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# **GCSE MARKING SCHEME**

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**AUTUMN 2020**

**DESIGN AND TECHNOLOGY – COMPONENT 1  
C600U10-1**

## **INTRODUCTION**

This marking scheme was used by WJEC for the 2020 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

**GCSE DESIGN & TECHNOLOGY**  
**COMPONENT 1: PRODUCT DESIGN**  
**AUTUMN 2020 MARK SCHEME**

**Guidance for examiners**

**Positive marking**

It should be remembered that learners are writing under examination conditions and credit should be given for what the learner writes, rather than adopting the approach of penalising him/her for any omissions. It should be possible for a very good response to achieve full marks and a very poor one to achieve zero marks. Marks should not be deducted for a less than perfect answer if it satisfies the criteria of the mark scheme.

For questions that are objective or points-based the mark scheme should be applied precisely. Marks should be awarded as indicated and no further subdivision made.

**Banded mark schemes**

For band marked questions mark schemes are in two parts, the indicative content and the assessment grid.

The indicative content suggests the range of and issues which may be included in the learner's answers. It can be used to assess the quality of the learner's response. Indicative content is **not** intended to be exhaustive and learners **do not** have to include all the indicative content to reach the highest level of the mark scheme.

In order to reach the highest levels of the mark scheme a learner need not cover all of the points mentioned in the indicative content but must meet the requirements of the highest mark band. Where a response is not creditworthy, that it contains nothing of any significance to the mark scheme, or where no response has been provided, no marks should be awarded. For each question, descriptors will indicate the different skills and qualities at the appropriate level.

Examiners should first read and place a tick in the learner's answer/s to indicate the evidence that is being assessed in that question; the mark scheme can then be applied. This is done as a two stage process.

## **Stage 1 – Deciding on the band**

Beginning at the lowest band, examiners should look at the learner's answer and check whether it matches the descriptors for that band. If the descriptors at the lowest band are satisfied, examiners should move up to the next band and repeat this process for each band until the descriptors match the answer.

If an answer covers different aspects of different bands within the mark scheme, a 'best fit' approach should be adopted to decide on the band and then the learner's response should be used to decide on the mark within the band. For instance if a response is mainly in band 2 but with a limited amount of band 3 content, the answer would be placed in band 2, but the mark awarded would be close to the top of band 2 as a result of the band 3 content.

Examiners should not seek to mark learners down as a result of small omissions in minor areas of an answer.

## **Stage 2 – Deciding on the mark**

During standardising (marking conference), detailed advice from the Principal Examiner on the qualities of each mark band will be given. Examiners will then receive examples of answers in each mark band that have been awarded a mark by the Principal Examiner. Examiners should mark the examples and compare their marks with those of the Principal Examiner.

When marking, examiners can use these examples to decide whether a learner's response is of a superior, inferior or comparable standard to the example. Examiners are reminded of the need to revisit the answer as they apply the mark scheme in order to confirm that the band and the mark allocated is appropriate to the response provide.

## Section A

Answer **all** questions

This question is about the smart and technical materials.

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
1. (a) (i)			<p>The pictures below are examples of products that use smart materials.</p> <p>Define a smart material. <span style="float: right;">[2]</span></p> <p>Smart materials react to changes in their environment (1). The reactions are only temporary (1) once the environmental stimuli is removed the material returns to its original state (1). Environmental changes can involve light, heat, moisture or pressure (1). Changes seen can be with colour, shape or resistance (1).</p>	AO4 1b [1] AO4 1c [1]	<b>2</b>
(ii)	✓	2	<p>A retailer sells a range of thermochromic baby spoons. The table below identifies the prices of each pack sold.</p> <p>Calculate the saving a consumer would make per spoon if they purchased a pack of three. <i>Show all workings.</i> <span style="float: right;">[2]</span></p> <p>Award one mark for each correct step in the calculation.                      Pack of three spoons = £2.25  <math>£2.25/3 = 75\text{p}</math> (1)  <math>95\text{p} - 75\text{p} = 20\text{p}</math> saving per spoon (1)</p> <p><i>Credit any appropriate approach to calculating the saving made.</i></p>	AO4 1c [2]	<b>2</b>

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(iii)	✓	2	<p>Calculate the percentage (%) saved per spoon if the consumer purchased a pack of ten. <i>Show all workings.</i> [2]</p> <p>Award 1 mark for each correct step in the calculation:</p> <p>Pack of ten spoons = £4.50  <math>\text{£}4.50/10 = 45\text{p}</math> (1)  <math>95-45 = 50\text{p}</math>  <math>\text{Saving} = 50/95 \times 100 = 52.6</math> or 53% (1)</p> <p><i>Credit any appropriate approach to calculating the percentage saved per spoon.</i></p>	AO4 1c [2]	<b>2</b>
(b) (i)			<p>Explain why electroluminescent films are beginning to replace traditional LCD (Liquid Crystal Display) screens in products such as calculators. [2]</p> <p>Answers must relate to electroluminescent film (EL).</p> <p>1 mark for each point explained, up to two required</p> <ul style="list-style-type: none"> <li>• They can be flexible (1)</li> <li>• They do not generate heat (1)</li> <li>• They have increased reliability compared to traditional LCD screens (e.g. no cracking) (1)</li> <li>• They are more durable (1)</li> </ul> <p><i>Credit any other appropriate response.</i></p>	AO4 1a [2]	<b>2</b>

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(ii)			<p>Using an example of a named fabric, describe the basic principles of biomimicry. [2]</p> <p>Answers must relate to biometrics. 1 mark for a correct named fabric, 1 mark for description of biomimicry.</p> <p>Biomimicry is where influence is taken from the natural environment/world to create new materials (1). These materials mimic or copy nature (1). Fast skin is an example of a fabric (1) as it mimics the aerodynamics of shark's skin (1). Velcro The lotus leaf effect.</p> <p><i>Credit any other appropriate response.</i></p>	AO4 1b [2]	<b>2</b>
				<b>Total</b>	<b>10</b>

This question is about energy and the impact of new technologies on our society.

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
2. (a) (i)	✓		Name <b>one</b> of the renewable energy sources shown in the picture below. [1]  Two possible answers, one required: <ul style="list-style-type: none"> <li>• Solar power or</li> <li>• Wind power</li> </ul> These are the only acceptable answers.	AO4 1a [1]	<b>1</b>



Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(ii)	✓		<p>Describe <b>one</b> disadvantage of using renewable energy sources to provide heat to households. [2]</p> <p>Answer must relate to renewable energy sources only and relevant for heating the home. 1 mark for a disadvantage and 1 mark for description.</p> <p>Disadvantages could include:</p> <ul style="list-style-type: none"> <li>• Facilities are needed for installation so enough energy can be produced to heat a home;</li> <li>• It isn't necessarily a constant source of energy e.g. sunlight needed for solar power is not available at night;</li> <li>• Energy output may not be enough to heat a home;</li> <li>• Energy needs storing which can be a disadvantage if space is limited or not enough energy can be stored to heat a home;</li> <li>• Batteries are needed to store energy, these can be expensive, and they can wear out and need replacing;</li> <li>• Some consumers don't like the aesthetic of renewable energy sources;</li> <li>• Not all communities have the access to renewable energies so not all homes can be heated this way;</li> <li>• Not all renewables are pollution free some can emit carbon dioxide and methane;</li> <li>• At the moment costs are still more expensive than non-renewable energy sources which is putting consumers (companies and politicians) off investment.</li> </ul> <p><i>Credit any other appropriate response.</i></p>	AO4 1b [2]	<b>2</b>

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(b)	✓		<p>The demand for electric cars has increased. Explain <b>one</b> benefit of buying an electric car. [2]</p> <p>Answer must relate to electric (or hybrid) cars. 1 mark for a reason, 1 mark for explanation of reason given.</p> <p>Sales of electric cars are rising due to:</p> <ul style="list-style-type: none"> <li>• Electricity isn't free but it is cheaper than petrol or diesel;</li> <li>• Petrol/diesel prices continue to rise considerably, consumers are requiring long term savings;</li> <li>• Government/companies are offering incentives/discounts to purchase;</li> <li>• Cost of buying has reduced considerably in recent years making purchase cost comparable to cost of petrol cars;</li> <li>• Their eco-friendly design, no harmful emissions – consumers are becoming more aware of environmental issues and want to make a difference;</li> <li>• Choice of designs – competition within the marketplace has produced a range of designs to choose from;</li> <li>• Low maintenance costs – no lubricants needed, and servicing is not necessary compared to combustions engines</li> <li>• Safer to drive – no fuel to cause fire and these cars go through the same safety testing as petrol driven cars;</li> </ul> <p><i>Credit any other appropriate response.</i></p>	AO4 1c [2]	<b>2</b>

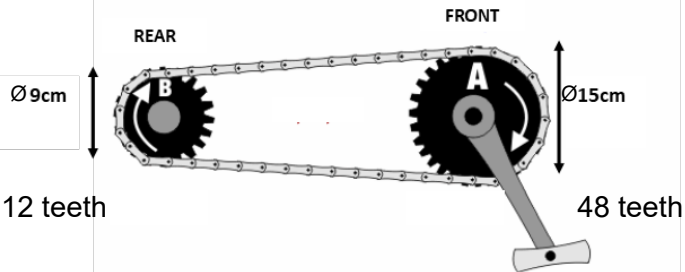
Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(c)	✓		<p>The pictures below are examples of wind-up energy products.</p> <p>Describe the limitations of using these products. [2]</p> <p>1 mark for each limitation, 2 required.</p> <p>Wind-up product limitations:</p> <ul style="list-style-type: none"> <li>• Power provided is temporary;</li> <li>• Energy power is weaker than battery operated alternatives;</li> <li>• Reliability – cannot rely or guarantee how long the product will work for, not useful therefore in an emergency;</li> <li>• Are more expensive than other products currently available;</li> <li>• Consumer using the product need to have the strength and manipulative skills ability to wind the product up.</li> </ul> <p><i>Credit any other appropriate response.</i></p>	AO4 2c [2]	<b>2</b>

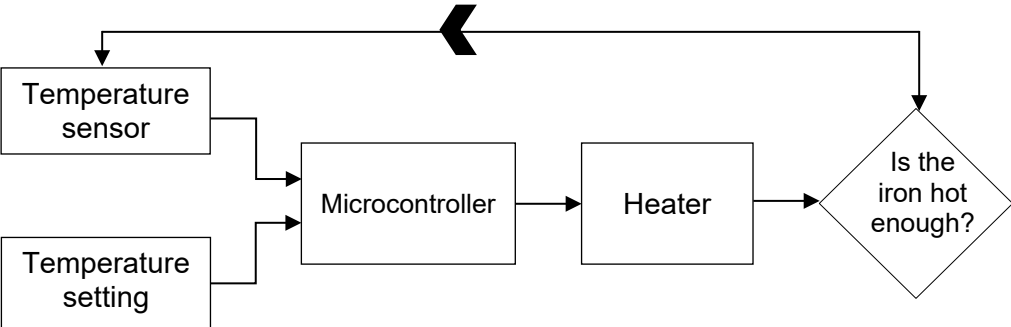
Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(d)	✓		<p>Using an example, analyse how technological advances are having a negative impact on our society. [3]</p> <p>Answers must relate to new technologies. 1 mark for each effect/impact on society, 1 mark for analysing the impact suggested and 1 mark for justifying answer given. Two effects with a sound explanation can also be awarded 3 marks.</p> <p>Impacts on society of new technologies could include:</p> <ul style="list-style-type: none"> <li>• To reduce costs, manufacture is being completed in developing countries where labour costs are much lower than in developed countries. This may keep retail costs lower, but job losses are increased so unemployment levels rise;</li> <li>• In addition, workers in developing countries may be treated unfairly to the detriment to their health and wellbeing;</li> <li>• Reliance and dependency on technology results in a reduction in using our memory and developing new skills;</li> <li>• A reduction in social face-to-face interaction and verbal communication skills (particularly with children);</li> <li>• Anxiety and loneliness can result as new technologies are able to control all aspects of our lives;</li> <li>• Personal data is easily founded and shared without individual's awareness or consent;</li> <li>• Advances in technology can reduce the number of workforce employed or lead to unemployment.</li> </ul> <p><i>Credit any other appropriate response.</i></p>	AO3 2a [3]	<b>3</b>
				Total	<b>10</b>

This question is about electronic systems, programmable components and mechanical devices.

