



**Coimisiún na Scrúduithe Stáit**  
**State Examinations Commission**

**Leaving Certificate 2013**

**Marking Scheme**

**Technology**

**Higher 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, 2013*

***Technology***

***Higher Level***

***Marking Scheme***

***Section A - Core*** (72 marks)

*Answer any twelve questions in the spaces provided.*  
*All questions in Section A carry 6 marks.*

**Section A.** Answer any twelve questions. All questions carry 6 marks.

1. When constructed, 'The Shannon Scheme' hydro-electric plant at Ardnacrusha Co. Clare, had the capacity to supply power for the entire country. It currently accounts for 2-3% of Ireland's power generation.
- Outline the main environmental consequences of this hydro-power generating station on Ireland's largest river.

**Impact on fish travel on traditional route may be impeded,  
Change in water table level, leading to possible flooding, etc.**



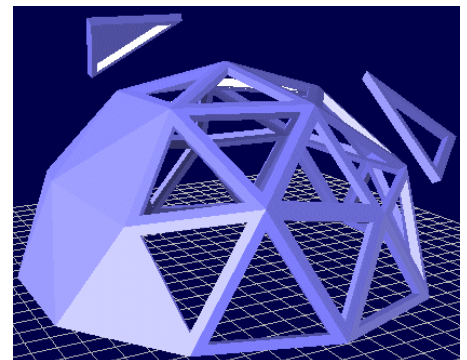
2. Analyse the toy design shown and then outline **two** aspects of the toy that must meet safety criteria before the toy reaches the market.

**Toxicity testing of surface finishes,  
Choke tests for small parts,  
Choice of materials for each part,  
Assembly of parts,  
Sharp edges,  
CE mark, etc.**



3. Geodesic designs can be used to form any curved enclosed space. The geodesic dome has been widely used in structures ranging from Disney's dome at Epcot to tents for leisure use.

- (i) Suggest **two** advantages of geodesic domes.
- Allows for strong and lightweight structures to be built,  
Assembly can be fast, etc.**
- (ii) Suggest **one** reason why the geodesic designs have been less successful in the domestic housing market.
- Specialised design not commonly used in houses,  
Difficulty in installing windows/doors,  
Planning permission difficulties, etc.**



4. In the design and production of safety products such as the mining helmet shown, identify a specific use for **each** of the following processes:

- (i) Model making.  
**To give an idea of size/scale,  
Assembly methods to be considered, etc.**
- (ii) Computer simulation.  
**Testing of electronic circuits/ materials, etc.**
- (iii) Computer-aided drafting.  
**Production drawings for moulding plastic parts,  
CAD for CAM, etc.**



5. Manufacturers invest time and money in market research. Explain the purpose of undertaking market research in **each** of the following cases:

- (i) On a product range which has been on the market for 18 months.  
**To expand the target market, test that all targets have been achieved,  
Identify customer needs/suggested modifications, etc.**
- (ii) When launching a new product.  
**Establish the viability of products, establish size of market, pricing, etc.**

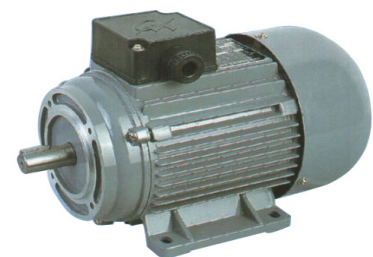


6. The operating voltage of an electric motor is 240 V and the current it draws from the supply is 12 amps. The power output of the motor is 2400 watts. Calculate the efficiency of the motor (expressed as a %).

Calculation:

$$\text{Input power} = V \times I = 240 \times 12 = 2880 \text{ watts}$$

$$\text{Efficiency} = \frac{\text{Output power}}{\text{Input power}} = \frac{2400}{2880} = 0.83 \\ = 83\%$$



7. Most cameras sold today are digital and such cameras are also incorporated into many mobile devices.

Describe, with specific examples, how a computer can be used to edit digital images.

**Red eye removal, colour editing, crop picture, etc.**

Explain **one** factor that may affect the quality of a digital image.

