



TECHNOLOGY

HIGHER & ORDINARY LEVEL

MARKING SCHEME

Pre-Leaving Certificate Examination 2024

Higher Level: page 2

Ordinary Level: page 12

HIGHER LEVEL - SECTION A

Answer 12 / All question carry 6 marks

Question 1

Tidal power is guaranteed due to tide times; however, solar power or wind generators are far less efficient due to sunny weather / windy climate.

Tidal power is hidden underwater, where solar or wind turbines are visible and deemed unsightly.

One advantage = **3m**

Two advantages = **6m**

Accept any other appropriate answer

Question 2

Positive

The Waste Electrical and Electronic Equipment (WEEE) directs all manufacturers to take ownership for their products when they reach their end of life

Negative

Electronic products must be disposed of at an approved facility / electronic waste – can contain high levels of hazardous or toxic substances / Technology innovation leads to electronic components being updated before their end of life cycle / If products are disposed of in normal waste they will go straight to landfill, which can lead to hazardous materials will leaking into the environment / Hazardous materials that leak from electronic products disposed of get into the water system and potentially cause serious health problems for people

One issue = **3m**

Two issues = **6m**

Accept any other appropriate answer

Question 3

(i) Driven and Driver will rotate in the same direction / it allows two fixed shafts which are apart from each other to be connected / The Driver and Driven will remain at the same speed / connect two fixed shafts which are located apart from each other
Accept two for **4m (2m each)**

(ii) Speed of the driven gear output gear will be reduced / The driver and driven will rotate in opposite directions / The driven gear will have a higher torque / Direction of rotation
Any brief description = **2m**
Accept any other appropriate answer

Question 4

Aluminium is a lightweight material compared to steel, which means they are easy to move /

Aluminium does not rust / Aluminium is easier to install due to it being lighter than steel

Accept any other appropriate answer

Appropriate advantage = **3m**

Aluminium is a non-ferrous metal as it does not contain iron which means it is non-magnetic and cannot corrode

Award **3m** for a detailed answer / reference to no iron and not corroding must be mentioned for 3m

Question 5

A = Farads / B = Ohms / C = Amps or Ampres

2m each = 6m

Question 6

- (i) Complex shapes can be produced / each piece can be manufactured to the same standard over and over / surface finish is excellent / highly accurate

Accept any other appropriate answer

2m for each benefit = **4m**

- (ii) CNC lathe / Laser machine / 3D printer / Plasma Cutter

1 + 1 = 2m

Accept any other appropriate answer

Question 7

Detailed sketch of A award **6m**

Poor sketch award **2m**

Question 8

The shape of sander fits into the hand comfortably, quick replacement of sandpaper, dust collection for health and safety, appropriate size to handle

3m awarded for each design feature **3m + 3m**

Question 9

Electronic component drawn correctly with pin 1 located next to the notch

Pins 1 to 8 labelled

Drawn correctly with pins 1 to 8 labelled award **6m**

Question 10

Elasticity: is the ability of a material to return to its normal shape after being stretched or compressed

Plasticity: is the ability of a material to undergo permanent deformation

Malleability: is the ability of a material to be hammered or pressed into a new shape without breaking or cracking:

Ductility: is the ability of a material to be stretch without breaking e.g. wire

Award 3m each to two terms appropriately explained = **6m**

Question 11

- (i) C = Variable resistor or potentiometer / D = Thermistor

2 + 1m = 3m

- (ii) $3/98 \times 9 = 0.0306 \times 9 = 0.275\text{v}$ at X **3m**

calculations must be shown

Question 12

$$R1 (600 \times 1) + (2.5 \times 850) = R2 \times 4$$

$$R2 = (600 + 2125) / 4 = 2725 / 4$$

$$R2 = 681.25 \text{ N}$$

$$R1 = (600 + 850) - 681.25 = 768.75 \text{ N} \quad \mathbf{6m}$$

No calculations shown but candidate has correct answer for R1 and R2 award **3m**

Question 13

- (i) Fibreglass / Silicone fibre / Carbon fibre

3m for named material

Accept any other suitable answer

- (ii) Good corrosion resistance / Lightweight / Flexible in one direction i.e. over its length not its cross section / Good strength to weight ratio / Good wearing properties /

2m+ 1m for properties discussed

Question 14

- (i) Carbon footprint is carbon dioxide (CO₂) and other equivalent greenhouse gases that are associated with an individual, product, person or even country **3m**

Accept any other appropriate answer

- (ii) They can cause fires or explosions / They can contribute to the climate change / They can contaminate soil and water / Impact on the local community as it's a visual eyesore which can impact house prices **3m**

Accept any other appropriate answer

Question 15

Two distinct graphic techniques required e.g. Shade, Colour, Texture, Shadow, etc.

