Pearson Edexcel

Mark Scheme

Summer 2022

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

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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 – 1DT0/1D

Section A – Core content

Question number	Answer	Additional information	Mark
1 (a) (i)	Any **one** property from: • Malleable (1) • Ductile (1) • Excellent strength to weight ratio (1) • Lightweight / low density (1) • Waterproof / Impermeable (1) • Resistance to corrosion / won't rust (1) • Food safe / non-toxic (1)	Do not accept 'can be recycled' Do not accept 'durable'	**(1)**

Question number	Answer	Additional information	Mark
1 (a) (ii)	Any **one** property from: • Elasticity / mouldability (1) • Soft (1) • Insulator (1) • Permeable / breathable (1) • Insulator / heat insulator (1)	Do not accept 'durable'	**(1)**

Question number	Answer	Mark
1 (a) (iii)	Any **one** property from: • Transparent / see through (1) • Translucent / semi translucent (1) • Smooth surface (1)	**(1)**

Question number	Answer	Additional information	Mark
1 (a) (iv)	Any **one** property from: • Flexible / flexibility / bendable (1) • Good tensile / compressive strength (1) • Moisture / water resistance (1) • Elasticity (1) • Tough / impact resistance (1)	Do not accept 'durable'	**(1)**

Question number	Answer	Mark
1 (b)	Any **one** disadvantage of urea formaldehyde (UF) for the 3-pin plug (1) and a linked justification of that disadvantage (1) • UF is brittle (1) therefore if it gets banged / knocked it can break / shatter / splinter (1) • UF is a thermosetting plastic (1) therefore it cannot be recycled if it breaks / is not biodegradable (1) • UF can melt / burn at high temperatures (1) therefore it becomes a hazard / danger (1)	**(2)**

Question number	Answer	Additional guidance	Mark
1 (c)	A calculation that includes: • correct calculation of ratios 50 / (13 + 7) = 2.5 (1) • correct answer 2.5 x 13 = 32.5 kg (1)	Award full marks for correct numerical answer without working. Allow for ECF if candidate gets part of transposition wrong.	**(2)**

Question number	Answer	Additional guidance	Mark
2 (a)	Any one other hardwood from: • Oak (1) • Beech (1) • Ash (1) • Birch (1) • Jelutong (1) Any other appropriate hardwood	Do not accept balsawood or mahogany	**(1)**

Question number	Answer	Mark
2 (b)	Any **one** working property of mahogany that makes it an appropriate choice of material (1) and a linked justification of that working property (1) • It is hard / durable (1) which means that it will withstand wear as the books are placed in and taken out of the holder (1) • It is tough (1) which means that it is capable of being knocked / bumped / dropped without damaging (1) • It has close / tight grain (1) which means it does not damage the book when lifted in or out (1)	**(2)**

Question number	Answer	Mark
2 (c)	Any **one** advantage for the manufacturer (1) and a linked justification of that advantage (1) • They do not hold lots of stock (1) which means they do not need to pay for storage space / tie up finance / not susceptible to falling demand (1) • They could change the type of wood used / easily change the size / change design (1) which means they can respond to individual customers' needs / wants / size of book (1) • Each one will be unique / exclusive (1) which means the manufacturer can charge a higher price (1) • No excess products / stock (1) which means the manufacturer will not have to reduce the price to get rid of stock (1) • Happier / more engaged workforce (1) therefore higher quality products manufactured / greater staff retention (1)	**(2)**

Question number	Answer	Additional guidance	Mark
2 (d)	A calculation that includes: • correct calculation of the total length of timber required (2 x 30) + 40 = 100 cm (1) • correct calculation of volume 100 cm x 5 cm^2 = 500 cm^3 (1) • correct conversion of units from cm^3 to m^3 500 cm^3 = 500/1,000,000 or 10^6 = 0.0005 m^3 (1) • correct calculation of final cost 0.0005 x 1200 = £0.6 or 60 pence (1)	Award full marks for correct numerical answer without working. Allow for ECF if candidate gets part of calculation wrong. Special case: Award a max of 3 marks if the factor of 6 unit conversation is incorrect or not evident; for example: £6, £60, £6000, £600000	**(4)**

Question number	Answer	Mark
3 (a)	• Light emitting diode / LED (1) (Only answer)	**(1)**