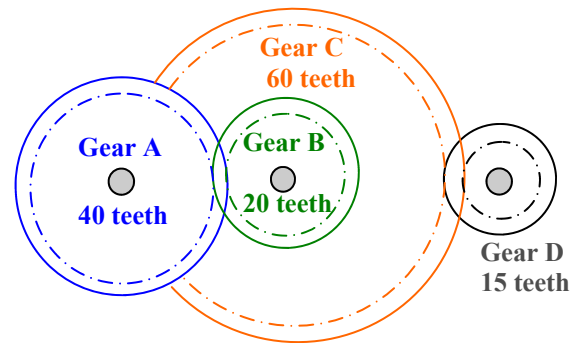
**Image size, distance, camera resolution, light levels, file type, etc.**



8. A gear system is used in the transmission of power.

(i) Name the type of gear system shown.

**Compound Gears**



(ii) Calculate the gear ratio of this gear system.

Calculation:

$$\text{Gear ratio} = \frac{\text{Driven}}{\text{Driver}} = \frac{B}{A} \times \frac{D}{C} = \frac{20}{40} \times \frac{15}{60} = \frac{1}{8}$$

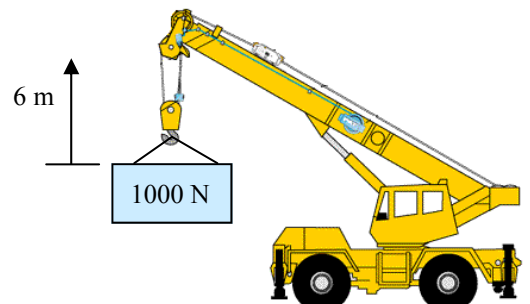
**Ratio = 1:8**

9. Calculate the power needed by the mobile crane to raise the load shown 6 m in 5 seconds.

Calculation:

$$\begin{aligned} \text{Work} &= \text{Force} \times \text{Distance} = 1000 \times 6 \\ &= 6000 \text{ Joules} \end{aligned}$$

$$\begin{aligned} \text{Power} &= \frac{\text{Work}}{\text{Time}} = \frac{6000}{5} \\ &= 1200 \text{ watts} \end{aligned}$$

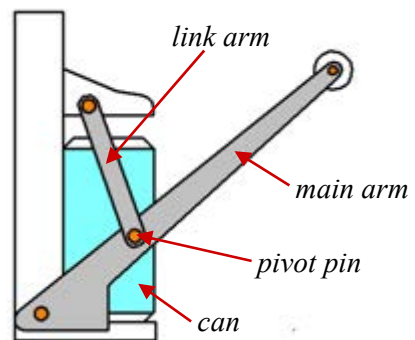


10. The Health and Safety Authority (HSA) provides a range of standardised safety signage. For **each** of the safety signs shown, name the hazard and state where the sign might be used.



<i>Hazard</i>	<i>Hazard</i>	<i>Hazard</i>
<b>Flammable</b>	<b>Corrosive</b>	<b>Electrical</b>
<i>Where used</i>	<i>Where used</i>	<i>Where used</i>
<b>Gas containers, Fuel tankers, etc.</b>	<b>Chemical bottles, Car batteries, etc.</b>	<b>Live electrical equipment in vicinity, Electrical boxes, etc.</b>

11. A number of forces are present when the can crusher shown is in use.



While the can crusher is in use, identify the force exerted on **each** of the following parts:

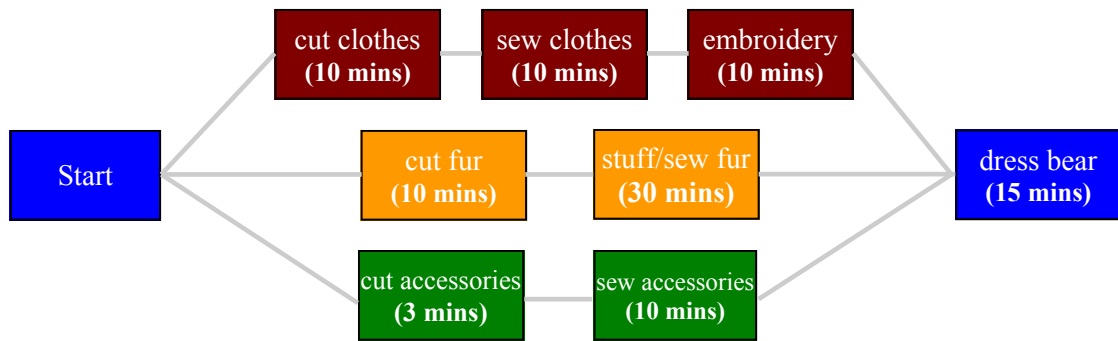
The main arm **Bending force**

The pivot pin **Shear force**

The link arm **Tension force**

The can being crushed **Compression force**

12. In the manufacture of stuffed toy bears, the following process is used:



- (i) Determine how long it takes to make one stuffed toy? **55** minutes
- (ii) The manufacturing company wants to increase productivity in this process. Identify **one** area where it would be possible to produce bears at a faster rate.