3m for **each** graphic technique

Section B - 48 marks - two questions @ 24 marks

Question 2 - 24 marks

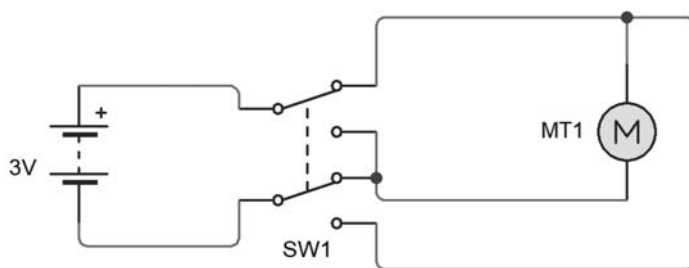
- (a) (i) Artificial intelligence is the intelligence of machines or software, as opposed to the intelligence of humans / Artificial intelligence refers to computer systems capable of performing complex tasks that generally only a human could do, such as reasoning, making decisions, or solving problems.
AI defined = **2m**
AI is software that learns patterns from information and performs tasks that normally require human intelligence / AI works by combining a large amount of data via intelligent and quick algorithms, and self-learning from the characteristics of the data/
Basic principles = **2m**
Accept any other suitable answers
- (ii) **Efficiency**
Automating repetitive processes / it could be used for predicting / Better serving customers and clients / Analysing data on customer behavior or market trends to make informed decisions **2m**
- Safety**
Identifying potential hazards and risks / Monitoring employee behaviour and performance / Giving employees real-time feedback to correct unsafe behaviours before an accident occurs / Automating tasks
Accept any other suitable answers **2m** **(8 marks, 4+4)**
- (b) (i) Detailed answers only – award 1m for answers lacking in-depth knowledge
Energy labels allow consumers to compare products prior to buying / Decisions may be made on an efficiency basis, consumers should ethically and morally be made aware of the running costs of products prior to purchase **4m**
Accept any other suitable answers
- (ii) Consumers can clearly see the energy rating of the product / Labels simplify running costs, the higher the A rating, the more economical or efficient the product is / Consumers can compare products using the labelling system / Consumers are made fully aware of running costs of the product
Accept any other suitable answers **4m**
- (iii) Electrical energy is converted into mechanical energy by a motor. **2m** **(10 marks, 4+4+2)**
- (c) A suitable Gantt chart produced indicating the manufacturing process, award **6m**
Reference must be made to wheels, body, handle, finishing, assembling to be awarded full marks
No reference to two of the above in the Gantt chart award 3m only **(6 marks)**
- OR**
- (d) (i) Rotary – in a circle / Linear – in a straight line / Oscillating – swinging over and back / Reciprocating – in/out or up/down
1 mark for each one named and defined **3m**
- (ii) Knife follower, flat follower, offset follower and roller follower
Award 2m for all 4 correct / award 1m for 2 correct **3m** **(6 marks, 3+3)**

Question 3 - 24 Marks

- (a) (i) A – Push to Break / B – Reed Switch / C – Microswitch (limit switch) / D – DPDT switch (Double pole double throw)
1m for each correct switch mentioned **4m**
- (ii) A magnet is required to activate a reed switch
Accept any other suitable answers **4m** **(8 marks, 4+4)**
- (b) (i) CAM machines are precise and time-efficient / CAM machines can run all day with little or no error / Easy to build prototypes to visualise what your end product will look like
Two valid reasons mentioned @ 2m each **4m**
Accept any other suitable answers
- (ii) Solidworks / Corel draw / Onshape / Cura
Accept any other suitable answer **4m**
- (iii) Easy to share files with your teacher to review/edit / Easy to use / Saves time / Accurate and easy to make adjustments
Accept any other suitable answers
2 @ 1m each **2m** **(10 marks, 4+4+2)**
- (c) **Triangulation:** is used in structures to strengthen the object, e.g. Eiffel tower. A triangular form is one of the strongest shapes known.
Stress: Stress refers to force acting on the unit area of a material which can lead to a material becoming deformed.
Strain: Strain occurs as a result of stress (force) which causes deformation of the material.
Factor of Safety: relates to a system or product that is stronger than it needs to be so it is fit for purpose.
Three answers @ 2m each
Accept any other suitable answers **(6 marks, 2+2+2)**

OR

- (d) (i) Accept any other suitable circuit diagram (**4 marks drawn correctly / 2 marks partially correct**)
4m



- (ii) Variable resistor/Potentiometer 1m
Sketch 1m **2m**

**(6 marks, 4+2)**

Section C

Answer any one of the five optional questions – 40 marks

Question 1 - 40 Marks

(a) (i) Ethical

- Trust: The driver is trusting the algorithms in the car to make the correct decisions whilst driving.
- Decision making: The car must make human-like decisions when confronted with unusual circumstances.
- Safer driving. Autonomous vehicles could be safer drivers than human drivers e.g. by keeping a safe distance from the car in front at all times.
- Accessibility. Disabled passengers will not have to operate traditional car controls.

Legal impacts

- Liability. There is a discussion as to who is at fault (the manufacturer or the driver) in case of an accident.
- Insurance: The need for driving insurance will change as drivers are no longer responsible for the control of the car.
- Data protection: Car manufacturers must keep driving data secure in accordance with data protection laws.
- Security: Autonomous vehicles could be vulnerable to being hacked and hijacked for criminal purposes.

Accept any other suitable answers

(6 marks, 3+3)

- (ii)** Industry: Autonomous vehicles have become important in the area of logistics and parcel deliveries. Delivery robots are used broadly by companies such as Amazon, Alibaba and other sorting and online companies. The robots are given instructions remotely on what parcels to collect and where to drop them.

