

## Component 1 Mark scheme

Question number	Answer	Mark
<b>1(a)</b>	<p>An explanation that includes identification of a method (1) and linked justification of that method (1).</p> <ul style="list-style-type: none"> <li>The power/speed of the laser can be adjusted (1)</li> <li>graduations of burn/hatching can be used to achieve the contrast (1).</li> </ul>	<b>(2)</b>

Question number	Answer	Additional guidance	Mark
<b>1(b)</b>	<p>Any <b>two</b> explanations that include identification of a benefit (1) and linked justification of that benefit (1).</p> <ul style="list-style-type: none"> <li>Plywood is a dimensionally stable material (1), which means it will not twist/warp/the figures will stay flat (1).</li> <li>Plywood can be knot free (1), which means there is no chance of any bits falling out/which would result in a good quality product visually/aesthetically/functionally (1).</li> <li>Plywood has no short grain/has uniform strength (1) so small details will be less likely to break off.</li> </ul>	<p>Allow answers written in the negative referring to solid wood, e.g. solid wood is not a dimensionally stable material (1), which means it may twist/warp/figures will not stay flat (1).</p>	<b>(4)</b>

Question number	Answer	Mark
<b>1(c)</b>	<p>An explanation that includes identification of an advantage (1) and linked justifications of that advantage (1) + (1).</p> <ul style="list-style-type: none"> <li>• The edges of the acrylic will melt/won't change colour/won't burn if cut with the laser (1), therefore they will not require any additional surface/edge finishing (1), which speeds up manufacturing time/reduces manufacturing costs (1).</li> <li>• Acrylic is available in a wider range of colours/ pre-coloured/coloured throughout (1), therefore no colour/surface finishing needs to be applied (1), which reduces manufacturing time/reduces manufacturing costs (1).</li> <li>• Acrylic is self-finished (1), therefore no surface treatment is needed (1), which speeds up manufacturing time/reduces manufacturing costs (1).</li> <li>• Acrylic can be cast/injection moulded (1), therefore they will not require any additional surface/edge finishing (1), which speeds up manufacturing time/reduces manufacturing costs (1).</li> </ul>	<b>(3)</b>

Question number	Answer	Additional guidance	Mark
<b>2(a)</b>	<p><b>Two</b> additional marking-out tools from:</p> <ul style="list-style-type: none"> <li>• marking-out knife/Stanley® knife/cutting knife/knife (1)</li> <li>• try square (1)</li> <li>• marking/mortise gauge (1)</li> <li>• sliding bevel (1).</li> </ul>	Do not accept metalwork marking-out tools or tools that could not be used to mark out the 'L' shape (e.g. compass, scribe, centre punch).	<b>(2)</b>

Question number	Answer	Additional guidance	Mark
2(b)	<p>In order for the candidate to solve the problem, they will need to recognise that each of the following stages are required.</p> <p>Stage 1: area of L shape = <math>(60 \times 20) + (20 \times 20)</math> (1) = 1600 mm<sup>2</sup> (1)</p> <p>Stage 2: area of star = <math>\frac{15 \times 17.3}{2} \times 12</math> (1) = 1557 mm<sup>2</sup> (1)</p> <p>Stages 1 and 2 can be done in any order.</p> <p>Stage 3: total area of waste = 1600 + 1557 = 3157 mm<sup>2</sup> (1)</p> <p>Stage 4: area of component A = <math>200 \times 90</math> = 18 000 mm<sup>2</sup> (1) Stages 3 and 4 can be done in any order.</p> <p>Stage 5: % waste = <math>\frac{100 \times 3157}{18\,000}</math> (1) = 17.5% (1)</p>	<p>Accept alternative methods of correct working out.</p> <p>Error carried forward should be applied.</p> <p>Award full marks for correct answer only.</p>	(8)

