



---

# **GCSE MARKING SCHEME**

---

**SUMMER 2018**

**DESIGN & TECHNOLOGY  
SYSTEMS AND CONTROL  
4121/01**

## **INTRODUCTION**

This marking scheme was used by WJEC for the 2018 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

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

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

## GCSE DESIGN & TECHNOLOGY: SYSTEMS AND CONTROL

### SUMMER 2018 MARK SCHEME

Q	Part	Answer	Marks	Total		
1.	(a)	(i)	Batch Production underlined. (only acceptable answer)	1	1	
			Incorrect answer / wrong scale of production circled.	0		
		(ii)	Full answer should demonstrate understanding e.g. the cover provides protection for the used or new brushes being stored. Or Keeps dust / dirt away from brushes, clean / hygienic storage in a visible transparent case.	1	1	
			Incorrect answer / wrong answer	0		
		(iii)	Full answer should demonstrate understanding e.g. The average family has 4 members so each person has their own brush but uses the same handle. Or For various people to use their own individual brush head and to keep spares.	2	2	
			Limited answer e.g. for different people or replace broken ones.	1		
			One word responses like spares.	0		
		(b)	(i)	Full answer should demonstrate understanding e.g. There are 34,000 strokes per minute, timing for 2 minutes and auto alert to clean teeth properly, and different modes for teeth / gums etc. Or The toothbrush helps people clean their teeth more effectively than by hand because it is timed, different modes to suit, auto alert for coverage.	2	2
			Limited answer e.g. people will clean their teeth better than by hand / without device. Plastic cover keeps brushes clean.	1		
			Inappropriate or incorrect answer e.g. better toothbrush.	0		
		(ii)	Full and detailed response e.g. the electronic brush is rechargeable, can be used multiple times without replacing batteries. Or The toothbrush uses replaceable heads meaning you do not need to buy new handsets or dispose of old ones. (less waste). Or You only buy one toothbrush for the family instead of multiple – reducing cost and materials.	2	2	
			A weaker response worthy of some credit e.g. the toothbrush is rechargeable.	1		
	Inappropriate or incorrect answer.		0			
	(c)	A full and detailed response e.g. The base is rounded and slimline and looks modern and stylish. The chrome matches taps / fittings in bathrooms. Or The white colours are clean and clinical and the colour coded brush heads are easy to identify individual brush attachment.	2	2		
		A weaker response with some credit e.g. fits in with bathroom colour schemes.	1			
		Inappropriate or incorrect answer.	0			

Q	Part	Answer	Marks	Total
	(d)	The manufacturer will make a profit by selling replacement packs of brushes without users needing to buy the whole product. Or There will always be a market for replacement brush heads if users purchase the product in the first place.		<b>2</b>
		A weaker response with some credit e.g. manufacturer will make profit even after the toothbrush has been sold.	1	
		Inappropriate or incorrect answer.	0	
	(e) (i)	Popularity increases once the product has been released. Or Sales increase as the product becomes more popular / more people buy and trend patterns occur.	1	<b>1</b>
		Inappropriate or incorrect answer.	0	
	(ii)	Correct calculation method and correct answer e.g. $20/100=5$ , $5*450=2250$ Or $450/20=22.5$ , $22.5*100=2250$	2	<b>2</b>
		Correct answer, no workings OR correct workings wrong answer	1	
		Incorrect answer, incorrect or no workings.	0	
	All	Unexpected answers – candidates may respond in a way that is unexpected or does not fit with the marking scheme. Examiners to follow code of practise and contact team leader.		
				<b>15</b>

