

GCSE



WJEC GCSE in
DESIGN AND TECHNOLOGY

APPROVED BY QUALIFICATIONS WALES

**SAMPLE ASSESSMENT
MATERIALS**

Teaching from 2017



This Qualifications Wales regulated qualification is not available to centres in England.



For teaching from 2017
For award from 2019

GCSE DESIGN AND TECHNOLOGY
(PRODUCT DESIGN)

SAMPLE ASSESSMENT
MATERIALS

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Candidate Name	Centre Number					Candidate Number				



GCSE DESIGN AND TECHNOLOGY

UNIT 1

PRODUCT DESIGN

SAMPLE ASSESSMENT MATERIALS

2 hours

ADDITIONAL MATERIALS

In addition to this examination paper, you will need a calculator.

INSTRUCTIONS FOR CANDIDATES

Answer ALL questions.

Write your name, centre number and candidate number in spaces at the top of this page.

Write your answers in the spaces provided in this booklet.

Use black ink or black ball-point pen.

Do not use pencil or gel pen.

Do not use correction fluid.

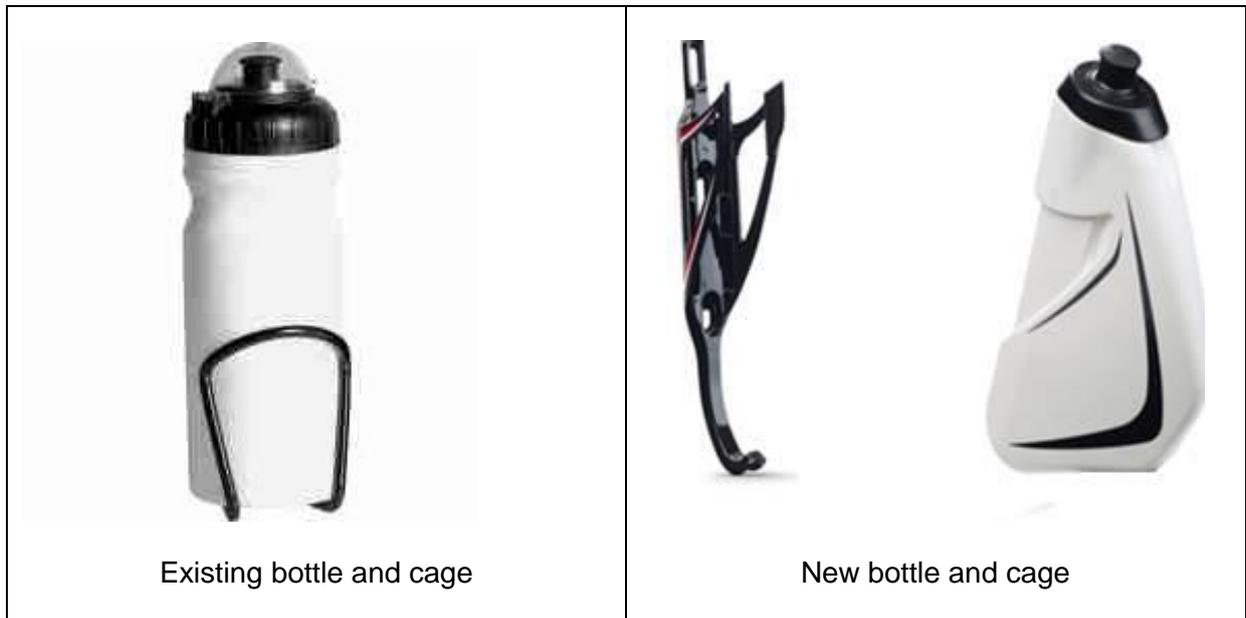
INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part question. You are advised to divide your time accordingly.

The total number of marks available is 100.

You are reminded of the need for good English and orderly, clear presentation in your answers. The quality of your written communication, including appropriate use of punctuation and grammar, will be assessed in your answer to question 4(a).

1. Study the images shown below of a new cycling bottle and cage that has been designed to replace an existing product.



- (a) Identify **two** changes in the new bottle and cage, in comparison with the existing bottle and cage. [2]

First change:

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Second change:

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- (b) When users replace the existing bottle and cage with the new bottle and cage, they should consider sustainability issues carefully.

Explain how users could effectively manage this change. [4]

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- (c) During the development of the new bottle and cage, designers used computer aided design (CAD) to produce iterations of ideas.

Discuss the benefits of using CAD to develop the new bottle and cage. [4]

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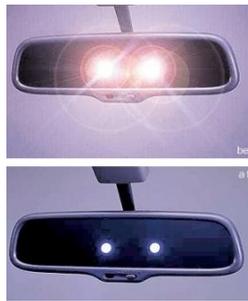
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2. The two images below show a rear view mirror from a car. It includes smart materials and is designed to eliminate the glare from headlights of vehicles travelling behind.