Agriculture: Autonomous vehicles for agriculture have been developed using sensors and microprocessors to control tractors for large-scale activities such as planting and harvesting huge fields. This frees up farmer time to engage in other activities.

(6 marks, 3+3)

- (b) (i)** PIC Programmable IC - integrated circuit capable of being programmed and edited by computer control software etc.

Inputs - Allows a program to respond to its inputs. i.e switch being pressed / a sensor being activated etc.

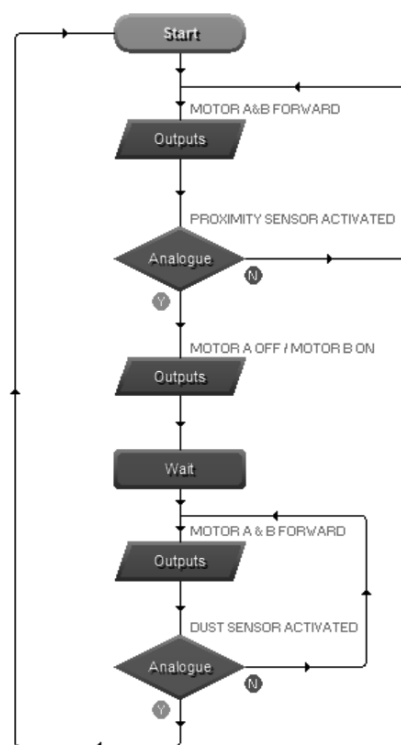
They can also sense and switch components that activate a program e.g. LDR, switches, etc.

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

(4 marks 2+2)

Accept any other suitable answers

- (ii) (8 marks for a completed flowchart)
(Award 4m for partial completion)
Any other valid alternative solution should be accepted



(8 marks)

- (iii) Motion Sensor / Temperature Sensor / Ultrasonic / Infrared
Accept any other suitable answers

(4 marks 2+2)

- (c) (i) A cartesian robot has three axis: X, Y and Z, which is used to determine its correct position and direction. The cartesian operates inside a rectangle area and is used in CNC milling, 3D Printing, manufacturing
Accept any other suitable answers

(6 marks 3+3)

- (ii) Stepper motors are excellent at precision movement due to its quick response to starting and stopping, longer working life, high torque
Accept any other suitable answers

(6 marks 3+3)

OR

- (d) (i) Food packaging, pneumatic tools, compressors, printing press, packaging, etc.
Accept any other suitable answers
- (ii) Safer, fewer problems detecting leaks than hydraulics, system lasts longer, no rust or corrosion, less maintenance.
Accept any other suitable answers

(6 marks 3+3)

(6 marks 3+3)

Question 2 - 40 Marks

- (a) (i) Diode.
Diode drawn parallel to the motor in correct position in answer book
Diagram and name **3 + 3m**
- (ii) Component Q1 is a transistor.
The transistor is used to control a large amount of current or voltage with a small amount of voltage or current.
- Resistor: resistor at R1 protects transistor from excess current **6m** **(12 marks)**
- (b) (i) **Astable** means the circuit is not stable in any state. The output is continually changing from low and high, which produces output at intervals.
Monostable: This system has only one stable state. It can be designed to change but it will always return to its original stable state. It's used in timing circuits.
Accept any other suitable answers **3 +3m**
- (ii) Alter the values of the resistors
Accept any other suitable answers **4m**
- (iii) Pin 2 trigger: passes the voltage to start the timing operations
Pin 6 threshold: monitors voltage across capacitor and when it reaches 2/3 of supply voltage, timing cycle ends, pin 3 goes low.
Pin 7 discharge: connected to a capacitor in conjunction with resistor to control timing interval **2+2+2** **(16 marks)**
- (c) (i) Open Loop: There is no feedback to indicate if the input has reached its target position/goal
Closed Loop: It allows accurate movement within machines e.g 3D printer as feedback is constantly going back to the controller from the sensors to operate the machine
Accept any other suitable diagram **6m**
- (ii) EMF is electromotive force.
Brief description must be included for **6m**
Accept any other suitable answer **(12 marks)**
- OR**
- (d) (i) Candidates answer must reference the magnetic field, torque action and reference to the main parts
Diagram is worth **3m**
Description **3m**
- (ii) Speed could be controlled by the use of a variable resistor / potentiometer
Component symbol is worth **3m**
Description **3m** **(12 marks)**

