.

Give **two** advantages of producing a prototype before manufacturing a product.

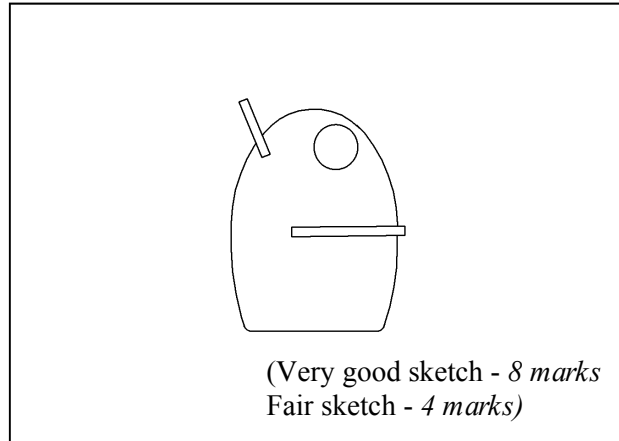
Producing a prototype allows for design flaws to be identified.

A prototype can also help to identify unforeseen manufacturing difficulties, etc.



(4+4 marks)

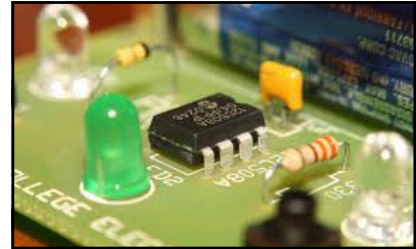
7. In the box provided, make a well proportioned 2D sketch of the chair shown when viewed in the direction of the arrow A.



8. The image shows an LED mounted on a PCB.
 (i) Explain the abbreviation PCB.

Printed Circuit Board

- (ii) Calculate the value of the *voltage* across the LED if the current is 0.012 amps and the resistance is 200 ohms.
Note: $V = I \times R$



Calculation:

$$\text{Voltage} = 0.012\text{A} \times 200\Omega$$

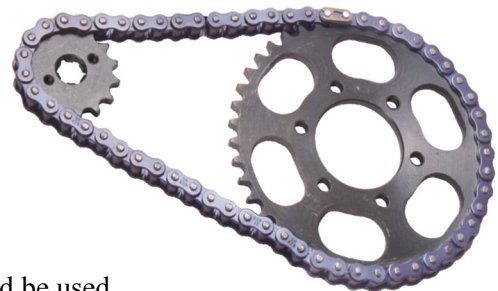
$$\text{Voltage} = 2.4\text{V}$$

(4+4 marks)

9. The image shows a mechanism commonly used to transmit rotary motion from one shaft to another.

- (i) Name the mechanism shown.

Chain and Sprocket mechanism.



- (ii) Give **one** example of where this mechanism could be used.

Bicycle, motor bike, etc.

(4+4 marks)

10. The image shows a machine commonly used in Technology workshops.

(i) Name the machine shown.

Scroll Saw.

(ii) Give **two** safety precautions which should be observed when using this machine.

Make sure the guard is down, wear eye goggles, no loose clothing, etc.

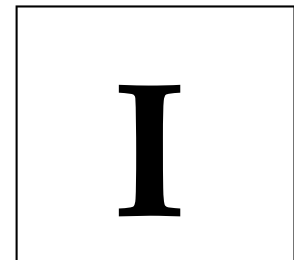


(4+2+2 marks)

11. Steel beams are often used to construct the frame structures of buildings.



(i) In the box provided, sketch the profile (cross-section) of **one** steel beam used in frame structures.



(ii) Name **one permanent** and **one semi-permanent** joint used to assemble beam structures.

Permanent joint: **Welded joint.**

Semi-Permanent Joint: **Nut and bolt joint, etc.**

(4+2+2 marks)

12. Use **two** graphic techniques to enhance the graphic representation of the claw hammer shown.



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

(4+4 marks)



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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 image at 2(b) below shows a water fountain and food dispenser for use by pet animals such as dogs. The height of the water container can be adjusted to suit the pet.

(i) Outline **two** reasons why plastics are popular in the manufacture of products like the water and food dispenser shown.

Mouldable, aesthetics, waterproof, easy to mass produce, etc.

(ii) Describe using notes and annotated sketches how the height of the water container **B** could be adjusted on the column **C**.

