Mark Scheme (Results)

Summer 2024

Pearson Edexcel GCSE
In Design & Technology (1DT0)
1D: Systems

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Summer 2024
Question Paper Log Number 74050
Publications Code 1DT0_1D_2406_MS

General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

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Component 1 mark scheme

Section A – Core content

Question number	Answer	Mark
1 (a) (i)	Any **one** property from: • Soft / softness (1) • Absorbent / absorbs water (1) • Insulator of heat / thermal insulator (1)	**(1)**

Question number	Answer	Mark
1 (a) (ii)	Any **one** property from: • Sets rigid / rigid (1) • Hard / scratch resistant (1) • Transparent (1) • Non-toxic / skin safe (1)	**(1)**

Question number	Answer	Mark
1 (a) (iii)	Any **one** property from: • Smooth surface (1) • Printability / takes colour / ink / toner well (1) • Absorbent (1) • Opaque (1) • Flexible / flexibility (1)	**(1)**

Question number	Answer	Mark
1 (a) (iv)	Any **one** property from: • Hard (1) • Tough (1) • Fine grain / close grain / even texture (1) • Non-toxic / food safe (1) • Good heat resistance / thermal insulator / low thermal conductor (1)	**(1)**

Question number	Answer	Additional guidance	Mark
1 (b) (i)	Any **one** advantage of using cast iron for the frying pan (1) and a linked justification of that advantage (1) • It is a good conductor of heat (1) therefore the pan surface gets hot quickly / will transfer heat to the food to cook it (1) • It is dense / heavy (1) therefore it will be quite stable on the oven top / unlikely to get knocked over easily (1) • It has good dimensional stability when heated (1) therefore the pan will not distort / buckle (1) • It holds the heat well (1) therefore meaning it stays hot for some time / longer (1) • It has a high melting point (1) therefore it can withstand the temperatures involved in cooking (1)	Do not accept anything related to melting	**(2)**

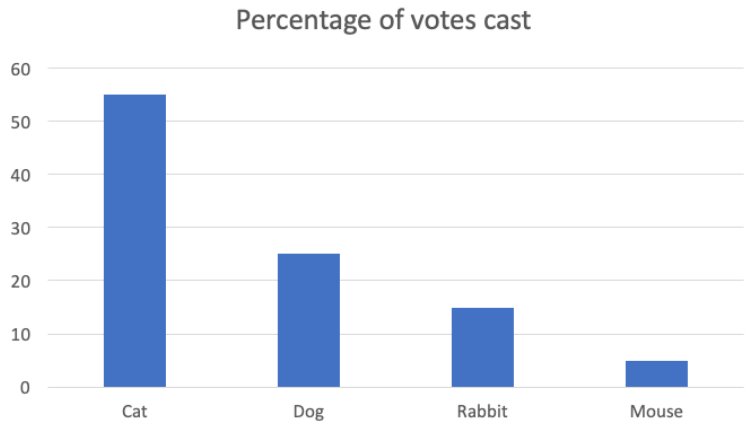
Question number	Answer	Additional guidance	Mark
1 (b) (ii)	A calculation that includes: • correct conversion of units 3 kg = 3000 grams (1) • correct answer 3000 x 2/100 = 60 grams (1) If no conversion of units: 3 x 2/100 = 0.06 grams (worth 1 mark)	Award full marks for correct numerical answer / correct numerical answer without working. Conversion of units could be done after the percentage calculation. Allow for ECF if candidate gets part of transposition wrong.	**(2)**

Question number	Answer	Additional guidance	Mark
2 (a)	Any **one** specific animal fibre from: • Wool (1) • Silk (1) • Mohair (1) • Horsehair (1) • Cashmere (1) • Angora (1) • Alpaca (1)	Do not accept plant fibres, e.g. cotton / cotton wool	**(1)**

Question number	Answer	Mark
2 (b)	Any **one** advantage of using biofuels (1) and a linked justification of that advantage (1) • Biofuels are a renewable / sustainable source of energy (1) which means there will always be a supply / not run out / reduce the rate at which conventional fuels are being used (1) • Less carbon emitted when burnt as fuel (1) which reduces pollution levels / emissions by the delivery vehicles (1) • Biofuels are relatively carbon neutral / smaller carbon footprint (1) which means the absorption of CO^2 during growth is almost equal to the emissions produced when being burnt (1)	**(2)**

