Pearson Edexcel

Mark Scheme (Results)

November 2021

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

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November 2021
Question Paper Log Number 65429
Publications Code 1DT0_1C_2111_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.

Component 1 mark scheme – 1DT0/1C

Section A – Core content

Question number	Answer	Mark
1 (a) (i)	Any **one** property from: • Hard (1) • Tough (1) • Straight / close grained (1) • Slightly flexible (1) • Compressive strength (1)	**(1)**

Question number	Answer	Additional information	Mark
1 (a) (ii)	Any **one** property from: • Lightweight (1) • Tough (1) • Hygienic / inert (1) • Plasticity (1) • Waterproof (1)	Do not accept 'High impact' on its own Do not accept 'can be recycled' Do not accept 'durable'	**(1)**

Question number	Answer	Mark
1 (a) (iii)	Any **one** property from: • Warm / traps air / insulator (1) • Breathable (1) • Durable (1) • Soft (1)	**(1)**

Question number	Answer	Mark
1 (a) (iv)	Any **one** property from: • Opaque (1) • Absorbent (1) • Rough / textured surface (1)	**(1)**

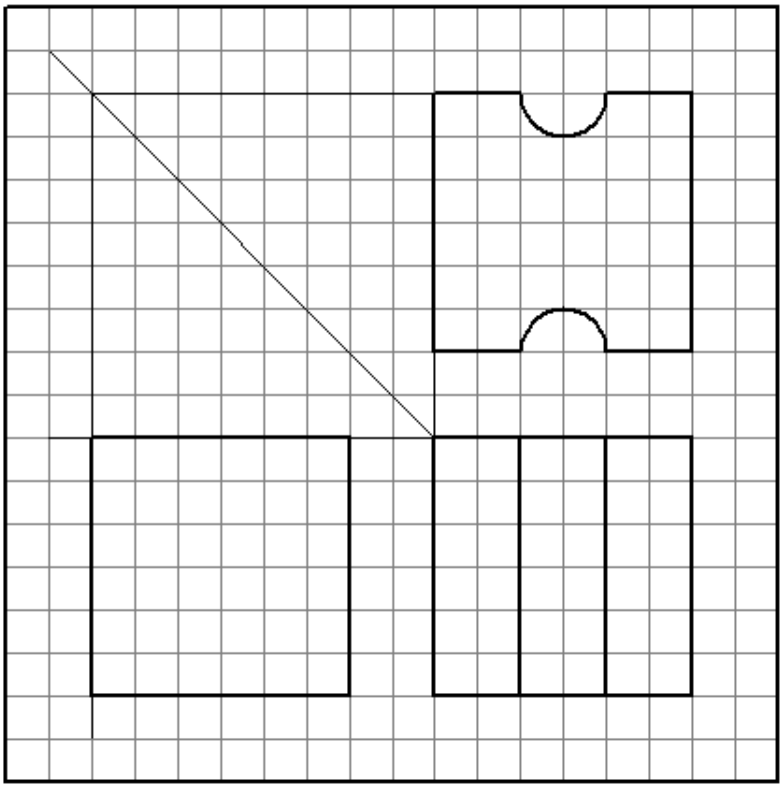
Question number	Answer	Mark
1 (b)	Any **one** advantage of using wind to generate energy (1) and a linked justification of that advantage (1). • The energy generated is free (1) once the installations / construction / investment costs have been paid off (1) • The energy generated is a clean fuel source / does not rely on any burning of materials (1) therefore reducing emissions / greenhouse gases / preserves fossil fuels (1) • It is a sustainable / renewable source of energy (1) which means it will never run out (1) • The UK has good levels of offshore wind / hilly terrain / exposed landscape (1) which provides a good / constant / consistent level of power / electricity (1)	**(2)**

Question number	Answer	Additional guidance	Mark
1 (c)	A calculation that includes: • correct setting out of formula $\frac{800 - 500}{500} \times 100$ (1) • correct answer 60% (1)	Award full marks for correct numerical answer without working. Allow for ECF if candidate gets part of transposition wrong.	**(2)**