A screw knob could be used to lock fountain B at a given height on column C, etc.



(10 Marks, 4+6)

2(b) The base **A** of the product has been manufactured using a *thermoplastic* material.

(i) Briefly describe what is meant by a thermoplastic material.

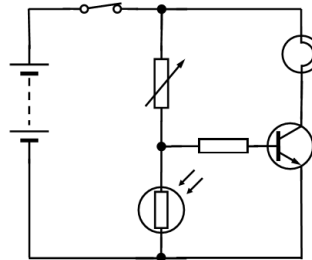
Plastics which can be reformed/remoulded with heat, etc.

(ii) Suggest a suitable plastic for the base **A**.

HIPS, PVC, etc.

(iii) An electronic circuit is required to activate a light which illuminates the feeder when darkness falls.

Draw a labelled diagram of a suitable circuit to activate the light as required.



Answer 2(c) or 2(d)

(8 Marks, 2+2+4)

2(c) A manufacturer has issued a *product recall* for a pet feeder similar to the one shown in 2(b) above.



RECALL

(i) Outline **two** reasons why a product might be recalled by a manufacturer.

Poor design, poor manufacture, health and safety risks, etc.

(ii) Describe **two** consequences for a manufacturer when a product has to be recalled.

Loss in sales, damage to reputation, potential lawsuits taken against the

(6 Marks, 4+2)

OR

2(d) The image shows a model in card, produced by a student when developing a response to a design brief.

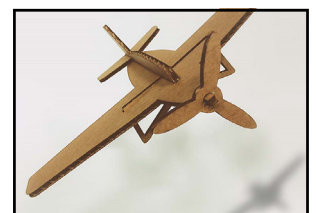
(i) Describe **two** ways in which producing a card model can benefit a student when developing their design.

Size and proportion can be adjusted before manufacture, Potential manufacturing problems can be identified and rectified, etc.

(ii) Give **one** example of how the environmental impact of producing a technology task can be reduced.

Minimise production techniques, reduce material wastage, reuse components,

(6 Marks, 4+2)



Question 3 - Answer 3(a) and 3(b)

(a) - 10 marks, (b) - 8 marks, (c) OR (d) - 6 marks

3(a) In 2015, *drones* (Unmanned Aerial Vehicles) and other modern technological devices were used to enhance the television coverage of the U.S. Open Golf Championship.

- (i) Give **two** advantages of using drones in television coverage of sporting events.

Easy to fly/control, provide greater camera access, relatively cheap and quiet, etc.

- (ii) Give a brief outline of **two** other uses of new technologies in sporting events.

TMO in rugby, hawk eye in GAA, flight simulation of golf balls, etc.



(10 Marks, 6+4)

3(b) The images show a drone with a 14 megapixel camera attached. Images from the camera are stored on a 32 GB SD card.



- (i) Name **one** energy conversion that takes place when a drone is in flight.
Chemical to electrical, electrical to mechanical, etc.

- (ii) Using notes and annotated sketches, suggest a suitable method of rotating the camera while in use.

Any appropriate method, e.g., gearbox motor, worm/worm wheel, etc.

- (iii) Explain what is meant by '32 GB SD card' when referring to data storage.

A 32 Gigabyte (GB) Secure Digital (SD) card is a non-volatile memory format developed for portable devices, etc.

(8 Marks, 2+4+2)

Answer 3(c) or 3(d)

3(c) The increased use of drones has raised concerns among the general public.

- (i) Outline **two** problems for the general public arising from the increased use of drones.
Invasion of privacy, risk to commercial aircraft, etc.

- (ii) The use of drones can also be of benefit to society.

Give **one** example where the use of drones might benefit society and the general public.

Provide visual data to rescue services when dealing with natural disasters, crime prevention, etc.



(6 Marks, 4+2)

OR

3(d) Computer *simulation* software is often used during the design stage of a new product.

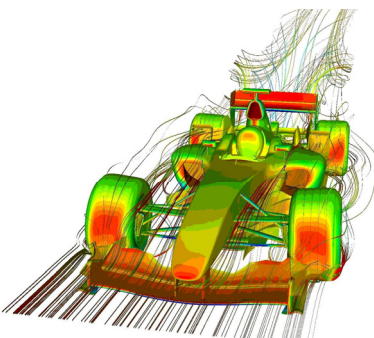
- (i) Suggest **two** benefits of using computer simulation to improve the design of cars such as a formula one racing car.