Eliminates glare

- (a) (i) Tick the boxes to show if the following statements about smart materials are true or false. [2]

Smart materials change their properties depending on the environment.

Changes in the properties of smart materials are reversible.

True	False

- (ii) State the name of a suitable smart material that could be used in this rear view mirror and describe how this material functions. [2]

Name of Smart Material:

Function:

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- (b) Fill in the spaces in the sentences below, which describe two different influences on product design.

The design of the mirror has been influenced by 'technology,', where developments in materials enable products to be re-designed. [1]

Other products are sometimes influenced by 'market,', where products are re-designed in response to market forces. [1]

- (c) When designing the adjustable ball joint for the rear view mirror, the designer produced a number of 3D printed models using rapid prototyping as shown below.



Explain **one** advantage and **one** disadvantage to the designer of 3D printing when rapid prototyping the models for the rear view mirror. 2 x [2]

Advantage:
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Disadvantage:
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3. (a) Study the images of renewable energy sources shown below.



Energy Source A



Energy Source B

(i) State the name of Energy Source A and Energy Source B.

Energy Source A:.....

Energy Source B:..... [2]

(ii) Describe how Energy Source A is intended to generate renewable energy. [2]

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(iii) Explain why renewable energy sources are becoming more popular in comparison with named non-renewable sources. [4]

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- (b) Many homes are now fitted with smart energy meters like the one shown below.



- (i) Explain why energy companies are offering to provide homes with smart energy meters free of charge. [2]

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- (ii) Discuss the impact on the consumer of having a smart energy meter fitted. [5]

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4. A concept bicycle lock has been designed to offer a quick release unlocking mechanism when the user scans their fingerprint.



- (a) (i) The bicycle lock is made from steel.
Explain the advantages and disadvantages of making this product out of steel. [5]

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- (ii) The bicycle lock has been dip coated with a thermoplastic powder.
Explain the functional and aesthetic reasons for applying this type of finish to the bicycle lock. [5]

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- (b) Analyse how the fingerprint scanner provides benefits and limitations for users of this bicycle lock. [10]
Marks will be awarded for the content of the answer and the quality of written communication.

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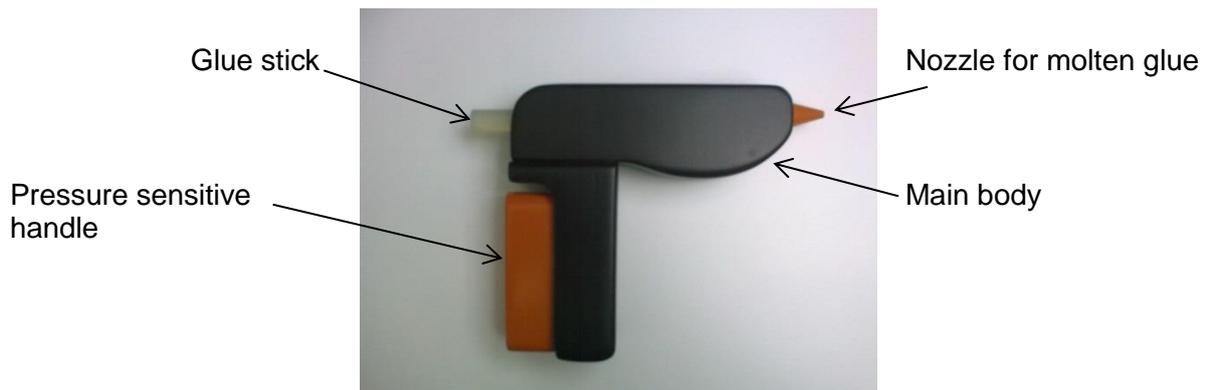
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5. (a) A student has designed and made a concept model of a new hot glue gun.



- (i) Tick **two** boxes below to show the reasons why medium density fibreboard (MDF) is a suitable material for making the model. [2]

MDF can be moulded to shape by heating.	<input type="checkbox"/>
MDF conducts electricity so the model glue gun can be made to work	<input type="checkbox"/>
MDF is easy to cut and shape.	<input type="checkbox"/>
MDF can be painted to represent different materials or finishes	<input type="checkbox"/>

- (ii) Using notes and sketches, show how the MDF could be accurately marked out, cut and shaped by hand in a school workshop. (Name all tools / equipment required). [8]

(b) Shown below is a typical glue gun on the market today.



(i) Evaluate how selection of a plastic material for the body of the glue gun has been influenced by functional and aesthetic factors. [5]

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(ii) Like many products today, the glue gun body is manufactured using injection moulding.

Evaluate the benefits and limitations of injection moulding components for products such as the glue gun. [5]

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6. A portable space saving football goal has been launched to promote sport and activities for 3 to 5 year old children.



Product Features:

- Includes a nylon net.
- RRP (recommended retail price) £15.99.