Question 3 - 40 Marks

- (a) (i) Your posts are searchable / Employers could be monitoring your online behaviour / HR for companies vet potential candidates online / there is no privacy online as anyone can search you up
Accept any other suitable answers (6 marks 3+3)
- (ii) Identity theft is the act of stealing another person's personal identity in order to gain access to their financial resources, or obtain access to other benefits, such as money, credit, or insurance benefits.
Accept any other suitable answers (6 marks)
- (b) (i) Bluetooth / Near-field Communication/NFC / Wireless USB
Accept any other suitable answers (4 marks)
- (ii) LANs cover relatively small geographical areas, whereas WANs usually cover a wide geographic area / WANs are (usually) slower than LANs / WANs are (usually) several LANs connected together / LANs are often owned and controlled by a single person / WANs are generally under collective ownership
Accept any other suitable answers (6m – 3m each)
- (iii) Flexibility to expand network, there is no need to drill holes and install wires, modern devices are designed to connect wirelessly, no cables, so no trip hazard
Accept any other suitable answers (6 marks – 2m each)
- (c) (i) Proprietary software has source code that cannot be modified by anyone but the person, team, or organisation who created it and maintains exclusive control over it. Open source is software whose source code is available for modification or enhancement by others.
Accept any other suitable answers (6 marks)
- (ii) Protect your privacy online by keeping your passwords secret / blocking bullies / Stay connected with your parents or trusted adults / Be a role model by not posting inappropriate content
Accept any other suitable answers (6 marks 3 + 3)

OR

- (d) (i) **Phishing filter:** Phishing is a cybercrime in which a person targets people by email, telephone or text message. Someone poses as a legitimate institution to lure individuals into providing sensitive data such as personally identifiable information, banking and credit card details, and passwords.
Pop-up blocker: Pop-up blockers automatically prevent pop-up windows from hindering your web browsing.
Computer firewall: uses software program that helps examine our hackers, viruses and worms that try to reach your computer over the Internet. (6 marks 2m each)
- (ii) Encryption means to scramble data in such a way that only someone with access to the code / key can read it.
Computer hacking exploits computer software for access to protected information. Spam is the use of electronic messaging systems to send unsolicited bulk messages (spam), especially advertising, indiscriminately.
Accept any other suitable answers (6 marks 3 + 3)

Question 4 - 40 Marks

- (a) (i) Just in time (6 marks)
- (ii) Businesses don't keep quantities of excess inventory; instead, they manufacture a product as an order comes in and reorder stock.
Accept any other suitable answers (6 marks)
- (b) (i) Benchmarking: To try and get the best product available and base performance specifications for new products on it
Reverse Engineering: Disassemble and inspect competitors' product(s) and select features to incorporate into new product
Accept any other suitable answers (6 marks 3+3)
- (ii) Quality Function Deployment (QFD) has a known track record for putting customers' needs first. This occurs right through the entire product development process. QFD focuses on the customers' requirements and constantly refers to these throughout the design process
Accept any other suitable answers (4 marks)
- (iii) DFE Design for Environment involves designing products from recycled material, using materials or components that can be recycled, designing a product so that it is easier to repair than discard and minimising unnecessary packaging
Accept any other suitable answers (6 marks)
- (c) (i) It is to test the longevity of a product and whether it is reliable and to quantify the life of the product and to determine a warranty period.
Accept any other suitable answers (6 marks)
- (ii) Quantitative testing as the data will be used to determine the expected life span of the product.
Accept any other suitable answers (6 marks)

OR

- (d) (i) **Make to stock:** Products are designed and produced for a 'standard' customer in anticipation of demand.
Make to order: Products are designed, produced and delivered to customer specifications in response to an order.
Assemble to order: In this case, a base unit or module is produced onto which options can be added according to the specification of the customer.
Accept any other suitable answers (6 marks 2+2+2)
- (ii) **Once-off:** Once-off production is the manufacturing of a single product e.g. bespoke furniture.
Batch: is a method whereby a group of identical products are produced simultaneously rather than one at a time.
Mass: Mass production is described as the manufacturing of goods on a large scale without compromising on the quality.
Accept any other suitable answers (6 marks 2+2+2)

Question 5 - 40 Marks

- (a) (i) Birch is a hardwood that is strong and durable / Birch can be cut into strips and laminated to improve its strength / Birch can be steam bent into different shapes / Birch can be finished in different ways. i.e. varnished, stained or painted.
Accept any other suitable answers (6 marks 3+3)
- (ii) CNC machining is faster than cutting the birch legs and seat out by hand / CNC machining ensures the accuracy of cutting out the same shape every time / CNC machining requires less labour to manufacture the product, so therefore can be manufactured at a reduced cost /CNC machining can allow for pilot holes and screw holes to be pre-drilled to allow for easy assembly of the stool by the customer. (6 marks 3+3)
- (b) (i) Compression moulding or injection moulding
Accept any other suitable answers (4 marks)
- (ii) It's a readily available material that is cheap to buy / it has excellent tensile strength / it resists moisture / it can withstand freezing temperatures
Accept any other suitable answer (6 marks 3+3)
- (iii) Laminating plastics makes them stronger, which makes the chassis more robust. The laminating process makes it a rigid base for landing but it does not impact the weight massively
Strength and rigidity should be mentioned in candidate's answer
Accept any other suitable answer (6 marks)
- (c) (i) Two smart materials mentioned and a suitable application
(6 marks = 2m each for name & 1m each for application)

Shape-memory alloys (SMA) / Piezoelectric / Thermochromic pigments
Accept any other suitable answer (6 marks 2+2+1+1)
- (ii) Suitable sketch with labels. Answer must include a brief description of the process
Accept any other suitable answer (6 marks, 3 for diagram & 3 for description) (6 marks 3+3)