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
3. (a) (i)	✓		<p>Study the products below.</p> <p>Identify the type of mechanical motion used by <b>each</b> product. <span style="float: right;">2 x [1]</span></p> <p>Award 1 mark for each correct answer.</p> <p>Bicycle = Rotary motion (1)</p> <p>Sewing machine = movement that is up and down or back and forth in a linear (1)</p> <p><i>Only acceptable response.</i></p>	AO4 1b [2]	<b>2</b>
(ii)			<p>Explain how <b>one</b> of the mechanical motions in (i) above functions. <span style="float: right;">[2]</span></p> <p>1 mark for identifying the correct motion in relationship to the product chosen and 1 mark for the explanation.</p> <p>Rotary/oscillating motion - movement of any object about an axis or point in a circular way – wheel about an axle.</p> <p>Reciprocating/linear motion – that is up and down or back and forth in a straight line- needle moves up and down.</p> <p><i>Credit any other appropriate response.</i></p>	AO4 1b [1] AO4 1c [1]	<b>2</b>

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(b) (i)	✓	4	<p>The rider of the bicycle turns the pedal crank 36 times in 30 seconds.</p> <p>Calculate the speed of the pedal crank in rpm (revolutions per minute).  <i>Show all workings.</i></p> <p>Rotation speed = <math>\frac{\text{number of revolutions}}{\text{time taken}}</math></p> <p><math>\frac{36}{30} = 1.2 \text{ rpm (1)}</math></p> <p>There are 60 seconds in a minute, therefore:  <math>1.2 \times 60 = 72 \text{ rpm (1)}</math></p> <p style="text-align: right;">[2]</p>	AO4 1c [2]	<b>2</b>

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(ii)			<p>The diagram below shows the gear system used on a bicycle.</p>  <p>Calculate the ratio of the gears used on the bicycle. <i>Show all workings.</i> [2]</p> <p>12:48 ratio 1 mark</p> <p>1:4 ratio 1 mark</p> <p><i>Credit any appropriate approach to calculating the rotational speed and rotational velocity.</i></p>	AO1b [1] AO4 1c [1]	<b>2</b>
(iii)	✓		<p>Using the word bank below, correctly complete the statement that follows:</p> <p>Fulcrum      Force      Lever      Load</p> <p>The hand brake on a bicycle is a <b>Lever</b> and the point at which the hand brake pivots is a <b>Fulcrum</b>.</p> <p><i>Do credit any other appropriate response.</i></p>	AO1 1b [1] AO4 2b [1]	<b>2</b>

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(c) (i)	✓		<p>The system diagram below is for an electrical iron. Precise control of an electrical iron is achieved through feedback.</p>  <p>Draw the feedback route for the iron on the systems diagram above. [1]</p> <p>Answer shown above. <i>This is the only acceptable answer.</i></p>	AO4 1b [1]	<b>1</b>
(ii)			<p>The iron uses a thermistor. Describe the function of a thermistor when the iron is in use. [2]</p> <p>Answers must relate to a thermistor with reference to an iron. 1 mark for a clear understanding of the function of a thermistor and 1 mark for describing it's use in a steam iron.</p> <p>A thermistor is a temperature sensing component (1) that produces an analogue signal that rises when the temperature rises (1). It measures and controls the temperature (of water) on/in the iron based on how it has been interfaced with the microcontroller (1).</p> <p><i>Credit any other appropriate response.</i></p>	AO4 1b [2]	<b>2</b>



Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(iii)			<p>Most irons use a light emitting diode (LED) as an output device. Explain <b>two</b> benefits of using LEDs in a product. [2]</p> <p>Award 1 mark for each benefit explained in full. Reference may be made to specific products, this should be credited if an accurate explanation is given. A maximum of 1 mark can be awarded without an explanation.</p> <p>Benefits of LED use:</p> <ul style="list-style-type: none"> <li>• Long life (and they don't burn out)</li> <li>• Energy efficient (therefore cheaper)</li> <li>• Ecologically friendly (and free from toxic chemicals)</li> <li>• Can be recycled</li> <li>• Design flexibility (can be combined in to any shape)</li> <li>• Operates in both cold and hot temperatures</li> <li>• Is available in many different colours</li> <li>• Is available in a variety of sizes</li> <li>• Safety feature</li> </ul> <p><i>Credit any other appropriate response.</i></p>	AO4 2a [2]	<b>2</b>
				Total	<b>15</b>

This question is about materials.

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
4. (a) (i)			<p>State the thermoforming plastic that could be used for the products shown above. [1]</p> <p>Award 1 mark for correct answer.</p> <p>Polystyrene (PS) (1) Expanded polystyrene (EPS) (1)</p> <p><i>Credit any other appropriate response.</i></p>	AO4 1a [1]	<b>1</b>
(ii)			<p>Thermoforming plastic are sold in many different forms. Name <b>one</b> example. [1]</p> <p>Award 1 mark for the correct answer.</p> <p>One answer from the following required:</p> <p>Sheet; film; bar; rod; and tube.</p> <p><i>Others acceptable answers not stated in the specifications are powder and granules.</i></p>	AO4 1a [1]	<b>1</b>

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(iii)			<p>Acrylic is a plastic commonly used in design and make projects. Describe the benefits of using this plastic. [2]</p> <p>Answers must be related to acrylic. 1 mark for each benefit described.</p> <p>For example: Acrylic can be moulded into almost any shape (1) and are available in many colours (1).</p> <p>Benefits:</p> <ul style="list-style-type: none"> <li>• It can be recycled (1)</li> <li>• Good thermal insulation (1)</li> <li>• Good weather resistance (1)</li> <li>• Good dimensional stability (1)</li> <li>• Good plasticity for shaping (1)</li> <li>• It can be shaped using a variety of processes (1)</li> <li>• The shape once formed maintains its shape well/stable (1)</li> <li>• It can be reheated and reformed into a different shape (1)</li> <li>• Readily available plastic and therefore cost (1)</li> </ul> <p><i>Credit any other appropriate response.</i></p>	AO4 2b [2]	<b>2</b>

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(b) (i)			<p>The image below is of a tablet stand in use.</p> <p>State the most appropriate non-ferrous metal used to make the tablet stand. [1]</p> <p>Award 1 mark for correct answer.</p> <p>Aluminium (1)</p> <p><i>Accept only aluminium as a response.</i></p>	AO4 1a [1]	<b>1</b>

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(ii)			<p>Discuss the properties of the material stated in (i) above that make it suitable for the tablet stand.[3]</p> <p>Answers must be related to the chosen material named. 1 mark for a benefit and 1 mark for a justification of the benefit. A maximum of 2 marks for just identifying properties without any justification.</p> <p>For example: Aluminium is a malleable metal (1) and is corrosion resistant (1) which helps to extend the life of the product (1).</p> <p>Other properties:</p> <ul style="list-style-type: none"> <li>• light in weight</li> <li>• easily recycled</li> <li>• ductile</li> </ul> <p>If the candidate does not correctly answer (i) then you must mark properties of another non-ferrous material as being correct.</p> <p>i.e. Brass is readily available can be shaped into the form required and can have an applied finish. <i>Credit any other appropriate response.</i></p>	AO4 1a [1] AO4 1c [2]	<b>3</b>
(c) (i)	✓		<p>The pictures below show a range of products made from denim fabric.</p> <p>State the main fibre content of denim fabric. [1]</p> <p><i>Only acceptable answer to state the main fibre in denim: Cotton (1)</i></p>	AO4 1a [1]	<b>1</b>

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(ii)			<p>State another fibre that is often blended with the fibre stated in (i) above to improve the flexibility of denim. [1]</p> <p>Award 1 mark for a correct answer.</p> <p>Elastane (1) or Lyra (1)</p>	AO4 2a [1]	<b>1</b>
(iii)			<p>Discuss the reasons why denim is such a versatile material in the construction of products. [6]</p> <p>Answers must relate to three properties of cotton (credit can be awarded with reference to cotton and an elastane blend). 1 mark for each property of cotton and 1 mark for justification or supporting comment, up to a total of 6 marks. A maximum of three marks can be awarded if three correct properties are stated without a supporting comment.</p> <p>An example: Denim is made from cotton which has good absorbency (1) which means it is comfortable to wear (1). It is used for clothing (1) as it washes easily (1). It is a durable material (1) so it can be used for bags which are often thrown on the floor, without damaging the fabric (1).</p> <p><i>Award 1 mark for each correct answer relating to:</i> Cotton/denim has a good handle, it is soft to touch Cotton/denim is absorbent Cotton/denim is easy to care for, it washes well and at a variety of temperatures Cotton/denim is cool to wear Cotton/denim has good (tensile) strength Cotton/denim has good durability/has a long life Cotton/denim is easily dyed and so available in a variety of colours</p>	AO4 1c [6]	<b>6</b>

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
			Cotton when blended with elastane: <ul style="list-style-type: none"> <li>• reduces crease resistance</li> <li>• increases fit (and body contour)</li> </ul> <i>Credit any other appropriate response.</i>		
(d) (i)	✓		Below is a picture of a child's pop-up book.  Name the most suitable type of paper used to manufacture this book. [1]  Award 1 mark for a correct answer. <ul style="list-style-type: none"> <li>• Copier paper (1)</li> <li>• Cartridge paper (1)</li> </ul>	AO4 1b	<b>1</b>

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(ii)	✓		<p>Many children’s books need to be laminated to improve their aesthetic and functional qualities. Explain the benefits of laminating books for children’s use. [3]</p> <p>Answers must relate to the aesthetics and/or the functional qualities of lamination. 1 mark for a benefit and 1 mark for a justification of the benefit. A maximum of 2 marks for just identifying the benefits without any justification.</p> <p>For example: Laminating paper means it can be wiped clean (1) this is important for children’s books as children often have dirty hands and leaves marks on books (1). Children don’t understand the properties of paper and that it tears easily (1), laminating will extend the life of the book (1).</p> <p>Example of aesthetic or functional qualities/benefits:</p> <ul style="list-style-type: none"> <li>• Improves strength of paper</li> <li>• Extends the life of the book/pop-up design</li> <li>• Improves the appearance of the book</li> <li>• Allows the paper to be wiped clean as it is waterproof/resistant</li> <li>• Prevents the paper from ripping or tearing</li> <li>• Improves the resistance to bending or creasing</li> </ul> <p><i>Credit any other appropriate response.</i></p>	AO4 1c [3]	<b>3</b>
				Total	<b>20</b>



Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
5. (a) (i)			<p>Name <b>one</b> finishing or decorative technique that could be used to improve the aesthetic of your chosen product. [1]</p> <p>Answers must relate to the product selected by the candidate and must be improving the aesthetic of the product. 1 mark for a correct response.</p> <p>Responses could involve:            Camera – print/pattern or symbolic images to convey messages; lamination or embossing of card for texture            Dinosaur – hand or machine embroidery; printing method; applique or, responses may be of a mechanical finish e.g. brushing            Car – enamelling (colour), painting, could be engraved with letters/number or patterns, anodising etc for aluminium            Clock – numbers could be a different coloured acrylic; number could be larger; handles of clock could be painted a bright colour            Mechanical toy – sealant and primer; varnish, wood stain, polish, paint            Wooden jigsaw - sealant and primer; varnish, wood stain, polish, paint</p> <p><i>Credit any other appropriate response.</i></p>	AO4 1a [1]	<b>1</b>

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(ii)			<p>A laser cutter can be used to cut the material of your chosen product.</p> <p>Explain the advantages of using a laser cutter. [3]</p> <p>1 mark per advantage. An additional mark awarded if answer given is explained well with clear reference to material chosen.</p> <p>Advantages of laser cutting use could include:</p> <ul style="list-style-type: none"> <li>• Limited wastage of material (no border required)</li> <li>• Improves edge quality (no stretch, deformation or breakage of materials)</li> <li>• Accuracy – every piece will be exactly the same, important for kits and materials needing to be slotted or sewn together</li> <li>• Can seal edges of materials, for example, synthetic textiles will melt and prevent the fabric fraying</li> <li>• Can engrave as well as cut, useful to add aesthetic design or personalise products</li> <li>• Keeps materials in correct position so no movement bringing inaccuracies</li> <li>• Quick to laser cut any material, more parts can be produced in less time</li> <li>• Can cut (relatively) any size of pattern or component part</li> <li>• Heat produced is small reducing deformation of materials that can melt</li> <li>• Uses less energy (reducing end cost of product)</li> <li>• Small and detailed patterns can be cut ready for component attachment guaranteeing component fit</li> <li>• Trials can be undertaken without the need to cut the material thus less wastage in prototype development.</li> </ul> <p><i>Credit any other appropriate response.</i></p>	AO4 1c [3]	<b>3</b>

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(b) (i)			<p>Designers need to consider a range of factors when creating new products.</p> <p>State <b>one</b> safety factor considered when designing your chosen product. [1]</p> <p>Responses could involve:</p> <ul style="list-style-type: none"> <li>• Finish of edges are smooth, not sharp</li> <li>• Size of component parts are not small enough to be swallowed or small component parts are attached securely</li> <li>• Products can be cleaned/wiped/washed (to remove bacteria)</li> <li>• Components parts are hidden (e.g. clock mechanism) preventing trapping of fingers</li> <li>• Material is soft to touch and not an irritant</li> <li>• No sections of product allow for fingers to be caught or trapped</li> </ul> <p><i>Credit any other appropriate response.</i></p>	AO4 2a [1]	<b>1</b>

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(ii)			<p>Apart from safety, describe other factors considered by the designer of your chosen product. [4]</p> <p>1 mark per factor; 1 mark for each description. 3 marks can be awarded for three correct factors with weak descriptions.</p> <p>Design considerations/factors:</p> <ul style="list-style-type: none"> <li>• Function – does it do what it is supposed to do and does it do it easily and well?</li> <li>• Aesthetics -does it look appealing? It the texture/handle suitable?</li> <li>• Anthropometrics – will it be the correct height/size for user to be able to use?</li> <li>• Ergonomics – will it be the correct colour? Weight? Can it be changed easily for different users/target markets?</li> <li>• Cost -what price is the target market prepared to pay? What will the manufacturing/material costs be?</li> <li>• Material suitability (for function and stakeholder/user) – is it suitable for function and purpose?</li> <li>• Construction methods and resources/equipment – is equipment available for use?</li> <li>• Environmental consideration – are materials from a sustainable source?</li> <li>• Research – has the appropriate type and amount of research been undertaken to check market suitability?</li> <li>• Lifespan – how long is the product meant to last for (planned obsolescence)?</li> <li>• Legislation – is there any legal requirement?</li> <li>• Standards – have all the BSI ISO standard been adhered to?</li> <li>• Quality – can the product be made to an appropriate quality?</li> <li>• The flammability of the fabric</li> </ul> <p><i>Credit any other appropriate response.</i></p>	AO4 2a [2] AO4 2b [2]	<b>4</b>

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(c) (i)			<p>Consumers are protected by law if products purchased are faulty or not fit for purpose.</p> <p>State <b>one</b> legislative act that protects the buyer when a product is found to be faulty. [1]</p> <p>1 mark to be awarded for an appropriate legislative Act protecting consumer.</p> <p>For example:</p> <p>The Consumer Rights Act 2015</p> <p><i>Credit any other appropriate response.</i></p>	AO3 2b [1]	<b>1</b>

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total
(ii)			<p>Evaluate how legislative acts protect the buyer or user. [5]</p> <p>Two marks to be awarded for each point made if evaluated clearly, three points made with no clear evaluative comment can be awarded a maximum of three marks. Three points made with some sound evaluative reasons can be awarded maximum marks. Evaluative comments can be both positive and negative in nature.</p> <p>Responses may include:</p> <ul style="list-style-type: none"> <li>• The Consumers Rights Act protects the consumer when the product purchased (or service received) does not function as expected or is defective even after use (2).</li> <li>• The Act protects you up 30 days after purchase, but it also ensures your purchase can be repaired (or replaced if it can't be repaired) after the 30 days (2).</li> <li>• The Act states the product should be of good quality, it should not be damaged in any way when purchased, so it is worth checking the product on purchase as proving the quality after purchase may be difficult (2).</li> <li>• The law doesn't protect the consumer if the product bought was knowingly faulty, for example when buying products in a sale (2).</li> <li>• The Act protects the consumer when products bought do not represent what was described for example. size, colour, material; this is particularly important when shopping on-line (2).</li> <li>• The Act also protects consumers on services they receive. The provider is legally required to offer compensation (2).</li> <li>• The Act does cover contracts signed for services, for example, those associated with mobile phones, hence it is regular practice for companies to offer the purchaser 30 days to cancel the contract without penalty (2).</li> </ul> <p><i>Credit any other appropriate response.</i></p>	AO3 2b [5]	<b>5</b>

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total														
(d) (i)		1	<p>A website company has analysed the total number of sales of the children's products for the month of November. The results are shown in the table below.</p> <table border="1"> <thead> <tr> <th>Product</th> <th>Number of Sales</th> </tr> </thead> <tbody> <tr> <td>Paper camera</td> <td>750</td> </tr> <tr> <td>Dinosaur toy</td> <td>4,000</td> </tr> <tr> <td>Metal toy car</td> <td>1,000</td> </tr> <tr> <td>Acrylic clock</td> <td>3,250</td> </tr> <tr> <td>Mechanical toy</td> <td>1,500</td> </tr> <tr> <td>Wooden jigsaw</td> <td>2,000</td> </tr> </tbody> </table> <p>State which product had the highest number of sales. [1]</p> <p><i>Only acceptable answer:</i> Dinosaur toy – 4,000 (1)</p>	Product	Number of Sales	Paper camera	750	Dinosaur toy	4,000	Metal toy car	1,000	Acrylic clock	3,250	Mechanical toy	1,500	Wooden jigsaw	2,000	AO4 1a [1]	1
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(ii)		1	<p>Calculate the total number of products sold. (<i>Show all workings.</i>) [1]</p> <p>1 mark awarded for correct selection of measurements and addition of total, and 1 mark for correct answer.</p> <p><math>750 + 4,000 + 1,000 + 3,250 + 1,500 + 2,000 = 12,500</math> (1)</p> <p><i>Credit any appropriate approach to calculating the average.</i></p>	AO4 1b [1]	1														

Q	Science	Maths	Question or outline of question / Marking scheme	AO	Total														
(iii)		3	<p>In the space below, draw and label a bar chart that displays the information provided in the table (i) above.</p> <div data-bbox="504 443 1462 1024" data-label="Figure"> <p>The bar chart displays the sales of six children's toys in November. The vertical axis is labeled 'Sales' and ranges from 0 to 4500 in increments of 500. The horizontal axis is labeled 'Products' and lists the toys: Camera, Dinosaur, Car, Clock, Mechanical toy, and Train. The sales values are: Camera (750), Dinosaur (4000), Car (1000), Clock (3250), Mechanical toy (1500), and Train (2000).</p> <table border="1"> <thead> <tr> <th>Product</th> <th>Sales</th> </tr> </thead> <tbody> <tr> <td>Camera</td> <td>750</td> </tr> <tr> <td>Dinosaur</td> <td>4000</td> </tr> <tr> <td>Car</td> <td>1000</td> </tr> <tr> <td>Clock</td> <td>3250</td> </tr> <tr> <td>Mechanical toy</td> <td>1500</td> </tr> <tr> <td>Train</td> <td>2000</td> </tr> </tbody> </table> </div> <p>Award marks for:</p> <ul style="list-style-type: none"> <li>• Correct display of sales for each product (1).</li> <li>• Correct labelling of axis (1)</li> <li>• Correct scale (1)</li> </ul>	Product	Sales	Camera	750	Dinosaur	4000	Car	1000	Clock	3250	Mechanical toy	1500	Train	2000	AO4 1b [3]	<b>3</b>
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				Total	<b>20</b>														



Q	Science	Maths	<b>Electronic systems, programmable components and mechanical devices.</b> Question or outline of question / Marking scheme	AO	Total
6. (a) (i)			The picture below is of an unpopulated printed circuit board used in school.  State a chemical process used to produce a printed circuit board. [1] <ul style="list-style-type: none"> <li>• Etching</li> <li>• Photo-resistive laminates</li> <li>• Direct Toner Transfer</li> <li>• Isolation Method</li> </ul> These are the only acceptable answers.	AO4 1a [1]	1
(ii)	✓		State the name of the material used to make the conductive tracks on the circuit board. [1] <ul style="list-style-type: none"> <li>• Copper, Silver or Gold</li> </ul> These are the only acceptable answers.	AO4 1b [1]	1
(iii)			A batch of 80 circuit boards are manufactured in school. Explain the importance of using a jig to help the drilling process. [2] <ul style="list-style-type: none"> <li>• A jig will be designed to hold the circuit board in the same position (1)</li> <li>• A jig will be used to accurately drill holes through the 80 circuit boards (1)</li> <li>• A jig will be used to ensure consistency when drilling the holes through the circuit boards (1).</li> <li>• A jig will be used to ensure repeatability.</li> </ul> <i>Credit any other appropriate response.</i>	AO4 2b [2]	2

Q	Science	Maths	<b>Electronic systems, programmable components and mechanical devices.</b> Question or outline of question / Marking scheme	AO	Total
(iv)			<p>The diagram below is a programmable circuit drawn using computer software.</p> <p>State the name of a suitable computer software package that could have been used to design the circuit. [1]</p> <ul style="list-style-type: none"> <li>• 2D PCB</li> <li>• DesignSpark PCB</li> <li>• Express PCB</li> <li>• TinyCAD</li> <li>• Circuit Wizard</li> </ul> <p><i>Credit any other appropriate response.</i></p>	AO4 2b [1]	1
(v)			<p>Choose any <b>two</b> components from the circuit board above and describe their function. 2 x [2]</p> <ul style="list-style-type: none"> <li>• Battery: Power supply for the circuit.</li> <li>• Resistor: To control/regulate current flow in a circuit.</li> <li>• Light Emitting Diode: To give a visual feedback from a circuit when current passes through it.</li> <li>• Switch: To connect or disconnect the battery from the circuit.</li> <li>• Download Socket/ Stereo 3.5mm jack socket: used with a number of software providers e.g. PICAXE/ GENIE to programming the circuit</li> <li>• PIC CHIP: Provide the means to control a sequence of events e.g. make a light flash rather than stay on continuously, drive a motor, sounder and count events.</li> </ul>	AO4 2c [4]	4

