

Please write clearly	in block capitals.	
Centre number	Candidate number	
Surname		
Forename(s)		
Candidate signature	I declare this is my own work.	

GCSE DESIGN AND TECHNOLOGY

Unit 1 Written Paper

Friday 22 May 2020

Afternoon

Materials

For this paper you must have:

- normal writing and drawing instruments
- a calculator
- a protractor.

Instructions

- Use black ink or black ball-point pen. Use pencils only for drawing.
- Fill in the boxes at the top of this page.
- Answer all questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

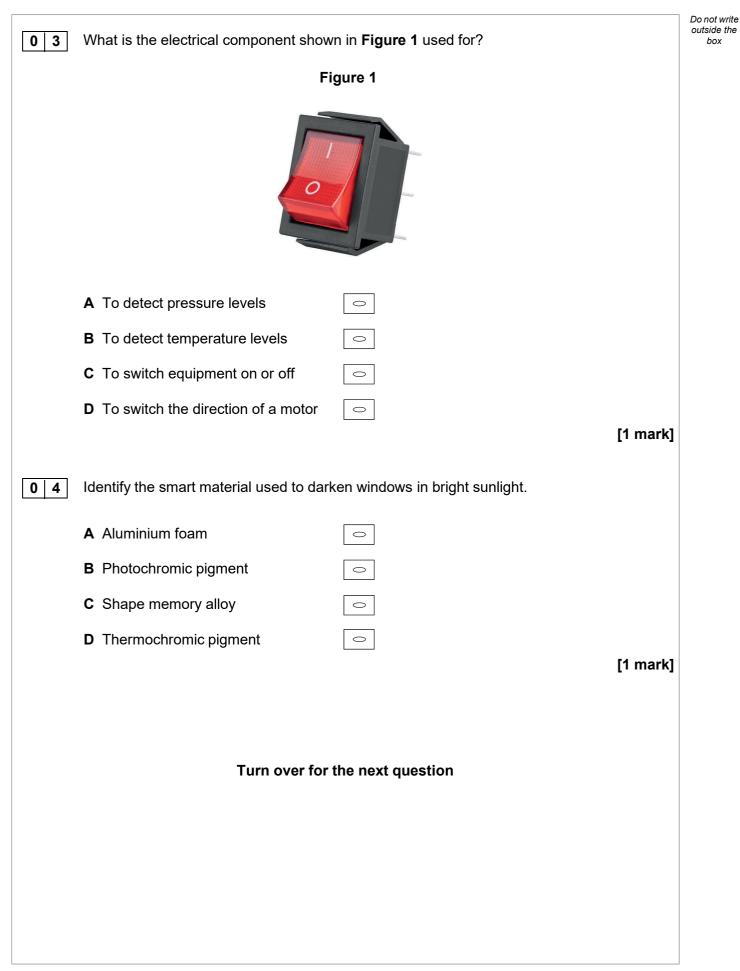
- All dimensions are in millimetres.
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 100.
- There are 20 marks for Section A, 30 marks for Section B and 50 marks for Section C.

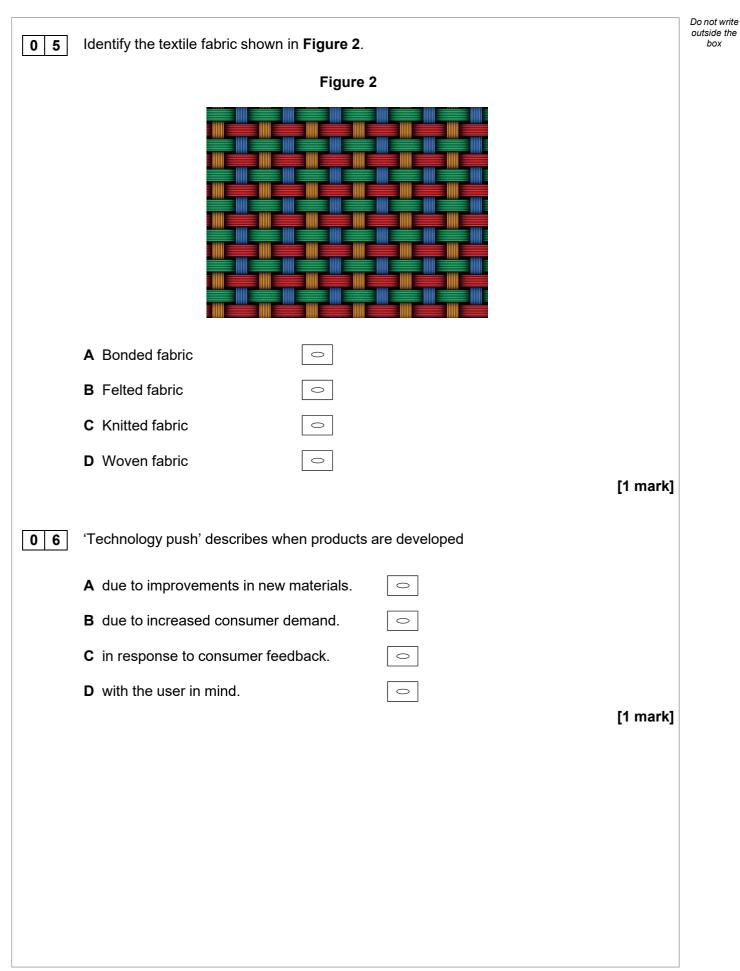
For Examiner's Use Section Mark A B C TOTAL

Time allowed: 2 hours

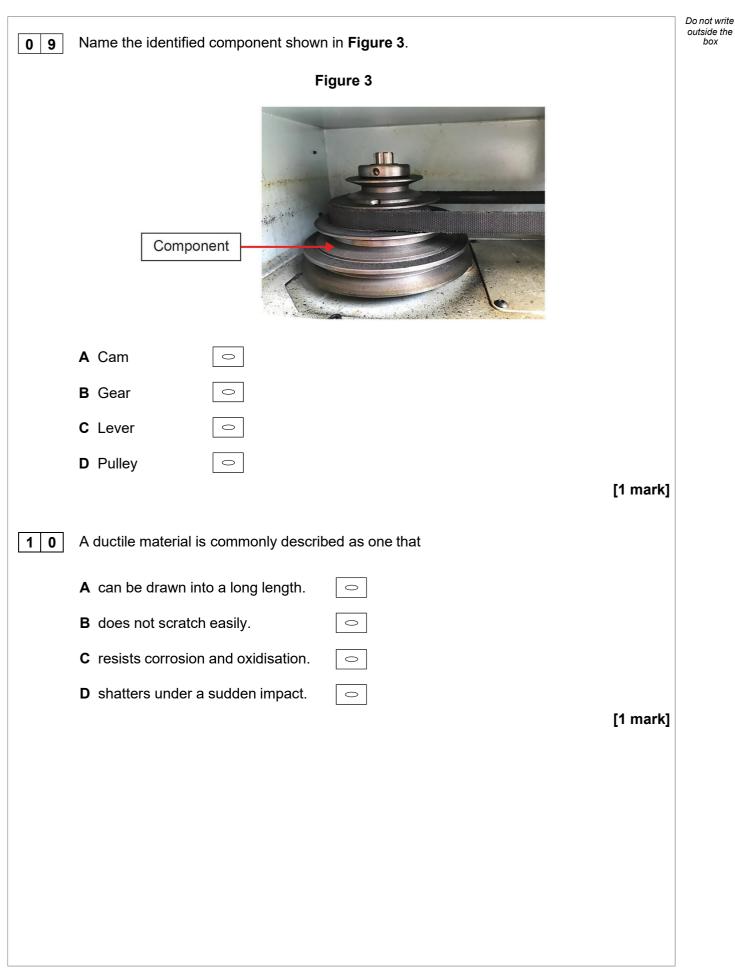


	Section A –	Core technical principles
		questions in this section.
Each of Qu	estions 01 to 10 is followed by	four responses, A , B , C and D .
For each q	uestion completely fill in the cir	cle alongside the appropriate answer.
CORRECT METH	HOD WRONG METHO	
lf you want	to change your answer you m	ust cross out your original answer as shown.
lf you wish as shown.	to return to an answer previou	sly crossed out, ring the answer you now wish to select
	high type of renewable operation	in coursed from plants?
0 1 Wh	nich type of renewable energy i	
Α	Biomass	0
В	Solar	0
С	Tidal	0
D	Wind	0
		[1 mark]
0 2 Pla	anned obsolescence is when a	product is designed
Α	to be repairable.	0
В	to have a short lifespan.	0
С	to have replaceable sections.	0
D	to take upgrades.	0
		[1 mark]