Question number	Answer	Mark
3 (b)	Any **one** reason for using a bevel gear (1) and a linked reason for the use (1) • To convert rotary motion through 90^0 (1) so it will take up less space inside the drill (1) • To increase / decrease rotary speed (1) which means that the chuck can be made to turn faster / slower than the motor speed (1) • To increase the torque (1) which means it will be able to drill harder / denser materials (1)	**(2)**

Question number	Answer	Additional guidance	Mark
3 (c)	A calculation that includes: • Correct calculation of the compound gear ratio (40 / 20) x (40 / 20) = 4 (1) • Correct calculation of driven RPM 4 x 400 = 1600 RPM (1) Alternative method: (40 / 20) = 2 x 400 = 800 (1) (40 / 20) = 2 x 800 = 1600 (1)	Special case: If only one step has been calculated, e.g. 40 / 20 = 2 x 400 = 800 (1) If no working out and answer is 800 (0)	**(2)**

Question number	Answer	Mark
3 (d)	Any **one** benefit of using a battery (1) and a linked justification of the benefit (1) • Portability / convenience (1) therefore the user does not need to be near a power supply / plug / ease of use (1) • No power leads (1) which means improved safety as there will be no trailing cables (1) • The battery can be replaced with a fully recharged battery (1) which means the hand drill can continue to be used (1)	**(2)**

Question	Answer	Additional	Mark

number		guidance	
3 (e)	Any **two** benefits of using carbon fibre for the main body (1) and a linked justification of that benefit (1) • It is lightweight (1) which means it is not too heavy for the user to hold / can work longer without tiring (1) • It can be formed into complex shapes / forms (1) which means smooth / sleek / ergonomic forms can be manufactured (1) • It has excellent strength to weight ratio (1) which means although being light, it is capable of normal / intended use (1)	Do not accept durable, hard wearing or tough	**(4)**

Question number	Answer	Mark
4 (a)	Any **two** explanations that references the way in which agro-textiles can be used (1) and a linked justification of each way (1) • They can be used to stop soil erosion (1) which means nutrients / soil will not be washed away (1) • They can be used to warm the ground (1) which means crops may grow faster / increased yields (1) • They can be used to help retain moisture in the soil (1) which means that the amount of water required to grow crops is reduced / saves valuable water (1) • They can be used to help protect the crops from birds / insects / pests (1) which means the crop will be bigger / more crops / fewer crops lost by being eaten (1) • They can be used to protect against adverse weather conditions such as wind / frost / hail / solar radiation (1) which means they have a greater chance of surviving / growing (1) • They can be used as a weed control membrane (1) which means time can be saved by not having to remove weeds (1)	**(4)**

Question number	Answer	Additional guidance	Mark

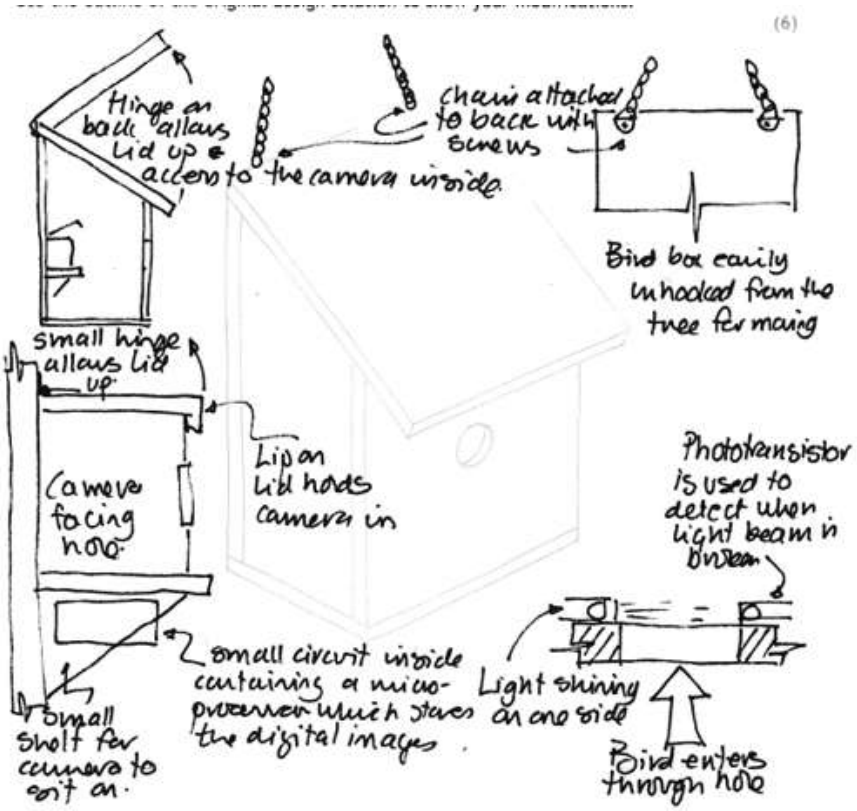
4 (b)	A calculation that includes: • correct working out of area of roll of agro-textile 50 x 1.2 = 60m^2 (1) • correct working out of number of rolls 420 / 60 = 7 rolls (1) Alternative method: 420 / 1.2 = 350 (1) 350 / 50 = 7 (1)	Award full marks for correct numerical answer without working. Allow for ECF if candidate gets part of calculation wrong.	**(2)**