Q	Part	Answer	Marks	Total
2.	(a)	Reuse Repair	2x1	2
		Incorrect or blank.	0	
	(b)	80% of this product has been made from recycled material Do not dispose of in normal household rubbish – indicates that an object such as batteries, should not be thrown away in standard wheelie bins.	1 1	2
		Incorrect or inappropriate answer	0	
	(c)	A clear and detailed response including 3 strands, and at least 1 winner and loser e.g. Winners could be consumers because products could be produced quicker and sold at cheaper prices, losers could be the environment because of the transportation involved. Losers could be companies / suppliers or workers losing contracts / orders / jobs as a result of cheaper options offered in developing countries.	3	3
		Weaker response or not 3 strands, but some truth e.g. winners could be small businesses who secure contracts from larger worldwide companies, losers could be local economies because work is shipped out of the country.	2	
		A basic response which is limited to one winner or loser only e.g. loser is environment because of carbon generated.	1	
		Incorrect or inappropriate answer.	0	
	(d)	A clear and detailed response including comparison to another named green energy source e.g. Tidal power is guaranteed due to tide times, solar power or wind generators are far less efficient due to sunny weather / windy climate. Tidal power is hidden underwater where solar or wind turbines are visible and deemed unsightly.	3	3
		Weaker responses with less detail or comparison, e.g. tidal happens naturally twice a day and causes no visual pollution.	2	
		Basic response with some truth e.g. tidal power is a natural resource and always there.	1	
		Incorrect or inappropriate answer.	0	
	All	Unexpected answers – Possibly a wide range of responses for C and D.		
				<b>10/25</b>

Q	Part		Answer	Marks	Total
3.	(a)	(i)	Names of designers Right – James Dyson Left – Shigeru Miyamoto (Do not accept Nintendo)	2x1	2
		(ii)	<p>Description of the chosen Designer's work:</p> <p>James Dyson:</p> <ul style="list-style-type: none"> <li>• Cyclonic action in vacuum cleaners, starting with DC01, giving increased suction</li> <li>• Bagless vacuum cleaners</li> <li>• Futuristically styled products and yellow / grey / purple colour schemes</li> <li>• Gender neutral</li> <li>• Many revitalised cleaners in the range, portability and wireless</li> <li>• Developed hand dryers with improved force / drying</li> <li>• Bladeless fans, very powerful and efficient</li> </ul> <p>Shigeru Miyamoto:</p> <ul style="list-style-type: none"> <li>• Character development for platform gaming</li> <li>• Power ups, levels and weapon upgrades</li> <li>• Skills learned in level tested with mini boss at end of level</li> <li>• Big boss challenge</li> <li>• Jumpman – Mario</li> <li>• Legend of Zelda</li> <li>• Mario, Mario Bros, super Mario, spin offs like Mario kart.</li> </ul> <p>Innovation (Dyson):</p> <ul style="list-style-type: none"> <li>• Market leader in vacuum cleaners</li> <li>• Sophisticated dual cyclonic action improved suction and performance over others</li> <li>• Perceived higher quality than competitors</li> <li>• Replaced bags with transparent container to show effectiveness of cleaning</li> <li>• Reliability and excellent build quality</li> <li>• Support / Customer services / aftersales Help</li> <li>• Bright, non-white products with high aesthetic value, as well as functional value.</li> </ul> <p>Innovation (Miyamoto):</p> <ul style="list-style-type: none"> <li>• Game play, enhanced graphics</li> <li>• Improved features and playability</li> <li>• Game saving – saving progress during games</li> <li>• Different levels / worlds to progress to.</li> <li>• First 3D camera view within a game</li> <li>• Increasing difficulty as game progresses.</li> </ul>		
			No response or inappropriate answer.	0	

Q	Part	Answer	Marks	Total
		<p>Some simple description of the work of the designer            Little, if any, understanding of their products or            Little, if any, understanding of their features.            Little, if any, understanding of how products are innovative when compared with others, or identifying features.</p> <p>Quality of Written Communication is limited, presenting material with limited coherence, many errors of grammar, punctuation and spelling.</p>	1	
		<p>Some description of the work of the designer            Little understanding of their products or            Little understanding of their design features.            Little understanding of why products are innovative, or identifying features.</p> <p>Quality of Written Communication is basic, presenting occasionally appropriate material with some coherence, some errors of grammar, punctuation and spelling.</p>	2	
		<p>Description of the work of the designer            Some understanding of their products or            Some understanding shown of their design features.            Some understanding of the innovation within their products when compared with others.            Some understanding of identifiable features that make the products successful.</p> <p>Quality of Written Communication is good, presenting mainly appropriate material in a coherent manner, few errors of grammar, punctuation and spelling.</p>	3 or 4	
		<p>Description of the work of the designer.            Understanding shown of their products or.            Discussion of the designer's design philosophy and product styling            Evidence of a reasonable understanding of why products are successful, and the features that represent the chosen designer.</p> <p>Quality of Written Communication is very good, presenting appropriate material in a coherent and logical manner, very few errors of grammar, punctuation and spelling.</p>	5 or 6	
		<p>Description of the work of the designer.            Clear understanding shown of their products or            Discussion of the designer's design philosophy and product styling with fully appropriate examples provided.            Detailed discussion and analysis of the successful aspects of products which make the designs iconic, standing out from competitors and easily identifiable.</p> <p>Quality of Written Communication is excellent, presenting wholly appropriate material in a coherent and logical manner, hardly any errors of grammar, punctuation and spelling.</p>	7 or 8	
				<b>10/35</b>