0 7	Which one of the following statements about industry is true?	Do not write outside the box
	A An increased use of robotics has led to a reduction in manual jobs.	
	An increased use of robotics means more people need to be employed.	
	c The latest production lines require more people who can use hand tools skilfully.	
	D The use of CAD and CAM in industry has led to less efficiency.	
0 8	Which of the following is part of a kinetic pumped storage system?	
	A Alkaline battery	
	B Oil field	
	C Photovoltaic cell	
	D Turbine	
	Turn over for the next question	



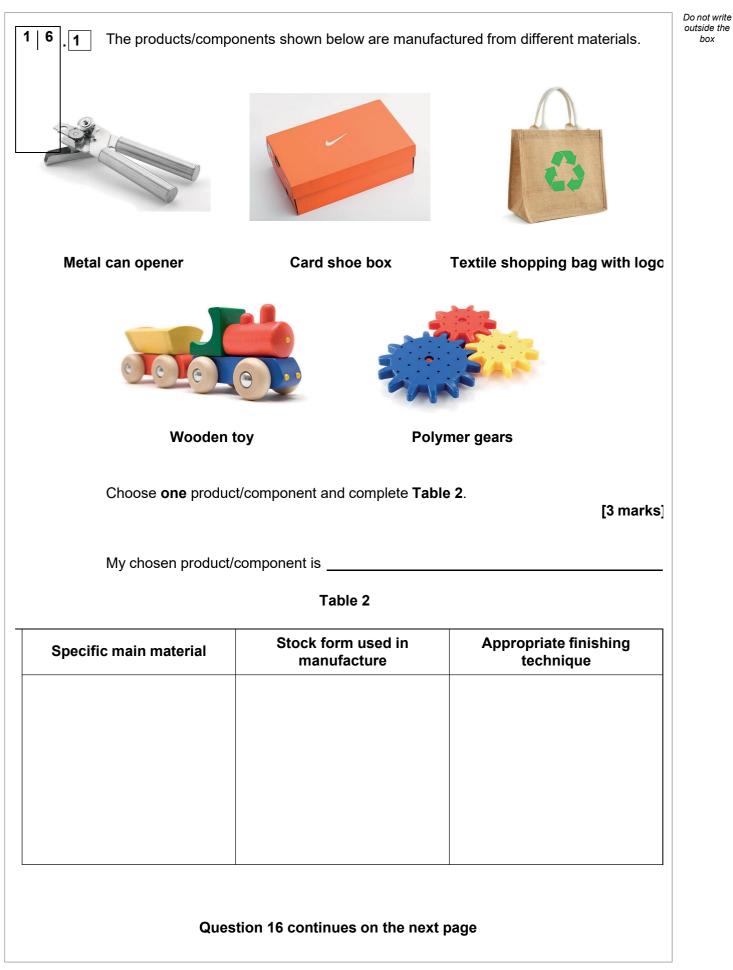
1 1.1	Name one alloy. [1 mark]	Do not write outside the box
1 1.2	Explain why metals are alloyed. [2 marks]	
	Turn over for the next sucction	
	Turn over for the next question	

1 2.1	Composite materials such as foil and polymer lined boards are used in food and drink packaging.	Do not write outside the box
	Give one advantage and one disadvantage of using composite materials for packaging.	
	[2 marks]	
	Advantage	
	Disadvantage	

Do not write

box

Section B – Specialist tec	hnical principles
Answer all questions in	n this section.
4 Name one specific commercial manufact for.	turing process and describe what it is used
Name of process	
Using notes and/or sketches describe the	e process you have named above. [4 marks]
	ed to be considered by a manufacturer when
5 Explain why each factor below would nee sourcing materials/components.	ed to be considered by a manufacturer when [2 x 2 marks]
	[2 x 2 marks]
sourcing materials/components.	[2 x 2 marks]
sourcing materials/components.	[2 x 2 marks]
sourcing materials/components. Bulk buying	[2 x 2 marks]
sourcing materials/components. Bulk buying	[2 x 2 marks]
sourcing materials/components. Bulk buying	[2 x 2 marks]
sourcing materials/components. Bulk buying Ethical factors	[2 x 2 marks]



1 6 2	A number of calendars are beir	ng made.		Do not writ outside th box
	Given the sizes provided in Fig made from one sheet?	j ure 5 and Figure 6 , ho		
				arks]
	Figure 5		Figure 6	
	1187 mm Material sheet	841 mm	280 mm Calendar page 210 mm	
		Not drawn to scale		
		Answ	/er	
1 6.3	What percentage of material is Question 16.2 ?	waste after cutting the	pages calculated in	
	Show your working and give yo	our answer to two decin		arks]
		Answ	ver	

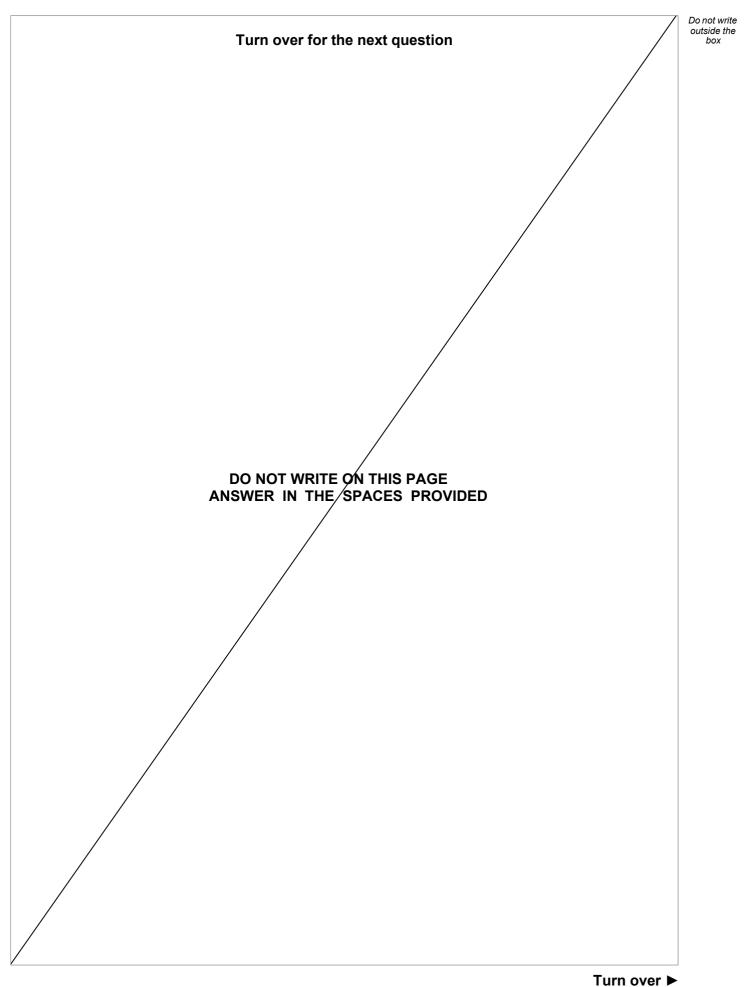
1 7	Responsible design should consider social issues in the design and manufacture of products.	Do not write outside the box
	Analyse and evaluate how pollution caused by the manufacture, use and disposal of products can impact the environment.	
	Give examples in your answer.	
	[8 marks]	
		1

1 8	Explain why the two methods below are used to manufacture products in different	Do not write outside the box
	volumes.	
	Give specific examples of products in your answer. [2 x 3 marks]	
	Mass	
	Batch	
		30
]

	Ansv	ver all questions in	this section.	
Table 3				
	Alessi	Apple	Braun	Dyson
	Gap	Primark	Under Armour	Zara
O cł	hoose one of the cor utline the design feat nosen company succ ou should refer to spe	ures and/or manufa essful.	cturing techniques that	have made your
				[6 marks
М	y chosen company is	3		

Figure 7 Image: problem in the second	2 0 Figure 7 shows three different kettles.				
Analyse and evaluate the kettles in terms of the three features identified below. You should not use an analysis or evaluation point more than once .		Figure 7			
Analyse and evaluate the kettles in terms of the three features identified below. You should not use an analysis or evaluation point more than once . 2 0 . 1 ergonomics					
You should not use an analysis or evaluation point more than once .	Cast iron stove kettle	Polymer electric kettle	Whistling kettle		
			[· · · · · · · · · · · · · · · · · · ·		

2 1	Describe the following two types of investigation.	Do not write outside the box
	Give examples to show how they help when designing. [2 x 3 marks]	
	Primary research	
	Secondary research	



22.1

A designer has been asked to design a prototype toy suitable for use by a child between 3 and 5 years of age. They are using the data in **Table 4**.

Complete the **two** missing values in **Table 4** for popularity votes.