Question number	Answer	Additional guidance	Mark
3(a)	<p>An explanation that includes identification of a property (1) and linked justification of that property (1).</p> <ul style="list-style-type: none"> <li>• Zinc has good fluidity when molten (1), which means it will flow readily into the die (1).</li> <li>• Zinc has a low melting point/changes quickly from solid to liquid (1), which results in less energy being used to melt it/which means you can use a range of materials for the die without melting it/can produce products more quickly (1).</li> </ul>	<p>Do not accept properties of zinc such as strength or conductivity that are unrelated to its suitability for die-casting.</p>	(2)

Question number	Answer	Additional Guidance	Mark
3(b)	<p>Labelled sketches that describe the process making reference to any <b>four</b> of the following points.</p> <ul style="list-style-type: none"> <li>• Die sprayed (1).</li> <li>• Molten metal shot into closed die (1).</li> <li>• Die/casting cooled (1).</li> <li>• Die is opened/casting removed (1).</li> <li>• Reference in graphic or label form to die being opened/closed/split (1).</li> </ul> <div data-bbox="523 741 884 981" data-label="Image"> <p>A hand-drawn sketch showing a cross-section of a closed die. A vertical rod or nozzle is positioned at the top, with three short horizontal lines radiating from its tip into the die cavity, representing a spray of molten metal.</p> </div> <p>die sprayed</p> <div data-bbox="499 1155 871 1339" data-label="Image"> <p>A hand-drawn sketch showing a cross-section of a closed die. An arrow on the left points towards the die cavity, which contains a small rectangular shape representing the molten metal being poured in.</p> </div> <p>molten metal shot into die</p> <div data-bbox="499 1496 863 1769" data-label="Image"> <p>A hand-drawn sketch showing a cross-section of a die with its two halves slightly separated. Inside the cavity, there is a small rectangular shape representing the cooled casting.</p> </div> <p>die/ casting cooled</p> <p>casting removed</p>	<p>If candidate uses only sketches, max 3 marks.</p> <p>If candidate uses only notes, max 3 marks.</p>	(4)

Question number	Answer	Additional guidance	Mark
<b>3(c)</b>	<p>Any <b>two</b> explanations that include identification of an advantage (1) and linked justifications of that advantage (1) + (1).</p> <ul style="list-style-type: none"> <li>Using a permanent die is quicker than preparing a sand mould for each casting (1), which increases throughput/produce more in a given time (1) and means keeping up with high volume/commercial demand (1).</li> <li>The surface quality of the cast item is much better than sand casting (1), therefore no additional surface finishing/secondary processing such as milling/grinding is required (1) to produce a bus that is suitable for being handled/played with/to get a commercial quality finish (1).</li> <li>Die casting can create finer details/thinner sections (1) as a sand mould may collapse (1) when trying to cast a small-scale product like the bus (1).</li> </ul>	Do not accept repeated justifications. Maximum of 4 marks for responses that give valid advantage and explanation, without specific link to the requirements for the bus and/or commercial production.	<b>(6)</b>

Question number	Answer	Additional guidance	Mark
<b>4(a)(i)</b>	<p>A description of the process that makes reference to:</p> <ul style="list-style-type: none"> <li>the screwdriver bits are heated up to around 900 °C/red hot/cherry red/critical temperature (1) and then quenched/cooled fast in water/oil (1).</li> </ul>	Do not accept a general term of heating and cooling.	<b>(2)</b>

Question number	Answer	Mark
4(a)(ii)	<p>An explanation that includes identification of a reason (1) and linked justifications of that reason (1) + (1).</p> <ul style="list-style-type: none"> <li>As a result of hardening, the bits will become brittle (1) and tempering will make the screwdriver bits tough enough for use/reduces brittleness to the level required for the screwdriver bits (1), which means when they are subjected to forces they are less likely to break/shatter (1).</li> </ul>	(3)