Question number	Answer	Mark
2 (a)	Any **one** non-ferrous metal from: • Copper (1) • Brass (1) • Bronze (1) • Pewter (1)	**(1)**

Question number	Answer	Mark
2 (b)	Any **one** reason for using standard sized rods (1) and a linked justification of that reason (1). • They will be readily available from a supplier (1) which means the company do not have to invest in machinery / time to manufacture the rods (1) • They will be able to buy long lengths which they simply cut to the size they require (1) which means only very simple processing is required which will reduce the level of skill required / speed up manufacturing times (1) • A standard 10mm drill bit can be used (1) so no further reduction of the material diameter is required (1) • They would be mass produced by specialist manufacturers (1) which means a reduction in unit cost / cheaper (1)	**(2)**

Question number	Answer	Mark
2 (c)	Any **one** property of felted wool fabric that makes it an appropriate choice of material (1) and a linked justification of that property (1) • It does not fray (1) which means it will leave a neat finish / edge around the base (1) • It is soft / smooth / cushioned (1) which means it will not damage any surface the game is placed on (1)	**(2)**

Question number	Answer	Mark
2 (d)	A completed orthographic drawing that shows:  • correct width of the cube at 30mm for side view = 6 spaces on the grid (1) • correct depth of the cube at 30mm for side view = 6 spaces on the grid (1) • correct size of the semi-circle on the plan view = 2 spaces on the grid (1) • correct position / presence of the second semi-circle at the front edge / bottom edge of the plan view (1)	(4)

Question number	Answer	Additional Guidance	Mark
3 (a)	Any **one** composite from: • Carbon fibre (1) • Concrete (1) • Plywood (1) • Chipboard (1) • MDF (1) • Robotic materials (1) • Reinforced polymers / textiles (1)	Do not accept GRP / fibre glass / glass fibre	**(1)**

Question number	Answer	Mark
3 (b)	Any **one** reason for using fibreglass (1) and a linked reason for the use (1) • Fibreglass is a tough material (1) which means it can withstand the knocks and bumps of hitting rocks / stones (1) • Fibreglass is water resistant (1) which means that it will not absorb water when out on the river (1) • Fibreglass can be moulded into complex shapes (1) which means it can be used to create curved shapes / smooth lines / streamlined shape / create a single piece moulding (1) • A high-quality surface finish can be achieved on the mould / product (1) which will reduce friction / allows to boat to move better through the water (1) • Fibreglass forms a lightweight structure (1) which means it will be easy to lift the boat out of the water (1) • Low maintenance material (1) which means it does not need to be re-varnished / repainted (1) • Resin can be pigmented (1) which means no painting / colouring is needed after moulding (1)	**(2)**

Question number	Answer	Additional guidance	Mark
3 (c)	A calculation that includes: • correct working out 100/2 = 650/x (2 x 650)/100 (1) • correct answer 13ml (1) Alternative method • 6 x 2 = 12ml + (0.5 x 2) = 1 ml (1) • 12 + 1 = 13ml (1) Alternative method • (650/100) x 2 = 6.5 x 2 (1) • 13ml (1) Alternative method • (2/100) x 650 (1) • 13ml (1)	Award full marks for correct numerical answer without working. Allow for ECF if candidate gets part of calculation wrong.	**(2)**

Question number	Answer	Mark
3 (d) (i)	Correct class of lever given • Class 1 / type 1 / 1st class (1)	**(1)**

Question number	Answer	Mark
3 (d) (ii)	Correct type of movement given • Oscillation (1)	**(1)**