- (a) (i) Describe the properties of ABS that make it a suitable material for the football goal. [4]

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- (ii) The football goal needs to be easily and quickly set up and collapsed. Explain how the ABS components enable this to happen. [2]

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- (iii) Describe the physical properties of nylon that make it a suitable material for the net. [4]

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- (iv) Describe one advantage and one disadvantage of sourcing the nylon in China and shipping it to the UK for the manufacture of the net. 2 x [2]

Advantage:

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Disadvantage:

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- (v) The goals are manufactured using mass production. Explain how this has an effect on the price (RRP) of the goals. [4]

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- (b) (i) The manufacturer uses a cutting jig to cut the lengths of ABS tubing.

Explain how the use of a cutting jig will benefit the manufacturer when producing the goals. [3]

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- (ii) Explain **two** benefits to the manufacturer when using CAM to automate the manufacturing process for making the goals. 2 x [2]

Benefit 1:

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Benefit 2:

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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.

The indicative content states a range of points and / or issues which may be included in candidates' answers. It is not exhaustive and credit should be given to any other response that is appropriate to the question set.

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 points 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 level 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 is, it contains nothing of any significance to the mark scheme, or where no response has been provided, no marks should be awarded.

In Design and Technology, each question addresses one assessment objective: either AO3 or AO4. The assessment grid sub-divides the total mark to allocate for a question. These are shown in bands in the mark scheme. 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 provided.

GCSE Design and Technology (Product Design)

MARK SCHEME

Question 1		AO3	AO4	Mark
(a)	Identify two changes in the new bottle and cage, in comparison with the existing bottle and cage.		✓	2
	<p><i>Candidates are required to identify any two visible changes (1 mark per change).</i></p> <p>Guidance to markers</p> <p>Changes can be either to the bottle or to the cage, and there is no requirement to have one of each. No justification of the suitability/benefit of the change is required.</p> <p>Responses could include:</p> <ul style="list-style-type: none"> • the shape of the bottle has changed • the new bottle is styled in a more modern way • graphics have been added to the bottle • the cage is more modern looking 			
	<i>Incorrect / no answer</i>			0
(b)	When users replace the existing bottle and cage with the new bottle and cage, they should consider sustainability issues carefully. Explain how users could effectively manage this change.		✓	4
	<p><i>Look for detailed responses, DO NOT credit repetitive statements.</i></p> <p>Candidates may use the 6R principle to respond. Possible answers relating to reusing the existing bottle as a drinks bottle without the cage, recycling the cage of the existing bottle which is likely to be aluminium or steel. Separating the plastic bottle and metal cage so that they can be disposed of and recycled effectively.</p> <p>Guidance to markers</p>			
	<i>No answer or no relevant information presented or discussed.</i>			0
	<i>Brief description</i> Do not throw the bottle away / do not throw the cage into rubbish bin.			1
	<i>More detailed response</i> Do not dispose of the existing bottle in household rubbish, it is made from a polymer and will not biodegrade in landfill.			2
	<i>Detailed response</i> Do not dispose of the existing bottle in household rubbish, it is made from a polymer and will not biodegrade in landfill. Consider reusing the bottle or cage.			3
	<i>Highly detailed response with explanation</i> Do not dispose of the existing bottle in household rubbish, it is made from a polymer and will not biodegrade in landfill. Consider reusing the bottle and cage. If either is broken or beyond use, then separate the metal cage and bottle and recycle effectively.			4

(c)	During the development of the new bottle and cage, designers used Computer Aided Design (CAD) to produce iterations of ideas. Discuss the benefits of using CAD to develop the new bottle and cage.		✓	4
<p><i>Candidates are required to produce a detailed and balanced response demonstrating benefits of using CAD. DO NOT credit repetitive statements.</i></p> <p>Possible answers</p> <p>Edit and change ideas using CAD.</p> <p>CAD is a quick and effective way to test and develop ideas.</p> <p>Ideas can be simulated and communicated with others.</p> <p>CAD designs can be generated using 2D and then changed easily into 3D and vice versa.</p> <p>CAD designs can be used to generate 3D models using CAM or 3D printing.</p> <p>Guidance to markers</p>				
	No answer or no relevant information presented or discussed.			0
	Brief description. It is easier to edit and change ideas using CAD.			1
	More detailed response. CAD is a quick and effective way to test and develop ideas. Ideas can be simulated and communicated with others / target market / client.			2
	Detailed response. CAD is a quick and effective way to test and develop ideas. Ideas can be simulated and communicated with others / target market / client, changes can be made by editing CAD designs.			3
	Highly detailed response with explanation. CAD is a quick and effective way to test and develop ideas. Ideas can be simulated and communicated with others / target market / client, changes can be made by editing CAD designs. CAD designs can be used to generate 3D models using CAM or 3D printing.			4
Total				10

