



GCSE MARKING SCHEME

SUMMER 2016

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

INTRODUCTION

This marking scheme was used by WJEC for the 2016 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 2016 MARK SCHEME

Q	Part		Answer	Marks	Total
1	(a)	(i)	Full answer should demonstrate understanding of how the specification point is met e.g. the dimensions of the product and weight allow users to move / carry the device, made from stainless steel and beech with are tough and robust materials.	2 marks	2
			Limited answer e.g. is small and not too heavy.	1 mark	
			Weak or short responses like small or easy to carry.	0 marks	
		(ii)	Full answer should demonstrate understanding of how the specification point is met e.g. the nut cracker is 'light-hearted' based on a squirrel shape which appears to hold / carry the nut when placed on the device. Or The nut cracker is 'light-hearted' based on using the squirrel's tail as the lever to crack the nuts.	2 marks	2
		Limited answer e.g. squirrels eat nuts.	1 mark		
		One word answers like fun	0 marks		
		(iii)	Full answer should demonstrate understanding of how the specification point is met e.g. the user's hands and fingers are distant to the part that could cause injury where the nut is cracked. All edges and corners are rounded with no sharp angles which could cut or injure the user.	2 marks	2
		Limited answer e.g. looks like it will not harm users.	1 mark		
		One word responses like safe	0 marks		
	(b)		Full answer should demonstrate understanding e.g. the stainless steel is very shiny and glossy and would be appealing as an ornament on display when not in use. Or The materials used provide aesthetic appeal and would fit in with kitchens, dining rooms or lounges where other similar products could be used. Or There is no box and the device is too tall to fit in a drawer so would be left in view and not put away.	2 marks	2
			Limited answer e.g. has nice colours or shapes.	1 mark	
			Inappropriate or incorrect answer looks nice,	0 marks	
	(c)	(i)	Only acceptable answer – Batch Production	1 mark	1
			Inappropriate or incorrect answer,	0 marks	
		(ii)	A clear and detailed response e.g. the manufacturer would order enough to satisfy early demand but not too many in case the product was unpopular. (Just In Time or JIT acceptable) To try and predict how many might be sold without running out or ordering too many. Small number because they are collector's items therefore limited editions	2 marks	2
		An unclear or less detailed response. A response which contains some truth e.g. do not want any left over.	1 marks		
			Limited response like e.g. guessing how many are needed.	0 marks	

Q	Part		Answer	Marks	Total
1	(d)	(i)	July – September (accept Jul-Sept)	1 mark	1
			Inappropriate or incorrect answer,	0 marks	
		(ii)	People tend to have less disposable income. Buying trends reduce after Christmas. Nuts could be seasonal / Christmas purchases so not needed January – March.	1 mark	1
			Inappropriate or incorrect answer,	0 marks	
		(iii)	The correct answer together with workings: $28/100 * 5600 = 1568$, or $5600/100 * 28 = 1568$.	2 marks	2
			Correct answer, no workings OR correct working wrong answer.	1 mark	
		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.		
					15

Q	Part	Answer	Marks	Total
2	(a)	REUSE RECYCLE	2x1 mark	2
		Incorrect or blank.	0 marks	
	(b)	A clear and detailed response e.g. CE means Conforms to European Standards and approved and safe for use.	2 marks	2
		An unclear or less detailed response, e.g. the product is safe for use.	1 mark	
		Incorrect or inappropriate answer	0 marks	
	(c)	A clear and detailed response . The energy and materials required to manufacture/transport the product. The effects the product has on the environment during its use. Effects on the environment when the product has reached the end of its life. Note: There could be some extended responses covering many areas – credit needs to be awarded for 'strands' covered in responses. (3 x 1) One strand with some depth, up to 2 marks.	1 mark 1 mark 1 mark	3
		Less developed responses covering 2 factors.	2 marks	
		Weak response but some truth only relating to 1 aspect.	1 mark	
		Incorrect or inappropriate answer .	0 marks	
	(d)	A clear and detailed response. Winners would be the homeowners who would gain 'free' electricity generated... And also benefit financially from feed in tariffs for unused generated electricity fed into the grid... Winners could be solar panel manufacturer or supplier selling units. Losers could be the homeowner or neighbours due to unsightly or ugly solar panels on view Losers could be the homeowner for having to invest large sums of money upfront before rewards. (Must offer balanced opinion i.e. winner AND loser 2 /1 or 1 /2)	1 mark 1 mark 1 mark	3
		Weaker responses or responses with 1 winner 1 loser or 2 of either.	2 marks	
		Weak responses with some truth or covering 1 winner OR loser.	1 mark	
		Incorrect or inappropriate answer.	0 marks	
	All	Unexpected answers – Possibly a wide range of responses for C and D.		