Q	Part	Answer	Marks	Total
4.	(a)	2 X clear and correctly named research strategies. Questionnaire and Results, Product Disassembly, Interview, Observation, Internet trail, Survey, Testing / samples and feedback, User Target groups (others may be acceptable).	2 x 1	2
		No answer or inappropriate answer.	0	
	(b)	A clear and detailed response. E.g. Using software like Yenka to build, model and test an electronic circuit to see if it works, and make any changes needed. Or Use CAD to drive cam machines to model shape, form or function of ideas. Or To undertake rapid prototyping e.g. 3d printing, so that physical ideas can be tested / with client or target market.	2	2
		A weaker / less clear response. E.g. to see what a design will look like.	1	
		No answer or inappropriate answer.	0	
		A clear and detailed response. E.g. An ongoing evaluation occurs during the design and development of a solution, a final evaluation is a summative analysis at the end of the process once complete, to identify further improvements required. Ongoing evaluations allow the designer to make refinements to improve solutions, final evaluation are too late to make changes as the product is complete.	3	3
		Weaker responses may not be as detailed, Ongoing happens during the designing but final evaluation happens at the end.	2	
		Basic response with some truth or only covering one aspect e.g. a final evaluation allows the designer to see whether the product was a success. Final ongoing is during designing.	1	
		Poor response / no clarity, no answer or inappropriate answer.	0	
				<b>7/42</b>
	(d)	(i) Block diagram with three main boxes, Input, Process, and Output. Components in relevant box e.g. LDR, Transistor, PIC or similar, LEDs and buzzer or piezo. Unexpected answers might appear here.	3 x 1	3
		No answer or inappropriate answer.	0	
	(ii)	Accurate and clear sketching of the external features of the healthy eating device including all the specification points.	4	4
		Clear sketching meeting most details of the specification.	3	
		Clear sketching meeting some details of the specification.	2	
		Limited information meeting some of the specification points.	1	
		No answer or inappropriate answer.	0	



Q	Part	Answer	Marks	Total
	(iii)	Fully labelled circuit diagram of a system that will work. Symbols and conventions correct and accurate. Comprehensive details of a PIC, transistor switch system or other that would be fully functioning meeting the specification.	[up to 4/5]	<b>5</b>
		Labelled circuit diagram that shows some conventions and components correct, some use of suitable components but may not function fully.	[up to 2/3]	
		Labelled circuit diagram with several errors or details missing. One or two components or conventions correct.	[up to 1]	
		No answer or inappropriate answer.	0	
	(iv)	Clear details of a fun themed product which encourages healthy eating and fits a refrigerator door.	2	<b>2</b>
		Some details of a method, maybe some errors / partially correct.	1	
		No answer or inappropriate answer.	0	
	(v)	Two or more dimensions given. Main material / s named. High quality sketching, communication. Conventions used.	4	<b>4</b>
		At least one dimension given or one material named. Sketching, communication and Conventions generally accurate.	3	
		Lacks appropriate dimensions and/or materials, Some errors, basic levels of sketching and communication.	2	
		No specific / appropriate dimensions or materials. Offered, weak quality sketching and Communication.	1	
		No answer or inappropriate answer.	0	
				<b>18/60</b>

Q	Part		Answer	Marks	Total
5.	(a)	(i)	One –off production (accept one-off or bespoke).	1 1	1
			No answer or inappropriate answer.	0	
		(ii)	Batch Production (accept batch).	1	1
			No answer or inappropriate answer.	0	
		(iii)	Continuous Flow production (accept continuous flow).	1	1
			No answer or inappropriate answer.	0	
	(b)	(i)	Stage 1 – Solder paste applied Stage 3 – Heating Stage 5 - Cooling	1 1 1	3
			No answer or inappropriate answer.	0	
		(ii)	A clear and detailed response. E.g. At the reflow stage, the solder paste becomes liquidised, bonding the components to the pcb pads.	2	2
			A less developed response e.g. the solder paste melts.	1	
			No answer or inappropriate answer. One word responses like faster.	0	
	(c)		A clear and detailed response. E.g. Reflow soldering uses accurate amounts of solder paste (no waste) and solders all components in one go, while through hole requires additional drilling, inserting and either individual soldering or wave.	2	2
			A less developed response e.g. Reflow soldering is a more efficient process than through hole.	1	
			No answer or inappropriate answer.	0	
					<b>10/70</b>