Develop a better understanding of the car's aerodynamics, identify stress and strain on the car, etc.

- (ii) Briefly describe **one** other situation where computer simulation software is used in everyday life.

Weather forecast modelling, flight simulation, etc.

(6 Marks, 4+2)



Section C - Options - Answer any two of the Options

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

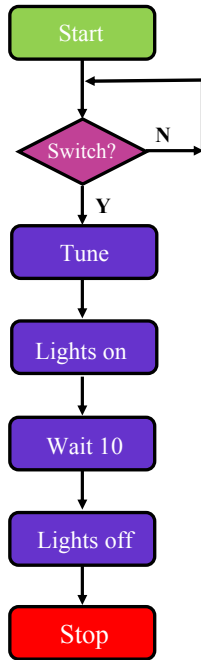
(a) - 10 marks, (b) - 20 marks, (c) OR (d) - 10 marks

1(a) The image shows a Furby® toy which includes a microcontroller chip.

- (i) When a switch is pressed, a tune plays and then the eyes light up for ten seconds before turning off again.



Complete a flowchart programme to satisfy these conditions.



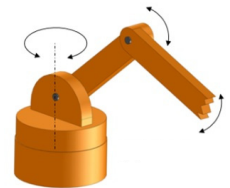
Any valid alternative solution accepted.

(10 Marks, 6+4)

1(b) The image shows a robotic arm. The arm has six *degrees of freedom*.

- (i) Describe, using notes and annotated sketches, what is meant by ‘degrees of freedom’.

A degree of freedom is a joint that allows a robotic arm to move in given direction. Servo motors are often used in conjunction with robotic joints, etc.



- (ii) Give **two** applications of robots in mass production systems.

Spray painting of cars on assembly lines, pick and place robots used to move drugs in pharmaceutical plants, etc.

- (iii) *In time, robots will outsmart human beings and rule the world!*

Indicate whether you agree or disagree with this statement and justify your answer.

A valid argument/justification made for or against the statement, etc.

(20 Marks, 8+6+6)

Answer 1(c) or 1(d)

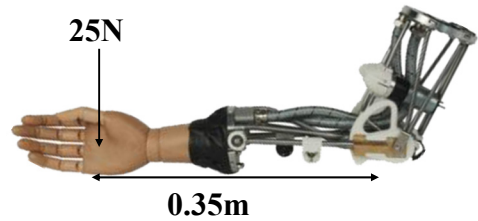
1 (c)

- (i) With reference to the robotic arm shown, describe what is meant by the term *end effector*.

An end effector is an attachment that is mounted on the end of a robotic arm. End effectors allow robotic arms to perform different tasks. A mechanical gripper is an example of an end effector.

- (ii) Calculate the moment acting about the elbow of the robotic arm if a load of 25N is acting on the hand.

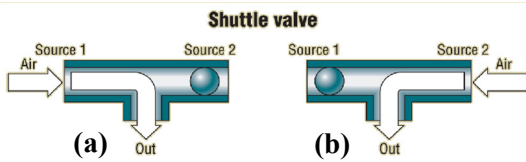
$$\begin{aligned} \text{Moment} &= \text{Force} \times \text{Distance} \\ &= 25\text{N} \times 0.35\text{m} \\ &= 8.75\text{Nm} \end{aligned}$$



(10 Marks, 6+4)

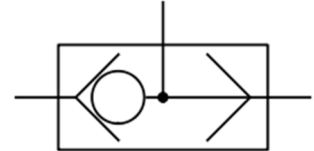
OR

1 (d)



- (i) Briefly outline how a pneumatic *shuttle valve* operates with reference to the images shown.
Draw the pneumatic symbol for a shuttle valve.

In diagram (a) the air pressure from source 1 is greater than the air pressure from source 2. Source 1 forces the ball bearing to block off the air supply from source 2. In turn, this allows source 1 air to exhaust through the outlet. The process is reversed in diagram (b), etc.



- (ii) Give **two** advantages of using a mini air compressor similar to that shown.

Portable, low voltage supply required, faster than a hand pump, etc.



(10 Marks, 6+4)

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

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

2(a) The image shows a universal 2000 mA AC/DC adapter with 3-12 V output.

