

Mark Scheme (Results)

Summer 2016

Pearson Edexcel GCSE
In Design and Technology (5EP02/01)

Electronic Products
Unit 2: Knowledge and Understanding of
Electronic Products

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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.

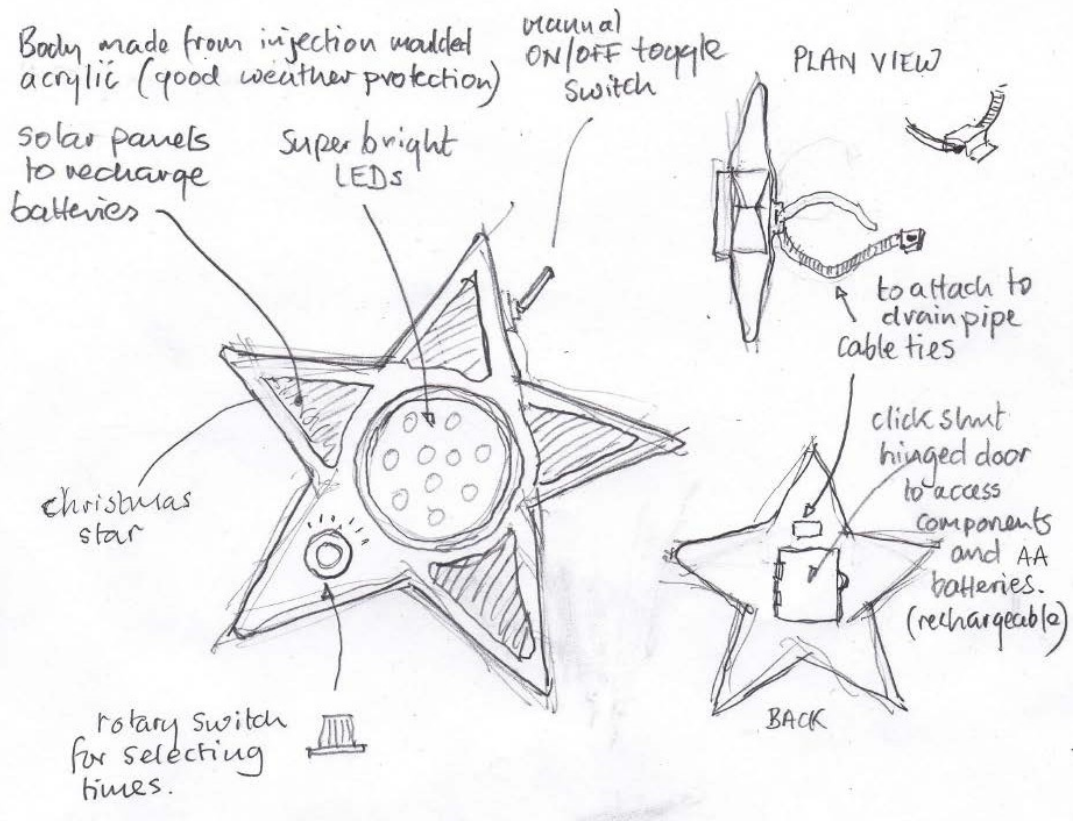
Question Number	Answer	Mark
1	C	1
Question Number	Answer	Mark
2	C	1
Question Number	Answer	Mark
3	D	1
Question Number	Answer	Mark
4	A	1
Question Number	Answer	Mark
5	C	1
Question Number	Answer	Mark
6	A	1
Question Number	Answer	Mark
7	B	1
Question Number	Answer	Mark
8	A	1
Question Number	Answer	Mark
9	C	1
Question Number	Answer	Mark
10	A	1

Question Number	Answer	Mark
11 (a)	LDR	Alters its resistance with changes in light / Senses light
	Motor	Converts electrical energy to rotary motion
	Side cutters	Used to cut wires / legs of components
	Thyristor	Latches a circuit output
		4 x 1
4		
Question Number	Answer	Mark
11(b)(i)	Accept any one from: <ul style="list-style-type: none"> • Thermistor • R1 • VR1 • Variable resistor Do not accept potentiometer	1 x 1
1		
Question Number	Answer	Mark
11(b)(ii)	Relay	1 x 1
1		
Question Number	Answer	Mark
11(b)(iii)	B - Collector C - Emitter Only answers	2 x 1
2		