Q	Part		Answer	Marks	Total
6.	(a)	(i)	Crank and slider.	1	1
			No answer or inappropriate answer.	0	
		(ii)	Linear or reciprocating	1	1
			No answer or inappropriate answer.	0	
		(iii)	Pawl and ratchet.	1	3
			A clear and detailed response. E.g. When the ratchet wheel rotates anti-clockwise, the pawl will drop into the next tooth. The Pawl stops the ratchet from rotating clockwise.	2	
			A less clear understanding but some truth e.g. The pawl and ratchet will move round one way but not the other.	1	
			No answer or inappropriate answer.	0	
	(b)	(i)	Photovoltaic cell (accept solar cell or solar panel or PV cell).	1	1
			No answer or inappropriate answer.	0	
		(ii)	Correct calculation method and correct answer e.g. Ratio is 1:20, $120/20 = 6\text{rpm}$ .	2	2
			or RV of driver x teeth = RV of driven x teeth. $250 \times 1 = 20 \times ?$ , $120/20 = 6\text{rpm}$ .	2	
			Correct answer, no workings OR correct workings wrong answer.	1	
			No answer or inappropriate answer.	0	
		(iii)	A clear and detailed response. E.g. The PV cell needs to have more UV light exposure to generate more electricity to make the motor rotate faster.	2	2
			Or The gear ratio of the Worm drive and spur needs to be reduced so that the buggy goes quicker. E.g. less teeth on the spur $1:15 = 16.6\text{rpm}$ .	2	
			Or Add additional PV cells in series with the one pictures to increase input voltage.		
			Or Increase the diameter of the back wheels which would increase the speed.		
			Or Reduce the overall weight of the buggy by using less or lighter materials and components.		
			A less developed response e.g. The motor needs to go faster / provide more rpm.	1	
			No answer or inappropriate answer.	0	

Q	Part	Answer	Marks	Total	
	(c)	(i)	<p>A clear and detailed response. Look for 3 strands. E.g. When the SPDT is in position Y, the capacitor begins to charge.</p> <p>This creates a time delay. (controlled by VR and Cap).</p> <p>Once almost full, the capacitor activates the NPN transistor. This turns on the outputs (Buzzer and LED).</p> <p>Reduce marks x 1 as responses become weaker / thinner. Incorrect answer, some correct workings.</p> <p>No answer or inappropriate answer e.g. to make the circuit work properly.</p>	<p>3</p> <p>1</p> <p>1</p> <p>1</p> <p>0</p>	<b>3</b>
		ii	<p>A clear and detailed response. E.g. Component A is a capacitor. It provides a time delay because it takes time to charge. The capacitor creates a rising voltage at the base of the transistor, eventually switching it on.</p>	2	<b>2</b>
			<p>A less developed response e.g. This is a capacitor which charges up. Or This component creates a time delay.</p>	1	
			No answer or inappropriate answer.	0	
					<b>15/85</b>