Question number	Answer	Mark
3 (e)	Any **two** benefits of sports textiles (1) and a linked justification of the benefits (1). • Sports textiles can be lightweight / flexible (1) therefore they will not weigh down the athlete too much / move with the body (1) • They can have inbuilt sensors / monitors such as heart rate monitors (1) therefore their performance can be monitored and data recorded for analysis later (1) • They can contain UVA/UVB blockers / barriers (1) which means they protect the athlete from harmful rays / sunburn when out training / exercising / performing (1) • They can be used to control bacteria (1) which means the athlete has more protection from infection / odours / reduces body odour (1) • They can have waterproof coatings (1) which means the fabrics will not absorb water / retain water / moisture / wet fabrics rubbing on the skin (1) • They can be wicking fabrics which draw water / moisture away from the body (1) which means they can take away / absorb sweat (1) • They can stretch / hug the body (1) which means they will provide less drag (1) • They can be breathable (1) which allows the moisture to escape from inside the garment (1)	**(4)**

Question number	Answer	Mark
4 (a)	Any **one** working property of corrugated board (1) and a linked justification of that property (1). • It is flexible / easily folded / bent (1) which means it can be folded along the 'grain / flutes' to create the form of the package (1) • It can be easily printed on / has good printability (1) which means surface graphics / branding can be easily applied to the surface (1) • It is a fully biodegradable material (1) which means it is sustainable / can be put into compost bins / does not need to go to landfill (1) • It has good impact resistance (1) which means it will offer some protection to the lightbulb in transit (1)	**(2)**

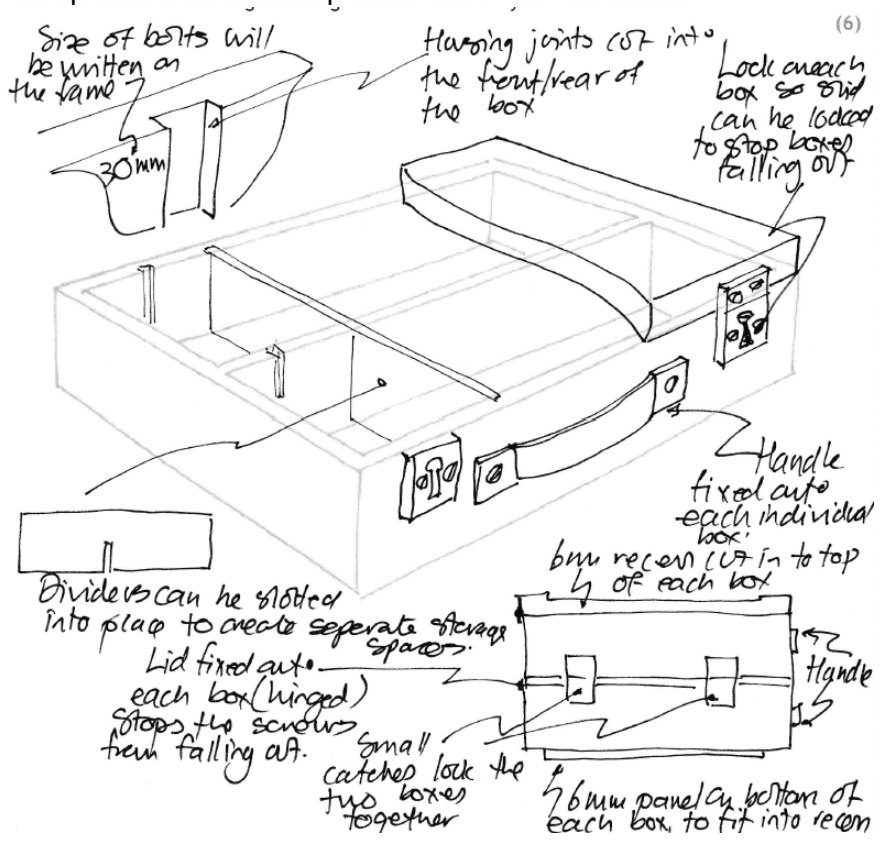
Question number	Answer	Mark
4 (b)	Any **one** explanation that references the way that the cost of materials has been kept to a minimum (1) and a linked justification of that way (1). • Only one material type has been used (1) which means other / separate / additional materials do not need to be purchased / stocked / incur additional / further costs (1) • It is an open-sided package with the bulb held inside a cutting (1) which has reduced the area of material required to make a fully enclosed package (1) • It is a regular / rectangular shape (1) which means that long rectangles can be cut efficiently from the stock material without leaving too much waste / can be effectively lay planned (1)	**(2)**