Question Number	Answer	Mark
11(c)	<p>Any answer from:</p> <ul style="list-style-type: none"> • Acts as an electrically operated switch/switches on heater (1) which allows the use of separate power supplies (1) • Connects a low voltage circuit and a high voltage circuit (1) so that higher powered devices can be controlled (1) • Acts as an interface between a primary and secondary circuit (1) so that the heater is powered by AC / the primary circuit is protected (1) • Coil/electromagnet causes switch to activate (1) so user does not have to operate high voltage circuit directly /is safely isolated from mains power (1). • It converts electrical to kinetic energy (1) <p>Accept any appropriate combination of responses.</p> <p style="text-align: right;">2 x 1</p>	2
Question Number	Answer	Mark
11(d)(i)	<p>Diode</p> <p>Do NOT accept an LED/light emitting diode</p> <p style="text-align: right;">1 x 1</p>	1
Question Number	Answer	Mark
11(d)(ii)	<p>Any answer from:</p> <ul style="list-style-type: none"> • The transistor/circuit/components could be damaged (1) because of a voltage spike/reverse EMF/back EMF (1) • The transistor could be damaged (1) if the diode wasn't there to safely prevent the current from flowing in the wrong direction/dissipate the current (1). <p style="text-align: right;">2 x 1</p>	2

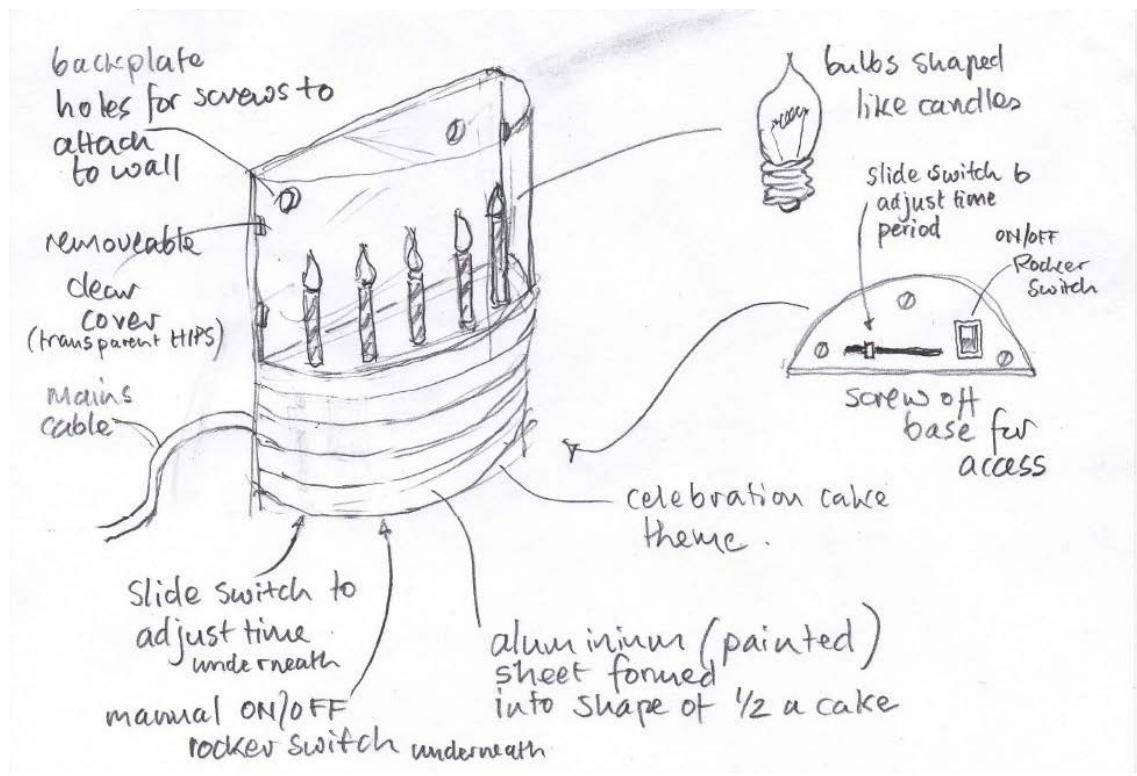
Question Number	Answer	Mark
11(e)	<p>Accept any two from:</p> <ul style="list-style-type: none"> • Designs can be simulated/Simulations allow faults to be easily identified (1) enabling modifications/edits to be easily made/ so problems can be identified before manufacture (1) • Experiment with different component circuits/building blocks/values/Components/variables can be changed easily (1) without risk of damage/saving time and money/to determine the best combination/ to find best/most efficient design (1) • Virtual circuits can be built to test (1) without cost (1) • Faults can be simulated (1) so real components are not damaged/problems can be identified/experiment safely (1) • It is quicker to draw/modify/build a test circuit than a real prototype (1) saving time/money/components (1). <p>Do not accept 'cheaper' unless accompanied by an appropriate explanation Do not accept repeated points or repeated expansions 'Testing' is in stem so responses need to go beyond this Must include some focus upon testing Accept appropriate combinations</p> <p>Accept reference to advantages of using circuit simulation software to build circuits in order to test them</p> <p style="text-align: right;">2 x 2</p>	4
Question Number	Answer	Mark
11(f)	<p>Accept any one from:</p> <ul style="list-style-type: none"> • Lower wages paid (1) mean lower manufacturing costs (1) • Specialist manufacturers (1) mean lower manufacturing costs (1) • Less regulation/Lower H&S requirements (1) mean lower manufacturing costs/reduces costs/time to market (1) • Raw materials cost less/are in abundance (1) which means products can be sold for less (1) • Subsidies from the government are sometimes available (1) which help to balance additional costs (1) • Proximity to emerging markets/existing customers (1) leads to reduced transport costs and increased profits/closer relationship (1) • Access to new customers/large market/emerging market (1) means potential increase in sales/profits/better understanding of e.g. cultural differences (1) • Huge capacity/larger factories/large workforce (1) can be massed produced on a larger scale/in large quantities/lower unit cost/more cheaply (1). <p>Do not accept repeated points or repeated expansions</p> <p style="text-align: right;">2 X 1</p>	2