OR

- (d) (i) Additive manufacturing is the process of creating an object by building it one layer at a time.
Accept any other suitable answer
A simple supporting sketch should accompany the written answer.
(6 marks = 4 marks description + 2m diagram) (6 marks 4+2)
- (ii) **Origin:** PLA is an environmentally friendly vegetable-based plastic material as its made from sugarcane or cornstarch / ABS is fuel-based plastic
Strength: PLA is more brittle as its not ductile / ABS is stronger and is better suited to application that will take impact
Printing temperature: PLA has a lower printing term than ABS (6 marks 2+2+2)
Accept any other suitable answer

ORDINARY LEVEL

Section A - Answer 9 of 12 questions @ 8 marks each

Question 1 (8)

Red – Prohibited
 Blue – Mandatory
 Green – Safety Locations
 Yellow - Caution
 Accept any suitable definition (2m each)

Question 2 (8)

- (i) Personal gain, organised crime, transferring funds, fraud etc.
 Accept any other suitable answer (2m each)
- (ii) Voice recognition technology / face recognition / fingerprint scan/ Iris scan
 Accept any other suitable answer (2m each)

Question 3 (8)

- (i) Lead is shorter, universal compatibility, won't overheat phone, convenient
 Accept any other suitable answer (2m each)
- (ii) Expensive to purchase, slower charging time, not fully wireless as it still requires a cable
 Accept any other suitable answer (2m each)

Question 4 (8)

3D printing can produce objects with high accuracy and detail, 3D printing can enable users to create unique and complex shapes, Easily accessible in school and public settings, Cost effective for model making
 Accept any two suitable answer (4m each)

Question 5 (8)

Increasing connectivity for tourism between the airport and the city centre, reduces traffic congestion on the M1, M50 and at the airport, Job creation, promoting choice for people travelling

Accept any two other suitable answers 2 x 4m

Question 6 (8)

- (i) LED – Light Emitting Diode 4m
- (ii) Negative leg is shorter and is closer to the flat edge of the LED 2m each

Question 7 (8)

An excellent sketch with the correct view drawn (8m)
 A fair sketch with the correct view draw (4m)

Question 8**(8m)**

- (i) No human error, cost effective, 24/7 availability, helps with research, advancements in medicine
Any two valid answers = 2m each
- (ii) Unemployment, lack of creativity, ethical issues, lack of transparency
Any two valid answers = 2m each

Question 9**(8m)**

- (i) Worm and worm wheel 4m
- (ii) Compact, slow speed, high torque, self-locking 2 + 2m

Question 10**(8m)**

- (i) $330\ \Omega$ 4m
- (ii) 0.02727A
Working out must be shown for 4m
No working out = 2m

Question 11**(8m)**

- (i) Reciprocating motion 4m
- (ii) It enables wiper 1 and wiper 2 to move in sequence with each other
Any valid answer then award 4m

Question 12**(8m)**

Rendering, colour, shadow, hatching, etc.
(4m each for two graphic enhancements)

Section B - Two questions @ 24 marks each

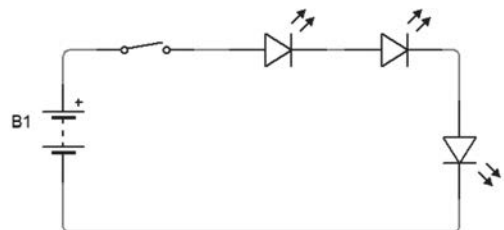
Question 2

- (a) (i) Increasing connectivity for tourism between the airport and the city centre, quicker journey times, cost effective
Accept any two suitable answers 2m each **4m**
- (ii) Advantage: Job creation during construction, connects Dublin airport to the city, improves tourists' journey time
Disadvantage: expensive to construct, wildlife impacted during construction, impacts jobs such as taxis and bus drivers
Accept any two suitable answers 3m each **6m**

(10m)

- (b) (i) Galvanised steel / Aluminium / Steel (2m for one suitable material)
Accept any other suitable answer **2m**

- (ii) 3m – Circuit Diagram correct
2m – Three components with no connections
1m – Partially completed – three components drawn correctly **3m**



- (iii) Advantages: Counts money quickly, fast and effective, easy to operate
Disadvantages: Increased costs, no personal touch, expensive to install
Accept any two suitable answers 2&1 = **3m**

(8m)

- (c) (i) Stainless Steel, Aluminium. **1m**
Accept any other suitable answer
Justified **2m**

- (ii) Synthetic materials do not occur naturally for e.g nylon, acrylic as they are manufacture while natural materials occur naturally for e.g leather, cotton & wool
Accept any suitable answers 2+1 = **3m**

(6m)

OR

- (d) (i) Global Positioning System
2m awarded if properly explained **2m**

- (ii) To ensure trains are where they are supposed to be, prevents trains from getting lost, prevents crashes and allows passengers to have up to date information
Accept any other suitable answers **2+2 m**

(6m)