Question number	Answer	Additional guidance	Mark
4 (c)	A calculation that includes: • correct working out of current area $40 \times 8 = 320cm^2$ (1) • correct working out of increase in area $320 \times 1/8 = 40cm + 320 = 360cm^2$ (1) Alternative method • correct working out of current area $40 \times 8 = 320cm^2$ (1) • correct working out of increase in area $320 \times 1.125 = 360cm^2$ (1) Alternative method • correct working out of current area $40 \times 8 = 320cm^2$ (1) • $320 \times 9/8 = 360cm^2$ (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 (d)	• IoT has given rise to services and products like 'Hive' • Electrical plug sockets / light bulbs can sense being used and can monitor and provide feedback / data to relatives to see daily routines are being carried out such as boiling kettles / ovens / toasters • Cameras / webcams can be placed in homes / on front doors so that movements can be observed by relatives / carers / when not at home • Trackers / presence sensors / 'track my mobile' can be used to monitor to see where people are • Personal alarms / alert / call buttons can be worn by users, if they fall / feel unwell the alarms can be pushed and will alert emergency services / relatives • On line shopping / supermarket / home deliveries allow users to shop from their own homes and to have food delivered to their own homes based on what has been eaten / what is left in the cupboards / use of RFID tags • Use of SMART locks / lights / heating • Smart appliances can be controlled remotely and through voice activation	**(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.

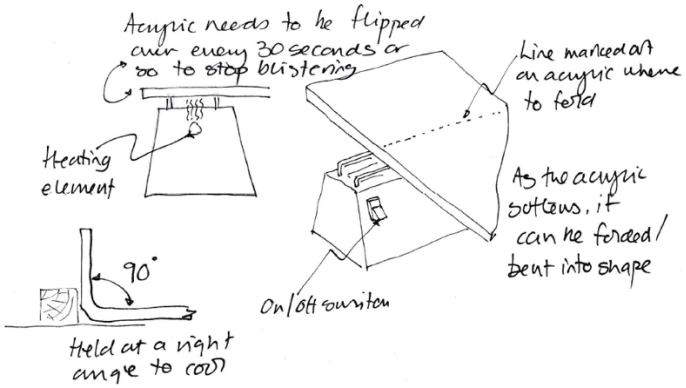
Section B – Polymers

Question number	Answer	Mark
5 (a)	**Marks will be awarded for understanding of design and technology, not graphical skills.** Notes and/or sketches that include: • provide separate storage spaces for different sized boxes of nuts and bolts (1) and allow the size of the nuts and bolts to be seen (1) e.g. removable slots / dividers / trays / label holders / boxes face up with sizes written on them • be portable (1) when two nuts and bolts tidy cases are securely fixed on top of each other (1) e.g. handle / strap / cut-out / location pegs / additional layer to sit inside the lid • include a lockable method (1) that will stop the boxes of nuts and bolts from falling out (1) e.g. latch / catch / padlock / hasp and staple / lid / layer / screen Example of candidate response.  	**(6)**

	Annotated notes: Size of bolts will be written on the frame Housing joints cut into front / rear of the box Lock on each box so lid can be locked to stop boxes falling out Handle fixed onto each individual box 6mm recess cut into the top of each box Dividers can be slotted into place to create separate storage spaces Lid fixed onto each box (hinged) to stop the nuts and bolts falling out Small catches lock the two boxes together 6mm panel on bottom of each box to fit into recess	

Question number	Answer	Mark
5(b)	Any **two** explanations that include a way the polymer boot meets or fails to meet the requirement (1) and a linked justification of that way (1). • It has holes on both sides of the boot / shaped like a boot (1) which means that the size / proportions will be the same as their own foot (1) • They will be able to sit down / work at a table when learning / have the boot in front of them (1) which means that they will not have to be bending / reaching down / be in the correct position behind the boot (1) • The boot may move about (1) which would make it difficult when pulling tight on the lace / doing up the bow (1) • The whole boot is quite small (1) therefore it might be difficult to tie knots and bows on (1) • The laces are quite long (1) which means they might get tangled / tied in knots (1) • The polymer might weaken / crease around the holes / seams (1) which may result in the shoe breaking / falling apart (1)	**(4)**