- (i) Explain what is meant by the abbreviations 'AC' and 'DC'.

AC: Alternating Current DC: Direct Current

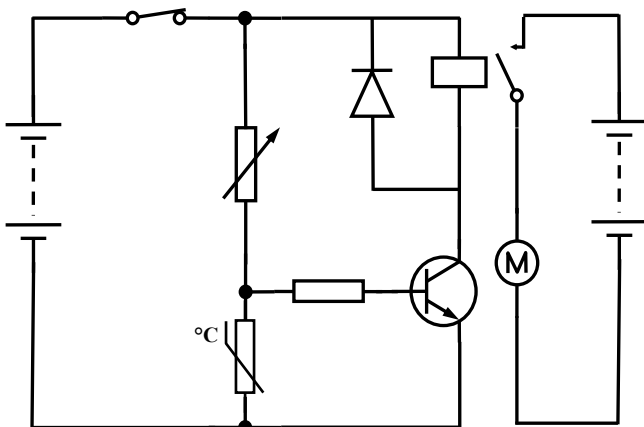
- (ii) Briefly explain why an adapter, like the one shown, might have multiple voltage output options.

Different electrical circuits/ electrical components require different voltage supplies to operate without being damaged/destroyed, etc.



(10 Marks, 6+4)

2(b) The circuit shown operates a motorised cooling fan when activated by a sensor at A.



- (i) Suggest a suitable sensor that could be placed at A.
Thermistor.

- (ii) Redraw the circuit diagram to include the electronic symbol for your chosen sensor.

- (iii) Describe why a relay is used in this circuit.

The motor may require a high voltage supply. A relay is an electronic component that allows higher voltage circuits to be activated using a safer low voltage

(20 Marks, 6+8+6)

Answer 2(c) or 2(d)

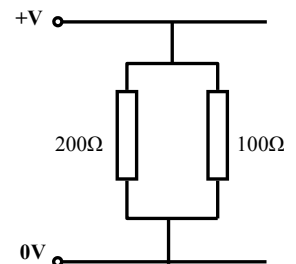
2(c) The graphic shows two resistors connected in parallel in a circuit.

- (i) Calculate the **total resistance** of the two resistors in parallel.

$$\begin{aligned} 1/R \text{ total} &= 1/R1 + 1/R2 \\ &= 1/200 + 1/100 \\ &= 3/200 \\ R \text{ total} &= 200/3 = 66.7\Omega \end{aligned}$$

- (ii) Other components, such as lights, are often wired in parallel. State **one** advantage of wiring lights in parallel.

Greater light intensity from bulbs in parallel, if one light bulb blows the remaining light bulbs continue to work, etc.



(10 Marks, 4+6)

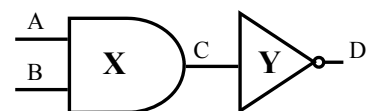
OR

2(d) The graphic shows a combination of two logic gates.

- (i) Name the logic gates shown at X and Y.

X- AND gate Y- NOT gate

- (ii) In your answer book, draw and complete the truth table for the combination of logic gates shown.



A	B	C	D
0	0	0	1
0	1	0	1
1	0	0	1
1	1	1	0

(10 Marks, 6+4)

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) Tablet computers have become very popular in recent times.



- (i) Outline **three** important factors that should be considered when purchasing a tablet computer.

Memory size, physical size, cost, operating system, etc.

- (ii) Describe **two** ways in which data can be transferred between a tablet and another electronic device.

Data can be shared via email, Bluetooth, USB connec-

(10 Marks, 6+4)

3(b) Streaming music services typically offer a huge library of songs that users can listen to on a variety of devices. Many people now prefer to listen to music in this way rather than listening to music on CDs.

- (i) Suggest **one** reason why music streaming has become very popular with users.

Users can listen to many artists, better internet access, etc.

- (ii) Name **one** sound file *extension* commonly used by media companies when recording music.

Wav, MP3, AAC, etc.



- (iii) Explain what is meant by *file compression* in relation to audio files.

Sound files are compressed to reduce their size, etc.

(20 Marks, 8+6+6)

Answer 3(c) or 3(d)

3(c) Manufacturers continue to improve computers through hardware and software development.