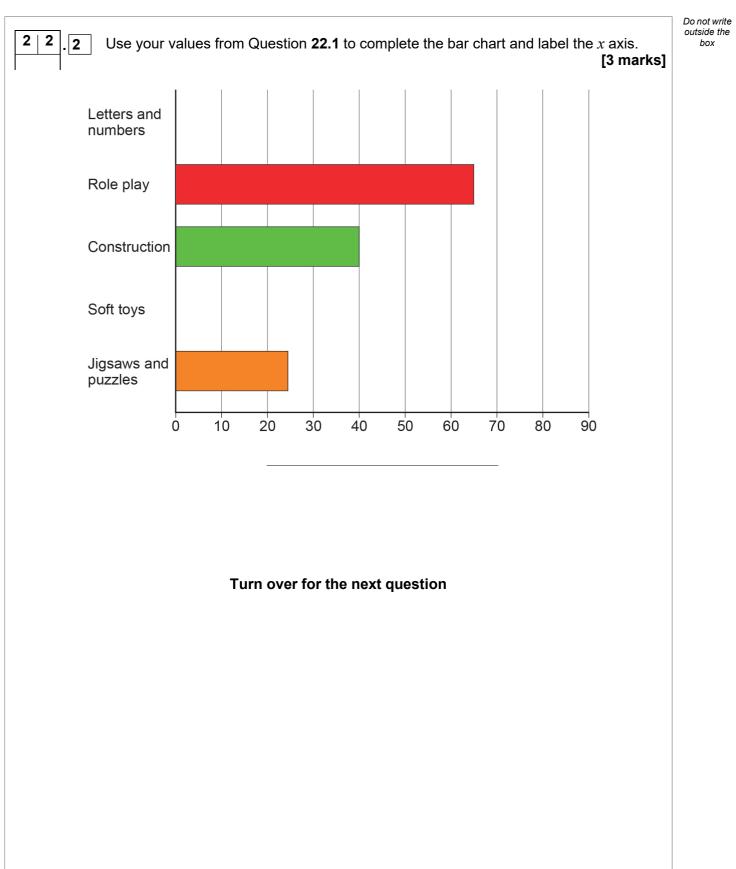
[1 mark]

Do not write outside the

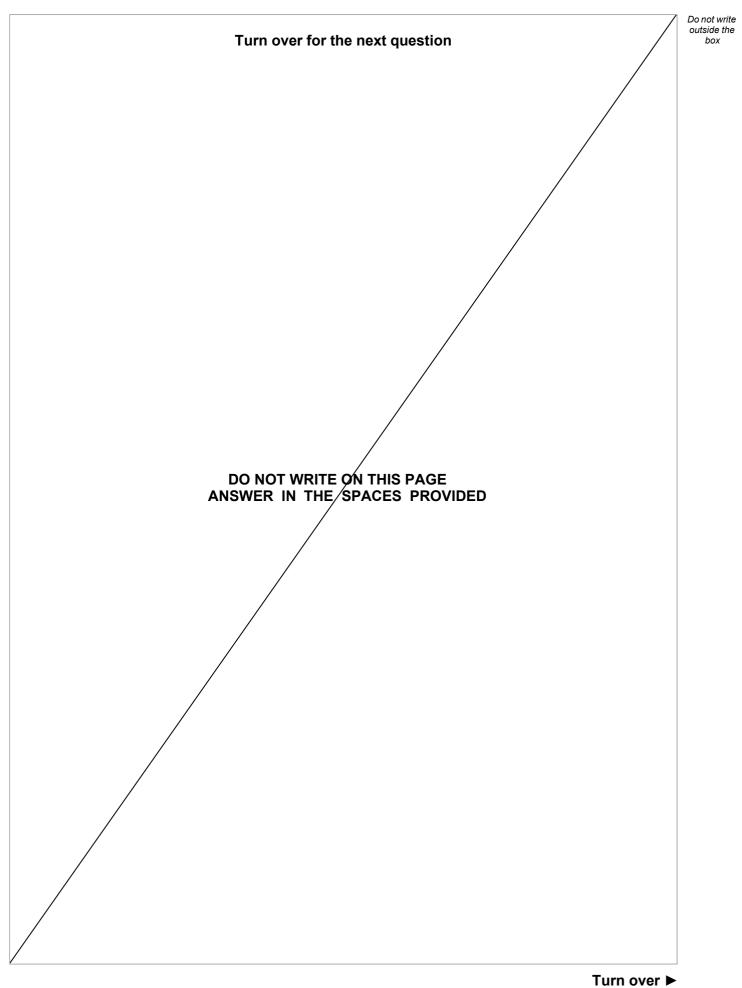
box

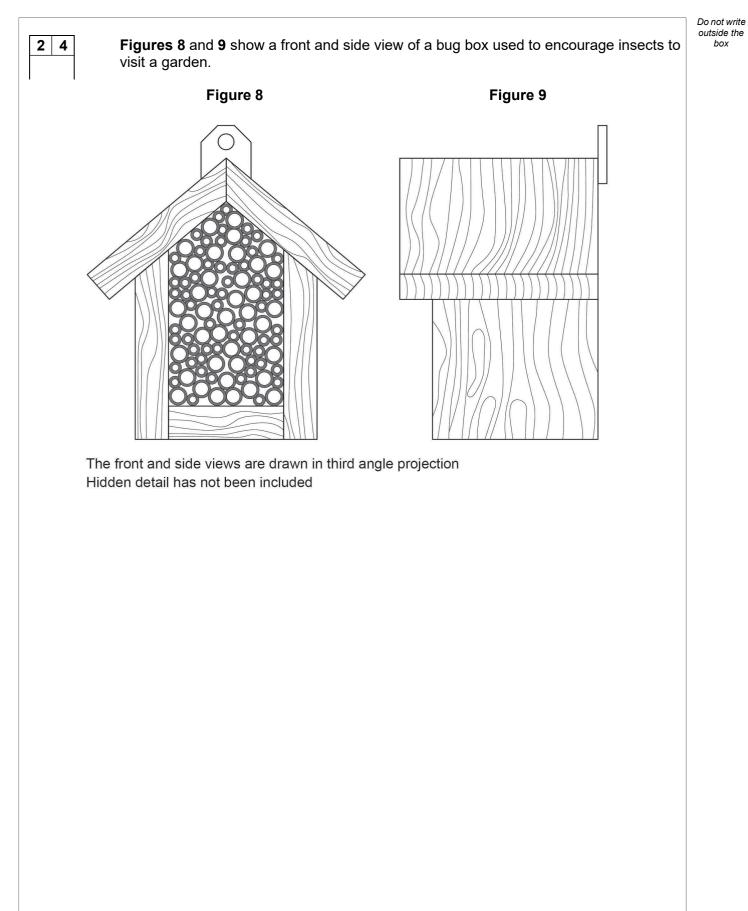
Type of toy	Popularity votes	Popularity votes as a percentage
Role play	65	26%
Construction	40	16%
Letters and numbers		34%
Jigsaws and puzzles	25	10%
Soft toys		14%
Total	250	100%

Table 4



3	Give five detailed specification points to help with the designing of a toy for use by a child between 3 and 5 years of age.	0
	[5 marks]	
	1	
	2	
	3	
	4	
	5	





4	.1	Complete a two-point perspective drawing of the bug box in the space provid below.	led
			[4 r

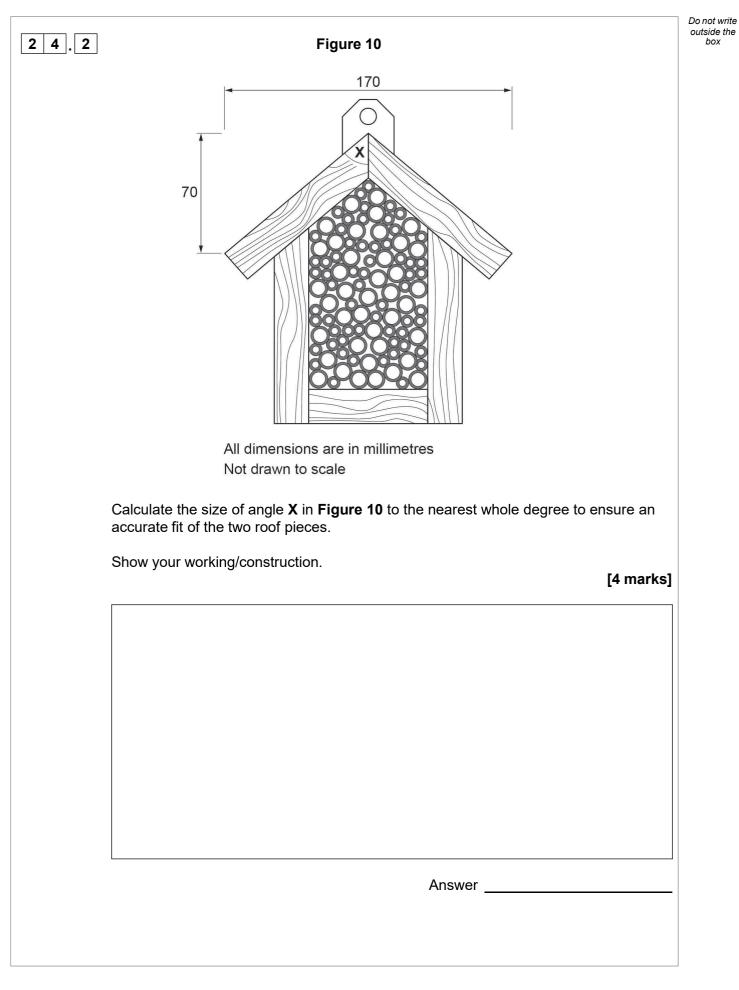
25

[4 marks]