**Reassign 'cut fur' to green team to equalise workload and make the process more efficient. Any relevant suggestion etc.**

13. Make well-proportioned freehand sketches of **two** principal orthographic views of the Dublin Convention Centre building shown.



**Any two views from front elevation, either end view or plan.**

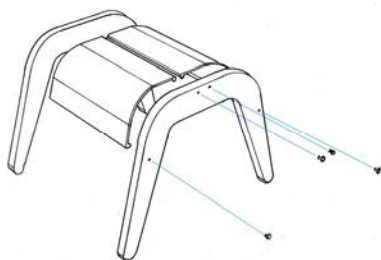


14. The schoolbag shown is manufactured from a variety of materials. For **each** labelled part, complete the table below by naming a suitable material and suggesting a property which makes the material suitable for this use.

Part	Material	Property
Straps	Nylon	Strong and hard wearing
Body	Canvas	Lightweight and waterproof
Fastener	Polypropylene	Bend resistant



15. An exploded view of a stool is shown. Draw a pictorial view of the **assembled** stool. Use **two** graphic techniques to enhance your graphic representation of the stool.



Exploded view

**Pictorial View**  
**Two suitable graphic techniques**

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***Leaving Certificate Examination, 2013***

# ***Technology***

***Higher Level***

## ***Marking Scheme***

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

**2(a) (i)** Explain **each** of the terms *malleable* and *self-curing*.  
**Malleable - the ability of a material to be spread out in all directions without breaking/rupture.**  
**Self-curing - when a material hardens and achieves its maximum properties over a period of time when exposed to the atmosphere, etc.**

**(ii)** Outline the importance of product shelf life.  
**It informs the consumer of the maximum period of time that a product is considered suitable for sale or use.**

**2(b)** Discuss, using examples, **each** of the following aspects of the ‘Sugru’ product:

**(i)** Sustainability through repair.

**This extends the life of a product by repairing it when parts get damaged e.g. repair broken handles on screwdrivers, doors, etc.**

**Reduces the necessity to make new products.**

**(ii)** Ergonomic features in design.

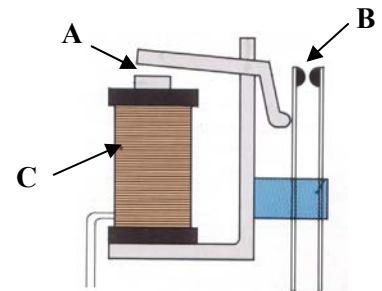
**Handles of saw and tap are customised to the needs of the consumer, are made individually, Design products that fit the human body form, etc.**

**(iii)** Internet marketing and selling.

**The ‘Sugru’ product could be marketed through websites and on-line forums using images of typical applications, etc.**

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

**2(c) (i)** Explain in detail, using annotated sketches, how a relay operates as an electronic switch for a motor circuit.  
 Make reference to parts **A**, **B** and **C**.



**When a small current flows through the coil (C), a magnetic field is produced to magnetise the iron core.**

**This attracts the armature at point (A) which forces the switch contacts (B) to touch and activate the secondary circuit.**

**Relays often switch on higher voltage circuits.**

**(ii)** Give **two** examples where a relay is used to control a motor.

**Automated window blinds, thermostatic air fans, automatic gates, etc.**

**OR**

**2(d) (i)** Conductors: **Materials that will allow electrical current to flow, e.g. Copper.**

Insulators: **Materials that prevent electrical current flowing, e.g. PVC.**

Semiconductors: **Materials that allow a small amount of electrical current to flow though them, e.g. Silicon.**

**(ii)** Draw the truth table

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

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

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

- 3(a) (i) Outline some societal benefits of the Paralympic Games.  
**Raising the profile of a range of disabilities, provides opportunity to gain recognition for athletes, opportunity for communities to demonstrate support for paralympic participants, etc.**
- (ii) Technology underpins many aspects of the organising, staging and managing of the Paralympics. Outline **two** ways in which technology supports or enhances such an event.  
**Internet advertising and promotion, TV/media coverage, electronic scoreboards and timing, etc.**

- 3(b) (i) Explain why these tricycles sit low to the ground with one wheel at the front and two at the back.  
**More streamlined, allows for greater speed, three wheels add stability, front wheel aids steering, etc.**
- (ii) Suggest suitable materials for the frame and for the wheels.  
**Frame: Duraluminium, carbon fibre or titanium, etc.**  
**Wheels: Aluminium alloy or carbon fibre etc., spokes in wheels could be made from stainless steel.**
- (iii) Describe, using annotated sketches, **one** method of maintaining tension on the drive-chain shown.