Q	Science	Maths	<b>Electronic systems, programmable components and mechanical devices.</b> Question or outline of question / Marking scheme	AO	Total
(b)		5	The image below shows a prototype circuit designed by a student.  The current I, flowing through resistor R <sub>1</sub> , is 10mA. Calculate the correct resistor value to enable the LED to switch on. V = I x R Show all workings. [2]	AO4 1b [2]	2
(i)			$R_1 = 5 - 2 = 3V \text{ (1)}$ $\frac{3V}{10mA} = 300\Omega \text{ (1)}$ <p>Or</p> $V = I \times R$ $3V = 10mA \times R$ $\frac{3V}{10mA} = R$ <div style="border: 1px solid black; padding: 5px; display: inline-block; margin-left: 100px;">3 divided by 0.001 = 300</div> $R = 300 \Omega$ <p><i>Credit any appropriate approach to calculating the value of R<sub>1</sub>.</i></p>		

Q	Science	Maths	<b>Electronic systems, programmable components and mechanical devices.</b> Question or outline of question / Marking scheme	AO	Total
(ii)			<p>There are 38 holes to be drilled through a printed circuit board. The diameter of the drill bit used is 1.5mm.</p> <p>Calculate the amount of waste as a result of the drilling. <i>Show all workings.</i> [3]</p> <p>Dimensions:            <math>\text{Area} = \pi r^2</math>  <math>A = 3.141 \times (0.75^2)</math> (1)  <math>A = 1.767 \times 38</math> (1)            Amount of wastage is = <math>67.2\text{mm}^2</math> (1)</p> <p><i>Credit any appropriate approach to calculating the material required</i>            Note Allowances must be made for students using technical calculators and the value of <math>\pi</math>.</p>	AO4 1c [3]	

Q	Science	Maths	<b>Electronic systems, programmable components and mechanical devices.</b> Question or outline of question / Marking scheme	AO	Total
(c)	✓		<p>Visual inspections detect faults when populating and soldering components onto a printed circuit board (PCB). Analyse a range of possible faults that could occur when populating and soldering components and suggest how they can be overcome. [5]</p> <p><b>Indicative content</b></p> <p>Answers must only relate to flaws encountered when assembling a PCB and how they can be overcome.</p> <p>One mark to be awarded for every fault and solution identified:</p> <ul style="list-style-type: none"> <li>• Component in backwards. Repair: Refer to the drawing on the PCB for correct positioning. (1)</li> <li>• Wrong components installed/wrong location. Repair: Refer to circuit design or assembly instructions. (1)</li> <li>• A solder starved joint which doesn't make good electrical contact. Repair: Re-heat the joint and add more solder to make a good strong joint. (1)</li> <li>• Leads that are too long are potential short circuits. Repair: Trim all leads just at the top of the solder joint. (1)</li> <li>• Solder Bridge with two solder joints melted together forming an unintended connection between the two. Repair: Excess solder can be drawn off by dragging the tip of a hot iron between the two solder joints. If there is too much solder, a solder sucker or solder wick can help get rid of the excess. (1)</li> <li>• Lifted Pad. This most often occurs when trying to de-solder components from the board. But it can result simply from overworking the joint to the point where the adhesive bond between copper and the board is destroyed. The simplest repair is to fold the lead over to a still-attached copper trace and solder it. (1)</li> <li>• Stray Solder Spatters held to the board by sticky flux residue. These can easily cause a short circuit on the board. They can be repaired by removing with the tip of a knife or tweezers. (1)</li> </ul>	AO3 2a [5]	5

(d)		<p>Evaluate the impact James Dyson has had on the design industry. [6]</p> <p>Answers must relate to the main features of James Dyson’s work and its impact on the design industry</p> <p>Main Features:</p> <ul style="list-style-type: none"> <li>• Unique products in the marketplace today; transparent and bright coloured plastic a trademark of his work.</li> <li>• Dyson is not afraid to develop an existing/traditional idea or product and look at it from a different angle.</li> <li>• He designs products that already exist but improves performance by applying engineering principles.</li> <li>• Producing many, many design ideas and prototypes using a collaborative approach with designers and engineers.</li> <li>• Product’s ‘technology/engineering’ is not hidden from user.</li> <li>• Innovations that have had an impact on the design industry.</li> <li>• All products go through extensive testing to ensure functionality.</li> <li>• Cyclone vacuum technology (based on a cyclonic extractor seen at a timber yard which collected wood dust).</li> <li>• Bagless vacuum cleaner to prevent poor suction/being less effective as found with vacuum cleaners that collect dust into a bag.</li> <li>• Ball wheelbarrow is all-terrain and spread load by using a ball that does not dig into the ground like a conventional wheel and steering is much easier.</li> <li>• The Dyson Air blade dries hands in just 10 seconds and uses around 80% less electricity than conventional hand dryers. It is different from other conventional hand dryers because, instead of using a wide jet of heated air, it uses a sheet of unheated air traveling at 400 miles per hour.</li> <li>• Bladeless fans</li> <li>• Supersonic Hair dryer with the motor in the handle.</li> <li>• Washing machine – twin drum – reduced washing cycle considerably. The design wasn’t successful, very expensive and purple/yellow plastics as aesthetic put consumer off who are used to selecting white ‘goods’.</li> <li>• Dyson supports design education through awards and scholarships.</li> </ul> <p><i>Credit any other appropriate response.</i></p>		
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Q	Science	Maths	Electronic systems, programmable components and mechanical devices. Question or outline of question / Marking scheme	AO	Total															
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				Total	<b>25</b>															

Q	Science	Maths	Papers and boards		AO	Total
			Question or outline of question/Marking scheme			
6. (a) (i)			<p>The images below show an innovative business card designed for a cheese manufacturer. The product is card-based, with a thin layer of metallic finished plastic bonded to its face. State the name of the process used to bond the plastic to the card. [1]</p> <p><i>Only acceptable answer – Lamination / Laminated</i></p>		AO4 1a [1]	1
(ii)			<p>Give <b>one</b> reason why the card has the plastic bonded to its face. [1]</p> <p><i>Only acceptable answers – Make the face stiffer / provide the metallic finish</i></p>		AO4 1b [1] AO4 2C [1]	1
(iii)			<p>Die cutting was the finishing process used to create the holes in the business card. Describe the process of die cutting as a finishing technique. [2]</p> <p>Appropriate answer with appropriate detail: <i>Can be awarded 2 marks</i> E.g. Die cutting is when parts of a products surface area is removed when a metal template called a die is pushed through the surface of the material under high pressure. Leaving carefully placed holes in the surface.</p> <p>Appropriate answer lacking detail: <i>Can be awarded 1 mark</i> E.g. Parts of the product are removed from the surface creating holes.</p>		AO4 2b [2]	2
(iv)			<p>The illustration below shows quality control markings on a business card printing plate.</p> <p><b>Underline</b> the word given to the process used to put a document into the correct order before printing. [1]</p> <p><i>Only acceptable answer – Imposition</i></p>		AO4 2C [4]	1



Q	Science	Maths	<p style="text-align: center;"><b>Papers and boards</b> Question or outline of question/Marking scheme</p>	AO	Total
(v)			<p>Choose <b>two</b> of the quality control markings from the illustration above and describe their importance to the printing process. <span style="float: right;">2 x [2]</span></p> <p><b>Registration Marks</b> - Registration marks print outside the trim area of printing. They can include bulls-eye targets, crop marks, plate information, etc. These marks allow the printer to accurately align separate letterpress plates for multiple colour print jobs.</p> <p><b>Colour Bars</b> - Colour bars are printed outside the trim area and are used for quality control purposes by the printer. Squares of colour are printed on the area of the page to be trimmed off, which the printing press operator uses to check colour density and consistency is maintained</p> <p><b>Crop Marks</b> - Crop marks, also known as trim marks, are lines printed in the corners of your publication's sheet or sheets of paper to show the printer where to trim the paper. They are used by commercial printers for creating bleeds where an image or colour on the page needs to extend all the way to the edge of the paper.</p> <p>Appropriate answer with appropriate detail: <i>Can be awarded 2 marks</i> E.g. Crop marks are used to trim documents printed on oversized papers, they are used as bleeds, so the colour of document prints right up to the edge of the paper.</p> <p>Appropriate answer lacking detail: <i>Can be awarded 1 mark</i> E.g. Crop marks show where the printer needs to cut the paper to size.</p>		4
(b) (i)			<p>Complete the table to give the correct sizes for a sheet of A3 paper. <span style="float: right;">[2]</span></p> <p>Only acceptable answers – 297mm x 420mm</p>	AO4 1b [1]	2

Q	Science	Maths	<p style="text-align: center;"><b>Papers and boards</b> Question or outline of question/Marking scheme</p>	AO	Total
(ii)			<p>A standard Business card is 55mm x 85mm. Calculate how many business cards could be printed on <b>one</b> A2 sheet of material. <i>Show all workings.</i> [3]</p> <p>Measurements of an A2 sheet = 420 x 594</p> <p> <math>420 \div 85 = 4.94</math>                      or                      <math>594 \div 85 = 6.99</math>  <math>594 \div 55 = 10.8</math>                      <math>420 \div 55 = 7.64</math>  <math>4 \times 10 = 40</math> cards                      <math>6 \times 7 = 42</math> cards                      Answer = 42 cards </p>	AO4 1c [3]	3