Question 2		AO3	AO4	Mark						
(a)	(i) Tick the boxes to show if the following statements about smart materials are true or false.		✓	2						
<p><i>Candidates are required to tick two boxes.</i></p> <p>Guidance to markers The two boxes shown are the only correct answers. If a candidate ticks both the true box and the false box for a statement, award 0 marks for that part of the question.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>True</th> <th>False</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">✓</td> <td></td> </tr> <tr> <td style="text-align: center;">✓</td> <td></td> </tr> </tbody> </table> <p style="margin-left: 40px;">Smart materials change their properties depending on the environment.</p> <p style="margin-left: 40px;">Changes in the properties of smart materials are reversible.</p>		True	False	✓		✓				1 1
True	False									
✓										
✓										
<i>Incorrect / no answer</i>				0						
	(ii) State the name of a suitable smart material that could be used in this rear view mirror and describe how this material functions.		✓	2						
<p><i>Candidates are required to state name and write a functional description.</i></p> <p>Guidance to markers</p> <p>No answer or no relevant information presented or discussed.</p> <p>Photochromic layer or film/ electro-chromatic layer or film (accept either)</p> <p>No answer or no relevant information presented or discussed.</p> <p>Response explaining how this material functions: During dark / night conditions, if a beam of light is sensed, the material automatically dims to prevent glare.</p>				0 1 0 1						
(b)	Fill in the spaces in the sentences below, which describe two different influences on product design.		✓	2						
<p><i>Candidates are required to complete the two sentences by adding 'push' and 'pull'. There are no other correct answers.</i></p> <p>The design of the mirror has been influenced by 'technology <u>PUSH</u>' where developments in materials enable products to be re-designed.</p> <p>Other products are sometimes influenced by 'market <u>PULL</u>', where products are re-designed in response to market forces.</p>				1 1						
<i>Incorrect / no answer</i>				0						
(c)	Explain one advantage and one disadvantage to the designer of 3D printing when rapid prototyping the models for the rear view smart mirror.		✓	4						
<p><i>Candidates are required to identify an advantage and disadvantage of 3D printing.</i></p> <p>Advantage</p> <p>3D printing allows the designer to realise a physical idea quickly from a CAD drawing. This prototype can then be tested and modifications identified.</p>										

	<p>Disadvantage</p> <p>The greatest disadvantage of 3D printers is the cost of manufacturing a high quality outcome. The higher the quality outcome the higher the cost of the machine. The quality of the finish can leave a lot to be desired in a 3D printed object. It isn't only the lack of polish that is the problem but also the possible dimensional inaccuracy.</p> <p>Guidance to markers</p>	
	No answer or no relevant information presented or discussed.	0
	<p>Brief description</p> <p>3D printing provides an accurate outcome of a CAD drawing.</p> <p>3D printing is very costly.</p>	1
	<p>More detailed response</p> <p>3D printing produces a physical model of a CAD idea very quickly for testing.</p> <p>3D printing is very costly and the finished quality at present is not up to other manufacturing methods.</p>	2
	Total	10

Question 3		AO3	AO4	Mark
(a)	(i) State the name of Energy Source A and Energy Source B.		✓	2
	Guidance to markers No answer or no relevant information presented or discussed.			0
	Energy Source A: Wind Farm / Wind Turbines / Wind Generators. Energy Source B: Solar Farm / Solar Panels / PV or photovoltaic panels.			1 1
	(ii) Describe how Energy Source A is intended to generate renewable energy.		✓	2
	<i>Candidates are required to describe Energy source A.</i> Accept responses that include negatives such as no wind no generating energy. Onshore (as shown) and off shore farms are used. Locations for wind farms are critical to exploit natural resource of wind. Guidance to markers No answer or no relevant information presented or discussed.			0
	Brief description Wind rotates the turbine which generates electricity.			1
	More detailed response Wind rotates the turbine which generates electrical current. This is collected through a substation. The more wind, the faster the turbines rotate generating more electricity.			2
	(iii) Explain why renewable energy sources are becoming more popular in comparison with named non-renewable sources.		✓	4
	<i>Look for detailed understanding of reasons why harnessing 'green' energy is increasing.</i> Government backed schemes with financial incentives, target / goals to reach to demonstrate sustainability figures, improved technologies allow increased generation of energy. Society is becoming more aware of the environmental issues, sustainability and world resources. Guidance to markers No answer or no relevant information presented or discussed.			0
	Brief description Environmental awareness has increased or developed recently.			1
	More detailed response Legislative agreements commit countries to become more environmentally friendly.			2
	Detailed explanation Legislative agreements commit countries to become more environmentally friendly. The development of wind farms is seen by society as the way ahead.			3
	Highly detailed response with explanation Legislative agreements commit countries to become more environmentally friendly. The development of wind farms is seen as a natural way to produce energy in a greener more environmentally friendly way.			4