Do not write outside the

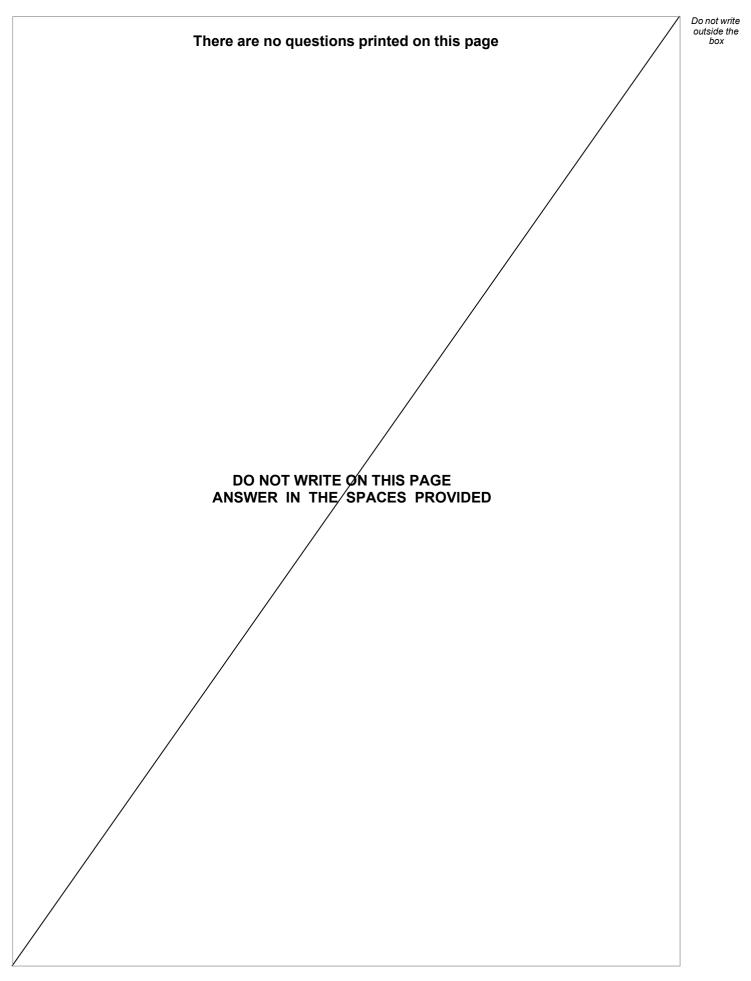
box

2



			Do not write outside the
2 5	During manufacture it is important to use materials efficiently and minim	nise waste.	box
	Explain how each of the following improves material management.	[2 x 3 marks]	
	Nesting of shapes and parts/lay planning		
	Cutting techniques		
	Turn over for the next question		

26	Describe how material can be formed when making a prototype. [3 marks]	Do not write outside the box
		50
	END OF QUESTIONS	



Question	Additional page, if required. Write the question numbers in the left-hand margin.		
number	Write the question numbers in the left-hand margin.		

Do not write outside the box

Additional page, if required. Write the question numbers in the left-hand margin.

Question number	Additional page, if required. Write the question numbers in the left-hand margin.	
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GCSE DESIGN AND TECHNOLOGY 8552/W

Unit 1 Written Paper

Mark scheme

June 2020

Version: 1.0 Final

206G8552/W/MS

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

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Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

Glossary for maths

If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt.

- **[a, b]** Accept values between a and b inclusive.
- For π Accept values in the range [3.14, 3.142]
- TheirAccept an answer from the candidate if it has been inaccurately calculated
but is subsequently used in a further stage of the question.

Questions which do not ask students to show working

As a general principle, a correct response is awarded full marks.

Qu	Part	Marking Guidance	Total marks	AO
1		A Biomass	1 mark	AO4
2		B To have a short lifespan	1 mark	AO4
3		C To switch equipment on or off	1 mark	AO4
4		B Photochromic pigment	1 mark	AO4
5		D Woven fabric	1 mark	AO4
6		A Due to improvements in new materials	1 mark	AO4
7		A An increased use of robotics has led to a reduction in manual jobs	1 mark	AO4
8		D Turbine	1 mark	AO4
9		D Pulley	1 mark	AO4
10		A Can be drawn into a long length	1 mark	AO4

Qu	Part	Marking Guidance	Total marks	AO
11	1	Name one alloy. 1 mark for a correct specific named alloy. Indicative content: Brass Bronze Duralumin Pewter Steel (accept any specifically named steel eg die steel (tool steel), high speed steel (HSS), stainless steel)	1 mark	AO4
		Accept all other valid responses.		

11	2	Explain why r	metals are alloyed.	2 marks	AO4
		2 marks	Two correct simple points of explanation or one point explained in detail possible using a specific example of use.		
		1 mark	One correct simple point of explanation.		
		0 marks	No attempt or nothing worthy of credit.		
		Indicative co	ontent:		
		 enhanced To produce Titanium cavanadium feasier worl Alloying measthetics Possible refe Stainless sresistant Brass – co 	e a tough corrosion resistant material eg stainless steel an be alloyed with other metals like aluminium and for increased strength, better corrosion resistance and		
		Accept all oth	ner valid responses.		

Qu	Part	Marking Guidance	Total marks	AO
12	1	Composite materials such as foil and polymer lined boards are used in food and drink packaging. Give one advantage and one disadvantage of using composite materials for packaging. 1 mark for one correct advantage and one correct disadvantage. Indicative content: Advantages: • Improve resistance to water absorption • Improve insulation properties • Improve ability to preserve contents • Improve strength and stability of the container Disadvantages: • Not always recycled by some local collection services hence may be incinerated or end up in land fill • Do not degrade easily if littered • Difficult to separate different materials from each other for recycling at the end of a containers life Accept all other valid responses.	2 marks	AO4

12	2	recycled by	wes the number of food and drink containers successfully a manufacturer in 2010 and 2017.	2 marks	AO4
			percentage increase in recycling of composite food and ners between 2010 and 2017?		
		1 mark	For recognising a 14 billion tonne increase in containers recycled ie 46-32 billion tonnes		
		1 mark	$14 \div 32 \times 100 = 43.75\%$		
			Accept 43.8%		
		Alternative	method		
		1 mark	46 ÷ 32 = 1.4375		
		1 mark	Answer 43.75%		
			Accept 43.8%		

Qu	Part		Marking Guidance		Total marks	AO
13			em diagram for an alarr by naming one compo Suitable processes		3 marks	AO4
		 Light sensors Temperature sensors Pressure sensors Switches Pressure pad Accept any switch/sensor used to activate or deactivate system, eg: PIR sensor Sensor + qualification Motion sensor SPST switch Key switch Reed switch Key pad 	 Microcontrollers Timers Decision making Accept trade names for specific components and: PIC chip Genie chips Picaxe Arduino Crumble Genie Counter Transistor Microprocessor Transistor Time delay Monostable Astable 	 Buzzers Speakers Lamps Accept specific components: Bell LED Siren App notification on phone 		

Qu	Part		Marking	Guidance	Total marks	AO
14		Name one spo what it is used		anufacturing process and describe	4 marks	AO4 1a AO4 1b
		Name of proce	ess			
		Using notes a above.	nd/or sketches descr	ibe the process you have named		
		1 mark for a c	orrectly named spec	ific process		
			imple descriptive po detailed response v	pint with two credit-worthy points made		
		Indicative co	ntent:			
		Papers and boards	Offset lithography Screen printing Digital printing	Printing design and information on paper and card.		
			Die cutting	Cutting out of nets. Making perforations. Creasing of card.		
		Timber based materials	Routing	Production of grooves, rebates and joints.		
			Turning	Turning cylindrical objects and shapes.		
			Lamination	Bonding layers of veneers or laminas together to create a large flat board or a complex curved shape using a former.		
			Machine morticing	Cutting square or rectangular holes in a piece of timber to create joints. (Also note that mortices often have round ends so must be considered if in answer).		
		Metal based materials	Milling	Horizontal or vertical milling of a flat surface, groove, rebate or hole.		
			Casting			