Question number	Answer	Additional guidance	Mark
4(b)(i)	<p>A calculation that includes:</p> $(7 + 8 + 10 + 13 + 18 + 26 + 31 + 34 + 36 + 37) \times 2 + 38 \text{ (sample is a symmetrical bell curve)} = 478 \text{ (1)}$ $478 \times 0.9 = 430 \text{ (1)}$	<p>Accept alternative methods of correct working out.</p> <p>Error carried forward should be applied.</p> <p>Award full marks for correct answer only.</p>	(2)

Question number	Answer	Additional guidance	Mark
4(b)(ii)	<p>A calculation that includes:</p> <p>Range of hand-grip sizes = <math>74 - 34 = 40 \text{ (1)}</math></p> <p><math>40 \times 0.05 = 2 \text{ (1)}</math></p> <p><math>34 + 2 = 36</math> and <math>74 - 2 = 72 \text{ (1)}</math></p>	<p>Accept alternative methods of correct working out.</p> <p>Error carried forward should be applied.</p> <p>Award full marks for correct answer only.</p>	(3)

Question number	Answer	Mark
4(c)	<p>An explanation that includes identification of a benefit (1) and linked justification of that benefit (1).</p> <ul style="list-style-type: none"> <li>It will protect their design/feature/concept so no one else can copy it (1), therefore it is potentially worth more money/the inventor will have time to develop it/it will give the designer more recognition (1).</li> </ul>	(2)

Question number	Indicative content	Mark
4(d)	<p><b>A03 1a = 3 marks, A03 1b = 6 marks</b></p> <p>This question asks candidates to evaluate the choice to use injection moulding as a method of manufacture in the context of a drill body.</p> <p>Candidates should analyse the product in order to weigh up the potential advantages and disadvantages of injection moulding and give reasoned justification to qualify their judgements and conclusion.</p> <p>Candidates might refer to the following in their responses:</p> <ul style="list-style-type: none"> <li>• the drill body has a thin wall section/complex shape and profile</li> <li>• the body will be required in high volume</li> <li>• the design requires cores/bushes/inserts/components/fastenings.</li> <li>• a range of colours can be offered</li> <li>• cost of mould/skilled labour required</li> <li>• speed of production</li> <li>• energy costs</li> <li>• environmental influences.</li> </ul> <p>Expansion that can be used to justify judgments relating to positive or negative points:</p> <ul style="list-style-type: none"> <li>• the form can be achieved with a highly complex mould</li> <li>• does not need any additional surface finishing</li> <li>• injection moulding process is capable of delivering the product to consistent level of quality time after time/suitable for high volume/the body will need to fit other components so must be same every time</li> <li>• cores/inserts/components/fastenings can easily be moulded into the drill body, which allows it to be produced in one process</li> <li>• the initial cost of the mould is expensive, requiring high volume to recoup costs</li> <li>• colour can be changed without need for additional moulds</li> <li>• a fast process allowing rapid volume production</li> <li>• the level of detail and craftsmanship/knowledge required to make the mould is expensive/limited number of people capable</li> <li>• if the process is 24/7 then it is more efficient than a costly start-up period each day, but this has to be weighed against 24/7 labour costs</li> <li>• ambient temperature/viscosity changes/mould temperature variations are all factors that can have an adverse effect on the moulding process and need careful monitoring/environmental control systems.</li> </ul>	(9)

Level	Mark	Descriptor
	0	No rewardable content
Level 1	1–3	<ul style="list-style-type: none"> <li>• Applies a basic understanding to deconstruct information, making limited connections between concepts.</li> <li>• Incomplete evaluation with unresolved conclusion that demonstrates limited syntheses of understanding.</li> <li>• Judgements are tentatively supported by evidence.</li> </ul>
Level 2	4–6	<ul style="list-style-type: none"> <li>• Applies a competent understanding to deconstruct information and provide some clear connections between concepts.</li> <li>• Imbalanced evaluation that synthesises some relevant understanding into a generally coherent conclusion.</li> <li>• Judgements are occasionally supported by relevant evidence.</li> </ul>
Level 3	7–9	<ul style="list-style-type: none"> <li>• Applies a thorough understanding to deconstruct information and provides logical connections between concepts throughout.</li> <li>• Balanced evaluation that synthesises relevant understanding into a well-developed conclusion.</li> <li>• Judgements are supported by relevant evidence throughout.</li> </ul>