Question 3

- (a) (i) Pine wood, oak, MDF, beech
Accept any suitable material **2m**
- (ii) Appropriate sketches with a detailed solution award 6m
Deduct marks for poor sketches/annotation **6m** **(8m)**
- (b) (i) Laser cutter / 3D Printer
Accept any other suitable answer **2m**
- (ii) Appropriate sketches with a detailed solution award 6m
Deduct marks for poor sketches/annotation
Accept any other suitable answer **6m**
- (iii) The material can be sanded by hand or by an orbital sander. Then it could be painted, sprayed lacquered or stained depending on the customers preference **2m** **(10m)**
- (c) (i) 1 = A
2 = C
C3 = B
1m for each component labelled correctly **3m**
- (ii) A – Stores electrical energy / B = Light Dependent Resistor used to detect light / C = Light Emitting diode – produces bright light that is energy efficient
1m each = 3m
Accept any suitable description **3m** **(6m)**

OR

- (d) (i) CE mark – indicates that the manufacturer of the product confirms its compliance with the relevant EU legislation
Accept any other suitable answer **2m**
- (ii) Accept any suitable answer
2m each = **4m** **(6m)**

Section C - one question @ 40 marks

Question 1 - 40 marks

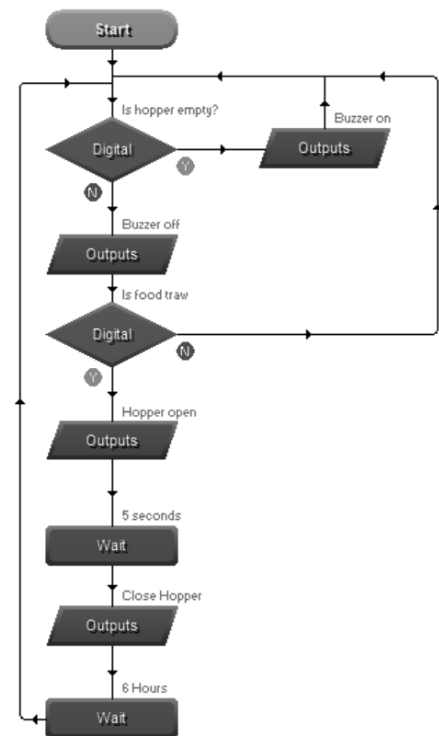
- (a) (i) Bluetooth control, you can change the bulb's colour, voice controlled, security, set them on timers
Accept two suitable answers **2 @ 3m** **(6m)**

- (ii) Alexa, Google nest, Google assist, Speakers, Security cameras, Video doorbells etc
Accept two suitable answers **2 @ 3m** **(6m)**

- (b) (i) Flowchart is completed below:

(8m) – Flow chart fully completed

(4m) – Partially completed **8m**



- (ii) The battery can wear out and the feeder will not operate / After a long period of use the battery may become unreliable and may result in little or no food being dispensed.
Accept any suitable answer around the battery life **4m**

- (iii) Servo motor, inline motor, stepper motor
Any one mentioned and a valid justification then award full marks **4m**

(16m)

- (c) (i) Compact and fits into a car boot, can be powered by the car USB port, quieter in operation, less maintenance
Accept any other suitable answers
3m for each advantage **2 @ 3m** **(6m)**

- (ii) In single acting cylinder air is supplied through one port to one side of the piston, causing the piston rod to extend in one direction for a user's chosen task
Accept any other suitable answers
6m for a descriptive answer **(6m)**

OR

- (d) (i) Pin number one is the pin closest to the notch/groove on the top surface of the controller – A diagram showing the pin closest to the notch must be used in the students answer for 6m
No diagram please award 3m **(6m)**

- (ii) Lights (LEDs), Speaker, Buzzer
Accept any other suitable answer **2 @ 3m** **(6m)**

Question 2 - 40 marks

- (a) (i) Measures voltage, current, resistance and temperature etc
Accept any other suitable answer **2 @ 3m**
- (ii) Continuity testing is to fault find breakages in a electronic circuit. If a fault is detected it can then be repaired.
Award 4m if a detailed answer is given
Award 2m if the answer is lacking detail **4m (10m)**
- (b) (i) A change in temperature is being sensed **8m**
- (ii) Potential dividers divide up the voltage within a circuit, so that parts of a circuit only receive the voltage they require.
Accept any other suitable explanation **6m**
- (iii) $V_{out} = (78/140) \times 9$
 $V_{out} = 0.5571 \times 9$
 $V_{out} = 5.01V$
 Working out must be shown to be awarded 6m
 No working out shown, award 3m **6m (20m)**
- (c) (i) A = Neutral – Blue
 B = Live – Brown
 (3m for each correct colour = 6m) **6m**
- (ii) The fuse is a safety device intended to stop the cable and connecting wire from overheating and possibly leading to a fire.
 (4m) Accept any other suitable answer **4m (10m)**

OR

- (d) (i)