Q	Part		Answer	Marks	Total
3	(a)	(i)	Names of designers Left – James Dyson Right – Shigeru Miyamoto (Do not accept Nintendo)	2x1 marks	2
		(ii)	<p>Description of the chosen Designer's work:</p> <p>James Dyson:</p> <ul style="list-style-type: none"> • Cyclonic action in vacuum cleaners • Bagless vacuum cleaners • Futuristically styled products and yellow / grey / purple colour schemes • Gender neutral. • Many revitalised cleaners in the range DC28 • Developed hand dryers with improved force / drying <p>Innovation:</p> <ul style="list-style-type: none"> • Market leader in vacuum cleaners • Sophisticated dual cyclonic action improved suction and performance. • Perceived higher quality than competitors • Replaced bags with transparent container to show effectiveness of cleaning. • Reliability and excellent build quality • Support / Customer services / aftersales Help <p>Miyamoto:</p> <ul style="list-style-type: none"> • Gaming design – characters and platforms • Iconic characters like Kong, Mario etc. • 3D perspective playing / viewing. Saving feature. • Improved graphics and playability • Multiple adventures / editions of games • Developed handheld, portable and wireless gaming – DS, Wii • Individual, team play and global communication with players <p>Innovation:</p> <ul style="list-style-type: none"> • Best gaming experience compared with competitors • Market leader in platform gaming • Designer of desirable and cherished characters • Maximum experiences multiplayer • Established a greater market share than rivals 		
			No response or inappropriate answer.	0 marks	
			<p>Some simple description of the work of the designer. Little, if any, understanding of their products or Little, if any, understanding of their design philosophy or Little, if any, understanding of how products are innovative.</p> <p>Quality of Written Communication is limited, presenting material with limited coherence, many errors of grammar, punctuation and spelling.</p>	1 mark	
			<p>Some description of the work of the designer. Little understanding of their products or Little understanding of their design philosophy or Little understanding of why products are innovative.</p> <p>Quality of Written Communication is basic, presenting occasionally appropriate material with some coherence, some errors of grammar, punctuation and spelling.</p>	2 marks	

Q	Part		Answer	Marks	Total
3	(a)	(ii)	<p>Description of the work of the designer. Some understanding of their products or Some understanding shown of their design philosophy or Some understanding of the innovation within their products.</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 or Evidence of a reasonable understanding of why products are accepted as innovative.</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 innovative features their products which separate these over other competitor products.</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	
4	(a)		<p>Correct design term linked to meaning. Evaluation – A reflection analysing whether the specification has been met fully. Final Solution – A detailed set of graphical and technical details. Design Brief – A statement of the designer's intent at the start of a project.</p>	<p>1 mark</p> <p>1 mark</p> <p>1 mark</p>	3
			No answer or inappropriate answer.	0 marks	
	(b)		<p>A clear and detailed response. e.g. to consider how parts of a product will be made and / or constructed, with specific tools, equipment and time estimates. Could include risk assessment/H&S issues.</p>	2 marks	2
			<p>A weaker / less clear response. e.g. to show how a product is made.</p>	1 mark	
			No answer or inappropriate answer e.g. find out information.	0 marks	
	(c)		<p>A clear and detailed response. Testing materials and components during development will tell the designer whether their ideas will function or work as expected before going into full scale production. Or So designers can see if there will be any problems with the materials or components and if any further development is needed. Or To see if they react as expected, and if not, to enable the designer to find alternatives.</p>	2 marks	2

Q	Part	Answer	Marks	Total	
4	(c)	Weaker responses may not be as detailed,..to improve products ...	1 mark		
		Poor response / no clarity, no answer or inappropriate answer.	0 marks		
	(d)	(i)	Accurate and clear sketching of the external features of the cooling fan including all the specification points.	4 marks	4
			Clear sketching meeting most details of the specification.	3 marks	
			Clear sketching meeting some details of the specification.	2 mark	
			Limited information meeting some of the specification points.	1 marks	
			No answer or inappropriate answer.	0 marks	
		(ii)	Block diagram with three main boxes, Input, Process, and Output. Components named in relevant box e.g. Thermistor, Transistor, PIC or similar, Motor. Unexpected answers might appear here.	3 x 1 mark	3
			No answer or inappropriate answer.	0 marks	
		(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 marks]	5
			Labelled circuit diagram that shows some conventions and components correct, some use of suitable components but may not function fully.	[up to 2/3 marks]	
			Labelled circuit diagram with several errors or details missing. One or two components or conventions correct.	[up to 1 mark]	
			No answer or inappropriate answer.	0 marks	
		(iv)	Clear details of an effective method of attaching the fan to devices using a clip, clamp, hook or other fitting.	2 marks	
			Some details of a method of attaching, maybe some errors / partially correct.	1 mark	
			No answer or inappropriate answer.	0 marks	