(b)	(i) Explain why energy companies are offering to provide homes with smart energy meters free of charge.		✓	2
	<p><i>Look for detailed understanding.</i></p> <p>By 2020, the target is to have every home using a smart energy meter. Energy companies are keen to provide best tariffs for times of the day where energy is required. Monitoring energy use and accurate billing for households. Meter reading becomes obsolete and estimated bills which are inaccurate are removed.</p> <p>Guidance to markers</p> <p>No answer or no relevant information presented or discussed.</p>			0
	Brief description Energy companies can see what homes are using.			1
	More detailed response The British Government is adopting smart meters to upgrade an ageing energy system and to tackle climate change, putting control in the hands of consumers.			2
	(ii) Discuss the impact on the consumer of having a smart energy meter fitted.		✓	5
	<p><i>Candidates are required to make evaluative comments on the impact of the smart meter.</i></p> <p>Guidance to markers</p> <p>No answer or no relevant information presented or discussed.</p>			0
	Brief or basic discussion, very little detail. Consumer can see how much energy is used.			1
	Discussion with some detail of the impact on consumer Consumer can see how much energy is being used and can manage bills effectively.			2
	More detailed discussion with some explanation of the impact on consumer. Consumer can see how much energy is being used and can manage bills effectively. The consumer does not need to rely on estimated bills or meter readings to calculate bills.			3
	A detailed discussion including a number of explanations of impact on the consumer. Consumer can see how much energy is being used and can manage bills effectively. The consumer does not need to rely on estimated bills or meter readings to calculate bills. The energy supplier can monitor energy usage and provide cheaper / better tariffs to suit customer needs.			4
	A highly detailed discussion with comprehensive explanations of both positive and negative impact on the consumer. Consumer can see how much energy is being used and can manage bills effectively. The consumer does not need to rely on estimated bills or meter readings to calculate bills because the smart meter is automatically connected to suppliers via wifi. The energy supplier can monitor energy usage and provide cheaper / better tariffs to suit customer needs.			5
Total				15

Question 4		AO3	AO4	Mark
(a)	(i) The bicycle lock is made from steel. Explain the advantages and disadvantages of making this product out of steel.		✓	[5]
	Candidate's response will need to address the advantages and disadvantages of using steel. Properties such as hardness making it tougher / stronger / wear resistant. Accept answer that could relate to steel being heat treated to improve strength and is readily available material. The steel is prone to corrosion and the exposed finish will need to give some form of protection from weather conditions. It is also heavy for the cyclist to carry around with them.			
	Guidance to markers No answer or no relevant issues described or discussed.			0
	Simplistic benefits or limitations identified but not analysed. Limited understanding evident. The steel will be tougher.			1
	Description of some benefits and limitations, with some analysis. Some understanding evident. The steel is suitable because it will be very difficult to cut due to it being a harder /tougher material than many others but is likely to corrode.			2-3
	Clear and detailed analysis of a range of benefits and limitations. Detailed understanding evident. The steel is suitable because it will be very difficult to cut due to it being a harder /tough material than many others and is strong, ideal for a bike lock. The steel is likely to corrode because the bike lock will be exposed to rain and all weather conditions. It is also a heavy material to carry around.			4-5
	(ii) The bicycle lock has been dip coated with a thermoplastic powder. Explain the functional and aesthetic reasons for applying this type of finish to the bicycle lock.		✓	[5]
	<i>Candidate's response will need to address the functional and aesthetic reasons for using the thermoplastic finish.</i> Functionally, the covering enhances the durability of the steel, and prevents damaging / scuffing other materials such as the finish of the bike frame. The user may find this easier to carry, less cold in winter conditions, improved grip in wet conditions. Aesthetically the plastic polymer gives a high quality finish which improves the quality of the look and this would attract possible purchasers. The finish also makes the product look stronger and difficult to break.			
	Guidance to markers No answer or no relevant issues described or discussed.			0
	Simplistic benefits or limitations identified This will give the steel a better finish.			1
	Description of some benefits and limitations. This will provide a durable weather resistant finish and prevent corrosion. The thermoplastic finish will improve the look of the bicycle lock.			2-3
	Clear and detailed description of a range of benefits and limitations. This will provide an aesthetic finish as well as preventing the steel from corroding. This will prevent the lock from scratching the bicycle or whatever it is locked to because the plastic is softer and much less abrasive. The plastic polymer finish will reflect quality and attract buyers.			4-5