Question number	Answer	Mark
<b>4(e)</b>	<p>Award <b>one</b> mark for each of the following stages of the process:</p> <ul style="list-style-type: none"> <li>• compile a list of all activities/work breakdown structure (1)</li> <li>• work out the length of time/duration required for each activity (1)</li> <li>• determine the relationships/links between the activities (1)</li> <li>• determine specific points of time in the process/milestones/deliverable items (1).</li> </ul>	<b>(4)</b>

Question number	Answer	Additional guidance	Mark
<b>5(a)</b>	<p>Any <b>two</b> requirements stated from:</p> <ul style="list-style-type: none"> <li>• products must take account of the description of the goods/do what it says it will do (1)</li> <li>• products must meet a specified standard (1)</li> <li>• the price of the products must be appropriate/relevant (1).</li> </ul>	Accept any other correct requirement of the Consumer Rights Act 2015 or later which relate to the purchase or use of the scooter.	<b>(2)</b>



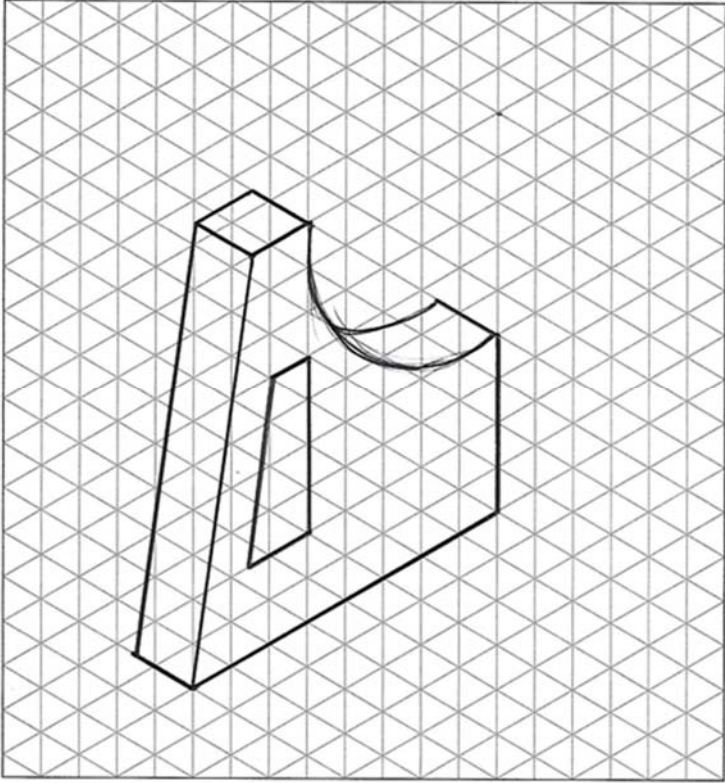
Question number	Answer	Mark
5(b)(i)	<p>Any <b>two</b> explanations that include identification of a performance characteristic (1) and linked justifications of that performance characteristic (1) + (1).</p> <ul style="list-style-type: none"> <li>• Rubber has a high coefficient of friction/does not slip easily (1), which means that it will be very good at gripping surfaces (1), making it safer as you are less likely to slip and fall/slide when braking (1).</li> <li>• Rubber is hardwearing/durable (1), which means it will last longer (1), saving money on replacement tyres/less maintenance/upkeep required (1).</li> <li>• Rubber is flexible/has high elasticity (1), which means it will deform/give as the tyres go over small bumps/stones (1), making the ride much smoother/can be used on a wider range of surfaces (1).</li> </ul>	(6)