Question number	Answer	Mark
2 (c)	Any **one** advantage of using CAD (1) and a linked justification of that advantage (1) • Colour / texture / grain / render can be added to the design (1) which means a realistic image is produced / able to see what it looks like / accurate visual representation (1) • Changes can be easily made (1) which means client feedback can be considered / design modified (1) • Files / part files can be output direct to CNC machines (1) which means prototypes can be produced quickly / reduce lead times to full production runs (1) • Files can be saved electronically (1) which means they can be sent to client / manufacturer as an email attachment (1) • Designs can be sent via email (1) which means stakeholders can provide immediate feedback (1) • Images / views can be manipulated / rotated / zoomed-in (1) which means the ideas can be seen from any angle / intricate details seen up close (1) • Design can be seen in 3D (1) which means thickness / proportions can be accurately represented / seen (1)	**(2)**

Question number	Answer	Additional guidance	Mark
2 (d) (i)	A calculation that includes: • correct calculation for the number of votes cast for the Rabbit (165 / 55) * 15 = 45 (1) • correct calculation for the number of votes cast for the Mouse • (165 / 55) * 5 = 15 (1) • Alternative method for second mark 300 – 165 – 75 – 45 = 15	Correct numerical answers only for full marks. Award full marks for correct numerical answers without working.	**(2)**

Question number	Answer	Mark
2 (d) (ii)	A completed bar chart that shows the two correct bars for the Rabbit at 15% and the Mouse at 5%: 	**(2)**

Question number	Answer	Mark
3 (a)	Award **one** mark from: • V-belt (1) • Vee belt (1) • V-shaped (1) • Vee shaped (1)	**(1)**

Question number	Answer	Mark
3 (b)	Any **one** reason for using aluminium rather than mild steel for the pulley (1) and a linked reason for the use (1) • Aluminium is a non-ferrous metal (1) therefore it will not rust if it comes into contact with water (1) • Mild steel is a ferrous metal / contains iron (1) therefore it is likely to rust / corrode (1) • Aluminium is lighter / less dense than mild steel (1) therefore it will have less of an impact on the weight of the boat / quicker to get up to speed (1) • Aluminium has a lower melting point than mild steel (1) which makes it easier / cheaper to cast (1) • Aluminium is softer than mild steel (1) which means it is easier to machine / turn on a lathe (1)	**(2)**

Question number	Answer	Mark
3 (c)	A calculation that includes: • Correct transposition of the formula Output speed = input speed / velocity ratio (1) • Correct calculation of output speed in rpm 2000 / (5/1) = 400 rpm (1)	**(2)**

Question number	Answer	Mark
3 (d)	Any **one** disadvantage of using the solar cell to power the motor (1) and a linked justification of the disadvantage (1) • The sun might not be bright enough / blocked by clouds (1) which means the boat could stop / get stranded in the middle of a lake / pond (1) • The solar cell might not be capable of providing the power required (1) which means the motor will not turn / turn fast enough to make the boat move (1) • A battery / storage system may be required to store electrical charge (1) which means an increase in weight in the boat hull / make the boat heavier / slower to move through the water (1) • Will not work in low light / dark (1) which means limited use in winter / late at night (1)	**(2)**

Question number	Answer	Mark
3 (e)	Any **two** benefits of using balsa wood to manufacture the frame for the model boat (1) and a linked justification of that benefit (1) • It is lightweight (1) making it easier to power with the solar cell (1) • It is soft (1) which means it is easy to cut with a sharp knife / sand to a smooth curve shape / form / work with (1) • It has a low density / buoyant material (1) which means it will float on the water / not sink (1)	**(4)**

Question number	Answer	Mark
4 (a)	Any **two** explanations that reference the way in which conductive inks can be used in products (1) and a linked justification of each way (1) • They can be used to draw / repair electronic circuits (1) which reduces the need for wires / soldering / expensive / dangerous chemicals to be used to make circuits / PCBs / can be drawn on flexible materials (1) • They can be used as antenna / wireless aerials in car windscreens (1) which means cars can have uninterrupted Wi-Fi connectivity / connected to internet for live traffic data / electric charging points (1) • They can be used to create interactive wall / visual displays / products (1) which means when parts of the wall / products are touched / connected electronic outputs are made to work / light up / move / sound (1) • They can be applied using a pen / printer / silk screen printed (1) which means circuits can be produced to decorate fashion / textiles garments / embed electrical components (1) • They reduce the need for dedicated circuit boards (1) which reduces product weight / useful in restricted spaces (1) • Conductive inks will bend / flex (1) therefore they will move without breaking / cracking (1)	**(4)**