	Welding	Redistribution of metal in molten form to fill a mould or cavity.	
	Brazing	Redistribution of at least 2 pieces of metal along and edge/spot/seam to create a permanent joint.	
	Sintering	Use of solder to join two or more pieces of metal together without physically melting them.	
		The compression of powdered metals in a die using heat and extreme pressure to create a solid product in final shape.	
Polymers	Injection moulding	The heating and injection of molten polymer into a mould to produce a 3D shape.	
	Extrusion	Where molten polymer is extruded through a die to produce a consistent shaped profile.	
	Vacuum forming	Heating of sheet polymer so that it softens and can be shaped in a mould by extracting the air between the material and the form.	
	Calendaring	Manufacture of thin thermoplastic film.	
	Rotational moulding	Used to manufacture hollow 3D products using an enclosed mould containing thermoplastic polymer in powder form.	
	Blow moulding	Polymer in tube form is extruded (parison), the end sealed and hot air blown in to forcing the polymer out into a mould to create a hollow shape.	
Textile based materials	Weaving	Fabrics are woven on looms to produce large rolls of cloth in either plain or repeating patterns.	
	Dying		

Г Г				
		Printing Machine sewing	Fibres are dyed commercially before weaving to establish a fibre colour dying can be done by batch dying in a tank or continuous dying using various tanks and rollers to move the fabric along. Roller printing, screen printing and digital printing all transfer images to the fabric. Specialist sewing techniques like the overlock stitch can be used to create a tough and durable edge, hem or seam.	
	Electrical and mechanical systems	Pick and place assembly	Used to select and position individual components in pre- determined positions quickly and consistently on a PCB.	
		Flow soldering/ Reflow soldering	Used in surface mounting of electrical components. Components are located on a PCB on pre-soldered pads. PCB is then placed in a reflow oven where the solder melts connecting the component to the PCB.	
		Wave soldering	Circuit boards have pre drilled holes with components located in position. PCB board then moves on a conveyer belt over a molten solder wave, bonding the components to the PCB as the solder cools.	
		PCB manufacture Etching	Different to photoresist PCB manufacture done in school by spraying the etch directly onto a developed PCB board.	
		PCB lacquering	Application of a polymer layer to protect PCB from corrosion, dust and dirt.	
	Accept other v	alid responses.		

Qu	Part		M	arking Guidance	Total marks	AO
15		manufacturer A maximum o considered with 2 marks	when sourcir of 2 marks ex hen selecting Two simple clarified in g	elow would need to be considered by a ng materials/components. plaining why each factor needs to be materials or components e points of explanation given or one greater detail	2 x 2 marks	AO4
		•	ntent: provided is il	prrect point of explanation given Ilustrative and not exhaustive. Credit any port of the band descriptors above.		
		Bulk buying		Economies of scale – buying in bulk will allow for reduced material/components costs and these can be passed on to the customer for a more competitive price. Manufactures will secure discounts that can be passed on to the customer. Stock forms – buying exactly the quantity of materials required for a product or range of products knowing they can be used without waste Standard components – bought in bulk to secure discounts and reduce final product cost		
		Ethical facto	rs	Finite v renewable – avoid unnecessary consumption of finite resources that will run out. Use sustainable materials where possible. Provenance – where do the materials come from? Are they from an ethical source eg Forest Stewardship council (FSC) or Fairtrade. Working conditions – the promotion and support of people and communities in developing countries to ensure they are not exploited, having a detrimental impact on education, health and general well-being.		
		Accept other	valid respons	es.		

Qu	Part		Marking Guidance		Total marks	AO
16	1	The products/compone different materials.	ents shown below are n	nanufactured from	3 marks	AO4
		Choose one product/co	omponent and complete	e Table 2 below.		
		One mark for each of:				
		 Specific main materi Stock form Appropriate finishing 				
		Indicative content:				
		Content is illustrative a rewarded.	nd other correct respor	nses should be		
		Product: Metal can	opener	I		
		Specific main material used	Stock form used in manufacture	Appropriate finishing technique		
		Steel Stainless steel	Sheet Strip Bar	Polymer over- moulding Left as finished/ polished finish Powered coated		
		Product: Card shoe	box			
		Specific main material used	Stock form used in manufacture	Appropriate finishing technique		
		Solid white board Corrugated cardboard	Sheet	Offset lithography Printing	-	
		Product: Textile sho	pping bag with logo			
		Specific main material used	Stock form used in manufacture	Appropriate finishing technique		
		Cotton drill Denim Hessian Calico	Roll	Dying Screen printing Digital printing Stain resist finish Water resist finish		

1		Product: Wo		J	A		
		Specific n material u		Stock form used in manufacture	Appropriate finishing technique		
	F	Beech Pine MDF Plywood		Plank Board	Cellulose Lacquer Varnish Oil		
	F	Product: Po	lymer g	ears		-	
		Specific n material u		Stock form used in manufacture	Appropriate finishing technique		
	n a A	Most gears ai nade from Ny and Polyace Also accept: Polyphenylen	ylon al	Granules Also accept named gear stock forms eg spur, bevel, helical,	Pigment added during injection moulding Left as finished in		
	S T F F	sulfide (PPS) Thermoplastic polyester, lon einforced pla and liquid cry polymers (LC	c g fibre stic stal P).	worm, bevel, hypoid, crown gear	mould		
	Ac	ccept other v	alid resp	onses.			
16	2 A	number of ca	alendars	are being made.		2 marks	AO4
1							
				ed in Figure 5 and Figu made from one sheet?			
	ca		s can be				
	ca In	alendar page	s can be itent: Correct	calculation = 1120 mm			
	ca In	alendar page:	s can be tent: Correct 280 × 4	calculation = 1120 mm			
	ca In	alendar page:	s can be itent: Correct 280 × 4 210 × 4 OR 1187 ÷	calculation = 1120 mm	one way)		
	ca In	alendar page:	s can be itent: Correct 280 × 4 210 × 4 OR 1187 ÷	calculation = 1120 mm = 840 280 = 4.2 (so 4 sheets	one way)		
	ca In	alendar page:	Correct 280 × 4 210 × 4 OR 1187 ÷ And 84 OR	calculation = 1120 mm = 840 280 = 4.2 (so 4 sheets	one way) ay		

	998267 ÷ 58800 = 16.9773 = 16 pages max.	
1 mark	Calculation that pages will fit in a 4 × 4 arrangement allowing 16 pages to be made from each sheet	

16	3		centage of material is waste after cutting the pages d in Question 16.2 ?	3 marks	AO4
		Give your	answer to two decimal places.		
		1 mark	Step 1: Total sheet area = 1187 × 841 = 998 267 Total area of their answer from 16.2 = their 16 × 280 × 201 = 940 800		
		1 mark	Step 2: Total waste = 57 467 mm ² – their 940 800 = their 57 467		
		1 mark	Step 3: Percentage waste = their 57 467 ÷ 998 267 × 100 = their 5.7567% = their 5.76%		
		Alternativ	ve method 1		
		1 mark	Step 1: Vertical waste portion their 67 × 841 = 56 347 mm ² Horizontal waste portion = their 1 × their 1120 = 1200 mm ²		
		1 mark	Step 2: Total waste = their 57 467 mm ² Total sheet area = 998 267 mm ²		
		1 mark	Step 3: Percentage waste = their 57 467 ÷ 998 267 × 100 = their 5.7567% = their 5.76%		
		Alternativ	ve method 2		
		1 mark	Step 1: Vertical waste portion their 67 × their 840 = their XXX mm ² Horizontal waste portion = their 1 × 1187 = their 1200 mm ²		

1 mark	Step 2: Total waste = XXX mm ² Total sheet area = 998 267 mm ²	
1 mark	Step 3: Percentage waste = their XXX ÷ 998 267 × 100 = their 5.7567% = their 5.76%	

Qu	Part		Marking Guidance	Total marks	AO
17		manufacture of Analyse and e manufacture,	lesign should consider social issues in the design and of products. evaluate the types of pollution caused by the use and disposal of products. s in your answer.	8 marks	AO4
		7–8 marks A	fully detailed analysis and evaluation of oceanic and/or atmospheric pollution and the impact it can have on the environment. Several good examples to support response.		
		5–6 marks	A good analysis of both oceanic and/or atmospheric pollution and the impact on the environment. Some evaluative points given in response to analysis information presented. Good example(s) to support response.		
		4–3 marks	Basic analysis of oceanic and/or atmospheric pollution. Expect an imbalance in response between the two types of pollution requiring consideration in the question. One or no evaluative point. Simplistic or vague attempt to include examples in response.		
		1–2 marks	One or two limited points considering oceanic and/or atmospheric pollution. Very limited analysis, evaluation and no examples.		
		0 marks	No attempt or nothing worthy of credit.		
		worthy points	ntent: provided is illustrative and not exhaustive. Credit any made in support of the band descriptors above. entification of component characteristics of each type of		