Question number	Indicative content	Mark
5(b)(ii)	<p><b>A04 1b = 3 marks, A04 1c = 3 marks</b></p> <p>This question is about considerations relating to repair versus replacement and asks candidates to discuss this in the context of scooter wheels. Creditworthy responses will make connections which show understanding of factors that need to be considered, going beyond general knowledge.</p> <p>Candidates might refer to the following in their responses:</p> <ul style="list-style-type: none"> <li>• Durability of materials and the potential frequency of need for replacement or repair in relation to predicted lifespan of the scooter</li> <li>• Expertise and access to tools and equipment required of each option</li> <li>• Availability of and/or compatibility of generic replacement wheels</li> <li>• The environmental impact of each option</li> <li>• Effects on the performance of the product</li> <li>• How the design of the scooter/wheel will be affected by allowing for removal of the wheels by consumers</li> <li>• The potential impact of frequent removal on connected elements/parts of the scooter wheels</li> </ul>	(6)

Level	Mark	Descriptor
	0	No rewardable content.
Level 1	1–2	<ul style="list-style-type: none"> <li>• Superficial discussion that considers a narrow range of factors, demonstrating limited understanding.</li> <li>• Partial application of understanding to the context of the question.</li> </ul>
Level 2	3–4	<ul style="list-style-type: none"> <li>• Coherent discussion that makes some relevant links between a sufficient range of factors, demonstrating competent understanding.</li> <li>• Generally sound application of understanding to the context of the question.</li> </ul>
Level 3	5–6	<ul style="list-style-type: none"> <li>• Comprehensive discussion that makes effective links between a wide range of factors, demonstrating thorough understanding.</li> <li>• Considered and effective application of understanding to the context of the question.</li> </ul>

Question number	Answer	Mark
<b>5(c)</b>	<p>Any <b>two</b> benefits given from:</p> <ul style="list-style-type: none"> <li>• readily available (1)</li> <li>• specification data is already known/predetermined (1)</li> <li>• design decisions are simplified (1)</li> <li>• consumer can source replacements easily/quickly (1)</li> <li>• manufacturer does not need to stockpile/can order in when required (1)</li> <li>• time saved by buying in/not designing and making custom parts/components (1).</li> </ul>	<b>(2)</b>

Question number	Answer	Additional guidance	Mark
<b>5(d)</b>	<p>A calculation that includes:</p> <p>steps to show:</p> $\cos\theta = \frac{\text{adjacent}}{\text{hypotenuse}}$ $\theta = \frac{\text{adjacent}}{\text{hypotenuse}} \cos^{-1} (1)$ $\theta = \frac{250}{800} \cos^{-1} (1)$ $\theta = 71.79^\circ \text{ given to 2 s.f.} = 72^\circ (1)$	<p>Accept alternative methods of correct working out.</p> <p>Error carried forward should be applied.</p> <p>Award full marks for correct answer only.</p>	<b>(3)</b>

Question number	Answer	Mark
5(e)	<p>An isometric drawing that includes an image drawn with a ruler or free hand. Marks to be awarded for the following.</p> <p>Accurate setting out of the straight edges (angles and parallels to create correct shape) (1).          Accurate setting out of the curved edge (elliptical not circular) (1).          Correct scaling down of all the box dimensions (scale 1 : 10) (1).          Correct box dimensions graphically represented (1).          Correct window dimensions graphically represented (1).          Correct placement of window (1).</p> 	(6)