Q	Part		Answer	Marks	Total
4	(d)	(v)	Two or more dimensions given Main material / s named High quality sketching, communication Conventions used.	4 marks	4
			At least one dimension given or one material named Sketching, communication and Conventions generally accurate.	3 marks	
			Lacks appropriate dimensions and/or materials, Some errors, basic levels of sketching and communication.	2 marks	
			No specific / appropriate dimensions or materials Offered, weak quality sketching and Communication.	1 mark	
			No answer or inappropriate answer.	0 marks	
5	(a)	(i)	Left: Through Hole Soldering Right: Surface Mount Technology	2x1 marks	2
			No answer or inappropriate answer.	0 marks	
		(ii)	A clear and detailed response e.g. quality control is managing to ensure that all products, parts or components are made accurately and meet a given specification.	2 marks	2
			A weaker response e.g. checking how good parts are. Credit may be awarded for describing quality control checks such as sampling / random testing	1 mark	
			No answer or inappropriate answer.	0 marks	
	(b)		A clear and detailed response e.g. pick and place allows lots of components to be positioned quickly and correctly in volume speeding up production and increasing quality.	2 marks	2
			A less developed response – Machines are more reliable than workers and make no mistakes.	1 mark	
			No answer or inappropriate answer.	0 marks	
	(c)		A clear and detailed response e.g. components are placed onto solder paste or similar	1 mark	2
			and	1 mark	
			PCB is heated, solder paste melts and bonds components to pad.	0 marks	
			No answer or inappropriate answer.		
	(d)		A clear and detailed response e.g. Moore's Law states that the amount of transistors on an IC / chip doubles every two years.	2 marks	2
			A less developed response e.g. circuits gets smaller because technology improves.	1 mark	
			No answer or inappropriate answer.	0 marks	

Q	Part		Answer	Marks	Total
6	(a)	(i)	Idler No answer or inappropriate answer.	1 mark 0 marks	1
		(ii)	Component A allows the direction of the two larger gears to be the same. Allow the other gears to be distanced. No answer or inappropriate answer.	1 mark 0 marks	
		(iii)	Correct response with evidence of workings. RV=driver x teeth = driven x teeth 12 x 33 = 396 396/18=22rpm Correct answer / no workings or some correct workings no incorrect /answer.	2 marks 1 mark	2
	(b)	(i)	Rotary Linear/reciprocating No answer or inappropriate answer.	1 mark 1 mark 0 marks	
		(ii)	The follower lifts / rises to its highest point. The follower falls / lowers to its lowest point. The follower dwells / stays in the same position. No answer or inappropriate answer.	1 mark 1 mark 1 mark 0 marks	3
	(c)	(i)	Darlington Pair No answer or inappropriate answer.	1 mark 0 marks	
		(ii)	A clear and detailed response e.g. Component B is a diode and needs to be present to prevent any back emf once the motor is activated. If the diode was removed the transistor would overload. A less developed response e.g. to protect the motor or transistor. Identifies the components as a diode and describes what it does in theory. No answer or inappropriate answer e.g. to make the circuit work properly.	2 marks 1 mark 0 marks	2
		(iii)	Look for 3 strands: <ul style="list-style-type: none"> As it gets darker the value of the LDR increases. This alters the potential difference. Once there is 1.2v at the base of the transistor, the motor is activated. Accept the reverse of above i.e. when it is light, the LDR resistance decreases and motor stops. No answer or inappropriate answer.	1 mark 1 mark 1 mark 1 mark 0 marks	