(b)	Analyse how the fingerprint scanner provides benefits and limitations for users of this bicycle lock.	✓		10
<p><i>Response needs to address the benefits and limitations of the fingerprint scanner.</i> Typical basic responses within the work could be: No need for a key. It is a quick way of opening the lock. No one else can use or borrow the lock. New technology can often be costly – this could affect the retail price. Looks modern – aesthetically appealing. Power source needs to be checked regularly. More detailed explanation or response within the work could be: The fingerprint scanner is a quick way of opening the bike lock without a key. In cold weather, the user would have to remove gloves because it would be unable to scan fingerprint. The cyclist would never have to worry about the key and therefore losing the key would not be an issue. Sharing the lock with others or locking two bicycles together would be a problem because of the fingerprint access. The face of the scanner and the finger needs to be clean to be able to open the lock; issues of muddy conditions, certain weather conditions could be problematic.</p>				
Guidance to markers No answer or no relevant issues described or discussed.				0
Simplistic benefits or limitations identified but not analysed. Limited understanding evident. Quality of written communication is limited or basic, presenting material with limited coherence, many errors of grammar, punctuation and spelling. The fingerprint scanner is a quick way of opening the bike lock without a key.				1-2
Description of some benefits and limitations, with some analysis. Some understanding evident. Quality of Written Communication is basic, presenting occasionally appropriate material with some coherence, some errors of grammar, punctuation and spelling. The fingerprint scanner is a quick way of opening the bike lock without a key. In cold weather, the user would have to remove gloves because it would be unable to scan fingerprint.				3-4
Detailed analysis of a range of benefits and limitations. Reasonable understanding evident. Quality of Written Communication is good, presenting mainly appropriate material in a coherent manner, few errors of grammar, punctuation and spelling. The fingerprint scanner is a quick way of opening the bike lock with a keyless access. The cyclist would never have to worry about the key and also losing the key would not be so problematic. One problem might be that the same person only can open the lock. This would restrict use for families or groups that shared the lock. In cold weather, the user would have to remove gloves because it would be unable to scan fingerprint. Cyclists often wear gloves for additional grip so this feature might be inconvenient.				5-7
Clear and detailed analysis of a range of benefits and limitations. Detailed understanding evident. Quality of Written Communication is excellent, presenting wholly appropriate material in a coherent and logical manner, hardly any errors of grammar, punctuation and spelling. The fingerprint scanner is a quick way of opening the bike lock with a keyless access. The cyclist would never have to worry about the key and also losing the key would not be so problematic. One problem might be that the same person only can open the lock. This would restrict use for families or groups that shared the lock. In cold weather, the user would have to remove gloves because it would be unable to scan fingerprint. Cyclists often wear gloves for additional grip so this feature might be inconvenient. Sometimes, wet weather or muddy riders might make it difficult to scan fingerprints.				8-10
Total				20

Question 5		AO3	AO4	Mark								
(a)	Tick two boxes below to show the reasons why medium density fibreboard (MDF) is a suitable material for making the model.		✓	2								
<p><i>Candidates are required to tick two boxes.</i></p> <p>Guidance to markers</p> <p>The two boxes shown are the only correct answers. If a candidate ticks three boxes and two are correct, award 1 mark. If a candidate ticks three boxes and one is correct, award 0 marks. If a candidate ticks all four boxes, award 0 marks.</p> <table border="1" style="width: 100%;"> <tr> <td>MDF can be moulded to shape by heating.</td> <td></td> </tr> <tr> <td>MDF conducts electricity so the model glue gun can be made to work</td> <td></td> </tr> <tr> <td>MDF is easy to cut and shape.</td> <td>✓</td> </tr> <tr> <td>MDF can be painted to represent different materials or finishes</td> <td>✓</td> </tr> </table>		MDF can be moulded to shape by heating.		MDF conducts electricity so the model glue gun can be made to work		MDF is easy to cut and shape.	✓	MDF can be painted to represent different materials or finishes	✓			1 1
MDF can be moulded to shape by heating.												
MDF conducts electricity so the model glue gun can be made to work												
MDF is easy to cut and shape.	✓											
MDF can be painted to represent different materials or finishes	✓											
<i>Incorrect / no answer</i>				0								
	Using notes and sketches, show how the MDF could be accurately marked out, cut and shaped by hand in a school workshop. (Name all tools / equipment required).		✓	8								
<p>Guidance to markers</p> <p>No answer or no relevant information presented or discussed.</p>				0								
<p>Brief description, very little detail of the process supported by limited sketches of tools and equipment required. Mark the shape with a pencil, cut MDF and sand to shape on the disc sander.</p>				1-2								
<p>Description of an appropriate method with some detail including a sketch. Use a pencil to mark out the shape required with a tri square and rule, cut MDF using coping saw and file to shape.</p>				3-4								
<p>More detailed description with some explanation of the process using notes and sketches. Mark out shapes required with a pencil, rule / tape measure and tri square. Cut using a scroll saw or coping saw, finish edges with cross / draw filing or similar filing process.</p>				5-6								
<p>Fully detailed description of the process with clear explanation of the process using effective notes and sketches. Use a pencil to mark out shape required with tri square, rule, and tape measure. Place MDF in wood vice and cut on waste side of the mark using coping saw / cut on waste side of mark using scroll saw. Use cross filing to work down closely to mark, draw filing to remove deeper scratches. Disc sander for external curves, Smooth finish using glass paper from rough to smooth grade, wet and dry to finish.</p>				7-8								
(b)	(i) Evaluate how selection of a plastic material for the body of the glue gun has been influenced by functional and aesthetic factors.	✓		5								
<p><i>Candidate's response will need to address the selection of a plastic material for the glue gun body in terms of functional and aesthetic factors:</i></p> <p>Functional Heat resistant Electrical resistance/insulator Hardwearing Aesthetics Plastic is available in a range of colours - contrasting colours. Complex forms/shapes and styling can be achieved. Decorative features or functional textures can be easily achieved.</p>												