- (i) Explain what is meant by the terms *processor* and *memory* in relation to computer hardware.

Processor: The central processing unit (CPU) is a piece of hardware in a computer that executes programs and performs tasks.

Memory: This is where information is stored as tasks are required. Primary storage e.g., RAM, Secondary storage devices e.g., hard disk drives or solid state drives, etc.



- (ii) Give **two** reasons why computer operating systems *automatically update* on a regular basis.

To keep a computer secure and reliable, operate efficiently, protect privacy, etc.

(10 Marks, 6+4)

OR

3(d)

- (i) Give **one** advantage and **one** disadvantage of purchasing goods from *internet auction sites*.

Advantage: Goods can be purchased from home, anonymity, etc.

Disadvantage: Goods cannot be physically inspected, scam auctions, etc.



- (ii) Describe **three** ways in which ICT could be used to help a person plan a short break to a European city.

Book flights/hotels, plan excursions, review restaurants, etc.

(10 Marks, 4+6)

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

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

4(a) The quantity of a product required can influence the manufacturing process used to produce it. The images show two products which have been produced using different manufacturing systems.

(i) Select an appropriate manufacturing process for **each** of the items shown.

Tayto Crisps - any relevant mass production process such as vacuum packing, etc.

Statue - any relevant once-off production process such as casting, etc.



(ii) Outline the reasons for your choice of manufacturing process in **each** case.

Mass production processes are appropriate for the manufacture of crisps due to the large volume of crisps produced.

Once-off production processes are suitable for the manufacture of the statue as only one bespoke statue may be required.

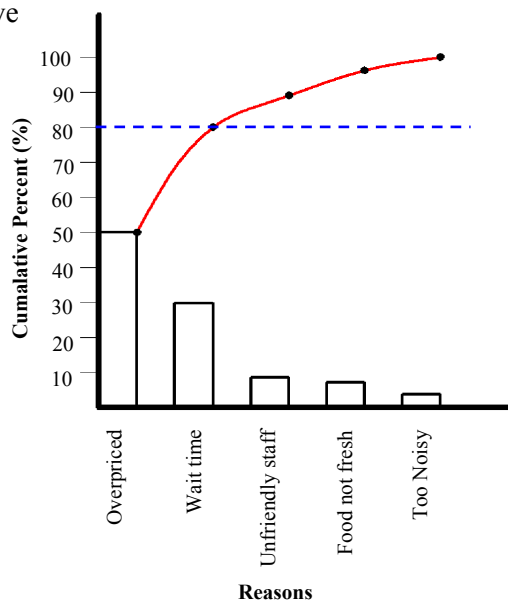
(10 Marks, 4+6)

4(b) The table below records the reasons why customers were unhappy with a particular restaurant.

	Overpriced	Wait time	Unfriendly staff	Food not fresh	Too noisy
Percent(%)	50	30	9	7	4
Cumulative Percent (%)	50	80	89	96	100

(i) Draw a Pareto bar chart to represent the data in the table above.

(ii) Plot the cumulative graph.



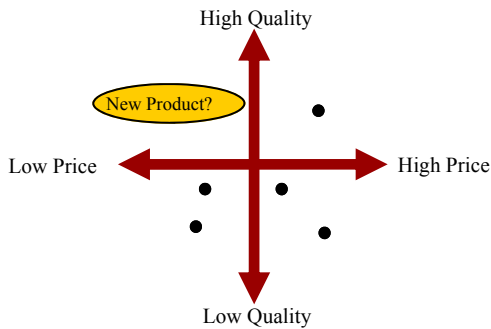
total distribution curve on the

(20 Marks, 8+6+6)

(iii) From the graph, determine the **two** main reasons for customer complaints.

Answer 4(c) or 4(d)

4(c) *Perceptual Mapping* is a technique used by companies when generating ideas for new products.



(i) Briefly describe how this technique works.

Customers perceptions of various products are visually represented on a map. The map can be used to identify gaps in the market and to generate ideas for new products.

(ii) Explain what is meant by the term *reverse engineering*.

This is a process where a competitors product is analysed in relation to its design and manufacture. The good design elements are then used when designing a new product.

(10 Marks, 6+4)

OR

4(d) To maximise repeat sales and build customer loyalty, manufacturers strive to make high quality products.

(i) Explain what is meant by the term *durability* when referring to the quality of a product.