Question Number	Answer	Mark
12	<p>Candidates may clarify sketches with annotation. However, it is important for candidates to show significant detail. (e.g. a label 'removable back' should not be credited if method is not shown)</p> <p>No marks are awarded for the quality of graphical communication</p> <p>It must:</p> <ul style="list-style-type: none"> • have a festive or celebration theme (1) e.g. stars, trees, cake and candles • be able to be fixed to the outside of a house (1) e.g. screw holes, hooks, cable ties • be adjustable for the time it is on before it switches off automatically (1) e.g. roller switch, dial, rotary switch, PTM switches, touch screen (switches must be specific) • have a suitable power supply (1) e.g. AC mains, solar with rechargeable batteries, specified battery type • be made from a weather resistant material (1) e.g. acrylic, HIPS, aluminium, treated pine (not e.g. MDF/untreated steel) • have easy access to the components inside (1) e.g. hinged door and catch, screw-off/sliding panel • have an appropriate light source (1) e.g. LEDs, bulbs • have a method of turning on and off manually (1) e.g. rocker switch, toggle switch, multi-position slide switch (switches must be specific). <p>Same switches may be used in each idea but not for same function</p>	16



Design idea 2

Marks for design idea 2 can only be awarded where specification points are resolved with response which is technically different



Question Number	Answer	Mark
13(a)(i)	<p>Any one from:</p> <ul style="list-style-type: none"> • Rubber clamp (1) grips guitar neck/head (1) • Handle fits fingers/thumb ergonomically (1) so it's easier to open and therefore attach to the guitar head (1) • The jaws are spring loaded (1), which apply pressure when released (1). • Rubber is 'grippy' (1) so will not fall off/slip in hand (1) • Handle fits fingers/thumb ergonomically (1) so it's easier to open and attach to the guitar head (1) • Handle has shaped finger and thumb levers (1) fits fingers/thumb ergonomically so it's easier to grip (1) • The spring loaded jaws can be operated with one hand (1) because they close automatically (1) • The spring loaded jaws are adjustable/opens to a range of sizes (1) so easy to fit to different sized necks (1). <p>Accept: identification of feature (1) justification (1)</p> <p style="text-align: right;">2 x 1</p>	2
Question Number	Answer	Mark
13(a)(ii)	<p>Any one from:</p> <ul style="list-style-type: none"> • Colour LCD/LCD display can display a wide range of colours (1) making information clearer/easier to read (1) • High resolution (1) displays detailed/clear/sharp characters and symbols (1) • The case can be positioned/turned (1) for optimising viewing angle (1) • The case can be clamped to any part of the guitar (1) so that it can be easily viewed in a direct line of sight (1) • Graphical display (1) communicates information more effectively than using text/numbers (1) • Pivoting screen allows viewing from different angles (1) suits different people/guitars (1). <p>Accept: identification of feature (1) justification (1)</p> <p>Do not accept repeated points or repeated expansions Do not accept 'cheaper' or 'bright' Do not accept 'clearer' in isolation, without explanation Do not accept 'large' as this is relative</p> <p style="text-align: right;">2 x 1</p>	2