Q	Science	Maths	<p style="text-align: center;"><b>Papers and boards</b> Question or outline of question/Marking scheme</p>	AO	Total												
(c)			<p>Analyse the benefits of using natural cards from sustainable sources instead of laminated cards and boards when manufacturing card-based products. [5]</p> <table border="1" data-bbox="506 475 1803 1050"> <thead> <tr> <th colspan="3" data-bbox="506 475 1803 515" style="text-align: center;"><b>AO3 2a 5 marks</b></th> </tr> </thead> <tbody> <tr> <td data-bbox="506 515 658 727"><b>BAND 3</b></td> <td data-bbox="658 515 1713 727">Responses that demonstrate a clear understanding of the environmental impact including difficulties in recycling materials that have another bonded to it under high pressure. Candidates should also mention the cost and impact of recycling the materials, often it will be plastic that has been laminated in a thin film across the surface of the card and this makes the whole material difficult to recycle, meaning the whole material will probably end up in landfill</td> <td data-bbox="1713 515 1803 727" style="text-align: center;">4-5</td> </tr> <tr> <td data-bbox="506 727 658 906"><b>BAND 2</b></td> <td data-bbox="658 727 1713 906">Responses that demonstrate some understanding of the issues surrounding the difficulties in reprocessing materials bonded under high pressure. Mention should be made of the card becoming difficult to recycle and most probably end up in land fill due to the difficulty and cost of the exercise. Responses will not be as detailed as band 3.</td> <td data-bbox="1713 727 1803 906" style="text-align: center;">2-3</td> </tr> <tr> <td data-bbox="506 906 658 1050"><b>BAND 1</b></td> <td data-bbox="658 906 1713 1050">Responses that demonstrate little understanding of the issues surrounding the recycling process. Responses may be very limited in detail showing a lack of real understanding of the reasons why most of the materials will end up in land fill, but responses may reference one of the issues mentioned in band 2 or 3.</td> <td data-bbox="1713 906 1803 1050" style="text-align: center;">1</td> </tr> </tbody> </table> <p>Responses make refer to the points below: Candidate's responses should refer to the fact that the manufacturing of such boards leads to an increase in manufacturing pollution. Often boards are coated with a plastic or other material and component pieces may be manufactured in different parts of the world and brought together to make the board, increasing transportation pollution. The boards are often difficult to recycle and separating them is nearly impossible, making the reprocessing of such materials very difficult and expensive. Products that could have used recycled paper and card then have to use card or paper that is classified as new.</p>	<b>AO3 2a 5 marks</b>			<b>BAND 3</b>	Responses that demonstrate a clear understanding of the environmental impact including difficulties in recycling materials that have another bonded to it under high pressure. Candidates should also mention the cost and impact of recycling the materials, often it will be plastic that has been laminated in a thin film across the surface of the card and this makes the whole material difficult to recycle, meaning the whole material will probably end up in landfill	4-5	<b>BAND 2</b>	Responses that demonstrate some understanding of the issues surrounding the difficulties in reprocessing materials bonded under high pressure. Mention should be made of the card becoming difficult to recycle and most probably end up in land fill due to the difficulty and cost of the exercise. Responses will not be as detailed as band 3.	2-3	<b>BAND 1</b>	Responses that demonstrate little understanding of the issues surrounding the recycling process. Responses may be very limited in detail showing a lack of real understanding of the reasons why most of the materials will end up in land fill, but responses may reference one of the issues mentioned in band 2 or 3.	1	AO3 2a [5]	5
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Q	Science	Maths	<p style="text-align: center;"><b>Papers and boards</b> Question or outline of question/Marking scheme</p>	AO	Total												
(d)			<p>Environmental concerns have meant recycled papers and boards are being used to manufacture products that traditionally have used plastic.</p> <p>Evaluate the disadvantages of this shift in manufacturing practice. [6]</p> <table border="1" data-bbox="506 533 1805 1023"> <thead> <tr> <th colspan="3" data-bbox="506 533 1805 571" style="text-align: center;"><b>AO3 2a 6 marks</b></th> </tr> </thead> <tbody> <tr> <td data-bbox="506 571 658 746"><b>BAND 3</b></td> <td data-bbox="658 571 1711 746">Responses that demonstrate a clear understanding that the cards and boards are being used primarily for the sustainable issues raised. Candidates should also detail that these materials will not have the same working properties as plastics. Reference should also be made about the cost of improving the characteristics of such properties.</td> <td data-bbox="1711 571 1805 746" style="text-align: center;">5-6</td> </tr> <tr> <td data-bbox="506 746 658 884"><b>BAND 2</b></td> <td data-bbox="658 746 1711 884">Responses that demonstrate some understanding of the disadvantages of trying to use papers and boards in place of other materials. Candidates will reference more than one of the issues mentioned in the guidance, but responses will not be as detailed as band 3.</td> <td data-bbox="1711 746 1805 884" style="text-align: center;">2-4</td> </tr> <tr> <td data-bbox="506 884 658 1023"><b>BAND 1</b></td> <td data-bbox="658 884 1711 1023">Responses that demonstrate little understanding of the issues and may be very limited in detail showing a lack of real understanding of the disadvantages of using boards and cards instead of using plastics. Responses will reference one of the issues mentioned in band 2 or 3 but will lack detail.</td> <td data-bbox="1711 884 1805 1023" style="text-align: center;">1</td> </tr> </tbody> </table> <p>Responses make refer to the points below. The materials that paper and card often replaces are normally cheaper to produce and can be manufactured to suit a specific need. Often papers and boards don't share the same material characteristics as the materials they are replacing so can be less strong or sturdy, and often need to be produced as a composite to gain some of the characteristics of the materials they are trying to replace thus becoming more difficult to dispose of and more expensive than the original material. However, regulations still along them to be branded as 'greener'.</p> <p><i>Credit any other appropriate response.</i></p>	<b>AO3 2a 6 marks</b>			<b>BAND 3</b>	Responses that demonstrate a clear understanding that the cards and boards are being used primarily for the sustainable issues raised. Candidates should also detail that these materials will not have the same working properties as plastics. Reference should also be made about the cost of improving the characteristics of such properties.	5-6	<b>BAND 2</b>	Responses that demonstrate some understanding of the disadvantages of trying to use papers and boards in place of other materials. Candidates will reference more than one of the issues mentioned in the guidance, but responses will not be as detailed as band 3.	2-4	<b>BAND 1</b>	Responses that demonstrate little understanding of the issues and may be very limited in detail showing a lack of real understanding of the disadvantages of using boards and cards instead of using plastics. Responses will reference one of the issues mentioned in band 2 or 3 but will lack detail.	1	AO3 2b [6]	6
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Q	Science	Maths	<p style="text-align: center;"><b>Natural and manufactured timber</b> Question or outline question / Marking scheme</p>	AO	Total
6. (a) (i)			<p>The picture below is of an oak veneered desk.</p> <p>State a surface finish that could be applied to the oak parts of the desk. [1]</p> <p><i>Acceptable answers for finish of the oak parts of the desk: wax, Danish oil, varnish. Accept trade names such as bri-wax.</i></p>	AO4 1a [1]	1
(ii)			<p>Give <b>one</b> advantage of using oak veneered manufactured board for the top of the desk instead of solid oak. [1]</p> <p>1 mark for one reason.</p> <p><i>Acceptable answers based on:</i></p> <ul style="list-style-type: none"> <li>• Veneer on top of a man-made board is cheaper than solid oak.</li> <li>• Veneer can be available in wider sections to avoid too many joins.</li> <li>• Veneered boards are lighter than solid wood planks.</li> <li>• Veneered boards can be more structurally stable than solid oak.</li> </ul> <p><i>Credit any other suitable response.</i></p>	AO4 1b [1]	1

Q	Science	Maths	<p style="text-align: center;"><b>Natural and manufactured timber</b> Question or outline question / Marking scheme</p>	AO	Total
(iii)	✓		<p>Spray painting a high gloss paint finish onto the drawer fronts will increase the lustre and aesthetic qualities of wood. Describe the process of spray painting gloss paint as a finish on the drawer fronts. [2]</p> <p>Responses should describe the main process of spray painting:</p> <ul style="list-style-type: none"> <li>• Surfaces should be sanded and clean.</li> <li>• Primer sealer is sprayed onto the drawer fronts. H&amp;S wear a mask/ventilation.</li> <li>• Gloss coats added and built up to final finish.</li> </ul>	AO4 2b [2]	2
(iv)			<p>The fitting shown below is used to assemble the drawers.</p> <p>State the name of the fitting used. [1]</p> <p>Correct answer: Cam fitting / it could also be a knock-down cam fitting.</p>	AO4 1c [1] AO4 2c [4]	5
(v)			<p>The frame of the desk is constructed using a mortise and tenon joint. Sketch a mortise and tenon joint and label its features.</p> <p>Up to 2 marks for a reasonable sketch that looks like the joint.</p> <p>1 mark each for correctly labelling each – mortise, tenon.</p> <p>1 mark for a key feature: stopped joint, haunches, greater surface area increases strength of the joint, sawn surfaces increase better cohesion of the joint.</p>		4

Q	Science	Maths	<p style="text-align: center;"><b>Natural and manufactured timber</b> Question or outline question / Marking scheme</p>	AO	Total
(b) (i)		5	<p>The desk drawers have tapered handles fitted to each drawer front.</p> <p>How many handles would need to be manufactured if an order was made for 20 desks? <i>Show all working.</i> [2]</p> <p>Calculate how many desk handles are required for a batch order of 20 desks.  <i>3 handles required for each desk</i>  <i>20 desks in batch</i>  <i>20 x 3 = <u>60 handles</u></i></p>		2
(ii)			<p>The manufacturer of the desk wants to inlay a circular plastic veneer as a mouse mat. Calculate the total area in cm<sup>2</sup> of veneer required for <b>one</b> mouse mat, and the total area for a batch of 12. [3]</p> <p>Area of a circle = <math>A = \pi r^2</math></p> <p>21cm/2 = 10.5cm = radius  = 3.142 x 10.5 cm<sup>2</sup> (1)  = 3.142 x 110.25 = 346.41 cm<sup>2</sup></p> <p>Total for a batch of 12 = 12 x 346.41 cm<sup>2</sup> = 4156.92 cm<sup>2</sup> (1)  Accept answers from 4156 – 4157 cm<sup>2</sup>. Note Allowances must be made for students using technical calculators and the value of <math>\pi</math>.</p>		3

(c)		<p>Modern furniture products are often made from man-made boards.</p> <p>Analyse the benefits of using man-made boards instead of natural solid woods when manufacturing furniture products. [5]</p> <p><b>Band descriptors and mark allocations</b></p> <table border="1" data-bbox="506 440 1805 927"> <thead> <tr> <th colspan="3" data-bbox="506 440 1805 483"><b>AO3 2a 5 marks</b></th> </tr> </thead> <tbody> <tr> <td data-bbox="506 483 667 628"><b>BAND 3</b></td> <td data-bbox="667 483 1715 628">A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the benefits of using man-made boards over natural solid woods. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td> <td data-bbox="1715 483 1805 628"><b>4-5</b></td> </tr> <tr> <td data-bbox="506 628 667 774"><b>BAND 2</b></td> <td data-bbox="667 628 1715 774">Answer has some coherence, demonstrating partial knowledge and understanding to analyse the benefits of using man-made boards over natural solid woods. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td> <td data-bbox="1715 628 1805 774"><b>2-3</b></td> </tr> <tr> <td data-bbox="506 774 667 884"><b>BAND 1</b></td> <td data-bbox="667 774 1715 884">Answer demonstrates only basic knowledge and understanding, to analyse the benefits of using man-made boards over natural solid woods. There will be limited evidence of relevant examples or a logical chain of reasoning.</td> <td data-bbox="1715 774 1805 884"><b>1</b></td> </tr> <tr> <td colspan="3" data-bbox="506 884 1805 927">Award 0 marks for incorrect or irrelevant answers</td> </tr> </tbody> </table> <p><i>Benefits of using manmade boards:</i></p> <ul data-bbox="506 1034 1776 1313" style="list-style-type: none"> <li>• Available in larger sheets.</li> <li>• Less likely to twist and warp out of shape.</li> <li>• Cheaper to buy so products can be manufactured at a cheaper cost.</li> <li>• Eco-friendlier as it uses less solid wood to make.</li> <li>• Less absorbent when finish is added so can be sealed to add finishes.</li> <li>• Available with smooth finishes with no grain which makes it easier to paint and achieve a good finish.</li> <li>• Available with textured painted finishes</li> </ul> <p><i>Credit any other appropriate response.</i></p>	<b>AO3 2a 5 marks</b>			<b>BAND 3</b>	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the benefits of using man-made boards over natural solid woods. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.	<b>4-5</b>	<b>BAND 2</b>	Answer has some coherence, demonstrating partial knowledge and understanding to analyse the benefits of using man-made boards over natural solid woods. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.	<b>2-3</b>	<b>BAND 1</b>	Answer demonstrates only basic knowledge and understanding, to analyse the benefits of using man-made boards over natural solid woods. There will be limited evidence of relevant examples or a logical chain of reasoning.	<b>1</b>	Award 0 marks for incorrect or irrelevant answers			AO3 2a [5]	5
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			<ul style="list-style-type: none"> <li>• Best known for his commissioned work as a designer for Italian homeware manufacturer Alessi and the lighting company FLOS</li> <li>• Success came from the aluminium lemon squeezer known as 'Juicy Salif' which combined function with aesthetics. The design was inspired from the shape of a squid.</li> <li>• Renowned for using materials that are not associated with functional products by working with manufacturers to overcome manufacturing problems.</li> <li>• An example is the 'Louis Ghost' chair injection moulding polycarbonate to produce the product with no fixings or fittings.</li> <li>• Transparent plastic – a cheap material used normally for disposable products - was used to produce high end pieces of furniture.</li> <li>• Democratic design philosophies meant that he designed for the mass market which led him to mass-produced consumer goods rather than one-off pieces, seeking ways to reduce cost and improve quality in mass market goods.</li> <li>• A modern-day maverick, not happy in being involved in one area of industry, became world respected designer with many of his ideas and collections of products being shown in design museums across the globe.</li> <li>• He changes visual perceptions and plays with materials. With his vision of a better world.</li> <li>• His creations harbour a responsibility for society and the environment.</li> <li>• His goal is to improve as many people's lives as possible.</li> <li>• He is involved in what we would now say as classics such as: Plastic ghost Chair, Passion chair, Juicy Salif Lemon squeezer, Modern alternative toothbrush, Ara table lamp, Berta kettle</li> <li>• Controversial designs include the building known as 'Asahi Beer Hall' in Tokyo, one of Tokyo's more recognisable buildings.</li> </ul> <p><i>Credit any other appropriate response.</i></p>		

