Pearson Edexcel

Mark Scheme

Summer 2022

Pearson Edexcel GCSE
In Design & Technology (1DT0)
1C: Polymers

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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 – 1DT0/1C

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	Answer	Additional information	Mark

number			
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	Answer	Additional guidance	Mark

number			
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	Answer	Additional	Mark

number		guidance	
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 number	Answer	Additional guidance	Mark
3 (e)	Any **two** benefits of using carbon fibre for the main	Do not	**(4)**

	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)	accept durable, hard wearing or tough	

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)**

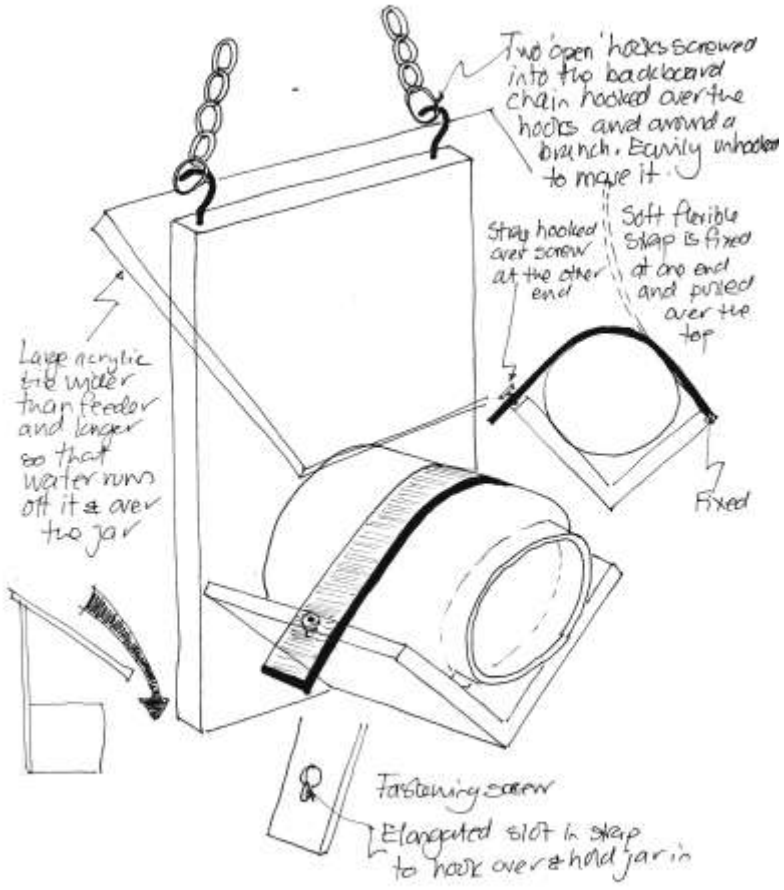
Question number	Answer	Additional guidance	Mark
4 (b)	A calculation that includes:	Award full marks	**(2)**

	• 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)	for correct numerical answer without working. Allow for ECF if candidate gets part of calculation wrong.	

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.

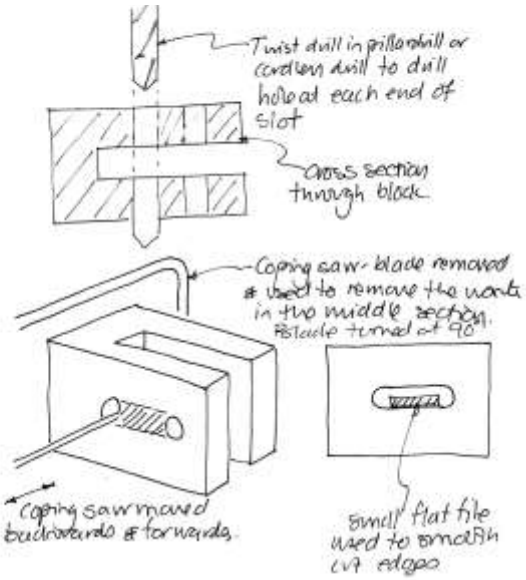
Section B – Polymers

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 jar securely (1) and allow an empty jar to be easily replaced (1) e.g. clips / straps / turn buttons / lid over the top / **MUST** not be a permanent fixing ● include a cover that protects the backboard (1) and jar support and keeps the jar dry (1) e.g. roof / tile / pitch roof / slope / water run off / beyond the neck of the jar / cover the width as a minimum ● 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 Example of candidate response:  	**(6)**

	Notes: Two 'open' hooks screwed into the backboard. Chain hooked over the hooks and around a branch. Easily unhooked to move it. Strap hooked over screw at the other end. Soft flexible strap is fixed at one end and pulled over the top. Fastening screw – elongated slot in strap to hook over and hold jar in. Large acrylic tile wider than feeder and longer so that the water runs off it and over the jar.	

Question number	**Answer**	**Mark**
5(b)	Any **two** explanations that include a way the polymer 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 see-through screens are likely to get scratched / react with the UV light (1) meaning the young children can't see the coins very well / coins will be obscured (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** advantages of using a standard sized sheet (1) and a linked justification (1) ● The size of the front panel can be made to match the size of a standard sheet (1) which means less waste being produced / potentially ends up in landfill (1) ● Standard sized sheets cost less (1) which will reduce the overall cost of the material / product (1) ● As it is supplied to a set size therefore there will be less cutting required (1) which means the overall manufacturing time will be reduced / quicker (1) ● The sheets will be of a known size (1) which means the designer can maximise the material / make most efficient use of the sheet (1) ● Standard sized sheets are more readily available (1) which means that the front panel is easily replaced if damaged (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: ● Hold in machine vice / use of hand drill / in workshop vice (1) ● Drill / chain drill a series of holes all the way through / use of protective / sacrificial material to protect PVC (1) ● Remove blade from coping saw and insert through drilled holes (1) ● Remove waste sections with coping saw / round file (1) ● Once blade / waste removed file sawn edges flat / smooth (1) Example of candidate response:  Notes: Twist drill in a hand drill / cordless drill to drill a hole at each end of the slot Cross section through the block Coping saw blade removed and used to remove the waste in the middle section. Blade turned 90^0 Coping saw moved backwards and forwards Small flat file used to smooth cut edges	Cap at 3 marks if no sketches or all sketches with no notes	**(4)**