*Suggested solution:*



**Tensioner can be adjusted to keep chain tight, etc.**

*Answer 3(c) or 3(d)*

- 3(c) (i) Use annotated sketches to show how the front wheel could be mounted to the frame.  
*Suggested solution:*



**Quick release wheel has wheel rotating on the axle.  
Mechanism uses lever release.  
Alternative method:  
Bicycle fork with axle/lock nuts, etc.**



- (ii) Explain how a wheel bearing can be used to minimise friction.



**The wheel rotates on the bearing rather than on the static axle.  
The use of ball bearings reduces the amount of surface contact between the shaft and housing. As a result friction is reduced and consequently the build up of heat, etc.**

**OR**

- 3(d) (i) Identify **two** key properties required of the composite material used to make the helmet.  
**Impact resistant, reasonably lightweight, suitable for moulding, etc.**
- (ii) Name **any two** common composite materials.  
**Carbon fibre, reinforced concrete, plywood, GRP, etc.**

# Section C - Options - Answer any two of the Options.

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

(a) - 10 marks, (b) - 16 marks, (c) OR (d) - 14 marks

1(a) (i) Outline **two** advantages of the increased use of automation in industrial welding.  
**Reduced labour cost, speed, accuracy, etc.**

(ii) Identify **two** other industrial processes that use automated control.  
**Spray painting, fabrication, assembly, etc.**

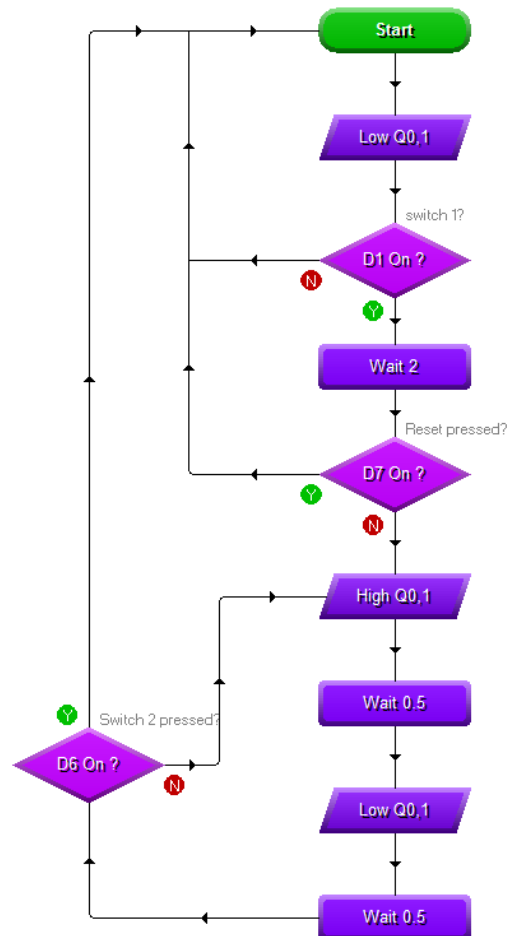
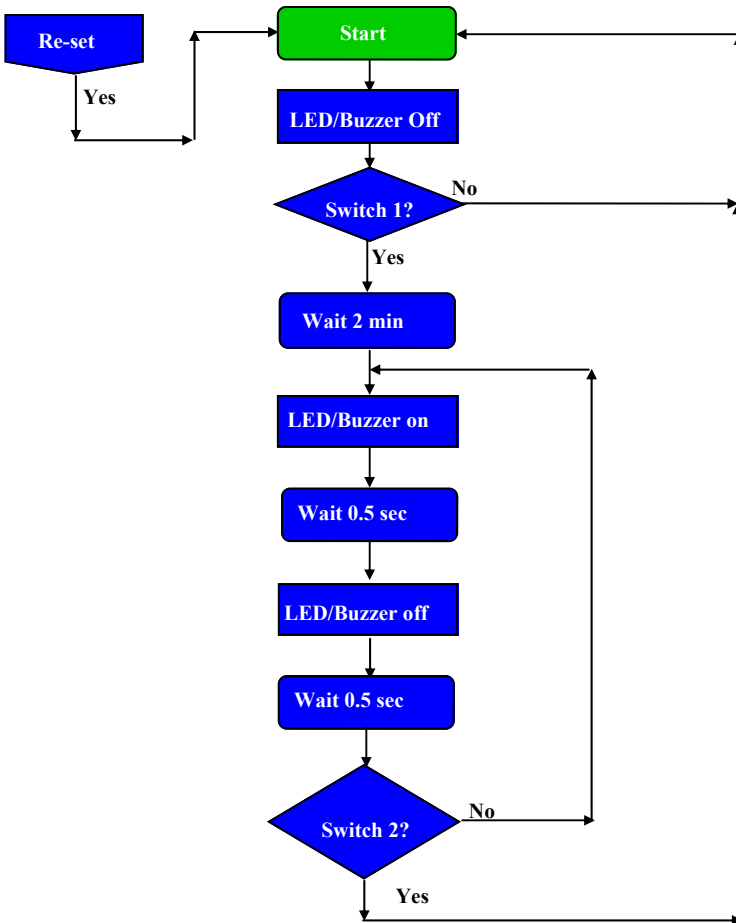
1(b) (i) A microcontroller contains a *programmable IC* with *input* and *output* components.  
 Explain the function of **each** part of the microcontroller.