Q	Science	Maths	<b>Ferrous and Non-Ferrous Metals</b> Question or outline question / Marking scheme	AO	Total
6. (a) (i)			<p>The picture below shows a glass shelf clamp bracket manufactured from brass with a chrome plated finish.</p> <p>State why a chrome plated finish has been applied to the glass shelf clamp bracket. [1]</p> <p><i>Acceptable answers:</i></p> <ul style="list-style-type: none"> <li>• To protect the clamp from moisture which will cause corrosion.</li> <li>• To enhance the aesthetics of the clamp with a shiny silver chrome finish.</li> <li>• Allows the clamp to be cleaned easily.</li> <li>• It makes the surface harder and is less likely to get damaged in any way.</li> </ul>	AO4 1a [1]	1
(ii)	✓		<p>State a manufacturing process used to create the glass shelf clamp bracket. [1]</p> <p><i>Acceptable answer:</i></p> <ul style="list-style-type: none"> <li>• Casting</li> <li>• Compression moulding</li> </ul> <p><i>Credit any other appropriate response.</i></p>	AO4 1b [1]	1
(iii)			<p>Describe the term alloy. [2]</p> <p><i>Responses:</i></p> <ul style="list-style-type: none"> <li>• An alloy is a mixture of at least two different metals that are mixed together to change the working properties of a material to make it suit a purpose or use. Brass is made up of a mixture of copper zinc and lead.</li> </ul> <p><i>Credit any other appropriate response.</i></p>	AO4 2b [2]	2

Q	Science	Maths	<p style="text-align: center;"><b>Ferrous and Non-Ferrous Metals</b> Question or outline question / Marking scheme</p>	AO	Total
(iv)			<p>The dimension drawing below is used to aid in the manufacture of the glass shelf clamp bracket.</p> <p>State the correct name of the type of drawing used. [1]</p> <p>First Angle Orthographic Drawing.</p> <p>The standard commonly used in the UK and in schools is third angle orthographic accept this answer.</p>	AO4 2c [5]	5
(v)			<p>Choose <b>two</b> drawing details from the working drawing of the shelf clamp bracket above and describe their function. [2] x2</p> <p>Responses must name the feature and describe its use in the product.</p> <ol style="list-style-type: none"> <li>1. Feature: Centre line. Use: when the Centre is crossed by another it indicates the position of the hole in the clamp.</li> <li>2. Feature: Hole Diameter Use: Indicates how big a hole is for the product to be secured to the wall or surface.</li> <li>3. Feature: Hidden detail line. Use: Indicates the hole below the surface.</li> <li>4. Feature: Dimension lines. Use: the sizes of components.</li> </ol> <p>Award 1 mark for each feature and 1 mark for each use.</p>		

Q	Science	Maths	<p style="text-align: center;"><b>Ferrous and Non-Ferrous Metals</b> Question or outline question / Marking scheme</p>	AO	Total
(b) (i)		✓	<p>The image below shows the template for the rubber insert on the inside of the shelf clamp bracket. Calculate the area of material required to make the rubber inserts, if an order of 100 shelf clamp brackets was placed.</p> <p><i>(Show all workings).</i> [2]</p> <p>40 x 70 mm = 2800 mm<sup>2</sup> 2800 mm x 100 = 280,000 mm<sup>2</sup></p>	AO4 1c [2] AO4 1b [3]	5
(ii)			<p>The image below shows the pattern for a semicircular glass shelf.</p> <p>Calculate the total area in cm<sup>2</sup> of glass required for <b>one</b> shelf, and the total for a batch of 12. <i>(Show all workings)</i> [3]</p> <p>Size of Shelf diameter = 40cm Radius of shelf is 40cm / 2 = 20cm</p> <p><i>Area of a circle is Pie r<sup>2</sup> / Pie x r x r</i> 3.142 x 20 x 20 = 1256.8 cm<sup>2</sup> Semi-circular shelf = divide area / 2 1256.8 / 2 = 628.4cm<sup>2</sup></p> <p>Answer 628 cm<sup>2</sup> 628.4 x 12 (Batch of 12 shelves) = 7540.80 cm<sup>2</sup></p>		

Q	Science	Maths	<p style="text-align: center;"><b>Ferrous and Non-Ferrous Metals</b> Question or outline question / Marking scheme</p>	AO	Total															
(c)			<p>Many products in the home are made from non-ferrous metals. Analyse the benefits of using non-ferrous metals when manufacturing bathroom fittings/products.[5]</p> <p><b>Band descriptors and mark allocations</b></p> <table border="1" data-bbox="504 539 1809 1129"> <thead> <tr> <th colspan="3" data-bbox="504 539 1809 582" style="text-align: center;"><b>AO3 2a 5 marks</b></th> </tr> </thead> <tbody> <tr> <td data-bbox="504 582 660 762"><b>BAND 3</b></td> <td data-bbox="660 582 1713 762">A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the advantages of using non-ferrous metals when manufacturing bathroom fittings/products. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td> <td data-bbox="1713 582 1809 762" style="text-align: center;">4-5</td> </tr> <tr> <td data-bbox="504 762 660 943"><b>BAND 2</b></td> <td data-bbox="660 762 1713 943">Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the advantages of using non-ferrous metals when manufacturing bathroom fittings/products. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td> <td data-bbox="1713 762 1809 943" style="text-align: center;">2-3</td> </tr> <tr> <td data-bbox="504 943 660 1086"><b>BAND 1</b></td> <td data-bbox="660 943 1713 1086">Answer demonstrates only basic knowledge and understanding, to analyse the advantages of using non-ferrous metals when manufacturing bathroom fittings/products. There will be limited relevant examples or a logical chain of reasoning.</td> <td data-bbox="1713 943 1809 1086" style="text-align: center;">1</td> </tr> <tr> <td data-bbox="504 1086 660 1129"></td> <td data-bbox="660 1086 1713 1129">Award 0 marks for incorrect or irrelevant answers.</td> <td data-bbox="1713 1086 1809 1129" style="text-align: center;">0</td> </tr> </tbody> </table> <p><b>Indicative content:</b></p> <p>This content is not prescriptive, and the candidates are not expected to refer to all the non-ferrous metals identified below.</p>	<b>AO3 2a 5 marks</b>			<b>BAND 3</b>	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the advantages of using non-ferrous metals when manufacturing bathroom fittings/products. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.	4-5	<b>BAND 2</b>	Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the advantages of using non-ferrous metals when manufacturing bathroom fittings/products. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.	2-3	<b>BAND 1</b>	Answer demonstrates only basic knowledge and understanding, to analyse the advantages of using non-ferrous metals when manufacturing bathroom fittings/products. There will be limited relevant examples or a logical chain of reasoning.	1		Award 0 marks for incorrect or irrelevant answers.	0	AO3 2a [5]	5
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Q	Science	Maths	<p style="text-align: center;"><b>Ferrous and Non-Ferrous Metals</b> Question or outline question / Marking scheme</p>	AO	Total
			<ul style="list-style-type: none"> <li>• Advantages of using non-ferrous alloys is that they can be chrome plated or brass plated to suit customer needs or preference.</li> <li>• Non-ferrous alloy can be tailored/formed to the needs of the use of the product. E.g. taps and shower fittings.</li> <li>• Non-ferrous metals have good resistance to wear and tear</li> <li>• Natural metals in their raw state would be unsuitable as their properties would not suit the intended purpose. Although we say copper or Aluminium fittings, we really are saying Copper alloys or Aluminium alloys fittings.</li> <li>• Non-ferrous metals are less likely to corrode and sometimes do not require and special protective finish.- particularly in the bathroom where there is a higher percentage of water in the atmosphere.</li> <li>• Non-ferrous metals are malleable and ideal for complex shaped fittings found in the bathroom environment</li> </ul> <p><i>Credit any other appropriate responses given.</i></p>		

Q	Science	Maths	<p align="center"><b>Ferrous and Non-Ferrous Metals</b> Question or outline question / Marking scheme</p>	AO	Total															
(d)			<p>Evaluate the impact James Dyson has had on the product design industry. [6]</p> <table border="1" data-bbox="506 440 1796 994"> <thead> <tr> <th colspan="3" data-bbox="506 440 1796 483"><b>AO3 2a 5 marks</b></th> </tr> </thead> <tbody> <tr> <td data-bbox="506 483 658 627"><b>BAND 3</b></td> <td data-bbox="658 483 1666 627">A coherent answer demonstrating detailed, relevant knowledge and understanding, to the impact James Dyson has had on the Product Design industry. There will be evidence of relevant examples and a well-developed substantiated judgment in a response that is logically structured.</td> <td data-bbox="1666 483 1796 627">5-6</td> </tr> <tr> <td data-bbox="506 627 658 807"><b>BAND 2</b></td> <td data-bbox="658 627 1666 807">Answer has some coherence, demonstrating partial knowledge and understanding, to the impact <b>James Dyson</b> has had on the Product Design industry. There will be some evidence of mostly relevant examples and partly substantiated judgments in a response that is generally structured.</td> <td data-bbox="1666 627 1796 807">3-4</td> </tr> <tr> <td data-bbox="506 807 658 951"><b>BAND 1</b></td> <td data-bbox="658 807 1666 951">Answer demonstrates only basic knowledge and understanding, to the impact James Dyson has had on the Product Design industry. There will be limited evidence of relevant examples or judgments in a response that demonstrates little structure.</td> <td data-bbox="1666 807 1796 951">1-2</td> </tr> <tr> <td data-bbox="506 951 658 994"></td> <td data-bbox="658 951 1666 994">Award 0 marks for incorrect or irrelevant answers.</td> <td data-bbox="1666 951 1796 994">0</td> </tr> </tbody> </table> <p><b>Indicative content:</b></p> <p>Main Features:</p> <ul data-bbox="506 1134 1776 1337" style="list-style-type: none"> <li>• Unique products in the marketplace today; transparent and bright coloured plastic a trademark of his work.</li> <li>• Dyson is not afraid to develop an existing/traditional idea or product and look at it from a different angle.</li> <li>• He designs products that already exist but improves performance by applying engineering principles.</li> </ul>	<b>AO3 2a 5 marks</b>			<b>BAND 3</b>	A coherent answer demonstrating detailed, relevant knowledge and understanding, to the impact James Dyson has had on the Product Design industry. There will be evidence of relevant examples and a well-developed substantiated judgment in a response that is logically structured.	5-6	<b>BAND 2</b>	Answer has some coherence, demonstrating partial knowledge and understanding, to the impact <b>James Dyson</b> has had on the Product Design industry. There will be some evidence of mostly relevant examples and partly substantiated judgments in a response that is generally structured.	3-4	<b>BAND 1</b>	Answer demonstrates only basic knowledge and understanding, to the impact James Dyson has had on the Product Design industry. There will be limited evidence of relevant examples or judgments in a response that demonstrates little structure.	1-2		Award 0 marks for incorrect or irrelevant answers.	0	AO3 2b [6]	6
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			<ul style="list-style-type: none"> <li>• Producing many, many design ideas and prototypes using a collaborative approach with designers and engineers.</li> <li>• Product's 'technology/engineering' is not hidden from user.</li> <li>• Innovations that have had an impact on the design industry.</li> <li>• All products go through extensive testing to ensure functionality.</li> <li>• Cyclone vacuum technology (based on a cyclonic extractor seen at a timber yard which collected wood dust).</li> <li>• Bagless vacuum cleaner to prevent poor suction/being less effective as found with vacuum cleaners that collect dust into a bag.</li> <li>• Ball wheelbarrow is all-terrain and spread load by using a ball that does not dig into the ground like a conventional wheel and steering is much easier.</li> <li>• The Dyson Air blade dries hands in just 10 seconds and uses around 80% less electricity than conventional hand dryers. It is different from other conventional hand dryers because, instead of using a wide jet of heated air, it uses a sheet of unheated air traveling at 400 miles per hour.</li> <li>• Bladeless fans</li> <li>• Supersonic Hair dryer with the motor in the handle.</li> <li>• Washing machine – twin drum – reduced washing cycle considerably. The design wasn't successful, very expensive and purple/yellow plastics as aesthetic put consumer off who are used to selecting white 'goods'.</li> <li>• Dyson supports design education through awards and scholarships.</li> </ul> <p><i>Credit any other suitable response.</i></p>		