Question number	Indicative content	Mark
4 (c)	• Fair trade supports the development of farmers and producers working in local communities / communes / cooperatives by receiving a fair price for their crops / products • Products / crops displaying the fair-trade logo have been produced by small-scale farmer organisations who employ local people • Locals benefit from employment / regular income / improved standards of living • Communities benefit from money going back into the local economy • There are a set of environmental and social conditions that must be met to be branded as a fair-trade producer meaning improved benefits for the environment and locals • Workers have some rights which are protected and enforced by being a fair-trade supplier • Minimum prices are set / adhered to / guaranteeing a fair price for the crop / products • Fairtrade Premiums are paid on products and are reinvested in local business / community projects to support farmers / residents • Fairtrade allows for farming to be a reliable source of income for local families meaning that the skills of farming can be passed from one generation to the next leading to improvements in lifestyle and local economy • Fairtrade emphasises the reduction of exploitation and child labour / developing the skills of workers / improved human rights	**(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.

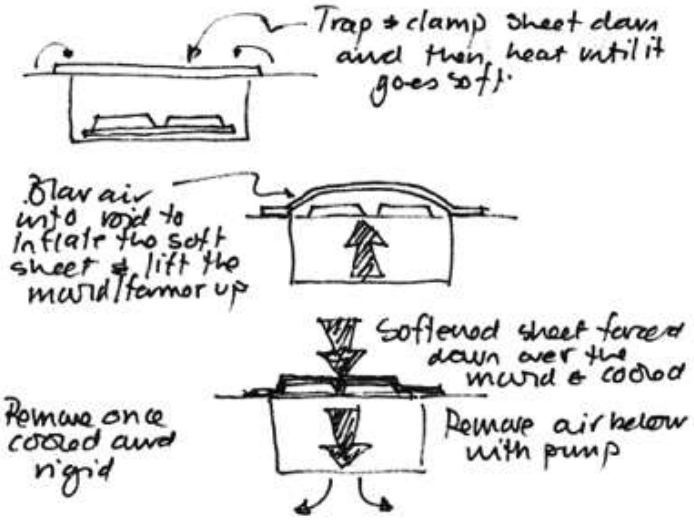
Section B – Systems

Question number	Answer	Mark
5 (a)	**Marks will be awarded for understanding of design and technology, not graphical skills.** Notes and sketches to show how to: • hold the camera inside so it can be easily removed to replace the batteries (1) and allows access to a digital photographic storage system (1) e.g. lid / clips / strap / velcro / non-permanent fixing / camera on shelf / opposite entrance hole / pointing towards hole from above or below e.g. clips / straps / turn buttons / screwed brackets **MUST** not be a permanent fixing allowing the camera to be removed / micro switch / SD card / Bluetooth connection to computer in house / microprocessor / PIC • take a photograph of the bird with the camera (1) when entry is detected through the hole (1) e.g. switch / electronic trigger to camera / infrared / phototransistor / pressure sensor / light beam e.g. phototransistor / LDR and light / micro switch • be able to be hung up in a tree (1) and easily moved to another tree (1) e.g. chain / string / hole / mirror plate / capable of being removed / non-permanent / screw / nail	**(6)**

	Example of candidate response:  Notes: Hinge on back allows lid up and access to the camera inside Chain attached to back with screws Bird box easily unhooked from the tree for moving Small hinge allows lid up Camera facing hole Lip on lid holds camera in Phototransistor is used to detect when the light beam is broken Light shining on one side Bird enters through hole Small circuit inside containing a microprocessor which stores the digital images Small shelf for camera to sit on	