**Programmable IC** - integrated circuit capable of being programmed and edited by computer control software etc.

**Inputs** - These allow a program to be downloaded to a PIC. They can also sense and switch components that activate a program e.g. LDR, switches, etc.

**Outputs** - components that carry out actions for the circuit e.g. Drive motors, turn on LEDs, etc.

(ii) Complete a flowchart for the operation of the chess timer.



Alternative solution, etc.

- (iii) A tournament chess game lasts for two hours. Suggest a sub-routine to indicate the end of the game. **A parallel process/program with a 'Wait' command and a suitable 'Output' command could be used to indicate the end of the game, etc.**

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

- 1(c)** (i) Describe the main features of a humanoid robot.  
**Asimo was the first walking robot created as a helper to people. This type of robot is designed in human form and it has the ability to recognise objects. It can grip items, interpret voice commands and it's joints (such as neck and waist joints) have three degrees of freedom, etc.**
- (ii) Identify **two** possible applications for humanoid robots.  
**They can be used as a research tool, assembly line worker, entertainment, etc.**

**OR**

- 1(d)** (i) Describe, in detail, the operation of the pneumatic circuit shown.  
**Either the top or bottom ports of the 5/2 valve allow compressed air into the cylinder. Depending on which inlet port is used the piston extends or retracts. The middle port is the exhaust port. The position of the spool determines whether the piston extends or retracts, etc.**
- (ii) Explain the purpose and use of a *cushioned cylinder* in such a circuit.  
**A cushioned cylinder will allow the piston to move slowly into position, this prevents the piston crashing into position, etc.**

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

(a) - 10 marks, (b) - 16 marks, (c) OR (d) - 14 marks

- 2(a) (i) State **two** advantages of using LED's rather than filament bulbs.  
**Low energy use, long life, bright lights from modern LEDs etc.**
- (ii) Select a resistor from the available sizes of 330Ω, 390Ω, 470Ω, 560Ω and 680Ω to protect the cluster and justify your selection.

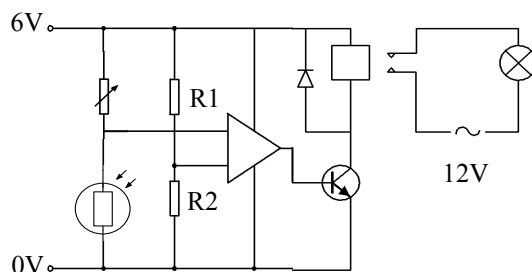
$$R = \frac{\text{Voltage} - V_f}{I_f} \quad R = \frac{9-2}{0.015} = 467\Omega$$

**470Ω provides the most effective protection as it is the lowest resistor greater than the calculated value.**

- 2(b) (i) The resistance of component R1 ranges from 2kΩ to 20kΩ.  
 Calculate the voltage V for **both** low light-level and high light-level conditions.