Question Number	Answer	Mark
13(b)	<p>Any two from:</p> <ul style="list-style-type: none"> • It requires a much smaller current/is more energy efficient (1) which saves batteries (1) • It is more energy efficient (1) and therefore has less environmental impact (1) • The product is smaller (1) because of a thinner display (1) • The display is clearer/contains more information (1) due to the high resolution (1) • LCDs are lighter than LED displays (1) creating a more portable product (1) • It is easier to see/display more information (1) because you can use colour to differentiate between frequencies (1). <p>Do not accept repeated points or repeated expansions Do not accept 'cheaper'</p> <p style="text-align: right;">2 x 2</p>	4
Question Number	Answer	Mark
13(c)	<p>Any one from:</p> <ul style="list-style-type: none"> • It can be sold in many countries/to a wider target market (1) so that no modifications are required (1) • Less likely to cause offense (1) because text may have different meanings in different languages (1) • Understandable in any language (1) access to larger market/sales (1) • Most counties/cultures use same musical notation (1) so would not have to change design for different markets (1) <p>Do not accept e.g.</p> <ul style="list-style-type: none"> • 'it is not necessary to use words as letters are used to represent musical notes' or similar references. • 'too small to read/display words' or similar references. <p style="text-align: right;">1 x 2</p>	2

Question Number	Answer	Mark																								
<p>13(d) QWC</p>	<p>It is important to reward the range and depth of knowledge and understanding exhibited in candidate responses. L3 answers should expand points beyond the obvious in some detail and display high levels of knowledge and understanding.</p> <p>EXEMPLAR ANSWERS</p> <p>The materials for the case are selected as they can be formed into the right shape. HIPS is much easier to form into more complex shapes like the tuner case because it can be injection moulded in one go into complex shapes which saves time. Mild steel is very strong and rigid and is difficult to form and can only be formed into relatively simple shapes (2).</p> <p>Mild steel is a very good conductor of electricity which means that the case could become live while HIPS is an insulator so would not conduct electricity providing natural protection. This means that the mild steel tuner case could be dangerous if it was mains powered or could cause a short circuit. (2)</p> <p>Mild steel will rust if it is not protected or if a surface finish is damaged which would make it less attractive while HIPS is prone to UV damage which would reduce its impact strength and toughness. However the tuner is most likely to be used indoors so it is more likely that it would be exposed to strong sunlight rather than water so steel would be a more durable choice of material for the tuner case. (2)</p> <p>Comparison to address the following issues:</p> <table border="1" data-bbox="277 1025 1394 2007"> <thead> <tr> <th data-bbox="277 1025 826 1077">HIPS</th> <th data-bbox="826 1025 1394 1077">Steel</th> </tr> </thead> <tbody> <tr> <td data-bbox="277 1077 826 1167">Poor conductor of heat so temperature more stable</td> <td data-bbox="826 1077 1394 1167">Good conductor of heat so more likely to feel hot or cold</td> </tr> <tr> <td data-bbox="277 1167 826 1249">Easily injection moulded</td> <td data-bbox="826 1167 1394 1249">Difficult to manufacture, (pressed/cast)</td> </tr> <tr> <td data-bbox="277 1249 826 1301">Self-finishing</td> <td data-bbox="826 1249 1394 1301">Requires a surface finish</td> </tr> <tr> <td data-bbox="277 1301 826 1368">Lightweight so more portable</td> <td data-bbox="826 1301 1394 1368">Heavier than HIPS so less portable</td> </tr> <tr> <td data-bbox="277 1368 826 1451">Threads, recesses, etc. easily moulded in</td> <td data-bbox="826 1368 1394 1451">Fittings require additional manufacturing operations</td> </tr> <tr> <td data-bbox="277 1451 826 1534">Insulator so no short circuits</td> <td data-bbox="826 1451 1394 1534">Conductor - may short out circuit/must be earthed</td> </tr> <tr> <td data-bbox="277 1534 826 1617">Good impact resistance but not as good as steel</td> <td data-bbox="826 1534 1394 1617">Durable, unlikely to be damaged</td> </tr> <tr> <td data-bbox="277 1617 826 1684">Good water resistance</td> <td data-bbox="826 1617 1394 1684">Good water resistance but can rust</td> </tr> <tr> <td data-bbox="277 1684 826 1803">Poor UV resistance</td> <td data-bbox="826 1684 1394 1803">Good environmental resistance but can rust if protective finish is penetrated</td> </tr> <tr> <td data-bbox="277 1803 826 1953">Threads in Hips are not as strong/reliable as threads in steel. They can easily be over tightened and strip.</td> <td data-bbox="826 1803 1394 1953"></td> </tr> <tr> <td data-bbox="277 1953 826 2007"></td> <td data-bbox="826 1953 1394 2007">Stronger than HIPS</td> </tr> </tbody> </table>	HIPS	Steel	Poor conductor of heat so temperature more stable	Good conductor of heat so more likely to feel hot or cold	Easily injection moulded	Difficult to manufacture, (pressed/cast)	Self-finishing	Requires a surface finish	Lightweight so more portable	Heavier than HIPS so less portable	Threads, recesses, etc. easily moulded in	Fittings require additional manufacturing operations	Insulator so no short circuits	Conductor - may short out circuit/must be earthed	Good impact resistance but not as good as steel	Durable, unlikely to be damaged	Good water resistance	Good water resistance but can rust	Poor UV resistance	Good environmental resistance but can rust if protective finish is penetrated	Threads in Hips are not as strong/reliable as threads in steel. They can easily be over tightened and strip.			Stronger than HIPS	<p>6</p>
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	Stronger than HIPS																									