Question number	Answer	Mark
5(b)	Any **two** explanations that include a way the money box meets or fails to meet the requirement (1) and a linked justification of that way (1). • You can see how much you have saved / filled it up (1) therefore you can continue to save / break it open to spend (1) • There is no easy / obvious way to gain access (1) which means that you are more likely not to touch / get the money out (1) • The tea cup is not an obvious shape / appealing to a young child (1) which means they are not going to be motivated to save (1) • The children may be amused each time money is put into the box by the tune (1) which means they may put lots of money in / parents put money in to entertain / reward the child / to see them happy / encourage them to do chores (1) • See-through screen may get scratched / UV damaged (1) which means the children will not be able to see how much money is inside (1) • Not a lot of space for coins / too thin (1) which means not a lot of money can be stored / saved (1)	**(4)**

Question number	Answer	Mark
6 (a)	Any **two** reasons for the manufacturer of using Ohm's law when designing the circuit for the alarm system (1) and a linked justification (1) • Resistance values can be calculated (1) which means an appropriate value can be selected / NPV / to protect a LED from blowing (1) • Currents can be calculated (1) which will ensure that there is not too much current flowing which could damage components / lead to overheating (1) • Voltage requirements can be calculated (1) which means the correct supply can be used / ensuring there is sufficient potential to be able to power the circuit (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 to show how to: • Trap / clamp the polymer sheet down / above the mould (1) • Heat the polymer sheet until it goes soft (1) • Blow the polymer sheet / lift the table / platten into the heated sheet (1) • Turn on vacuum pump to remove the air /sheet forms over the mould (1) • Release / remove the cooled / formed sheet from the mould (1) Example of candidate response:  Notes: Trap and clamp sheet down and then heat until it goes soft Blow air into void to inflate the soft sheet and lift the mould / former up Softened sheet forced down over the mould and cooled Remove air below with pump Remove once cooled and rigid	Cap at 3 marks if no sketches or all sketches and no notes	**(4)**

Question number	Answer	Mark
6 (c)	Any **one** explanation that includes a reason for anodising the front panel (1) and a linked justification for that reason (1). • An anodised finish improves the hardness of the surface (1) which means the panel will have increased resistance to wear (1) • An anodised finish allows for a colour to be applied (1) which results in a more attractive / visually appealing product (1) • An anodised finish creates an insulated surface (1) which means the risk of any potential electrocution is reduced / removed / protecting the user from harm (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). Cable / zip ties (1) • Can be placed around the cables once installed and pulled tight / gripping the cables (1) which means they are all held together / take any strain as a group / move set / but still visible / prevent tangling (1) Wire looms (1) • Looms are pre-made (1) which means they are quicker to install / connect as they contain the right number of cables / correct length (1) Ribbon cable / dupont cables (1) • Large groups of small cables are made as one group / coloured (1) which means lots of cables can be connected quickly / at the same time using edge connectors / male / female connectors (1) Terminal blocks (1) • Blocks are fixed / soldered to the PCB / wires connected in physically / screwed down (1) which means individual connections are easily replaced / repaired / cut to length (1) Heat shrink sleeve (1) • Heat shrink sleeve contracts when heated (1) which means that the cables are held together as one (1) Spiral sleeve wrap (1) • Spiral sleeve is a temporary means of holding the cables together (1) which means cables can be taken out / replaced / repaired (1)	**(6)**

Question number	Answer	Mark
7 (a)	• Compression (1) • Compressive (1)	**(1)**

Question number	Answer	Mark
7 (b)	Any **two** working properties of copper explained (1) plus a linked justification of the property (1). • Copper is an electrical conductor / has low electrical resistance (1) which means that a current can flow through it to power / light the LEDs (1) • Copper is ductile (1) which means it can be drawn down into very thin / fine wires / small sections (1) • Copper is malleable (1) which means it can be bent / flexed around corners / curved without breaking (1)	**(4)**