	Guidance to markers No answer or no evaluation			0
	Simplistic evaluation but no reasoning Limited understanding evident. The body of the glue gun is made from plastic because it is hardwearing.			1
	Some evaluation evident and limited reasoning Some understanding evident. The body of the glue gun is made from plastic because it is hardwearing and will be able to withstand everyday use and will not break if accidentally dropped. Plastic has both good heat and electrical insulation. It is aesthetically pleasing to look at because it has two contrasting colours.			2-3
	Clear evaluation with detailed reasoning Detailed understanding evident. The body of the glue gun is made from plastic because it is hardwearing and will be able to withstand everyday use and will not break if accidentally dropped. Plastic has both good heat and electrical insulation functions because the glue needs to be heated to be able to flow and the user needs to be protected from any possible electrical shocks. It is aesthetically pleasing to look at because it has two contrasting colours. The contrasting colours also indicate key parts such as the trigger mechanism for use.			4-5
	(ii) Like many products today, the glue gun body is manufactured using injection moulding. Evaluate the benefits and limitations of injection moulding components for products such as the glue gun.	✓		5
	Benefits of injection moulding. Ideal for mass produced items - complex shapes are easily achieved Speed – very quick manufacturing process Finish – high quality finishes are achieved Plastic granules are readily available, range of colours and at competitive prices. Limitations of injection moulding. Initial set up/tooling costs are high. The mould is very expensive to manufacture to the tolerances required. Changes to the design are not easy to implement, often the mould will need to be re-made and this is expensive.			
	Guidance to markers No answer or no relevant issues described or discussed.			0
	Simplistic evaluation but no reasoning Limited understanding evident. The body of the glue gun would be injection moulded because it is a quick and effective process.			1
	Some evaluation evident and limited reasoning. Some understanding evident. The body of the glue gun would be injection moulded because it is a quick and effective process to produce vast numbers in a short period of time. Injection moulding is a very expensive process mainly due to high tooling costs at the beginning of the manufacturing process.			2-3
	Clear evaluation with detailed reasoning. Detailed understanding evident. The body of the glue gun would be injection moulded because it is a quick and effective process to produce vast numbers in a short period of time. The quality of the basic body will need very little cleaning or working after manufacture and this will reduce the cost of the final product. Injection moulding is a very expensive process mainly due to high tooling costs at the beginning of the manufacturing process. The initial cost of the making mould is high due to the high tolerances and finishes required.			4-5
			Total	20

Question 6		AO3	AO4	Mark
(a)	(i) Describe the properties of ABS that make it a suitable material for the football goal.		✓	4
	<p><i>Candidates need to show understanding of ABS and how this would be appropriate for the goals.</i> Question asks for properties (plural) so there should be at least two described for full marks – up to 2 marks for each appropriate response to a total of 4 marks.</p> <p>Strength, lightweight to be moved around and carried in the bag. Space saving as the tubes are of two different lengths, will fit in a car boot or store easily. Glossy shiny finish, requiring no protection for indoor or outdoor use. Will not split, crack or shatter easily so safe for users especially with the foam football.</p> <p>Guidance to markers No answer or no relevant information presented or discussed.</p>			0
	<p>Brief description ABS is a hard polymer that wouldn't break easily. Or ABS is a strong stiff material for the goals.</p>			1
	<p>More detailed response. ABS is a tough, strong and hard polymer which would take impact of a football and would not break, split or shatter. Or ABS is a glossy and shiny polymer suitable for outdoors and will not corrode. It is easy to wipe clean when being portable or taken indoors.</p>			2
	(ii) The football goal needs to be easily and quickly set up and collapsed. Explain how the ABS components enable this to happen.		✓	2
	<p><i>Responses need to address the quickly erected and collapsed intention.</i> All joints are push fit, standard identical joints, only two different lengths of tubing so it would be a simple task, with few opportunities for error. No specialist tools, equipment or knowledge needed.</p> <p>Guidance to markers No answer or no relevant information presented or discussed.</p>			0
	<p>Brief description The ABS parts fit together tightly and quickly. Or The goals are made up from a small number of ABS parts.</p>			1
	<p>More detailed response. There are 6 corners all 90 degree elbow identical components. There would be no mistakes when setting the goals up or taking them down. Or Due to the different sizes of the component parts, it would be difficult to erect incorrectly. All joints can be used anywhere as they are identical. All parts are push fit with no need to fittings.</p>			2
	(iii) Describe the physical properties of nylon that make it a suitable material for the net.		✓	4
	<p><i>Look for explanation of nylon's properties:</i> Question asks for properties (plural) so there should be at least two described for full marks – up to 2 marks for each appropriate response to a total of 4 marks. Lightweight for portability, flexible and high tensile strength, durable outdoors, washable, soft on the hand, no sharp edges or hazards.</p> <p>Guidance to markers No answer or no relevant information presented or discussed.</p>			0
	<p>Brief description The net will need to be strong to take the impact of the ball at fast speed. Nylon is a strong material.</p>			1