Oceanic pollution	 Pesticides and fertilisers being washed from the land by rain and carried by rivers into the sea. Chemicals and toxic materials like mercury and lead find their way into oceans. These then can enter to food chain and poison water supplies. Plastic which does not degrade is carried by rivers into the sea creating large pools of rubbish in the deep oceans where sea currents converge. Pollution of the seas from oil spills during extraction and tanker accidents. Oil and sewage pollution whilst better than in previous years, can still contaminate and pollute ecosystems and marine life eg coastlines. Micro beads – no longer legal to use in cosmetics as from January 2018 in the UK (also banned in Europe and North America). Big problem due to size of less than 1 mm diameter is that they cannot be removed by water treatment making it all the way into the oceans to the detriment of sea life and ecosystems.
Atmospheric pollution	 Acid rain – the combination of nitrogen oxide and sulphur dioxide combine and fall as acid rain which when carried by prevailing winds fall raising acidity levels in lakes killing fish and marine life and also raising acidity in the soil destroying plant based life. Carbon monoxide contributes extensively to greenhouse gasses and raising the global temperature. Carbon dioxide emissions form vehicles using fossil fuels is known to lower air quality affecting the heath of the young, elderly and those with chronic breathing issues. Particulates – when released into the atmosphere they can cause 'global dimming' restricting light to the surface of the earth.

Lower air quality – impact on human health particularly the young, old, people with asthma, heart and lung problems. Net impact on increase health care costs and mortality rates. Affected groups are told to stay indoors on days identified as ones with poor air quality.	
Accept other valid responses.	

Qu	Part		Marking Guidance	Total marks	AO
18			he two methods below are used to manufacture fferent volumes.	2 x 3 marks	AO4
		Give specific	examples of products in your answer.		
		Maximum of 3	3 marks for each production method.		
		3 marks	Two simple/One detailed point of explanation and specific example (s) to further clarify response.		
		2 marks	One detailed/Two simple points or one simple point of explanation and a specific example to further clarify response.		
		1 marks	One simple point of explanation or appropriate specific example to clarify response.		
		0 marks	Nothing worthy of credit.		
		Indicative co	intent:		
		•	provided is illustrative and not exhaustive. Credit any made in support of the band descriptors above.		
		Mass			
		 runs eg TV Highly suite manufactur eg packagi Where a la needed, ma line. Used where effective pr 	oduce products in tens of thousands/ large production s, fridges, microwave ovens. ed to products that can be made using automated ring techniques requiring minimal human involvement ng and leaflets. rge number of identical products are known to be aking it worthwhile setting up a dedicated production e efficient material use is paramount to ensure a cost oduct with minimal waste/ zero defects to keep product g mobile phones.		
			g mobile phones.		
		Batch			
		 product eg paint), hom supplies et Batches ca what the pr Extensive t across a ba Opportuniti 	n be in single figures or several hundred depending on oduct is eg set of dining chairs, bridesmaid dresses use of jigs, templates and moulds to assure consistency		

 Quick change over between one batch of products and another without time consuming human involvement eg manufacture from a CAD file. Economies of scale as some materials/ components can be sourced/purchased in bulk. Accept other valid responses. 		
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Qu	Part		Marking Guidance	Total marks	AO
19		Outline the de have made yo	of the companies from Table 3 . esign features and/or manufacturing techniques that our chosen company successful. efer to specific products in your answer.	6 marks	AO4
		5–6 marks	Thorough description of a wide range of design features and/or manufacturing techniques provided for one company. Two or more clear examples provided to support response.		
		3–4 marks	A good description with consideration of some design features and/or manufacturing techniques provided for one company.		
		1–2 marks	Limited description identifying generic products associated with one company rather than design features and/or manufacturing techniques.		
		0 marks	Nothing worthy of credit/ a company not in the question has been discussed		
		-	ntent: provided is illustrative and not exhaustive. Credit any made in support of the band descriptors above.		
		Alessi Unique produ Heavy focus of Products mak coloured poly Artistic design A focus on hig crafted object Fun design im Products desi degrees of su • Whistling bi • Juicy Salif • Anna G cor • Condiment	cts produced with a distinctive design flavour. on kitchen products and products for the household. the extensive use of stainless steel mixed with brightly mers. of gh quality – hand s made with the help of machines oprinted with characterful features gned to be aesthetic as well as functional with varying		
		Apple 2 and	ortable music and phones: d 3 PCs in the 1970s ntosh computers in 1980s mouse 1984		

 iMac G3 1998 designed by Jonathan Ive with cases in distinctive and various colours to catch attention Mini desktops – the Power Mac cube 2000 PowerBook 100 1991 – miniaturised parts of the desktop range to create a lap top with integrated mouse iPod Generation 1 2001 with click wheel technology for ease of track selection iPod shuffle 2005 – random track selection MacBook Pro 2006 with aluminium case. The benchmark for all other manufacturers iPhone 2007 with touch screen technology. Apps from the Apple shop 	
 Braun A company forever linked with the work of German industrial designer Dieter Rams and his 10 principles for good design: 1. Innovative 2. Useful 3. Aesthetic 4. Understandable – good design that does not need an instruction 	
 booklet! 5. Unobtrusive 6. Honest 7. Long lasting 8. Design down to the last detail 9. Environmentally friendly 10. As little design as possible 	
 A range of electrical and electronic products designed with simple lines, function in mind and intuitive design: Portable radios Digital bedside radio/alarm clocks Battery powered/electric shavers eg Braun sixtant razor 1962 Hair and skin care products eg hairdryers Health products eg blood pressure monitors 	
 Dyson Electrical and electronic products using imagination and innovation to create stylish products that are also highly functional DC01 – the first dual cyclone vacuum cleaner 1993. Washing machine CR01 2000 with twin opposing drum technology for a quicker more thorough wash supposedly. Dyson digital motor 2004 – with high speed impeller. Used in later iterations of cleaners for improved efficiency. Dyson ball vacuum cleaner DC15 2005 – for improved manoeuvrability. Traditional cleaners have fixed wheel s and only go in straight lines. 	
 First Hand held cleaner 2006 – DC16 using root cyclone technology. Airblade AB01 2006 – hand dryer with airblade technology. Works by scraping water off washed hands, hygienic and drying hands in 10 seconds approx. 	

	I	
 Air multiplier fan AM012009 – no blades and multiplies air flow by 15 times. Dyson digital slim cordless vacuum cleaner 2018 – no cord connectivity. Power provided by high output lithium ion batteries effective for whole house cleaning. 		
 Gap Established in the late 1960s (American fashion) in response to different fashion requirements for customers between childhood and adulthood – the gap: Men – trousers, shirts, shorts Women – dresses, maternity Children – baby and kids 		
Empowering women – PACE (Personal Advancement and Career Advancement) launched 2007. Used to support women in the apparel industry where barriers to education have impacted on progression and development into leadership and management in the workplace and also personal and professional growth. Used as appositive promotional point for gap product.		
Products designed and marketed with sustainability in mind – great durable products designed using new technology and product innovation, reducing the impact on people and the planet of what we wear.		
By 2020 eliminate the use of wood derived fabrics sourced from ancient and endangered forests.		
By 2021 100% of cotton will be from sustainable cotton sources including Better Cotton Initiative (BCI).		
By 2020 80% of Athleta materials will be made from sustainable fibres. By 2020 25% of Athleta's products will be made using techniques that save water.		
Primark A focus on 'fast fashion' designed for rapid change beyond seasonal but also social, especially for teenagers and young adults.		
Clothes are marketed as cheaply as possible and this has led to complaints about irresponsible design as some items are worn only once.		
Products made sell themselves ie little advertising.		
Manufactured products don't use expensive hangers, tags or labels that add to the product cost.		
Suppliers are asked to pack clothes like t-shirts so they are ready to go on shelves straight away.		
Designs and products go beyond just clothing.		