$$V = \frac{R_2}{R_1 + R_2} \times 6V \quad \text{(i)} \quad \frac{5600}{2000 + 5600} \times 6 = 4.4V \quad \text{(ii)} \quad \frac{5600}{20000 + 5600} \times 6 = 1.3V$$

- (ii) **Draw circuit**

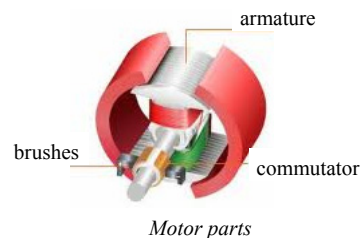


- (iii) Describe how the circuit you have drawn at (ii) above operates.

**The basic principle of this circuit is to compare the voltages at the Op-Amp. The potential divider provides a reference voltage when R1 = R2, this reference voltage will be 3V. The LDR and the variable resistor provide a potential divider circuit. The voltage from this part of the circuit feeds into the Op-Amp. As light increases, the resistance of the LDR changes. When the voltage into the Op-Amp is higher than 3V, the output of the IC is turned on. The transistor can then switch on the 12V light circuit through the activation of the relay.**

### Answer 2(c) or 2(d)

- 2(c) (i) Describe, using annotated sketches, the principles of operation of a DC motor.  
**Description to include reference to main parts, magnetic field, electromagnetic action and torque action etc.**



- (ii) Outline the key features of a mains power supply (220/240V) used to drive a 12V DC motor.  
**Transformer/rectifier required to convert AC mains supply to 12V DC supply, capable of carrying sufficient current to drive motor, smooth power output, etc.**

**OR**

- 2(d) (i) Name a suitable logic gate for this circuit.  
**OR gate.**

- (ii) Describe how the circuit could be improved by the addition of an electronic latch.  
**The output would stay on even if the window or door is closed again, the circuit will need to be re-set in order for the output to be turned off. Flip Flop IC/ Thyristor could be used to latch the circuit, etc.**



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

(a) - 10 marks, (b) - 16 marks, (c) OR (d) - 14 marks

3(a) (i) Outline **two** ways of protecting yourself against cyber bullying.  
**Protect with privacy settings, do not engage with inappropriate content, do not release personal or location details, report offensive content, etc.**

(ii) Outline what is meant by the term '*internet trolling*'.  
**Internet trolls tend to post inflammatory or off-topic messages in on-line community sites such as a forum, chat room or blog with the intent to provoke emotional responses, etc.**

3(b) (i) Name **two** expansion bus components.  
**External components such as USB printer, external drive, sound cards, etc.**

(ii) Suggest **two** advantages and **two** disadvantages of using computer networks.  
**Advantages such as shared access to peripherals, ease of data transfer, control of access, etc.**

**Disadvantages include security risks for sensitive data, fault detection, loss of productivity when network is out of operation, etc.**

(iii) Describe the main components, features, capabilities and limitations of a wireless network.  
Components: **wireless router, extender, repeater, etc.**  
Features: **connection of devices using radio waves, reduced wired connections, increased mobility and productivity, etc.**  
Capabilities: **distances can be expanded, robust security protections and access control, better access to information, user authentication, 'hotspot', etc.**  
Limitations of a wireless network: **distance and coverage, signal strength, etc.**

Answer 3(c) or 3(d)

3(c) The build-up of heat is a particular design concern in the development of computer laptops.

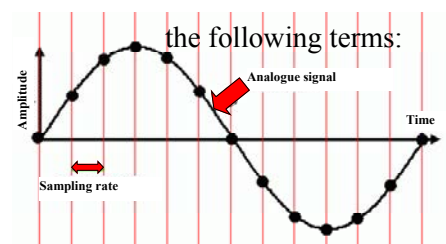
(i) Outline **three** ways in which heat may be dissipated in laptops.  
**Vents, cooling fans, air feed under laptops, docking stations, etc.**

(ii) Explain what is meant by 'screen resolution' and by '1280 x 800'.  
**Screen resolution signifies the number of dots (pixels) on the entire screen. 1280 x 800 is capable of displaying 1280 distinct dots on each of 800 lines, etc.**

OR

3(d) (i) A webpage can contain both text and images.  
Give **three** other elements which may also be included on a webpage.  
**Audio files, video clips, links to other sites, interactive features (forum, chat room), etc.**