A	B	Q1	Q2	Q3
0	0	1	1	0
0	1	1	0	0
1	0	0	1	0
1	1	0	0	1

(2m for each row correct Q1, Q2 & Q3 must be correct = 6m) **6m**

- (ii) Circuit 1 = And
 Circuit 2 = Or
 (2m each = 4m) **4m (10m)**

Question 3 - 40 marks

- (a) (i) Report successful phishing, Do not click on links in emails, and never go to websites by clicking links sent via emails, Communicate personal information only via phone or secure websites
Accept any other suitable answer
(3m for each = 6m) **6m**
- (ii) Passwords are easy to hack, they need to be uncommon and include capitals, numbers etc but people tend to use the same password for everything, If you use several passwords, keeping track of them is difficult
Accept any other suitable answer
(4m – 2m for each) **4m** **(10m)**
- (b) (i) PAN is computer network for interconnecting electronic devices within a individual person's workspace. A PAN provides information communication among devices like smartphones, tablets and laptops. Therefore Bluetooth would be a suitable method. As would Wireless USB, NFC, Infrared
Accept any other suitable answer **6m**
- (ii) LANs cover relatively small geographical areas / WANs usually cover a wide geographic area
WANs are (usually) slower than LANs
WANs are (usually) several LANs connected together
LANs are often owned and controlled by a single person / WANs are generally under collective ownership
Accept any other suitable answers
(8m – 4m for each one) **8m**
- (iii) Flexibility to expand network, there is no need to drill holes and install wires, modern devices are designed to connect wirelessly, no cables so no trip hazard
Accept any other suitable answers
(6m – 2m for each advantage) **6m** **(20m)**
- (c) (i) User accounts set up with secure passwords, Restricted accounts so not all users have the same privileges, Firewall to monitor all data moving in and out of the network
Accept any other relevant security measures
(6m – 3m for each security measure) **6m**
- (ii) Automatic updates reduce the need to manually check for and install updates, Automatic updates improve security by repairing vulnerabilities found in the system, Accept any other suitable answer
(4m – 2m for each reason) **4m** **(10m)**

OR

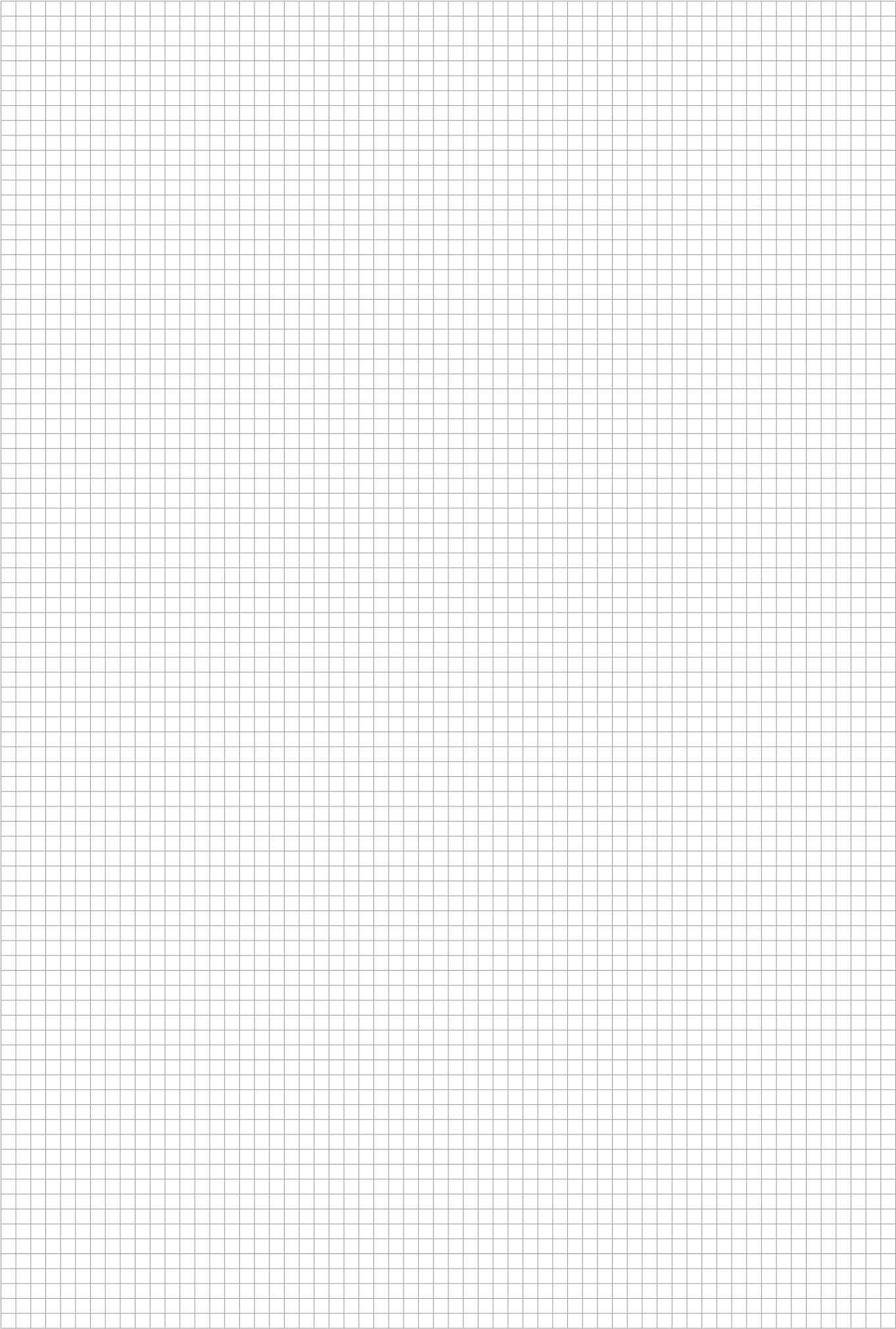
- (d) (i)** Primary storage is contained within the device through RAM and ROM. Secondary storage can be connected to the device USB / Secondary storage has slower access times than primary storage /
Primary storage is usually more expensive than secondary storage.
Accept any other suitable answers
(6m – 3m each) **6m**
- (ii)** SSD is more compact in size while HDD is larger in size, HDD is noiser than SSD due to mechanical parts moving in the HDD, SSD is less likely to breakdown due to less moving parts, SSDs can retrieve data quicker
Accept any other suitable answers
(4m – 2m for each one) **4m**
- (10m)**