Question number	Answer	Additional guidance	Mark
4 (b)	A calculation that includes: • correct working out of weight (40/100) x 9 or 9 x 0.4 (40 x 9) /100 (1) • correct answer 3.6 grams (1)	Award full marks for correct numerical answer without working. Allow for ECF if candidate gets part of calculation wrong.	**(2)**

Question number	Indicative content	Mark
4 (c)	• Designers should consider / try to use fewer materials when designing new products / developing new technology so as to minimise the impact on the natural resources available • Designers should try to use as many recyclable materials as possible to reduce the need for new / virgin grade materials • Products / technology should be lighter therefore costing less to transport / distribute post manufacture • Fewer toxic materials / processes should be used therefore causing less damage to the environment during / post use / less to be taken into account when disposing of the item / recycling • The carbon footprint of the product / technology should be considered so that minimal impact on the environment can be made / use locally available materials / less transportation • LCA should be carried out during the design process to make sure that the product / technology can be assessed in terms of its carbon footprint • Consideration should be given to the origin of the raw materials in terms of mining for minerals / oil exploration / cutting down of trees / mining for ore • Designers should try to use biodegradable materials if possible / appropriate • Carry out research into new / emerging materials to assess environmental impact / carbon footprint • Designers could make use of standardised parts / modular components • Designers create products that are easily dismantled / disassembled / repaired allowing materials / parts to be recycled / reused	**(6)**

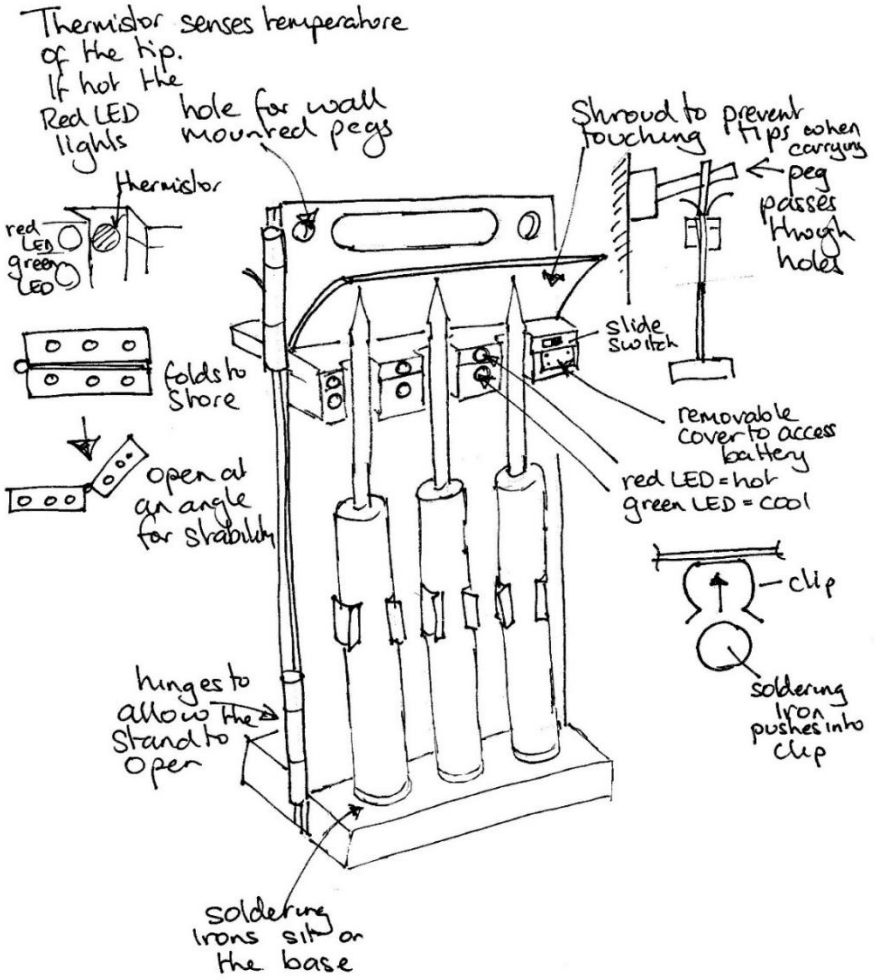
Level	Mark	Descriptor
	0	
Level 1	1 - 2	• Attempts to interrogate and deconstruct information but connections and logical chains of reasoning are flawed. • An unbalanced appraisal of the information/issues, containing judgements that show a limited awareness of the interrelationships between factors or competing arguments.
Level 2	3 – 4	• Interrogates and deconstructs information and provides some connections and logical chains of reasoning. • A balanced appraisal of the information/issues, containing judgements that show an awareness of the interrelationships between factors or competing arguments.
Level 3	5 - 6	• Interrogates and deconstructs information and provides sustained connections and logical chains of reasoning.