(ii) With reference to sound waves outline the meaning of **each** of  
**Sampling Rate—No. of times that measurements are taken every second.**  
**Amplitude—height/loudness of the wave, etc.**  
**Sample Format—No. of bits used to represent each sample.**  
**Audio CD—16 bits per sample.**



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

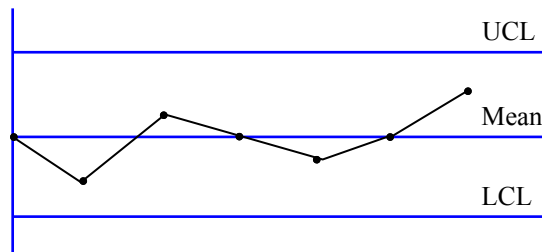
(a) - 10 marks, (b) - 16 marks, (c) OR (d) - 14 marks

- 4(a) (i) Explain the difference between *quality* and *reliability*.  
 Quality:  
**This is an assessment of conformance to product requirements. It can be perceived in terms of performance, features, conformance, reliability, durability, etc.**  
 Reliability:  
**The probability a product operates correctly for a given time frame under specific conditions, etc.**
- (ii) Suggest how the principles of DfE (Design for Environment) are incorporated into these devices.  
**Recyclable materials used in manufacture,**  
**Packaging is recyclable and bio-degradable,**  
**Use of rechargeable batteries,**  
**End of life process for return of used products, etc.**

4(b) The data table shown below gives the number of defects per day for a batch of cornflakes during its manufacture.

Day	July 11 <sup>th</sup>	July 12 <sup>th</sup>	July 13 <sup>th</sup>	July 14 <sup>th</sup>	July 15 <sup>th</sup>	July 18 <sup>th</sup>	July 19 <sup>th</sup>
No. of defects	10	8	11	10	9	10	12

- (i) For the data above and assuming  $\sigma = 1.29$ , calculate the following:
- The mean of the process  $70/7 = 10$
  - The UCL  $\text{Mean} + 3\sigma = 10 + 3(1.29) = 13.87$
  - The LCL  $\text{Mean} - 3\sigma = 10 - 3(1.29) = 6.13$
- (ii) Draw a suitable control chart for the above data.



- (iii) Interpret the control chart drawn at (ii) above and comment on the control state of the process.  
**Any relevant description of why the process is in control.**

Answer 4(c) or 4(d)

4(c) *Perceptual mapping, Benchmarking and Reverse Engineering* are often used in the generation of idea for technological products.

(i) Describe, with examples, the terms Benchmarking and Reverse Engineering.

**Benchmarking:**

**Uses the most effective product in the market as a basis for developing new improvements.**

**It hopes to create new products with the market leader as a starting point for design.**

**Reverse engineering:**

**Competitor products are dismantled and inspected with the best features incorporated into a new design, etc.**

(ii) Discuss with examples, the features of car brands placed at **A** and **B** of the perceptual map shown below.

**A - Cars are relatively cheap to buy with few extra features, designed to be operated and run at low cost but are efficient, etc.**

**B - cars are expensive to buy, high performance models, cost to run not the prime consideration, likely to have additional features, etc.**

**OR**

4(d) (i) Describe **two** basic layouts that are used by manufacturing firms.

Process Layout

**Similar activities grouped together in the work area, flexible, suitable for low volume or batch production, etc.**

Product Layout

**Activities arranged in sequence of operation, assembly line for each product, specialised machines, efficient, effective for mass production, flexibility not required, etc.**

Fixed-position Layout

**Used for large objects too big to move, highly skilled operative with equipment and parts moved into work area, costly, etc.**

(ii) Describe with examples, **each** of these processes.

Batch production

**Item produced in batches, demand for product can fluctuate, volume of items may be reasonably low, e.g. bakery products.**

Mass production

**Large volume of standard product, demand is stable, demand is high, e.g. lunch boxes, cars, etc.**

Continuous production.

**Very high volume items produced with high degree of standardisation and automation e.g. food products, paper printing, etc.**

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

(a) - 10 marks, (b) - 16 marks, (c) OR (d) - 14 marks

5(a) (i) Describe the key features of **each** of the following material categories:  
Use specific examples in each case to support your answer.