 Homeware Sweets and confectionary Under Armour A primary focus on sportswear and footwear. Designed originally to enhance performance by keeping athletes comfortable and cool. Origins based in the identified need of sports tops that did not become wet during exercise-led to the development of a synthetic 'moisture wicking' fibre that kept the participant dry Has moved into the design and manufacture of casual clothing. Examples of specific materials used in products like shorts, socks, trainers, tops are: Heatgear – Original product. Regulates body temperature, keeps you cool. Coldblack – reflects heat when it is hot Coldblack – reflects heat when it is hot Coloblack – reflects heat from the body to keep you cool. Zara A focus on 'fast fashion designed for rapid change beyond seasonal patterns, but also social change for particularly young girls and teenage girls. Prides itself on keeping up with fashion, high quality at reasonable prices. Products sold based on customer trends Men's clothing Kids clothing (Zara kids) Life label (Join life) – recycling scheme. Home pick up of unwanted clothes. Clothes they go for recycling and /or reuse to finance social projects. Use of REFIRRA – a fibre made from recycled cotton and wool from sustainable forests. Working to ensure all products are sustainable throughout raw materials used, design and production. Accept other valid responses.	· · · · ·		
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materials used, design and production.			
Accept other valid responses.		o	
		Accept other valid responses.	

Qu	Part		Marking Guidance	Total marks	AO
20	1,2,3	Analyse and eva identified below. You should not u	three different kettles. aluate the kettles in terms of the three features use an analysis or evaluation point more than once . narks for each of the three parts of the question.	12 marks	AO4
		e	Well described and justified analysis containing full evaluation, drawing on conclusions having considered both positive and negative factors.		
			Brief points mentioned but not fully explained. Analysis present but limited evaluation/ conclusions drawn. May have focused solely on either positive or negative factors.		
		0 marks	No attempt or nothing worthy of credit.		
		worthy points ma	ent: rovided is illustrative and not exhaustive. Credit any ade in support of the band descriptors above. ard repeats ie where some candidate may try to esponse multiple times in 20.1/20.2/20.3		
		Ergonomics	 Ergonomic handle on polymer kettle allowing firm safe grip Polymer construction is an insulator and prevents transfer of heat and burns Carrying handle is away (opposite side) from steam outlet on polymer kettle unlike other two when hot steam rises and may burn you Polymer could make use of thermochromic pigment to indicate when contents are hot Whistling kettle gives audible sound when water is boiling Polymer kettle needs re filling Awkward carrying position with handle over the top of the main kettle body No viewing window on cast iron kettle Cast iron kettle lid may prove difficult to reseat especially if hot and it has expanded Spout of cast iron kettle not as easy to control flow due to shape 		

	 Iron is a conductor so hot to the touch including the handle 	
Functionality	 No trailing flex with the iron stove top kettle – less chance of being pulled off stove surface Hinged lid on polymer kettle for ease of closure and resealing Docking unit means kettle flex an plug do not go anywhere near water which would be a possible risk of electric shock Light weight for elderly and less able body to carry and manipulate Thermostatic trip when the water has boiled, preventing kettle from boiling dry Cast iron kettle can be used over an open fire or hearth Cast iron kettle is heavy and could be dropped leading to scalding Risk of electric shock if kettle develops a fault or water accesses the electrics Rising steam could burn users hand on the cast iron kettle Difficult to gauge how much water you are boiling, which may lead to heating too much water Polymer kettle MUST be near an electrical point Whistling kettle MUST be near a gas/electric/inductive hob 	
Innovation	 Viewing window so you can see exactly how much water you are boiling Viewing window has water level marks to indicate precise capacity Trip switch to turn polymer kettle off and save electricity Polymer kettle acts as an insulator and will keep the water hotter for longer requiring less frequent boiling Use of lighter materials Use of materials that insulate and keep the water warmer for longer The polymer and whistling kettle consider the safety more effectively The polymer and whistling kettles consider the ease of use more effectively than the cast iron kettle The use of new materials has allowed for kettle development to consider the aesthetics of the product rather than just the function Modern kettles consider energy efficiency far more than the cast iron style kettle Just plug into electricity supply 	

 heat and energy will be lost more readily into the surrounding environment from the hob plate The polymer kettle MUST have a (240v) electric supply to work Accept other valid responses.

Qu	Part		Marking Guidance	Total marks	AO
21		Describe the f	ollowing two types of investigation.	2 x 3 marks	AO4
		Give examples be examples o	s to show how they help when designing. These can of use		
		Primary resea	arch:		
		3 marks	Correct definition of primary research and two or more named examples of primary research		
		2 marks	Correct definition for primary research and one correct example of primary research		
		1 mark	Simple definition point or one correct example of primary research		
		Indicative co	ntent:		
		-	provided is illustrative and not exhaustive. Credit any made in support of the band descriptors above.		
		DO NOT cred wants.	it vague responses like to identify needs and		
		Definition of primary research:	 Involves the collection of research first-hand Information you have collected yourself Completed by the author of the research All forms of field research 		AO4
		primary	Information you have collected yourselfCompleted by the author of the research		
		primary research: Examples of primary	 Information you have collected yourself Completed by the author of the research All forms of field research Interviews – telephone, social media and face to face Questionnaires Material testing Product analysis Measuring – useful sizes Surveys Focus groups 		
		primary research: Examples of primary research:	 Information you have collected yourself Completed by the author of the research All forms of field research Interviews – telephone, social media and face to face Questionnaires Material testing Product analysis Measuring – useful sizes Surveys Focus groups 		
		primary research: Examples of primary research: Secondary re	 Information you have collected yourself Completed by the author of the research All forms of field research Interviews – telephone, social media and face to face Questionnaires Material testing Product analysis Measuring – useful sizes Surveys Focus groups 		

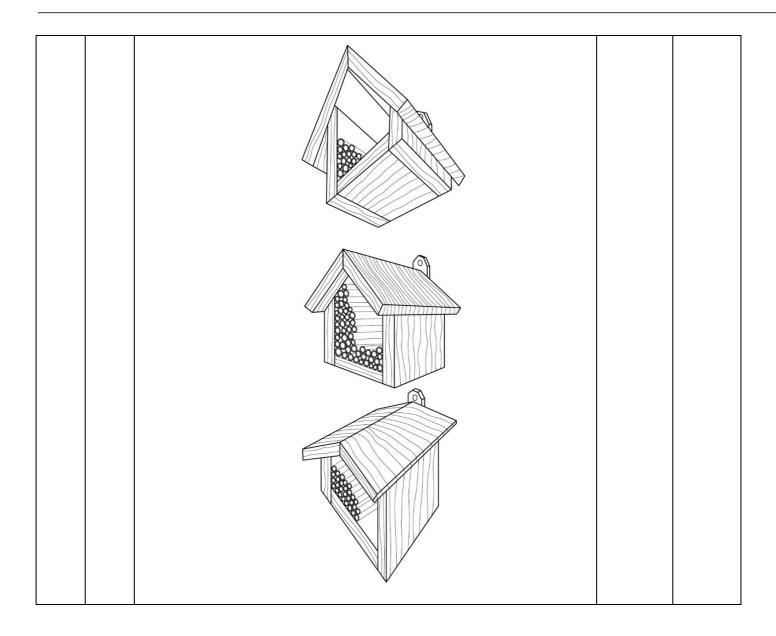
		Indicative con	tent:			
		The guidance provided is illustrative and not exhaustive. Credit any worthy points made in support of the band descriptors above.				
		Definition of secondary research:	 by an Data a perso Use o collat 	es the use of data and other person or 3 rd par and information preser on of material someone el ed and put together known as desk researd	rty hted by another se has initially	
		Examples of secondary research:	 Lookir comp Publis Mater TV pr 	f books, magazines, pong at the work of other banies shed anthropometric ar rials/component catalo rogrammes and social umer sources eg watc	designers and nd ergonomic data gues media outlets	
		Accept all valid	respons	ses.		
22	1	by a child betw Table 4 . Complete the t	een 3 ar wo miss	sked to design a protot nd 5 years of age. The ing values in Table 4 f	y are using the data in for popularity votes.	AO4
		1 mark	correct.	ark for both missing po NO MARKS IF ONE I UT OF TWO INCORRI	EFT BLANK OR	
		Indicative con	tent:			
		Type of toy		Popularity votes	Popularity votes as a percentage	
		Role play		65	26%	
		Construction		40	16%	
		Letters and numbers		85	34%	
		Jigsaws and puzzles		25	10%	
		Soft toys		35	14%	
		Total		250	100%	

22	2	Use your valu and label the :	es from Question 22.1 to complete the bar chart below x axis.	3 marks	AO4
		1 mark	Step 1 – 1 mark for <i>x</i> axis		
		1 mark	Step 2 – 1 mark for correct size of letters and numbers bar (ft their answer from 22.1)		
		1 mark	Step 3 – 1 mark for correct size and placement of soft toys bar (ft their answer from 22.1)		
		Indicative co	ntent:		
		<u>x axis label:</u>			
		Accept: Popularity of o Popularity vot Not: Popularity vot			
			aph below shows the correctly completed missing and pink) if a student has provided the correct 1.		
			as provided incorrect values for 22.1 but their bar ly matches their values, they should receive the		
		Completed gra	aph:		
		Correctly com	pleted missing bars shown in blue and pink below:		
		Letters and numbers			
		Role play			
		Construction			
		Soft toys			
		Jigsaws and puzzles			
		0	10 20 30 40 50 60 70 80 90		
			Popularity of different toy types		