Q	Science	Maths	Thermosetting and thermoforming plastics Question or outline of question/Marking scheme	AO	Total
6. (a) (i)			<p>The images below show a game controller for a games console. The main body of the game controller has been manufactured using HDPE (High Density Polyethylene) plastic. State the group of plastics to which HDPE belongs. [1]</p> <p><i>Only acceptable answer - thermoplastics</i></p>	AO4 1a [1]	1
(ii)			<p>State the manufacturing process used to produce the main body of the game controller. [1]</p> <p>Only acceptable answers – press moulding / injection moulding</p>	AO4 1b [1] AO4 2C [1]	1
(iii)			<p>Describe a property of HDPE that makes it a suitable material to use in the manufacture of the game controller [2]</p> <p>Responses must include reference to strength and rigidity, impact resistance, low heat conductivity, available in different colours</p> <p>Appropriate answer with appropriate detail: <i>Can be awarded 2 marks</i> E.g. HDPE is a strong and rigid plastic that withstands breaking and cracking when dropped due to its high impact resistance and rigidity</p> <p>Appropriate answer lacking detail: <i>Can be awarded 1 mark</i> E.g. HDPE is suitable because it doesn't break when it is dropped.</p>	AO4 2b [2]	2
(iv)			<p>The image below shows the game controller's joystick. The tip of the joystick has a soft rubberised tip for grip. State the name of the process used to create the rubberised finish on the joystick.</p> <p>Dip coating or plastic coating.</p>		1

(v)		<p>Describe the process used to achieve the rubberised finish on the joystick. [4]</p> <p>Responses that demonstrate a clear understanding of how products are dip coated in a mass/batch production setting <b>4 marks. (Written communication should be excellent).</b></p> <p>Responses that demonstrate some understanding of how products can be dip coated on a large scale can be awarded <b>3 marks. (Written communication should be good).</b></p> <p>Responses that demonstrate little understanding of how products can be dip coated on a large scale can be awarded <b>2 mark. (Written communication will be limited and answers basic).</b></p> <p>Responses that demonstrate little understanding of how products can be dip coated. <b>1 mark (Basic answer with poor communication).</b></p> <p>Appropriate answer with appropriate detail: Can be awarded 4 marks E.g. Thermoplastic coating material is ground into a fine powder and kept in a steel box (Fluid / liquid Bed) open at the top and with a fine gauze across the bottom, fine enough not to let the powder particles through. Air is then introduced up through the gauze which makes the powder particles rise and act like a box of liquid, the pre-heated parts are then dipped on mass for a specified time the powder melts to the component evenly. The products are then removed and left to cool.</p> <p>Appropriate answer with appropriate detail: Can be awarded 3 marks E.g. Thermoplastic coating material is ground into a fine powder and kept in a steel box (Fluid / liquid Bed) open at the top and with a fine gauze across the bottom, fine enough not to let the powder particles through. Air is then introduced up through the gauze which makes the powder particles rise and act like a box of liquid, the pre-heated parts are then dipped on mass, the powder melts to the component evenly.</p> <p>Appropriate answer lacking detail: Can be awarded 3 mark E.g. Thermoplastic powder is kept in a container and air is added to make it behave like a liquid. The parts and components that require the coating are then heated and dipped into the plastic powder.</p> <p>Appropriate answer lacking most detail: Can be awarded 1 mark E.g. hot parts of a product are dipped into a thermoplastic powder.</p>	AO4 2C [4]	3
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Q	Science	Maths	<b>Thermosetting and thermoforming plastics</b> Question or outline of question/Marking scheme	AO	Total
(b) (i)			Calculate the total number of joysticks needed to make 44 game controllers. <i>Show all workings.</i>  $2 \times 44 = 88$	AO4 1b [2]	2
(ii)			A circular logo of 12mm diameter is to be formed on the tip of the joystick. Calculate the area of the circular logo.  <i>Area of a circle is <math>\text{Pie} \times r^2 / \text{Pie} \times r \times r</math></i> $3.142 \times 0.6 \times 0.6 = 1.13\text{cm}^2$ Note Allowances must be made for students using technical calculators and the value of $\pi$ .	AO4 1b [2] AO4 1c [2]	3

Q	Science	Maths	<p align="center"><b>Thermosetting and thermoforming plastics</b> Question or outline of question/Marking scheme</p>	AO	Total															
(c)			<p>Analyse the benefits of using natural plastics instead of synthetic plastics. [5]</p> <p><b>Band descriptors and mark allocations</b></p> <table border="1" data-bbox="504 499 1807 967"> <thead> <tr> <th colspan="3" data-bbox="504 499 1807 544">AO3 2a 5 marks</th> </tr> </thead> <tbody> <tr> <td data-bbox="504 544 665 683"><b>BAND 3</b></td> <td data-bbox="665 544 1713 683">A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the benefits of using natural plastics instead of synthetic plastics There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td> <td data-bbox="1713 544 1807 683"><b>4-5</b></td> </tr> <tr> <td data-bbox="504 683 665 821"><b>BAND 2</b></td> <td data-bbox="665 683 1713 821">Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the benefits of using natural plastics instead of synthetic plastics There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td> <td data-bbox="1713 683 1807 821"><b>2-3</b></td> </tr> <tr> <td data-bbox="504 821 665 927"><b>BAND 1</b></td> <td data-bbox="665 821 1713 927">Answer demonstrates only basic knowledge and understanding, to analyse the benefits of using natural plastics instead of synthetic plastics. There will be limited evidence of relevant examples or a logical chain of reasoning.</td> <td data-bbox="1713 821 1807 927"><b>1</b></td> </tr> <tr> <td colspan="3" data-bbox="504 927 1807 967">Award 0 marks for incorrect or irrelevant answers</td> </tr> </tbody> </table> <p><b>Indicative content</b> This content is not prescriptive, and candidates are not expected to refer to all the factors identified in the table below.</p> <p><b>Natural plastics are easy to recycle.</b>- These types of plastics not only take less time to decompose when discarded but can also be easily recycled through an organic process. They are also non-toxic since they have no chemicals or toxins. Recycling helps to lessen landfill problems and besides, the recycled bio-waste can be used as compost or as renewable energy for biogas.</p> <p><b>They consume less energy.</b>- Less energy is needed in the manufacturing of biodegradable plastics compared to ordinary plastics. Manufacturing natural plastics also do not require the process of finding, accessing, and transportation of hydrocarbons. This means fewer fuel fossils will be in use hence,</p>	AO3 2a 5 marks			<b>BAND 3</b>	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the benefits of using natural plastics instead of synthetic plastics There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.	<b>4-5</b>	<b>BAND 2</b>	Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the benefits of using natural plastics instead of synthetic plastics There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.	<b>2-3</b>	<b>BAND 1</b>	Answer demonstrates only basic knowledge and understanding, to analyse the benefits of using natural plastics instead of synthetic plastics. There will be limited evidence of relevant examples or a logical chain of reasoning.	<b>1</b>	Award 0 marks for incorrect or irrelevant answers			AO3 2a [5]	5
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Q	Science	Maths	<p style="text-align: center;"><b>Thermosetting and thermoforming plastics</b> Question or outline of question/Marking scheme</p>	AO	Total
			<p>reduction of environmental pollution. Also, it produces 68% fewer greenhouse gases during its manufacture, posing a significant environmental benefit.</p> <p><b>Management of waste reduction.</b> - Natural plastics break down only in a period of a few months. Other types of traditional plastic constitute 13 percent of the waste stream that is 32 million tons of trash annually, and only 9 percent of this type of plastic can be recycled. Natural plastics are a better choice as they are broken easily, and can be absorbed by the soil or converted into compost. Moreover, even if a complete breakdown does not occur, it is easy to achieve a reduction in the amount of space required to dispose of the globe's plastic waste.</p> <p><b>Lower petroleum consumption.</b> - Natural plastics use the idea of natural products; therefore, the use of bioplastic can profoundly reduce the amount of petroleum used and consequently lessen its environmental hazards.</p> <p><b>Composability</b>-Composting of natural plastics can make the <u>soil fertile</u>, thereby enhancing soil fertility. The reason for this is because plastic is not made using artificial chemicals but from natural materials. The materials decay improves the soil's water and nutrient retention and helps in the growth of healthier plants with no need for pesticides and chemical fertilizers.</p> <p><b>Reduction of carbon dioxide levels and greenhouse gases.</b> - The production of plastics has increased significantly over the years. Scientists have approximated that by the year 2050, there could be more plastics in the ocean than fish. The use of biodegradable plastic products instead of traditional plastics lessens the amount of greenhouse gas emissions. Research states that plastic products harm the landfills as they produce an intoxicating greenhouse gas when burnt. Switching to bioplastics can profoundly reduce the number of greenhouse gasses emitted.</p> <p><b>Biodegradable plastics products do not release harmful products upon decomposing.</b>-Discarding traditional plastics can also mean releasing methane, toxic chemicals, and other types of pollutants to the environment. These substances are upon breaking down, are potentially dangerous as they can easily harm marine and terrestrial ecosystems, and human overall health as well.</p>		