- Thermoplastics  
**Thermoplastics will mould more than once and are recyclable, polyethylene and polyvinyl chloride (PVC) are examples.**
- Smart materials  
**Materials that respond to an external input e.g. thermochromatic materials may change colour when heated. Other examples include polymorph, memory wire, lenticular sheet, etc.**
- Manufactured boards  
**Wooden products generally produced from by-products of cutting timber e.g. plywood, MDF, Laminboard, etc.**

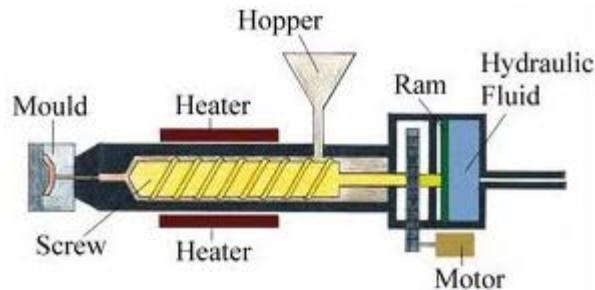
(ii) Outline the main safety hazards associated with **each** of the following processing techniques:

- Cutting MDF on a circular saw:  
**Generation of dust, fine particles, need for extraction, etc.**
- Joining plastic materials using adhesives:  
**Fumes from solvent adhesives, flammability, etc.**
- Cutting metal on a centre lathe:  
**Sharp, and hot metal chips, need eye protection, etc.**

5(b) (i) Select an impact-resistant material for the door wedge and justify your selection.  
**Polypropylene - can be injection moulded, resistant to impact, colourful, etc.**

(ii) Describe, using annotated sketches a method of commercially manufacturing the front cover of this device.

**Injection moulding:**

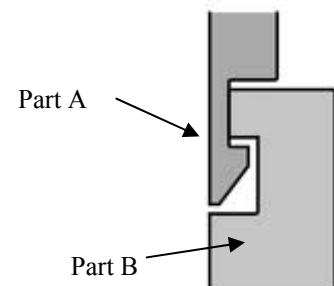


A hollow split mould is machined to the shape of the casing. Plastic granules are held in the hopper and fed into the machine where it is heated and pushed into the mould cavity by a screw or ram mechanism. The molten plastic fills the mould under heat and pressure. It sets quickly, the mould is split and the casings can be removed and trimmed.

(iii) Explain, using notes and annotated sketches, a method of assembling the three parts of the key fob.

**Thermoplastic materials are flexible and can be fastened together by push fittings. These take many forms such as the fitting shown where the leg of part A will clip and hold part B in place.**

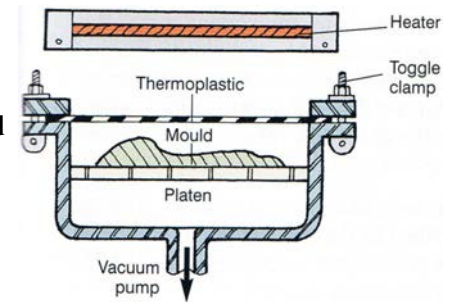
**Any suitable alternative method.**



Answer 5(c) or 5(d)

- 5(c) (i) Explain, using annotated sketches, the process of vacuum forming.

**This method is used to produce hollow shapes in plastic sheets. A shaped mould is produced, usually in wood, and placed in the machine. The sheet of plastic is placed over the mould and clamped. An air-tight seal is required. The sheet of plastic is heated until soft and then drawn down onto the mould. A vacuum is created when the air is removed from the area around the mould. The plastic sheet will take the shape of the mould. The machine is turned off and the mould is removed from the plastic. The hollow car shape is trimmed, etc.**



- (ii) Discuss the environmental impact of producing the toy car using vacuum forming techniques.

**Production of plastic materials from oil in terms of extraction, energy use, transport, processing, etc.  
Electrical energy used in vacuum forming process,  
Disposal of trimmed plastic material might be a concern for the environment,  
Recyclable plastic material, etc.**

**OR**

- 5(d) (i) State **three** advantages of the increased use of this conversion technology.  
**It provides an option for reusing mixed plastic materials,  
Less effort needed to separate different plastic materials,  
Provides a useful end product,  
Innovative technology with potential to expand as oil and plastic raw materials get scarce, etc.**
- (ii) Outline **three** properties of thermosetting plastics.  
**Can not be recycled,  
Good resistance to heat,  
Range of colours,  
Can be compression moulded into shape, etc.**

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