Question number	Answer	Mark
6 (c)	Any **one** explanation that includes a reason for laser engraving (1) and a linked justification for that reason (1). ● Different depths / textures can be achieved (1) which means that different visual effects / appearances can be created (1) ● A light application of coloured paint can be rubbed over the engraved area (1) which means that the paint gets caught and creates a coloured outline (1) ● Lights can be shone on the edge (1) which means the logo will light up / shine (1) ● Laser engraving will provide a permanent finish / etched in (1) whereas vinyl stickers / paint might peel off over time / become unattractive (1)	**(2)**

Question number	Answer	Mark
6 (d)	Any **two** explanations that includes a method (1), plus **two** linked justifications of that method (1) + (1). Epoxy resin (1) ● No heat is involved (1) which means there is less chance of melting / burning the front panel / or uprights (1) Tensol cement (1) ● It dries clear (1) which means there is no change to the visual appearance / aesthetics (1) Mechanical fixing / machine screws / bolts / self-tapping screw (1) ● It is a temporary method of fixing / means it can removed (1) which means it can replaced if parts get broken / damaged (1) Polymer / PVC welding (1) ● Melts both the bracket and upright (1) which results in a fused / permanent joint (1)	**(6)**

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

Question number	Answer	Additional guidance	Mark
7 (b)	Any **two** working properties explained (1) plus a linked justification of the property (1). ● Acrylic has excellent optical clarity (1) which means it gives the impression of being glass if a clear acrylic is used / creating a more visually appealing product / increase value (1) ● Acrylic is waterproof (1) which means that it will not soak up / absorb any spilt water / be affected by it (1) ● Acrylic has excellent weathering ability / resistance to sunlight (1) which means it will not lose its colour if left in bright sunshine on a window sill / used outside on a garden table (1) ● Acrylic has some flexibility / has elasticity (1) which means that it is capable of being bent / flexed to create the open shape of the vase (1) ● Acrylic has good compressive strength (1) which means the small part across the top will not distort under pressure from the two sides (1)	Do not accept anything related to acrylic being an electrical insulator or durable	**(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 flower vase 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 PET (1) and a linked justification of that benefit (1). ● PET would not be affected by the heat of any hot food inside / moisture from 'wet' foods / sauces (1) which means it will not leak / go soggy / lose its shape when filled with food (1) ● PET is food safe (1) which means the container can hold / store food safely without the risk of any harm / contamination of the food (1) ● PET is recyclable (1) which means that it can be used to make other products / not be sent to landfill (1) ● PET is an insulator of heat (1) therefore food will stay warm / hot for longer when being transported (1) ● PET can be vacuum formed (1) which means single piece containers can be manufactured (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 tray can be checked for flaws / errors /dimensional accuracy / snap / close together properly (1) which means mould can be checked / changed if the container is not the correct size / mould worn / issue corrected (1) therefore reducing the number of containers that would be cut of the wrong size / reducing waste / rejects (1) ● The edges of the containers can be checked for sharp edges (1) which means edges can be hand finished (1) therefore reducing the risk of injury / cut / scratches to users (1) ● The containers can be tested to check they have no holes (1) which means that air could get in (1) therefore causing food to go off / not stored air tight / cold (1)	**(3)**

Question number	Answer	Mark
8 (c)	Any **two** reasons for using a vacuum forming machine (1) and a linked justification of those advantages (1). ● A vacuum forming machine uses a thin sheet over a mould (1) which means that it is an ideal machine for making lightweight hollow products (1) ● Ribs can be moulded into the container via the mould (1) which means that the stiffness / rigidity of the thin sheet used can be improved to make the container stiffer / less likely to collapse / more rigid (1) ● The whole product can be formed in one pull / lid / hinge formed / cropped in one single process (1) which means that no secondary processing / machining is required resulting in a very quick manufacturing time / reduces overall waste (1) ● A single mould is manufactured (1) which means it can be used over and over / forms identical products (1)	**(4)**

Question number	Indicative content	Mark
8 (d)	● The food container can be washed out and reused making it quite sustainable in some respects as a lunch box ● It will be a lightweight container therefore easier for hospital patients to use / not too heavy as a take away container ● The food container can be used as a one off in hospitals where food selected / served can be put in it and given to the patient sealed reducing the risk of any contamination ● The food container is not very good for being used with hot food as it is quite thin and could potentially harm / burn the user ● The food container is clear and so the food inside can be seen / made to look quite appealing / fresh / colourful salads on show ● The food container is made from a stock sized sheet which means that the cost of the sheet is likely to be cheaper than having to have sheets cut to size / reducing the amount of waste generated ● The boxes can be shipped open with them being stacked on top of each other with the lid open rather than closed which would increase the volume of the package / parcel being sent ● Could be customised / personalised for use in restaurants with the logo / name formed into the surface which would only require a small change to the mould being used ● The tray is manufactured from widely available materials ● There could be issues with the supply of oil from Russia in terms of political relationships / transportation of oil ● Potential risk of environmental damage due to the drilling / transportation of oil around the world	**(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.