	<ul style="list-style-type: none"> • Arguments should relate to product and performance requirements. • Generalised lists may gain no credit. • Do not accept reference to e.g. 'comes in many colours' • Bullets or tables are limited to L2 at most but only if high levels of understanding and comparative argument are evident. Most are likely to be L1 level or zero. 	6 x 1
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Level	Mark	Descriptor
	0	No rewardable material
Level 1	1-2	Candidate identifies the area(s) of comparison with no development OR identifies and develops one area. Shows limited understanding of the comparison. Writing communicates ideas using everyday language but the response lacks clarity and organisation. The candidate spells, punctuates and uses the rules of grammar with limited accuracy.
Level 2	3-4	Candidate identifies some areas of comparison with associated developments showing some understanding of the comparison. Writing communicates ideas using D&T terms accurately and showing some direction and control in the organising of material. The candidate uses some of the rules of grammar appropriately and spells and punctuates with some accuracy, although some spelling errors may still be found.
Level 3	5-6	Candidate identifies a range of areas of comparison with associated developments showing a detailed understanding of the comparison. Writing communicates ideas effectively, using a range of appropriately selected D&T terms and organising information clearly and coherently. The candidate spells, punctuates and uses the rules of grammar with considerable accuracy.

Question Number	Answer	Mark								
14(a)	<p>Any combination of references to:</p> <ul style="list-style-type: none"> The output alternates between high and low/sinking and sourcing (1) producing a pulsed/square wave output (1) The output is not stable in any one state (1) which causes it to switch between high and low/on and off/1 and 0/mark and space/pulse/flash (1). 	2								
Question Number	Answer	Mark								
14(b)(i)	LED1 (only acceptable response)	1								
Question Number	Answer	Mark								
14(b)ii	<p>Any one from</p> <ul style="list-style-type: none"> LED1 is reverse biased/the wrong way round (1) so current cannot flow through it (1) LED1 blocks current (1) because the polarity is reversed (1) Reference to sinking current (1) xxx (1). 	2								
Question Number	Answer	Mark								
14(c)	<p>Any four of the following five stages. A correct answer without working e.g. $700\ \Omega$ - 2 marks maximum</p> <table border="1" data-bbox="260 1279 1254 1516"> <tbody> <tr> <td>$R = V/I$</td> <td>Correctly transposing formula/values in correct positions (1)</td> </tr> <tr> <td>$R = 7/10\text{mA}$ (or $V=9-2$)</td> <td>Correct voltage calculation (1)</td> </tr> <tr> <td>$R = 7/0.01$ (or standard form)</td> <td>Correct conversion from mA to A (1)</td> </tr> <tr> <td>$R = 700$</td> <td>Correct calculation/answer (1)</td> </tr> </tbody> </table> <ul style="list-style-type: none"> ECF (error carried forward) maximum of 3 marks No unit symbol necessary 	$R = V/I$	Correctly transposing formula/values in correct positions (1)	$R = 7/10\text{mA}$ (or $V=9-2$)	Correct voltage calculation (1)	$R = 7/0.01$ (or standard form)	Correct conversion from mA to A (1)	$R = 700$	Correct calculation/answer (1)	4
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$R = 700$	Correct calculation/answer (1)									