Question number	Indicative content	Mark
6	<p><b>A03 1a = 3 marks A04 1c = 3 marks, A03 2c = 3 marks</b></p> <p>Candidates should consider the design of the chair, showing understanding and the influence of modernist philosophy and the manufacturing technology of the period.</p> <p>Impacts:</p> <ul style="list-style-type: none"> <li>• shape</li> <li>• materials</li> <li>• manufacturing techniques</li> <li>• aesthetics</li> <li>• ergonomics</li> <li>• form/function</li> <li>• comfort.</li> </ul> <p>Candidates might refer to the following in their responses:</p> <ul style="list-style-type: none"> <li>• usefulness versus beauty/form is led by function</li> <li>• beautiful/artistic design for the masses</li> <li>• liberal upsurge in experimentation with art forms</li> <li>• 'total' work of art in which all arts could be brought together</li> <li>• heavy steel industry available for manufacture</li> <li>• use of new materials (steel tube) of the time was characteristic of the modernist style</li> <li>• mass production allowed beautiful design at a reasonable/affordable cost</li> <li>• rise of consumer products/standardised parts/exposed steel</li> <li>• new processes such as chroming allowed new/different finishes to be applied</li> <li>• automation allowed processes to be completed more accurately and at a higher speed</li> <li>• new manufacturing techniques allowed new sections of material (e.g. tubing) to be produced, which led to an ability to form new shapes with less material but equal/sufficient strength.</li> </ul>	(9)

Level	Mark	Descriptor
	0	No rewardable content.
Level 1	1–3	<ul style="list-style-type: none"> <li>• Applies a basic understanding to deconstruct information, making limited connections between concepts.</li> <li>• Partial application of understanding of technical factors to the context of the question.</li> <li>• Partial application of understanding of design theory to the context of the question.</li> </ul>
Level 2	4–6	<ul style="list-style-type: none"> <li>• Applies a competent understanding to deconstruct information and provide some clear connections between concepts.</li> <li>• Generally sound application of understanding of technical factors to the context of the question.</li> <li>• Generally sound application of understanding of design theory to the context of the question.</li> </ul>
Level 3	7–9	<ul style="list-style-type: none"> <li>• Applies a thorough understanding to deconstruct information and provides logical connections between concepts throughout.</li> <li>• Considered and effective application of understanding of technical factors to the context of the question.</li> <li>• Considered and effective application of design theory understanding to the context of the question.</li> </ul>

Question number	Answer	Mark
7(a)	<p>Any <b>three</b> explanations that include identification of a valid feature (1) and linked justifications of that feature (1) + (1).</p> <ul style="list-style-type: none"> <li>• The phone is thin (1) as developments in battery technology have allowed the miniaturisation of the battery pack (1) while maintaining battery life/reducing weight/less bulky to carry (1).</li> <li>• Increased functionality/storage capacity features, e.g. camera, torch, pay scan, etc. (1) due to miniaturisation of electronics (1) so the consumer can use it for a greater range of tasks/store more data, pictures, videos, music, games, etc. (1).</li> <li>• Smart materials have been used to develop the colour LCD screen (1) enabling clear/detailed/high-quality images (1), resulting in increased consumer appeal.</li> <li>• Smart material is used in the piezo-electric transducers (1), enables reasonable quality sound/music without the use of bulky speakers (1) so consumers can access their music anywhere (1).</li> <li>• The development of touch screen technology (1) has reduced the need for physical buttons/keyboards on the phone (1), allowing improved looks, clean aesthetic lines/leading to easier use of the phone /improved ergonomics (1).</li> </ul>	(9)

Question number	Answer	Additional guidance	Mark
7(b)	<p>Any <b>three</b> explanations that include identification of a valid impact (1) and linked justifications of that impact (1) + (1).</p> <ul style="list-style-type: none"> <li>• The increasing functionality of phones makes some tasks become more convenient/easier/quicker for people to carry out, e.g. scan pay, communication, etc. (1), which saves people time (1) and allows them to carry out an increasing number of tasks 'on the go'/where ever they are (1).</li> <li>• Society is wealthier (1) as obsolescence causes consumers to continually replace out-dated/broken phones (1), which maintains employment levels in related industries (1).</li> <li>• Further encourages our 'throw away' society (1) as people are encouraged to discard fully functional phones for up-to-date models (1), causing people to value products less/compounding sustainability issues/landfill/resource depletion, etc. (1).</li> <li>• Increased levels of dissatisfaction/depression/debt (1) as some people can't afford to keep updating their phones (1) so feel rejected/isolated/mockd by peers (1).</li> <li>• People lose social skills (1) as the lure of phones means people talk less when together (1), so people are less able to handle disagreement or confrontation appropriately/become more inward looking/defensive/selfish (1).</li> <li>• Increasing communications technology increases the risk of threats to privacy (1), leading to people being inundated with unwanted information (1) and increasing levels of cyber bullying/new forms of criminal activity, etc. (1)</li> </ul>	<p>Accept rationalised negative alternatives to the positives stated in the mark scheme and vice versa.</p> <p><b>Do not reward</b> explanation of environmental or economic impacts unless directly justified in terms of their social impact.</p>	(9)