Question number	Answer	Additional guidance	Mark
7 (c)	A calculation that includes: • Conversion of units at the start or end (1) • Calculation of the area of the semi-circle (1) $\pi r^2 / 2$ $3.142 \times 1.5^2 / 2 = 3.53475\ cm^2$ • Calculation of the area of the rectangle (1) $10 \times 3 = 30\ cm^2$ • Calculation of the total area (1) $30\ cm^2 + 3.53475\ cm^2 = 33.53475\ cm^2$ • Calculation of the total volume (1) $33.53475\ cm^2 \times 2 = 67.0695\ cm^3$ Rounded to $67\ cm^3$	Award full marks for correct numerical answer without working. Allow ecf if candidate gets part of calculation wrong. Credit full marks for 67.0695 or 67. Alternative method may show calculation of volume of separate parts that are then added together	**(5)**

Question number	Answer	Mark
7 (d)	Any **two** explanations that includes a reason for fabricating the main body of the desk lamp rather than making from a single piece (1), plus **two** linked justifications of that reason (1) + (1). • Fabrication will require less volume of material (1) which means the cost will be less (1) therefore allowing the product to be sold for less / make more profit for the manufacturer (1) • Less waste will be produced during the manufacture (1) which means that less material must be disposed of (1) therefore reducing the amount going to landfill / tipping (1) • Smaller sections of acrylic can be used (1) which reduces the amount of bigger section acrylic needing to be purchased / small off cuts used up (1) therefore maximising material usage / reducing the need for more virgin material / oil exploration / polymer production / more sustainable long term (1)	**(6)**

Question number	Answer	Mark
8 (a)	Any **one** explanation that includes a benefit of using LEDs (1) and a linked justification of that benefit (1). • They use very little current (1) which means any battery will last a long time / could be solar powered / will not be too expensive to run (1) • LEDs can be multi-coloured / bi-coloured (1) which means that they can be controlled to be red if the car is going too fast / green if the car is below the speed limit (1) • Lots can be connected in series / parallel (1) which means that larger arrays / numbers can be created (1) • LEDs are bright / can be viewed from wide / any angle (1) which means they can be seen in a range of weather conditions (1)	**(2)**

Question number	Answer	Mark
8 (b)	Any **one** explanation that includes an advantage of carrying out quality control checks (1), plus **one** linked justification of that advantage (1) + (1). • The LEDs can be checked for dimensional accuracy (1) which means tooling can be checked / changed if the LEDs are not the correct size (1) therefore reducing the number of LEDs that would be made the wrong size / reducing waste / rejects (1) • The LEDs can be tested for water / weather resistance (1) so water can't get in and damage the LED (1) and therefore create a short circuit (1) • The length of the legs can be checked (1) and tooling adjusted accordingly (1) which reduces the chance of legs not being of different lengths / make sure that the legs show / reflect the correct polarity (1) • A continuity check would be carried out (1) to ensure that the LED is wired / connected correctly / connections made (1) so that it allows current to flow through it / light up when a current passes through it / luminosity levels can be tested (1)	**(3)**

Question number	Answer	Mark
8 (c)	Any **two** advantages of using photo etching to make the circuit boards (1) and a linked justification of those advantages (1). • Photo etching allows for a high quality / high definition image to be created / CAD generated (1) which means that a high-quality image will be transferred to the board / dense image (1) • The image / mask can be used repeatedly (1) which means that identical boards / circuits can be produced / for batch or mass production (1) • Photo etch masks / files / print outs can be saved electronically / stored (1) which means they can be accessed at any stage to make a one-off / new batch if the customer wants more (1)	**(4)**

Question number	Indicative content	Mark
8 (d)	• The sign shows numbers which will be easier to understand and interpret when driving at speed so can be understood and interpreted without having to understand a spoken language • When used outside schools the sign will encourage drivers to drive at an appropriate / safe speed / speed can be reduced at certain times of the day • The sign can also be understood by a whole range of generations from young children to older drivers • The LED sign has more impact than a static / unchanging sign as the speed displayed is personalised so it is more noticeable and drivers are more likely to respond • The message appears in a graphical format quickly without needing to be able to read much text when driving • Could be customised / personalised for use in different environments with branding / town names as they are made in batches / screen printing could be done to order • The sign is manufactured from widely available components / materials / sustainable given it is made from aluminium which is a widely-recycled material • Aluminium does not contain any iron and so will not rust outside in the rain / damp air conditions • The sheet is quite thick and will not be blown about in the wind • The LEDs could be multi-coloured and controlled / programmed to be either red / green / amber depending on the speed being measured and displayed in relation to the local speed limit • LEDs are widely available in different colours and sizes	**(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.