

## **GCSE**

# **Design and Technology: Electronics and Control Systems**

Unit **A515/01**: Sustainability and technical aspects of designing and making electronics

General Certificate of Secondary Education

## **Mark Scheme for June 2016**

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.







All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.


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These are the annotations, (including abbreviations), including those used in scoris, which are used when marking

Annotation	Meaning
	Blank Page – this annotation must be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
	Level 1
	Level 2
	Level 3
	Noted but no credit given
	Tick

Question		Answer	Mark	Guidance
1		C	1	
2		B	1	
3		D	1	
4		A	1	
5		C	1	
6		SMA, smart metal, memory metal, memory alloy, muscle wire, smart alloy, nitinol, smart wire	1	
7		Any of: <ul style="list-style-type: none"> <li>• Poison</li> <li>• Toxic to humans</li> <li>• Harmful</li> <li>• Reduces brain development</li> </ul>	1	Allow other legitimate hazards. Do not allow 'can be dangerous'.
8		Reduction in transport costs brought about by not having to 'go to the meeting' by sundry transport methods.	1	
9		Crowded/dangerous/difficult overheated working environment often for minimum wage, child labour and no rights, unregulated working.	1	
10		Acrylic (pmma, perspex, plexiglass,) polystyrene, ABS, polyester,	1	Or other oil based polymers not common in schools such as polyethylene, polypropylene, PVC. Exclude natural plastics such as casein or horn, not 'polymer' nor 'thermoplastics'.
11		False	1	
12		False	1	
13		False	1	
14		True	1	
15		True	1	

Question		Answer	Mark	Guidance
16	(a)	Any of: <ul style="list-style-type: none"> <li>• Slot for player to be held in</li> <li>• Lead to connect to audio source/ipod/mp3</li> <li>• USB power lead</li> <li>• Can be charged (via usb)</li> <li>• Two removable speakers</li> <li>• Volume control</li> <li>• on/off switch</li> <li>• Some sort of stand/base/prop device</li> <li>• Can be folded up</li> <li>• Speakers protected in transit</li> <li>• Aesthetics</li> </ul>	3	Allow any other valid response.
	(b)	Any of: <ul style="list-style-type: none"> <li>• Batteries not needed</li> <li>• No disposal issues of spent batteries</li> <li>• Can power and charge should it have rechargeable cells fitted</li> <li>• Increasing availability of standardised USB style chargers (PSU)</li> <li>• Means it can be used in any country</li> <li>• Could accept power from other sources e.g. host computer, solar or 'emergency/duration extender' power packs.</li> </ul>	2	

Question	Answer	Mark	Guidance														
(c)	<p>Parts identified as per question</p> <table border="1"> <thead> <tr> <th>Name of Part</th> <th>Letter on Fig.2</th> </tr> </thead> <tbody> <tr> <td>Integrated Circuit (IC) audio amplifier</td> <td>A</td> </tr> <tr> <td>Loudspeaker from PC monitor</td> <td>C</td> </tr> <tr> <td>MP3 player earphone lead with broken earphones</td> <td>E</td> </tr> <tr> <td>Piece of hardboard salvaged from back of a cupboard</td> <td>F</td> </tr> <tr> <td>Speaker grill from broken PC monitor</td> <td>D</td> </tr> <tr> <td>Tropical hardwood from old school bench</td> <td>B</td> </tr> </tbody> </table>	Name of Part	Letter on Fig.2	Integrated Circuit (IC) audio amplifier	A	Loudspeaker from PC monitor	C	MP3 player earphone lead with broken earphones	E	Piece of hardboard salvaged from back of a cupboard	F	Speaker grill from broken PC monitor	D	Tropical hardwood from old school bench	B	5	The first one is given in the question (Letter A).
Name of Part	Letter on Fig.2																
Integrated Circuit (IC) audio amplifier	A																
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Piece of hardboard salvaged from back of a cupboard	F																
Speaker grill from broken PC monitor	D																
Tropical hardwood from old school bench	B																
(d)	<p>Essentially expecting something like the picture but presented in a variety of ways such as multiple 2-D views, exploded view(s), rendered 3-D view(s) or combinations.</p> <ul style="list-style-type: none"> <li>• Use of parts from Fig.2 1 mark</li> <li>• Drawings that communicate intentions clearly 1 mark</li> <li>• Annotation 1 mark</li> <li>• Functional design 1 mark</li> </ul>	4	<p>Example of possible design (hardboard used as backing board)</p> 														