Question number	Indicative content	Mark
8	<p><b>A03 1a = 4 marks, A03 1b = 8 marks</b></p> <p>This question asks candidates to evaluate the choice to use a transparent collection tube in the design of a vacuum cleaner.</p> <p>Candidates should analyse the product in order to weigh up the potential benefits and disadvantages of this design choice and give reasoned justification to qualify their judgements and conclusion.</p> <p>Points of analysis:</p> <ul style="list-style-type: none"> <li>• being clear impacts the function because you can see: <ul style="list-style-type: none"> <li>○ how full it is</li> <li>○ the internal components</li> <li>○ if it is working</li> </ul> </li> <li>• being clear impacts the design aesthetics because: <ul style="list-style-type: none"> <li>○ you can see the internal workings</li> <li>○ colour or detail can be used as a feature of the internal components</li> <li>○ the overall look of the vacuum is affected by including a transparent element v a fully opaque design.</li> </ul> </li> </ul> <p>Points of evaluation:</p> <ul style="list-style-type: none"> <li>• over time could become scratched and dirty, which will distract from the aesthetics</li> <li>• allows a quick visual check to see if the cleaner requires emptying</li> <li>• the visible dirt and dust collection will detract from the overall aesthetics</li> <li>• full level indicator can be included on the plastic tube</li> <li>• allows the user to see the performance of the suction action</li> <li>• fits in with the post-Modernist design aesthetics in terms of being unconventional and displaying the working design/they can be used as part of the aesthetic appeal</li> <li>• some consumers may prefer designs with fewer visible working parts/more traditional aesthetics</li> <li>• suction holes can be easily checked to see if they are blocked/need cleaning</li> <li>• the use of clear plastic may highlight imperfections during manufacturing</li> <li>• the transparent material will have an increased impact on the cost.</li> </ul>	(12)



Level	Mark	Descriptor
	0	No rewardable material
Level 1	1–3	<ul style="list-style-type: none"> <li>• Applies a basic understanding to deconstruct information, making limited connections between concepts.</li> <li>• Incomplete evaluation with unresolved conclusion that demonstrates limited synthesis of understanding.</li> <li>• Judgements are tentatively supported by evidence.</li> </ul>
Level 2	4–6	<ul style="list-style-type: none"> <li>• Applies a generally sound understanding to deconstruct information and provide some clear connections between concepts.</li> <li>• Imbalanced evaluation that synthesises some relevant understanding into a generally coherent conclusion.</li> <li>• Judgements are occasionally supported by relevant evidence.</li> </ul>
Level 3	7–9	<ul style="list-style-type: none"> <li>• Applies an effective understanding to deconstruct information and provide logical connections between concepts.</li> <li>• Balanced evaluation that synthesises relevant understanding into a considered conclusion.</li> <li>• Judgements are mostly supported by relevant evidence.</li> </ul>
Level 4	10–12	<ul style="list-style-type: none"> <li>• Applies a comprehensive understanding to deconstruct information and provides insightful connections between concepts throughout.</li> <li>• Thorough and balanced evaluation that synthesises relevant understanding into a well-developed conclusion.</li> <li>• Judgements are supported by pertinent evidence throughout.</li> </ul>