This is the ability of a product to withstand wear, pressure or damage to it.

(ii) Suggest **two** other factors which could indicate that a pair of headphones are of high quality.

Cost, comfortable, excellent sound, etc.



(10 Marks, 6+4)

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

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

5(a) Natural wood is generally classified as either *hardwood* or *softwood*.



- (i) Outline the main differences between hardwoods and softwoods.

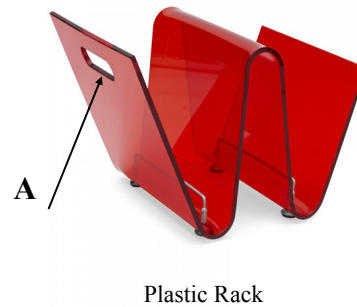
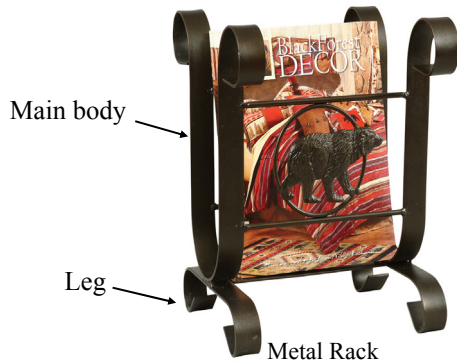
Hardwoods: Deciduous, broad leaves, typically reach maturity in 60-100 years, relatively expensive, etc.

Softwoods: Coniferous, needle leaves, typically reach maturity in 25-50 years, generally cheaper than hardwoods, etc.

- (ii) Name a *native hardwood* suitable to manufacture the bowl shown. Briefly describe how the bowl could be produced.

(10 Marks, 6+4)

5(b) The images show two magazine racks. One is made from metal and one from plastic.



- (i) Give **two** reasons why products with a similar function are sometimes manufactured from different materials.

Appearance, cost, design features, assembly, strength of materials, etc.

- (ii) Using notes and annotated sketches, describe how slot A on the plastic rack could be processed in a Technology room.

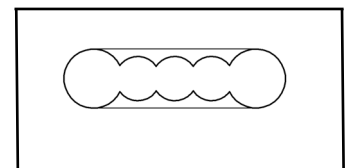
Drill the holes to form the ends of the slot.

Drill additional holes of smaller diameter within the slot.

Use a coping saw/abrafile to cut between the holes.

File to the lines of the slot.

Alternative method: The process of CAD/CAM explained, etc.



- (iii) Suggest **two** appropriate safety precautions that should be observed when drilling metals.

Wear safety goggles, use machine/use hand vices as appropriate, use an appropriate feed rate when drilling, use coolant as necessary, etc.

(20 Marks, 6+8+6)

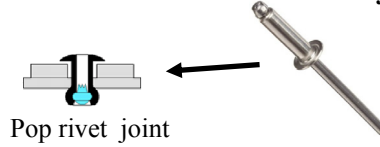
Answer 5(c) or 5(d)

5(c)

- (i) Using notes and sketches, suggest a suitable method of joining the leg to the main body of the metal magazine rack in 5(b) above.

Welded joint, pop rivet joint, nut

and bolt assembly, etc.



- (ii) Some materials are prone to *corrosion*. Explain what is meant by the term corrosion.

This is a natural process where materials such as metals are gradually destroyed by a chemical reaction with



(10 Marks, 6+4)

OR

- 5(d) Designers and manufacturers are utilising *smart materials* to create new products, often making the products simpler or safer to use.

The baby feeding spoons shown change colour when hot.

- (i) Explain what is meant by the term ‘smart material’.

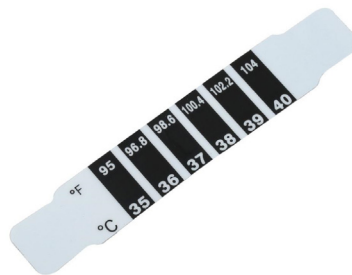
Smart materials have one or more properties that can be significantly changed in a controlled fashion by external stimuli such as temperature, moisture, etc.

- (ii) Suggest **one** other use for the smart material used to make the temperature sensitive spoons shown.

Any situation where the colour of the material indicates the temperature, e.g. head thermometer, etc.



(10 Marks, 6+4)



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