		• A well-balanced appraisal of the information/issues, containing judgements that show a thorough awareness of the interrelationships between factors or competing arguments.

Section B – Systems

Question number	Answer	Mark
5 (a)	**Marks will be awarded for understanding of design and technology, not graphical skills.** Notes and sketches that include: • be able to hold an additional three cordless soldering irons (1) and to stop soldering irons from moving as the rack is carried around a workshop (1) e.g. extra three holes / slots alongside / longer / double sided (but not at the expensive of being able to hang it up on a wall) / clips on the back plate / frame around it to hold it in place • protect the user from potential burns when carrying the rack (1) and have an indicator to show if the soldering irons are still hot (1) e.g. shelf over the tips of the soldering irons / removable covers / thermistor / LED / LCD temperature display • be more stable when placed on a bench (1) and be capable of being hung up on a wall (1) e.g. wider base / triangular back supports / holes to hang it up on / dowels to go through carrying handle to allow hanging on the wall / nails / screws / pegs **See next page**	**(6)**

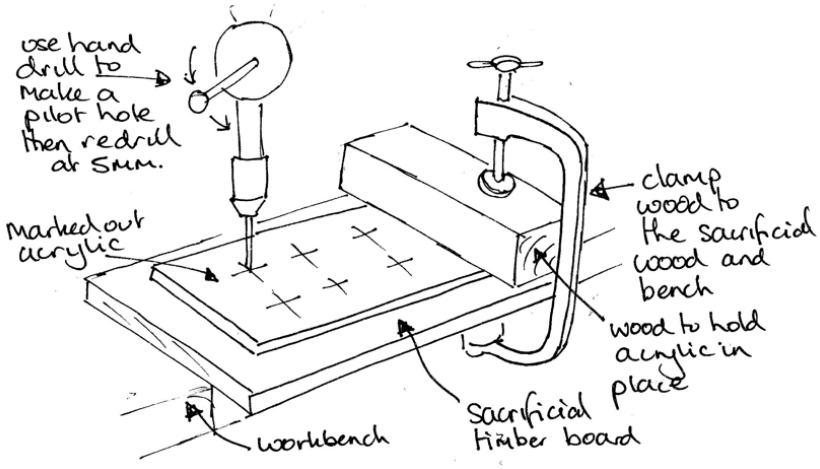
Example of candidate response:



Notes:
Hole for wall mounted pegs
Thermistor senses the temperature of the tip if hot red LED lights up
Red and green LEDs
Shroud to prevent touching tips when carrying
Peg passes through holes
Folds to store
Open at an angle for stability
Removable cover to access battery
Slide switch
Soldering iron pushes into clip
Hinges to allow the stand to open
Soldering irons sit on the base

Question number	Answer	Mark
5(b)	Any **two** explanations that include a way the food play set meets or fails to meet the requirement (1) and a linked justification of that way (1) • You can separate fruit into two halves (1) therefore the child is able to see what the fruit looks like on the inside / simulates preparing a healthy meal (1) • There are several different fruits (1) therefore there is quite a lot to be able to discuss with parents about the types of fruits / some have to be peeled to be eaten / others just eaten (1) • There are only fruits shown / featured in the set (1) therefore it only provides a narrow range of healthy foods / discussion points (1) • When the batteries in the fruits become flat the LEDs will not light up (1) which might cause the child to lose interest with the toy (1) • The LEDs give an indication of the correct matching (1) which enables learning to take place without adult intervention (1)	**(4)**