Q	Science	Maths	<b>Thermosetting and thermoforming plastics</b> Question or outline of question/Marking scheme	AO	Total															
(d)			<p>Evaluate how Apple are changing the way they use plastics in the manufacture of their products. [6]</p> <p><b>Band descriptors and mark allocations</b></p> <table border="1" data-bbox="504 507 1805 1098"> <thead> <tr> <th colspan="3" data-bbox="504 507 1805 550"><b>AO3 2b 6 marks</b></th> </tr> </thead> <tbody> <tr> <td data-bbox="504 550 667 727"><b>BAND 3</b></td> <td data-bbox="667 550 1700 727">A coherent answer demonstrating detailed, relevant knowledge and understanding, to evaluate how Apple are changing the way they use plastics in the manufacture of their products. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.</td> <td data-bbox="1700 550 1805 727"><b>5-6</b></td> </tr> <tr> <td data-bbox="504 727 667 904"><b>BAND 2</b></td> <td data-bbox="667 727 1700 904">Answer has some coherence, demonstrating partial knowledge and understanding, to evaluate how Apple are changing the way they use plastics in the manufacture of their products There will be some evidence of mostly relevant examples and partly substantiated judgements in a response which is generally well structured.</td> <td data-bbox="1700 727 1805 904"><b>3-4</b></td> </tr> <tr> <td data-bbox="504 904 667 1050"><b>BAND 1</b></td> <td data-bbox="667 904 1700 1050">Answer demonstrates only basic knowledge and understanding, to evaluate how Apple are changing the way they use plastics in the manufacture of their products. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.</td> <td data-bbox="1700 904 1805 1050"><b>1-2</b></td> </tr> <tr> <td colspan="3" data-bbox="504 1050 1805 1098">Award 0 marks for incorrect or irrelevant answers</td> </tr> </tbody> </table> <p><b>Indicative content</b></p> <p>This content is not prescriptive, and candidates are not expected to refer to all the factors identified below.</p>	<b>AO3 2b 6 marks</b>			<b>BAND 3</b>	A coherent answer demonstrating detailed, relevant knowledge and understanding, to evaluate how Apple are changing the way they use plastics in the manufacture of their products. There will be evidence of relevant examples and well-developed substantiated judgements in a response which is logically structured.	<b>5-6</b>	<b>BAND 2</b>	Answer has some coherence, demonstrating partial knowledge and understanding, to evaluate how Apple are changing the way they use plastics in the manufacture of their products There will be some evidence of mostly relevant examples and partly substantiated judgements in a response which is generally well structured.	<b>3-4</b>	<b>BAND 1</b>	Answer demonstrates only basic knowledge and understanding, to evaluate how Apple are changing the way they use plastics in the manufacture of their products. There will be limited evidence of relevant examples or judgements in a response which demonstrates little structure.	<b>1-2</b>	Award 0 marks for incorrect or irrelevant answers			AO3 2b [6]	6
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Q	Science	Maths	<b>Thermosetting and thermoforming plastics</b> Question or outline of question/Marking scheme	AO	Total
			<p>Apple are:</p> <ul style="list-style-type: none"> <li>• working to reduce the different forms of materials presently used. aim to one day source only recycled or renewable plastics in their products</li> <li>• also considering the safety of those who make, use, and recycle their products, restricting the use of hundreds of harmful substances often associated with plastics from the Petro-chemical industry.</li> <li>• very keen to preserve our natural environment.to protect people and the environment, transitioning to renewable and recycled plastics as alternatives from fossil fuel-based plastics</li> <li>• considering the use of materials used in packaging aim is to make with recyclable, fibre-based materials working to eliminate plastics or to use natural plastics to increase recycled content</li> <li>• keen to reuse and recycle any form of plastic that is presently used on their products</li> <li>• keen to offer consumers a returns policy when purchasing new products, money off if you bring in your old product</li> <li>• still a world leader and are keen to stay at the top- their specialist research team are looking into ways of recycling and reusing natural plastics and maintain their profile- majority of their products use a specific shade of white plastic</li> </ul> <p><i>Credit any other appropriate response.</i></p>		



Q	Science	Maths	<b>Fibres and textiles</b> Question or outline of question / Marking scheme	AO	Total
6. (a) (i)			<p>The picture below is of a printed dress designed by Matthew Williamson.</p> <p>State the printing method used to produce the patterned fabric. [1]</p> <p><i>Only acceptable answers for printing method:</i> Digital Printing or Screen Printing</p>	AO4 1a [1]	<b>1</b>
(ii)	✓		<p>The fabric used to make the dress was chosen for its high absorbency, handle and lustre. State the fibre used in the construction of the fabric. [1]</p> <p><i>Only acceptable answer for a fibre with high absorbency, handle and lustre:</i> Silk. Accept Tencel (Lyocell) as a microfibre/regenerated fibre.</p>	AO4 1b [1]	<b>1</b>
(iii)			<p>Calendering is a finishing process that increases the lustre and aesthetic qualities of a fabric. Describe the process of calendaring as a finishing technique. [2]</p> <p><i>Responses could be based on:</i></p> <ul style="list-style-type: none"> <li>• Fabric is folded (with face sides together) and stitched together (1)</li> <li>• Fabric is run through pressurised rollers (1) The rollers are heated (1)</li> <li>• The pressure and heat polish the surface of the fabric (1)</li> <li>• Fabric is run through cooling roller after passing through the calender unit (1)</li> </ul> <p><i>Credit any other appropriate response.</i></p>	AO4 2b [2]	<b>2</b>
(iv)			<p>The diagram below is a pattern piece for the dress. It shows four common pattern markings. State the name of the pattern piece shown below. [1]</p> <p><i>Only acceptable answers for pattern piece:</i> Back or Dress Back (accept any answer that refers to the back of the desk)</p>	AO4 2b [1]	<b>1</b>

Q	Science	Maths	<p style="text-align: center;"><b>Fibres and textiles</b> Question or outline of question / Marking scheme</p>	AO	Total
(v)			<p>Choose <b>two</b> pattern markings from the pattern piece above and describe their use in garment construction. <span style="float: right;">2 x [2]</span></p> <p>Marks to be awarded for the description of the pattern markings. A maximum of one mark can be awarded if the description of the pattern markings is incorrect or not given, but <u>both</u> pattern markings have been identified correctly.</p> <ol style="list-style-type: none"> <li>1. Dart A dart is a tapered stitched fold of fabric (1). It is used to give garment shape (1) so the garment can fit the body (1). There are different types of dart, mainly used on women's clothing (1) for example, around the bust line (1) or to fit the waist more closely. (1)</li> <li>2. Lengthen or Shorten Line This pattern marking is usually found on the waistline of a pattern. (1) It allows the pattern to be shortened (1) or lengthened (1) to accommodate different heights of people. (1) The pattern is either folded to shorten it (1) or cut, adding additional length to the pattern by inserting a paper strip. (1)</li> <li>3. Notch(es) A notch(es) are v shaped markings on a pattern piece (1) that are used to align one pattern piece with another. (1) Notches can also be used to reduce seam bulk but cutting V-shapes from the seam allowance. (1)</li> <li>4. Place on Fold Fabric is folded so it is doubled over. (1) The pattern is placed on the fold of the fabric so when cut out you get a symmetrical pattern piece (1) and no seam is required (1). Consideration must be given to any pattern on the fabric too ensure it will be facing the correct way when the garment is assembled (1)</li> </ol> <p><i>Credit any other appropriate response.</i></p>	AO4 2c [4]	<b>4</b>

Q	Science	Maths	<b>Fibres and textiles</b> Question or outline of question / Marking scheme	AO	Total
(b)		5	Matthew Williamson's dress design included flounces sewn to the base of each sleeve.		<b>5</b>
(i)			Calculate how many flounce pattern pieces would need to be cut from fabric if an order of 12 dresses was made. <i>Show all workings.</i> [2]  4 flounces in total (2 per sleeve) (1) x 12 = 48 flounce pattern pieces (1)	AO4 1b [3]	
(ii)			The images below show the pattern piece for a flounce. [3]  The manufacturer of the dress wants to recycle the inner circle of the fabric and use it to make pockets for children's dresses. Calculate the total area in cm <sup>2</sup> of fabric recycled of <b>one</b> flounce. <i>Show all workings.</i>  Area of a circle = $\pi r^2$ The radius is 4 cm $\pi \times 4^2$ $3.14 \times 16 = 50.24 \text{ cm}^2$ (1) Note: Allowances must be made for students using technical calculators and the value of $\pi$ .  <i>Credit any other appropriate response or calculation method.</i>	AO4 1c [2]	

Q	Science	Maths	<p style="text-align: center;"><b>Fibres and textiles</b> Question or outline of question / Marking scheme</p>	AO	Total																
(c)	✓		<p>Many of Matthew Williamson's clothes are made from natural materials.</p> <p>Analyse the benefits of using natural fabrics instead of synthetic fabrics when manufacturing textile products. [5]</p> <p><b>Band descriptors and mark allocations</b></p> <table border="1" data-bbox="506 598 1794 1086"> <thead> <tr> <th colspan="3" data-bbox="506 598 1794 643" style="text-align: center;"><b>AO3 2a 5 marks</b></th> </tr> </thead> <tbody> <tr> <td data-bbox="506 643 667 786" style="text-align: center;"><b>BAND 3</b></td> <td data-bbox="667 643 1700 786">A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the benefits of using natural fabrics over synthetic ones. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.</td> <td data-bbox="1700 643 1794 786" style="text-align: center;"><b>4-5</b></td> </tr> <tr> <td data-bbox="506 786 667 930" style="text-align: center;"><b>BAND 2</b></td> <td data-bbox="667 786 1700 930">Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the benefits of using natural fabrics over synthetic ones. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.</td> <td data-bbox="1700 786 1794 930" style="text-align: center;"><b>2-3</b></td> </tr> <tr> <td data-bbox="506 930 667 1042" style="text-align: center;"><b>BAND 1</b></td> <td data-bbox="667 930 1700 1042">Answer demonstrates only basic knowledge and understanding, to analyse the benefits of using natural fabrics over synthetic ones. There will be limited evidence of relevant examples or a logical chain of reasoning.</td> <td data-bbox="1700 930 1794 1042" style="text-align: center;"><b>1</b></td> </tr> <tr> <td colspan="3" data-bbox="506 1042 1700 1086"></td> <td data-bbox="1700 1042 1794 1086">Award 0 marks for incorrect or irrelevant answers</td> </tr> </tbody> </table>	<b>AO3 2a 5 marks</b>			<b>BAND 3</b>	A coherent answer demonstrating detailed, relevant knowledge and understanding, to analyse the benefits of using natural fabrics over synthetic ones. There will be evidence of relevant examples and a well-developed logical chain of reasoning, sustained throughout.	<b>4-5</b>	<b>BAND 2</b>	Answer has some coherence, demonstrating partial knowledge and understanding, to analyse the benefits of using natural fabrics over synthetic ones. There will be some evidence of mostly relevant examples and a logical chain of reasoning, but this may not be sustained throughout.	<b>2-3</b>	<b>BAND 1</b>	Answer demonstrates only basic knowledge and understanding, to analyse the benefits of using natural fabrics over synthetic ones. There will be limited evidence of relevant examples or a logical chain of reasoning.	<b>1</b>				Award 0 marks for incorrect or irrelevant answers	AO3 2a [5]	<b>5</b>
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			<p><b>Evaluative points</b></p> <p><u>Matthew Williamson:</u></p> <ul style="list-style-type: none"> <li>• Has introduced digital printing</li> <li>• Uses bright, bold colours</li> <li>• Brings a romantic style to his clothes</li> <li>• Produces feminine clothes</li> <li>• Produces wearable clothes</li> <li>• Uses bold patterns and prints</li> <li>• Uses silk – a natural material</li> <li>• Is innovative, he doesn't follow current trends</li> <li>• Decorates using bead and sequin work</li> <li>• Branched out into interior design – selling fabric covered furniture, upholstery fabric and wall paper – influencing the home market</li> <li>• Was part of the collaboration era – designing for H&amp;M and Debenhams</li> </ul> <p><u>However:</u></p> <ul style="list-style-type: none"> <li>• His products are not accessible to the mass market because of price</li> <li>• Has a ready to wear collection but this is too expensive as are his interior products</li> <li>• Products are manufactured abroad</li> <li>• Uses components and processes in manufacture that are not environmentally sustainable</li> </ul> <p><i>Credit any other appropriate response.</i></p>		
				Total	<b>25</b>