Question number	Answer	Mark
6 (a)	Any **two** explanations of working properties of ABS (1) and a linked justification (1) • ABS is scratch resistant / hard (1) which means that it will not be damaged as the wheels rub against each other / wear down / marked by sharp finger nails (1) • ABS is tough / impact resistant (1) which means it is capable of withstanding knocks / being dropped without damage (1) • ABS is a lightweight material (1) which means that it can be carried around the classroom / moved without too much difficulty / wheels turned / rotated (1) • ABS has plasticity (1) which means it can be heated / formed / injection moulded into the shape of the wheel (1)	**(4)**

Question number	Answer	Mark
6 (b)	**Marks will be awarded for understanding of design and technology, not graphical skills.** Notes and/or sketches that include: • Mark out where the material is to be bent / masking tape / marker pen (1) • Place acrylic over heating element (1) • Turn over the acrylic from time to time so it does not blister / burn (1) • Fold the acrylic into shape (1) • Hold in place and let it cool (1) Example of candidate response:  Annotated notes: 1. On/off switch 2. Line marked out on acrylic where to fold 3. Acrylic needs to be flipped over every 30 seconds or so to stop it blistering 4. Heating element 5. As the acrylic softens, it can be folded / bent into shape 6. Held at a right angle to cool	**(4)**

Question number	Answer	Mark
6 (c)	Any **one** explanation that includes a reason for manufacturing to a tolerance (1) and a linked justification for that reason (1). • The outside diameter of the wheels must be within a set size so that the numbers line up (1) if not it might make it difficult to show the correct answer / sum / numbers (1) • The hole in the middle of the wheel must be within a set size (1) otherwise they might be too loose / too tight and the numbers will not line up horizontally / correct sum show (1) • The width of the wheels must be within tolerance (1) otherwise they might be too loose if they are too small / not fit into the frame if they are too big / too much friction restricting the wheels movement (1)	**(2)**

Question number	Answer	Additional guidance	Mark
6 (d)	Any **two** surface finishes or treatments (1), plus **two** linked justifications of that surface finish or treatment (1) + (1). • The numbers could be applied using vinyl stickers (1) which means the wheels can be manufactured separately (1) therefore the colour / type of font / size of font can be changed quite easily (1) • The numbers could be moulded into the wheel directly during the moulding process (1) which means that no secondary processing is required (1) therefore speeding up the overall manufacturing process time (1) • The numbers could be applied using paint (1) which means they can be different colours / sizes / fonts (1) therefore the number wheels could be one colour and the wheel with the sum operation on could be another making them stand out from each other (1)	Do not accept laser engraving.	**(6)**

Question number	Answer	Mark
7 (a)	One name given from: • Tensol cement (1) • Liquid solvent / cement (1) • Dichloromethane (1)	**(1)**

Question number	Answer	Mark
7 (b)	Any **two** explanations that include an advantage of using CAD (1) plus a linked justification for the advantage (1). • The software can be linked to CNC machines (1) which means that parts / panels can be cut direct from drawings (1) • Software can be used to lay plan panels / parts (1) which means efficient use can be made of the material available / plan to minimise waste (1) • Design software can be used to stress test / test loadings (1) which means that if parts fail / item is not capable of carrying load it can be modified (1) • Component parts can be copied and pasted (1) which speeds up the design process (1) • Models can be coloured / surface textures applied (1) which means accurate rendered drawings can be produced to show life like quality / get feedback from potential clients (1)	**(4)**