Q	Part		Answer	Marks	Total
7	(a)	(i)	Power Supply Unit Disc Sander Vacuum Former No answer or inappropriate answer.	3x1 mark 0 marks	3
		(ii)	A clear and detailed response e.g. to wear safety goggles to protect eyes in the event of a loose part flying off when sander is rotating. Always keep workpiece flat on table so that the disc does not pull the workpiece out of the users hands when sanding. Always switch on dust extraction to remove dust particles when sanding to avoid inhaling. A less developed response e.g. use the machine properly to avoid injury. No response or incorrect response .	2 marks 2 marks 2 marks 1 mark 0 marks	2
		(iii)	A clear and detailed response e.g. the possibility of overheating plastics when preparing to vacuum form, resulting in potential fire / triggering fire alarm / sprinklers. Ensure no materials are left on top of heating chamber when machine is in use or is cooling down having been used. A less developed response e.g. make sure operator does not leave the machine unattended when on. User being burnt / hurt during the vacuum forming process by touching the heater or hot HIPS can only be worth up to 1 mark because this could be misuse of the machine. No answer or inappropriate answer.	2 marks 2 mark 1 mark 1 mark 0 marks	2
	(b)	(i)	Voltage or Volts Resistance or ohms Current / amps or milliamps No answer or incorrect answer.	1 mark 1 mark 1 mark 0 marks	3
		(ii)	A clear and detailed response e.g. the two probes are connected across the area expected to conduct. With the meter dial in correct position, conducting between the two points will result in an audible beep. No sound means there is no conducting between the two points. A less developed response e.g. it will beep if the wire conducts No response or inappropriate answer.	2 marks 1 mark 0 marks	2
	(c)	(i)	Pine (accept other light softwoods like scotts pine, Red Deal) No response or inappropriate answer.	1 mark 0 marks	1
		(ii)	Acrylic or HIPS / High impact polystyrene or PVC sheet No response or inappropriate answer.	1 mark 1 mark 0 marks	1

Q	Part		Answer	Marks	Total
7	(c)	(iii)	<p>A clear and detailed response e.g. the logo has been engraved into the surface of the top using a Laser cutter / or CAMM 2 or CAM Router.</p> <p>A less developed response e.g. it has been engraved into the top.</p> <p>It has been laser cut into the top, It has been etched, rastering.</p> <p>No response or inappropriate answer.</p>	<p>2 marks</p> <p>1 mark</p> <p>1 mark</p> <p>0 marks</p>	2
		(iv)	<p>Sketches and notes should be used to convey stages. Look for four points:</p> <ul style="list-style-type: none"> • A clear and suitable method of holding / securing the circuit inside the product including. • Named materials, tools / equipment, details of making. • A clear and suitable method of holding / securing the battery inside the product including. • Named materials, tools / equipment, details of making. <p>If no sketches are used / all sketches no notes.</p> <p>The methods / materials / processes may be similar, but there needs to be sufficient detail for BOTH Circuit and battery. Hot glue gun is a credible way that is used in industry to support battery wires, not hold pcb's and power supplies, so up to 2 marks only depending on quality and clarity.</p> <p>No response or inappropriate answer.</p>	<p>1 mark</p> <p>1 mark</p> <p>1 mark</p> <p>1 mark</p> <p>Up to 2 marks</p> <p>0 marks</p>	4

Q	Part	Answer	Marks	Total
8	(a)	True True No response or inappropriate answer.	1 mark 1 mark 0 marks	2
	(b) (i)	<pre> graph TD Start([START]) --> D1{Is food hopper empty?} D1 -- Yes --> B1[Buzzer On] B1 --> D1 D1 -- No --> B2[Buzzer Off] B2 --> D2{Is food tray less than half full?} D2 -- No --> D1 D2 -- Yes --> B3[Open Hopper] B3 --> W1[Wait 5 secs] W1 --> B4[Close Hopper] B4 --> W2[Wait 6 hrs] W2 --> D1 </pre> <p>Completed flowchart (decisions require yes / no label to be correct) Marks reduced x1 as errors appear. Return loop can be correct in multiple positions. I returning above decision 'is food tray less than half full?' li above buzzer off lii missing the four commands that follow and returning to start or below.</p>	6x1 marks	6
	(ii)	<p>A clear and detailed response e.g. if the food tray is empty and the buzzer sounds for long periods this could run the batter flat. Or after long use the battery may become unreliable resulting in lack of food / no food being dispensed.</p> <p>A less developed response e.g. if the hopper is empty the buzzer will continually sound.</p> <p>No response or inappropriate answer.</p>	2 marks 1 mark 0 marks	2
	(c)	<p>There are a variety of programming methods available Look for 3 factors:</p> <ul style="list-style-type: none"> • A flowchart or program is designed, modelled, checked etc possibly using CAD. • Data is downloaded onto the PIC chip. • The PIC chip is placed in the circuit for the pet feeder and controls the system. The PIC can be reprogrammed if necessary. <p>No response or inappropriate answer.</p>	1mark 1 mark 1 mark 0 marks	3
	(d)	<p>A clear and detailed response e.g. a PIC is a small versatile IC that can control a number of inputs and outputs and time constraints. A PIC can be reprogrammed or edited to alter timings or settings.</p> <p>A less accurate or less developed response e.g. it is small and can fit inside the product easily.</p>	2 marks 1 mark	2