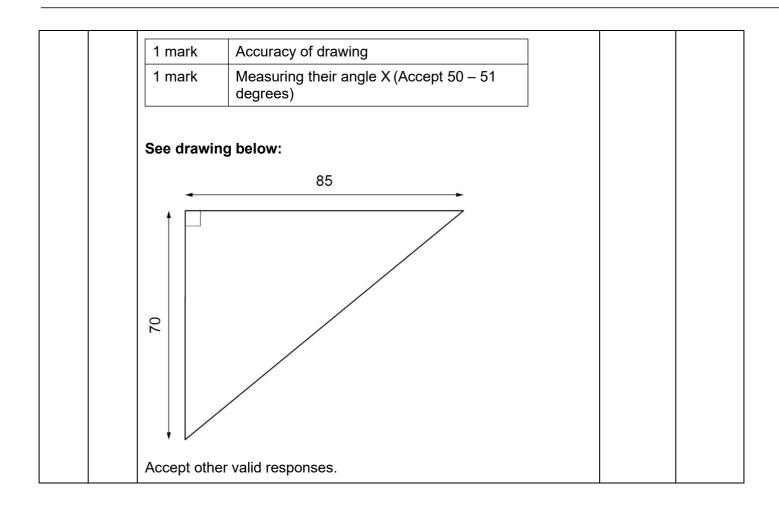
Qu	Part		Marking Guidance	Total marks	AO
Qu 23	Part	toy for use by 1 mark Indicative con The guidance worthy points 1. It must am 2. Bright and 3. It must not swallowed 4. There show child 5. There show	iled specification points to help with the designing of a 3 to 5 year-old-children. One mark for each design specification point given appropriate for a toy suitable for use by 3 to 5 year old children.		AO4
		 chewed/ing 7. If the toy c for a child 8. There musi- it 9. Materials t does not b 10. Materials r may chew A credit worth would be: It must be s It must be s It must be s It must be s 	ontains a battery it should be secured and not possible to remove – battery directive (labelling bit) at be no gaps where a child could put a finger and trap hat are tough and durable need to be used to ensure it reak if dropped or thrown need to be easy to clean (sanitise) because the child it, drop food on it. hy point must not be vague. Zero mark responses strong be too big made from cheap materials		

Qu	Part	Marking Guidance	Total marks	AO
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24	1	encourage	and 9 show a front and side view of a bug box used to insects to visit a garden. two-point perspective drawing of the bug box in the ded below.	4 marks	AO4 2c
		1 mark	A recognisable attempt at a 3-dimensional drawing e.g. 3 connected elevations/sides to object.		
		1 mark	Clear evidence of some perspective/ foreshortening.		
		1 mark	Drawing is recognisable as the bug box in the indicative content below (does not have to show hook or overhang of roof).		
		1 mark	Inclusion of hook or extension to the front edge of the roof.		
			with bug box drawn above, on or below a horizontal een two vanishing points (horizon line) are acceptable –		



24	2	degree to e	he size of angle X in Figure 10 to the nearest whensure an accurate fit of the two roof pieces. working/construction.	nole 4 r	marks	AO4
		Trig Meth	_			
		1 mark	85 seen			
		1 mark	Step 1 – correct use of tan formula: Tan Y = opp/adj			
		1 mark	Step 2 – correct substitution of correct size of opposite and adjacent lengths: Tan Y = 70/85			
		1 mark	Step 3 – Tan ⁻¹ 0.8235294117 = 39.47 (degrees) Subtraction of angle from 90 degrees to give angle X : 90 – 39.47 = 51 degrees (Accept 50 degrees)			
		Alternativ	ve Trig Method			
		1 mark	85 seen			
		1 mark	Step 1 – correct use of tan formula: Tan X = opp/adj			
		1 mark	Step 2 – correct substitution of correct size of opposite and adjacent lengths: Tan X = 85/70			
		1 mark	Step 3 – Tan ⁻¹ 1.214285714 = 51 degrees (Accept 50 degrees)			
		Drawn/co	onstructed method			
		1 mark	85 seen			
		1 mark	Constructing a triangle with sides 85 mm × 70 mm			
		1 mark	Accuracy of drawing			
		1 mark	Measuring interior angle with protractor to arrive at $39 - 40$ degrees and subtracting that angle from 90° (Accept $50 - 51$ degrees)			
		Alternative drawn/constructed method				
		1 mark	85 seen			
		1 mark	Constructing a triangle with sides 85 mm × 70 mm			



Qu	Part		Marking Guidance	Total marks	AO
25		minimise wa	ufacture it is important to use materials efficiently and ste. each of the following improves material management.	2 x 3 marks	AO4
		3 marks	Two or more correct explanation points clearly made in detail.		
		2 marks	Two or more simple explanation points lacking depth and understanding or one correct explanation point given in detail.		
		1 mark	One simple correct point for technique is given demonstrating limited understanding.		
		0 marks	Nothing worthy of credit.		
		Indicative c	ontent:		

	ovided is illustrative and not exhaustive. Credit any ade in support of the band descriptors above.
Nesting of shap	bes and parts/lay planning
 the effective upossible. By placing simwaste. Strategic way Looking for pathey are triang together as possible and they are triang together as possible. Tessellation is interlocking are 	a process by which parts are placed together in nd repeating patterns to minimise waste.
ensure materi minimise wast	
Cutting techniq	ues
ensure the proside the	vidth of saw cuts eg 2mm with a dovetail saw to beess of cutting does not accidentally reduce the al being cut out. sider material removed by saw cuts will make
and having toSeam allowan	being cut out possible too small (out of tolerance) be rejected ie material wasted. Ice to allow for an effective join to be formed along abric materials to be joined.
paper and boa to ensure effer • Use of red line	nt coloured lines for cut and score/crease lines in ards to ensure fold flaps and glue flaps are created ctive assembly. e for cut and black lines for engrave/raster lines on a avoid errors in pre-cut checks.
	•

Qu	Part		Marking Guidance	Total marks	AO
26		Describe how materials can be formed when making a prototype.		3 marks	AO4
		3 marks	A thorough understanding of what 'forming' is and how it can be used in prototype construction in a material area(s) studied by the candidate.		
		2 marks	Basic understanding of 'forming' and how it is used in prototype construction in a material area(s) studied by the candidate.		
		1 mark	Very limited understanding of 'forming' naming a forming process or giving an example of where it would be used in a prototype construction in a material area(s) studied by the candidate.		
		0 marks	Nothing worthy of credit.		
		Indicative co	ontent:		
		•	e provided is illustrative and not exhaustive. Credit any made in support of the band descriptors above.		
			nses may consider deforming of reforming. Both nvolve a change in material shape without adding or aterial.		
		Timber based materials			
		• Timber strips can be steamed to make them more pliable and easier to bend.			
		eg stair ha	r fibres are softened and bent without tearing or rupture nd rails, musical instruments.		
		using a for			
		Pressure is shape is m	s applied until the adhesive curs/set and a change in nade.		
		Metal based materials			
		 Bars and transformed to a linear ler 	ubes can be bent found a former to change shape from		
		 Metals car 	h be heated (annealed) to make them easier to bend. In be forged. Heating until red hot and shaped on an		
		 Metals car 	n be formed using casting processes where the metal is til molten and poured into a cavity or mould to make 3d		
		•	n be pressed using extreme pressure eg car body		
		Papers and	boards		

 Accurate folds can be produced using creasing bar on a paper or board first. Scoring can be used to cut fibres weakening a piece of paper of card making it easier. Perforations 'push' material apart (creating small holes) making it easier to tear and separate material eg tissue box lid. Scoring, creasing and perforations are all forming processes making it easier to perform a shape or direction change in a piece of paper or card. 				
Polymers				
 Simple bends can be created by heating a piece of thermoplastic polymer in a straight line (using a line bender) where a bend is needed. 3D shapes can be created using vacuum forming over a former by heating a polymer sheet and creating a permanent form when it cools. Plug and yoke method can be used to form a shape in polymer sheet. Injection moulding of polymers to create profiles and 3D products. 3D printing to create a 3D prototype 				
Textiles				
 Drape forming of felt based products like hats. Gathering – uses a sewing technique to increase the 'fullness' of a material or prototype eg curtains. Pleating – similar to gathering, but where textiles are folded and held by stitching along an edge. 				
Accept other valid responses.				