Q	Part	Answer	Marks	Total
7	(a)	Side cutters                  Digital Multimeter                  (Machine) Vice	3x1	<b>3</b>
		No answer or inappropriate answer.	0	
	(b)	Wear goggles on this machine / safety goggles must be worn.	1	<b>2</b>
		Hazardous material / hazardous substance. No response or incorrect response.	1 0	
		No response or incorrect response.	0	
	(c)	(i) Copper rod (accept Steel or aluminium).	1	<b>1</b>
		No answer or inappropriate answer.	0	
		(ii) HIPS or High Impact Polystyrene (accept acrylic). Accept PLA or ABS. No answer or incorrect answer.	1 0	<b>1</b>
		(iii) The hook could be fixed using a nut and bolt (with or without washers). 1. Mark out / drill holes in hook. Counter bore / countersink bolt heads. 2. Line up and mark / drill holes in back. 3. Place bolt through hook and back and fasten with nut/ locking nuts. (note: only temporary fixing methods can be credited).	3x1	<b>3</b>
		Reduce marks x 1 as responses appear weaker / detail becomes thin.		
		No response or inappropriate answer.	0	
		(iv) A clear and detailed response. E.g. The holes in the black layer allow air to be removed when vacuum forming so that the HIPS forms a close and tight fit around the mdf former and the black base.	2	<b>2</b>
		A less developed response e.g. The holes allow the case to fit better.	1	
		No response or inappropriate answer.	0	
		(v) Look for 4 steps: 4 x 1 1. MDF has been marked out and cut from stock. (2 layers have been glued together with PVA). 2. The front details / circle have been drawn on CAD Tecsoft 2D design and cut out using CAM / laser cutter. (Accept drawn and cut by hand using pencil / compass / coping saw). 3. Draft angles have been applied to the MDF by either planning or disc sanding. Edges have been rounded by filing and glass paper to achieve a smooth finish. 4. The front details have been glued using PVA glue. (Step 3 and 4 could be reversed and still be acceptable).	4 1 1 1 1	<b>4</b>
		Reduce marks x 1 as responses appear weaker / detail becomes thin.		
		No response or inappropriate answer.	0	

Q	Part	Answer	Marks	Total
	(vi)	<p>Look for 4 steps: 4 x 1.</p> <ol style="list-style-type: none"> <li>1. The probes need an appropriate block to house them and keep them in parallel. Nylon, acrylic, or wooden materials (insulators).</li> <li>2. The block needs holes drilled in it so that the probes can be inserted through but must remain tight. (bonding is acceptable here, epoxy resin/ flattening out copper rods and forcing them partially into the block).</li> <li>3. The wires from the pcb need to be soldered / bolted/ riveted to the rod ends.</li> <li>4. The block needs to be secured to the inside of the casing or to the casing back. Nut and bolt / adhesive / screw (depending on materials).</li> </ol> <p>Look to credit alternative methods. Candidates must name specific materials, fixings and joining methods.</p> <p>An alternative:</p> <ol style="list-style-type: none"> <li>1. Probes need to be cut to the same size.</li> <li>2. Lines need to be measured and marked identically on both probes.</li> <li>3. Probes could be attached directly onto pcb using soldering, with or without a bend. Large pcb pads / tracks would be required.</li> <li>4. Pcb would need to be held securely inside casing so that the probes line up and fit through the holes in the casing.</li> </ol>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p><b>4</b></p>
		No response or inappropriate answer.	0	
				<b>20/105</b>

Q	Part	Answer	Marks	Total	
8	(a)	(i)	False False	1 1	2
			No response or inappropriate answer.	0	
		(ii)	A clear and detailed response e.g. The device will still need to operate if mains power is cut or lost, therefore the battery back-up is essential.	2	2
			A less developed response e.g. To make sure the device is powered.	1	
			No response or inappropriate answer.	0	
	(b)	Completed flowchart (decisions require yes / no label to be correct). <pre>graph TD     START([START]) --&gt; GL[Green Lights On]     GL --&gt; D1{Is preset temperature reached?}     D1 -- Yes --&gt; YLO[Yellow Light On]     YLO --&gt; SO[Siren On]     SO --&gt; D1     D1 -- No --&gt; YL[Yellow Light Off]     YL --&gt; D2{Is smoke present?}     D2 -- Yes --&gt; RL[Red Light Flash]     RL --&gt; S2[Siren On]     S2 --&gt; D1     D2 -- No --&gt; RLO[Red Light Off]     RLO --&gt; SO2[Siren Off]     SO2 --&gt; D1</pre>	8x1	8	
			Marks reduced x1 as errors appear		
	(c)	A clear and detailed response e.g. Look for 3 reasons: A PIC is a small device able to fit inside the control panel and / or ceiling mount. A PIC can control a number of Inputs and Outputs simultaneously as required for the fire detection device. A PIC can be powered by a mains / battery supply. A PIC can be re-programmed to specific needs / circumstances.	3 x1	3	
			No response or inappropriate answer.	0	
			Note: Flow chart could gain some marks if vertical lines are reversed/vice versa.		
					<b>15/120</b>