Question number	Answer	Mark
6 (a)	Any **two** explanations for finishing the house with screen printing (1) and a linked justification (1) • Screen printing can be applied to a range of surfaces (1) which means designs can be printed on to both the walls and the roof of the house (1) • Screen prints can be applied after the house has been assembled (1) which means that assembly is not delayed whilst ink dries (1) • Screen printing allows for solid blocks of colour (1) which means the brick / tile patterns will look more effective / enhanced aesthetics (1)	**(4)**

Question number	Answer	Additional Guidance	Mark
6 (b)	**Marks will be awarded for understanding of design and technology, not graphical skills.** Notes and sketches that include: • Place acrylic on a sacrificial piece of wood (1) • Clamp / hold the acrylic piece secure with an additional piece of wood (1) • Drill a pilot hole with hand drill / cordless drill at each marked point (1) • Check / ensure the drill is vertical (1) • Slowly drill with a drill bit (1) Example of candidate response:  Notes: Use hand drill to make a pilot hole then re-drill Clamp wood to the sacrificial wood and bench Wood to hold acrylic in place Sacrificial timber board Workbench Marked out acrylic	Cap at 3 marks if no sketches or all sketches and no notes Do not accept the use of a centre punch	**(4)**

Question number	Answer	Mark
6 (c)	Any **one** explanation of a working property of acrylic (1) and a linked justification for that reason (1) • Acrylic can be opaque / fluorescent / translucent (1) which means that the whole of the nightlight will glow slightly when the LEDs are turned on (1) • Acrylic is rigid / stiff (1) which means the house will retain its shape once assembled (1)	**(2)**

Question number	Answer	Mark
6 (d)	Any **two** explanations that include a method (1), plus **two** linked justifications of that method (1) + (1) Cutting / sawing / use of a saw (1) • A saw can be used to cut along the lines whilst the work is held in a vice (1) which means the triangular sections would be removed as whole pieces (1) Filing (1) • A file could be used at an angle to remove small amounts whilst the work is held in a vice (1) which results in a flat surface (1) Machine sanding / sanding / abrading (1) • The work could be held against a band facer / sanding machine to remove the waste (1) leaving a very smooth surface finish (1) CAM / CNC machining (1) • The design for the end panel of the house would be designed in CAD / programmed (1) which would be followed by a cutter to remove the corners (1) Laser cutting (1) • A laser beam burns / cuts the material (1) which leaves a smooth finish (1)	**(6)**

Question number	Answer	Mark
7 (a)	• Ribbing / ribs / ribbed (1)	**(1)**

Question number	Answer	Mark
7 (b)	Any **two** working properties of ABS explained (1) plus a linked justification of the property (1) • ABS has good plasticity when heated (1) which means that it is capable of being forced / flowing into the mould to make the casing (1) • ABS has good thermal stability (1) which means that the casing for the siren and lighting unit will not deform/become soft in high temperatures (1) • ABS has good impact resistance (1) which means there is little risk of it cracking / breaking even if dropped by a child (1)	**(4)**

Question number	Answer	Additional guidance	Mark
7 (c)	A calculation that includes: • Calculation of the length of the semi-circle (1) $\pi D/2 = \pi$ (2 x 9) / 2 = 28.278 cm • Calculation of the total length of the part required (1) 28.278 cm + (2 x 16) = 60.278 cm • Calculation of how many whole strips can be cut from long length of the sheet (1) 244 / 30 = 8 • Calculation of how many whole strips can be cut from width of the sheet (1) 122 / 60.278 = 2 • Calculation of the number of whole pieces that can be cut from a single sheet (1) 8 x 2 = 16 pieces Alternative method from Step 3 (Step 1 and 2 same as above) • Calculation of small sheet area 60.278 x 30 = 1808.34 cm^2 (1) • Calculation of total sheet area 244 x 122 = 29768 cm^2 (1) • Calculation of number of sheets 29768 / 1808.34 = 16.46 rounded to 16 (1)	Award full marks for correct numerical answer without working. Allow ecf if candidate gets part of calculation wrong.	**(5)**

Question number	Answer	Mark
7 (d)	Any **two** explanations that include an advantage of using cable ties as a method of cable management (1), plus **two** linked justifications of that advantage (1) + (1) • Cable ties will keep all the cables / wires / leads together (1) which means all leads can be organised / prevents tangling (1) allowing for easier connection to the power source (1) • Cable ties can be fixed to the casing (1) which means wires are less likely to become loose (1) therefore ensuring that the siren and lighting will continue to work (1) • Cable ties can be separated if necessary (1) which means faulty wires / components can be replaced (1) allowing repairs to be made without dismantling the whole unit (1)	**(6)**