Question number	Answer	Additional guidance	Mark
7 (c)	A calculation that includes: • Calculation of the cost of the top / base (1) 2 x 0.14 x 11 = £3.08 • Calculation of the cost of the inner shelf (1) 0.06 x 11 = £0.66 • Calculation of the area of the upright (1) 0.15 x 0.15 = 0.0225m^2 • Calculation of the cost of 4 uprights (1) 4 x 0.0225 x 11 = £0.99 • Calculation of the total cost (1) 3.08 + 0.66 + 0.99 = £4.73	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 includes a reason for manufacturing in batches (1), plus **two** linked justifications of that reason (1) + (1). • Once the batch has been made the production line can be changed (1) which means that other products can be made (1) therefore ensuring that staff are employed / manufacture continues to utilise machinery / make profits (1) • Specific orders from retailers can be made / met (1) which means that manufacturers do not have to hold lots of stock (1) therefore they do not end up with lots of money invested / tied up in stock (1) • Batch production can generally respond quickly to customers' demands (1) which means any new orders can be turned around quickly / demand met (1) therefore ensuring that supplies reach the retailers in good time / when ordered (1) • Different materials / colours can be swapped in and out (1) therefore different trends / fashions can be met (1) therefore sales / profits keep coming in (1).	**(6)**

Question number	Answer	Mark
8 (a)	Any **one** explanation that includes an effect of the compressive force (1) and a linked justification of that effect (1). • The adjustable support arm might bend if it is not of a big enough section (1) which would result in the arm not being able to support the weight of the arm / lampshade collapsing / breaking (1) • The compressive force / pressure / weight on the adjustable arm would result in a shearing action on the pivot / hinge (1) which could result in the arm / hinge shearing / breaking (1) • The support arm is drilled and bears onto a pivot point (1) and the UF could split at this weak point (1)	**(2)**

Question number	Answer	Mark
8 (b)	Any **one** explanation that includes an advantage of using a jig (1), plus **one** linked justification of that advantage (1) + (1). • The arm will be held firmly in place (1) which means it will not move when being drilled (1) therefore there will be fewer errors / it will be safer (1) • The jig will hold the arm in the correct place (1) which means the holes will all be drilled in the correct place (1) therefore you do not have to mark out where they need to be drilled (1) • If you were making more than one arm / batch production (1) the jig would make the whole process more efficient (1) therefore speeding up manufacturing time / reducing the need to mark out where the holes would need to be drilled (1) • The use of a jig means the arms do not need to be marked out (1) which means an unskilled operative can drill the holes (1) therefore reducing production costs (1)	**(3)**

Question number	Answer	Mark
8 (c)	Any **two** explanations that include effects of oil exploration and extraction (1) and a linked justification of those effects (1). • The toxicity of oil / petroleum contributes to air pollution / acid rain / potential spillages (1) therefore potentially killing animals / making land toxic / not fit to grow crops on / farm on (1) • Oil must be heated / burned during the processing stages (1) which results in poor air quality / pollution in the local and surrounding areas / knock on health effects to animals / plants (1) • The extraction of oil results in large construction / processing sites / potential leaks / spills (1) which means local areas are destroyed / destroys animal habitats (1)	**(4)**

Question number	Indicative content	Mark
8 (d)	**AO3 (9 marks)** • It is a very square / geometric shape / square lampshade / shape of shade allows for easy moulding • It is adjustable / can be adjusted by moving the adjustable arm to a different position so that the height of the lampshade can be raised / lowered • The use of standard stock sized materials will help to minimise waste during production • It has a relatively small base in relation to its height and it may well over balance given the position of the lampshade • UF can be produced in any colour and so lamps would be produced in a range of key / identified colours / batches changed to meet trends and fashions • The use of a polymer is not necessarily in keeping with the style / shape of the lamp • Oil is a finite material with stocks going down all the time therefore it is not a very sustainable material • UF is a thermosetting polymer and as such it cannot be recycled / processed into new materials • The lamp uses mains voltage supply which puts a demand on electrical energy supplies • Issues related to the transportation / emissions / carbon footprint of moving large quantities of oil around the world from Saudi Arabia for processing	**(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.

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