Question 4 - 40 marks

- (a) (i) Performance: Carbon fibre body parts, aerodynamic features, electric and hybrid engines, weight, computer systems that control the performance of the car
Safe: airbags, anti-breaking, lane assist, cruise control, smart headlights, automatic breaking
(3m for each = 6m) **6m**
Accept any other suitable answers
- (ii) Incur the cost of replacing the faulty parts, any court cases (lawsuits) against the manufacturer will also have to be incurred by the company
(4m – 2m for each one)
Accept any other suitable answers **4m** **(10m)**
- (b) (i) Any two stages described
(3m for each = 6m) **6m**
- (ii) Allows the manufacturer to identify errors quicker, which leads to a quicker resolution, increases the company's profits, cuts down on wastage, which improves their stock
8m – 4m for each benefit – students should have at least two benefits discussed
Accept any other suitable answers **8m**
- (iii) Mass production. Large retail chains have multiple shops in a large city that sell the same product so this clothing is produced in a large factory and to a large scale in order to supply all the shops in their chain nationwide or worldwide.
Production selected – 3m / Justified award 3m
Accept any other suitable answers **6m** **(20m)**
- (c) (i) Companies want to continually improve their products to satisfy their customers' requirements. Take Apple for example - the majority of their new iPhones only have minimalistic upgrades yet they are continuously improving their product to meet the consumer's needs.
Accept any other suitable answers **5m**
- (ii) Reverse engineering is a company who takes a competitor's product and breaks it down to look at their design process/features. They then look at how they could incorporate their competitors features into their own designs to make a better product.
(5m for a detailed answer)
Accept any other suitable answers **5m** **(10m)**
- OR**
- (d) (i) Allows a company to share ideas as part of a team, to analyse their design and manufacturing process, delegate roles to the team and to improve employee productivity
(3m +2m)
Accept any other suitable answers **5m**
- (ii) Benchmarking is where a company takes a competitor's product and identifies strengths and weaknesses in that particular product.
(5m for a detailed answer)
Accept any other suitable answers **5m** **(10m)**

Question 5 - 40 marks

- (a) (i) Concrete is used for the foundation and floors so the modular home has a strong foundation to support the build. Wood is used to construct the main frames/partitions of the house while steel is used as a load barrier for the second floor etc.
Accept any other suitable answers
(All three materials mentioned for 2m each – 6m) **6m**
- (ii) A composite material is a solid material that is produced when two or more different substances which have their own properties are combined to create a new substance
Accept any other suitable answers **4m** **(10m)**
- (b) (i) PVC has one key ingredient which is salt which means it is readily available while also making it more appealing to manufacture windows and doors as it contains very little crude oil, PVC is a recyclable material, PVC is fireproof and is good at cancelling out noise
(6m – 3m each for two valid reasons)
Accept any other suitable answers **6m**
- (ii) A suitable wood selected and justified then award full marks
(8m) – 4m for naming the wood and 4m for justifying their selection
Accept any other suitable answers **8m**
- (iii) **Permanent:**
A permanent joint is a type of joint that does not allow you to disassemble workpieces without damaging one of the joined pieces. Welding, adhesives and riveting are general examples
- Semi-Permanent:**
A semi-permanent joint is a method of joining that is designed to be permanent, however it can be disassembled without damaging the materials. E.g. Nuts and bolts, screws, washers etc
(4m – 2m each) **4m**
Accept any other suitable answers **(18m)**
- (c) (i) The correct disposal is important to protect the environment and wildlife, it helps protect the health of people, it promotes upcycling
(6m – two considerations must be mentioned)
Accept any other suitable answers **6m**
- (ii) Reuse electronic components, upcycle, re-use various parts, nuts and bolts can be reused
(6m – 3m for each one) **6m**
Accept any other suitable answers **(12m)**
- OR**
- (d) (i) The properties of a smart material can be changed in a controlled environment by external stimuli. Light, Temperature and moisture are some examples of external stimuli. **6m**
- (ii) Thermochromic pigments change colour at a specific temperature – cups/mugs,
Photochromic pigments change colour when exposed to light – sunglasses, Shape memory alloys return to their original shape if heated up - structures
(6m – 3m for each smart material) **6m**
Accept any other suitable answers **(12m)**





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