Question number	Answer	Mark
8 (a)	Any **one** explanation that includes a benefit of using LEDs for the strip lights (1) and a linked justification of that benefit (1) • LEDs are available from a wide range of suppliers (1) which means that components will always be available (1) • LEDs are available in a range of colours (1) which means the strip light can be varied to meet customer needs (1) • LEDs are small / thin / low profile components (1) allowing the depth of the completed strip light to be small (1) • LEDs are available in a range of different sizes / intensities (1) allowing the unit to be made available with different levels of brightness (1) • LEDs have a long lifespan (1) which means the lighting units will not need to be replaced frequently (1) • LEDs only consume a small amount of power (1) meaning the strip lights provide an energy efficient solution for consumers (1) • LEDs don't radiate heat from the casing / get hot (1) therefore they reduce the chance of fire / case distortion (1)	**(2)**

Question number	Answer	Mark
8 (b)	Any explanation of using surface mount technology for the strip lights (1) plus **two** linked justifications of that advantage (1) + (1) • Fewer processes need to be completed (1) because there is no need for through holes to be drilled (1) therefore reducing the time needed to produce the LED strip lights (1) • Surface mount technology allows for smaller components / components to be placed closer together (1) which means the circuit board can be smaller (1) therefore reducing the overall width / dimensions of the strip light (1) • Surface mount components are cheaper than through-hole equivalents (1) which means the cost of manufacturing is reduced (1) therefore allowing the company to be more profitable / sell the product more competitively (1)	**(3)**

Question number	Answer	Mark
8 (c)	Any **two** explanations that includes a way pick and place technology is used to aid the manufacture of the LED strip lights (1) and a linked justification (1) • Pick and place machines are very flexible (1) which means the same machine can be used for both resistors and LEDs (1) • Pick and place machines have high levels of precision (1) which means components will be placed in the correct location with consistency (1) • Pick and place machines reduce the need for operatives on the production line (1) which improves safety / reduces chances of burns when soldering (1) • Pick and place machines move the components through the use of a vacuum (1) meaning there is reduced chance of electrostatic damage (1)	**(4)**

Question number	Indicative content	Mark
8 (d)	Impact on **cost factors** related to: • LEDs are a reliable form of lighting that have a long service life and use little energy • Polymers can be moulded with a smooth surface to allow for easier cleaning of the strip light unit • Polymers are insulators therefore there is a reduced risk of electric shock without the expense of adding further insulating materials • The PCB can be manufactured using automated processes which increases accuracy • SMT can be used when manufacturing the LED strip lights • Assembled LED strip lights would be subject to random quality control / continuity tests • The lens and the casing can both be extruded which ensures the two pieces will be manufactured with accuracy to minimise the reworking faulty products • The strip light can be assembled without the need for additional fixings and fittings if all the parts have an interference fit which reduces assembly time • Soldering will be needed to solder components to the PCB and also leads for the power supply • LEDs and resistors are readily available for manufacturing the lighting unit therefore the manufacturer can shop around to get the best deal • Stock shaped extrusions / channels could be used for the outer casing and lens which would reduce the need for the further machining processes • Batch production allows for economies of scale, reducing the cost per unit as the production volume increases. **See next page**	**(9)**

Level	Mark	Descriptor
	0	
Level 1	1 - 3	• Attempts to interrogate and deconstruct information but connections and logical chains of reasoning are flawed. • An unbalanced appraisal of the information/issues, containing judgements that show a limited awareness of the interrelationships between factors or competing arguments. • A conclusion may be presented but it is likely to be generic assertions rather than supported by relevant judgements.
Level 2	4 – 6	• Interrogates and deconstructs information and provides some connections and logical chains of reasoning. • A balanced appraisal of the information/issues, containing judgements that show an awareness of the interrelationships between factors or competing arguments. • A conclusion is presented that is partially supported by relevant judgements.
Level 3	7 - 9	• Interrogates and deconstructs information and provides sustained connections and logical chains of reasoning. • A well-balanced appraisal of the information/issues, containing judgements that show a thorough awareness of the interrelationships between factors or competing arguments. • A conclusion is presented that is fully supported by relevant judgements.