	Or Nylon is flexible to feed the net around the tubes			
	More detailed response. Nylon has good tensile strength and will not deform or snap / break easily Or Nylon has excellent resistance to weathering; it does not corrode in wet conditions. Or Nylon is flexible so easy to fit when erecting the goals or folding away after use.			2
	(iv) Describe one advantage and one disadvantage of sourcing the nylon in China and shipping it to the UK for the manufacture of the net.		✓	2 x 2
	<i>Comprehensive descriptions of both an advantage and a disadvantage.</i> China is one of the leading exporters of nylon in the world and the main benefit of buying from the Chinese market would be price. The operational cost of producing the nylon in China is vastly lower than other parts of the world - very low wage structure, raw material locally sourced, taxation lower, high government subsidies etc. Quality Control of products in China is not up to westernised standards - need for quality control procedures to be in place, returns to the manufacturer could be higher, - import taxes could affect the cost, moral issues - society is becoming aware of the social issues of China and this may affect sales. No answer or no relevant information presented or discussed.			0
	Brief description with some details of an advantage or disadvantage. The cost of the nylon is cheaper in China. The quality of the nylon netting may not be good.			1
	More detailed explanation or response of an advantage or disadvantage. The cost of the nylon is cheaper in China because they have very low overheads. The quality of the nylon netting may not be good and it would be essential to have quality checking in place which would increase costs.			2
	(v) The goals are manufactured using mass production. Explain how this has an effect on the price (RRP) of the goals.		✓	4
	<i>Credit candidates identifying the cost implications due to volume production.</i> The more that are made, the cheaper the end cost, maintaining profits. Mass production would be industrial production of large quantities of identical products. Products are likely to be sold by competitors, reducing the retail price due to strategies. Products or parts are often made overseas, where labour costs are less, therefore contributing to lower overall production costs. Guidance to markers No answer or no relevant information presented or discussed.			0
	Description with some explanation and some detail. Mass production means they make more goals so could sell them for less.			1
	More detailed explanation with some reasoning or justification. The manufacturer will be making more products so will buy materials for this in bulk. This makes it cheaper to make.			2
	A detailed explanation with some justification or reasoning The manufacturer will be making more products so will buy materials for this in bulk. This makes it cheaper to make. Therefore the retail price can be reduced making more competitive.			3
	A detailed explanation with a full justification or reasoning. The manufacturer will be making more products so will buy materials for this in bulk at a cheaper rate. This reduces the unit costs, and due to the volume being produced and sold, profits remain the same but the retail price can be reduced.			4

(b)	(i) The manufacturer uses a cutting jig to cut the lengths of ABS tubing. Explain how the use of a cutting jig will benefit the manufacturer when producing the goals.		✓	3
	<i>Credit candidates understanding that jigs can hold the tubes.</i> Align tools or machines to cut accurately. Repeatability is exact so outcomes are standardised. Higher productivity / production rate is increased, unit costs are lower. There is a reduction of rejects or errors and savings in labour costs. Guidance to markers No answer or no relevant information presented or discussed.			0
	Description with some explanation and some detail. Using a jig would speed up the cutting process.			1
	More detailed explanation with some justification or reasoning. A jig would provide increased accuracy and repetitive processing.			2
	A fully detailed explanation with a full justification or reasoning. A jig would ensure that the process is quality assured where all parts are cut exactly the same. This would increase efficiency and production, where manufacturer would make more identical items per hour.			3
	(ii) Explain two benefits to the manufacturer when using CAM to automate the manufacturing process for making the goals.		✓	2 x 2
	<i>Benefits must be related to manufacturer as a result of CAM.</i> Increased reliability, continuous production as a result of less workers required, increased productivity, increased efficiency less mistakes, errors or rejects. Guidance to markers No answer or no relevant information presented or discussed.			0
	Brief description CAM will replace manual worker with machines Or CAM will be more accurate than workers			1
	More detailed response Using CAM will automate the production process increasing accuracy and less money is spent on workers' wages. Or Slight changes can be made easily and quickly by adjusting CAM machine set up or operations.			2
Total				25