Question Number	Answer	Mark
14(d)	<p>Any two from</p> <ul style="list-style-type: none"> • more flexible/versatile (1) can be programmed to produce different patterns (1) • no need to remove from PCB (1) because it can be reprogrammed on-board/through socket (1) • Leads to smaller PCB/product (1) because PICs can perform many functions/replace complicated circuits (1) • Simple to program/can be programmed (1) different light patterns/outputs/fewer components/no need for specialist expertise/ (1) • Light pattern can be customised (1) without need to change components (1) • Control outputs with one IC (1) smaller PCB/product (1) • Easily reprogrammed (1) without need to change components (1) • Can customise/change inputs and output pins (1) allowing different combination of input and output components (1) • Can control/respond to many inputs/outputs (1) to create (more) complex circuit (1) <p>Accept 'coded' for programmed Accept appropriate combinations Do not accept 'PICs are cheaper/small/easily replaceable/easy to use' Do not accept repeated points or justifications</p> <p style="text-align: right;">2X1</p>	4

Question Number	Answer	Mark														
14(e) QWC	<p>It is important to reward the range and depth of knowledge and understanding exhibited in candidate responses. L3 answers should expand points beyond the obvious in some detail and display high levels of knowledge and understanding.</p> <p>EXEMPLAR ANSWER</p> <p>Advantage:</p> <ul style="list-style-type: none"> Using disposable products means that the consumer simply has to replace the whole product when it stops working. This avoids the need to wait for a repair which could take a long time and would inconvenience the user because the product may need to be sent away to a specialist repair department. (2) <p>Advantage:</p> <ul style="list-style-type: none"> Technology advances quickly as product design/function is improved and customers may want to have the latest, most desirable model. In this case it makes sense to design products which are designed with in built obsolescence. The replacement item will be the latest model. (2) <p>Disadvantage:</p> <ul style="list-style-type: none"> More customers would be keen to buy a product which can last for longer which would reduce the pressure on landfill. This would be particularly important to some people in the case of battery powered electronic products which contain dangerous substances which could poison the earth when buried in landfill sites. (2) <table border="1" data-bbox="264 994 1272 1547"> <thead> <tr> <th data-bbox="264 994 708 1028">Advantages</th> <th data-bbox="708 994 1272 1028">Disadvantages</th> </tr> </thead> <tbody> <tr> <td data-bbox="264 1028 708 1099">Convenience - Do not have to wait for repair</td> <td data-bbox="708 1028 1272 1099">Cost - Replacement incurs more expense over time</td> </tr> <tr> <td data-bbox="264 1099 708 1202">Costs - The costs of repair could exceed the cost of buying a replacement product</td> <td data-bbox="708 1099 1272 1202">Quality - Sometimes lower quality and may be less durable or attractive</td> </tr> <tr> <td data-bbox="264 1202 708 1305">Price - Products can be made cheaper because they can be designed to lower tolerances</td> <td data-bbox="708 1202 1272 1305">Environment - User may not want to harm the environment</td> </tr> <tr> <td data-bbox="264 1305 708 1408">Fashion - Customers may want to have the latest, most desirable model.</td> <td data-bbox="708 1305 1272 1408">Annoyance - may have to dispose of a perfectly good product.</td> </tr> <tr> <td data-bbox="264 1408 708 1512">Innovation - leads to better products as constant demand stimulates development</td> <td data-bbox="708 1408 1272 1512"></td> </tr> <tr> <td data-bbox="264 1512 708 1547"></td> <td data-bbox="708 1512 1272 1547"></td> </tr> </tbody> </table> <ul style="list-style-type: none"> Answers must focus upon user General discussion of environmental issues without adequate reference to user would be, at most, a L1 response (0,1 or 2 marks) Must have Advantages and Disadvantages or maximum mark 4 Bullets or tables are limited to L2 at most but only if high levels of understanding and comparative argument are evident. Most are likely to be L1 level or zero. <p style="text-align: right;">6X1</p>	Advantages	Disadvantages	Convenience - Do not have to wait for repair	Cost - Replacement incurs more expense over time	Costs - The costs of repair could exceed the cost of buying a replacement product	Quality - Sometimes lower quality and may be less durable or attractive	Price - Products can be made cheaper because they can be designed to lower tolerances	Environment - User may not want to harm the environment	Fashion - Customers may want to have the latest, most desirable model.	Annoyance - may have to dispose of a perfectly good product.	Innovation - leads to better products as constant demand stimulates development				6
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