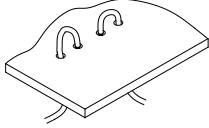
Question			Answer	Marks	Guidance	
					Content	Levels of response
	(e)*		<p>Candidates should use examples when illustrating their points. Answers should relate to these examples rather than generic text explaining how the carbon footprint might be reduced by 'turning lights and machines off'.</p> <p>Suggestions such as</p> <ul style="list-style-type: none"> <li>• Re-using LEDs</li> <li>• Chips</li> <li>• Screws and fixings</li> <li>• Wiring</li> </ul> <p>With explanation about the reduction in energy used in preparing the parts for manufacture and actual manufacture, transport implications.</p> <p>May be added to in light of candidate response.</p>	6	Maximum of 2 marks for short bullet point list	<p><b>Level 3 (5-6 marks)</b> Thorough explanation, with examples, showing a clear understanding of how secondary recycling can contribute to a reduced carbon footprint. There may be three or more clearly identified and explained points. Specialist terms will be used appropriately and correctly. The information will be presented in a structured format. The candidate will demonstrate the accurate use of spelling, punctuation and grammar.</p> <p><b>Level 2 (3-4 marks)</b> Adequate explanation, possibly with examples, showing a sound understanding of how secondary recycling can contribute to a reduced carbon footprint. There will be some use of specialist terms, although these may not always be used appropriately. The information will be presented for the most part in a structured format. There may be occasional errors in spelling, grammar and punctuation</p> <p><b>Level 1 (1-2 marks)</b> Basic explanation, possibly without examples, showing some understanding of how secondary</p>

Question			Answer	Marks	Guidance	
					Content	Levels of response
						<p>recycling can contribute to a reduced carbon footprint. There will be little or no use of specialist terms.</p> <p>Answers may be ambiguous or disorganised or 'list like'. Errors of grammar, punctuation and spelling may be intrusive.</p> <p><b>(0) response worthy of no marks</b></p>
			<b>Question 16 total</b>	<b>20</b>		
			<b>Section A Total</b>	<b>35</b>		

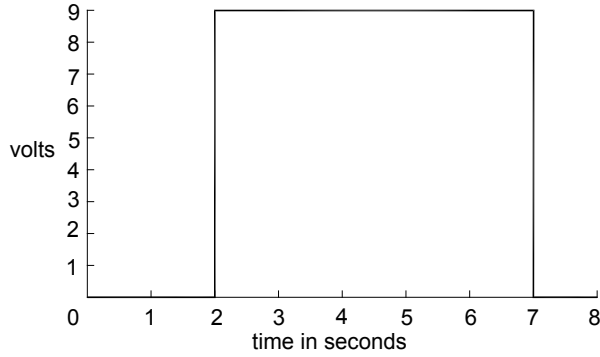


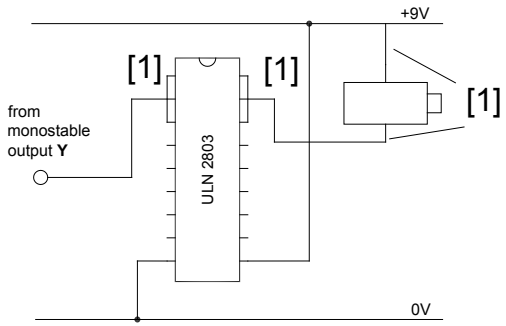
Question			Answer	Mark	Guidance
17	(a)	(i)	<pre> graph TD     A[clean hot tip of soldering iron on sponge] --&gt; B[tin the soldering iron]     B --&gt; C[place the tip of the soldering iron onto the joint]     C --&gt; D[allow heat to conduct]     D --&gt; E[feed the solder into the joint]     E --&gt; F[allow soldered joint to cool]           </pre>	3	<p>No marks for the first and last answer boxes which are given to candidates in the question paper.</p> <p>4 stages in correct order, 3 marks 3 stages in correct order, 2 marks 2 stages in correct order relative to each other, 1 mark.</p>
		(ii)	A joint that appears good but there is no electrical connection between component and track / wire and connector.	1	Allow mark for understanding shown. Allow mark for description of appearance of a dry joint
		(iii)	Through visual inspection 1 checking for physical movement 1 using a multimeter 1 using a logic probe 1 2 x 1 marks	2	Allow other valid testing method.
	(b)	(i)	Precautions could include PAT test, risk assessment, appropriate ventilation, providing PPE, medical checks, regular checks by supervisor.	1	Allow other valid checks / understanding shown.
		(ii)	User precautions will include checking cable for burns, checking plug for loose / frayed / exposed wires, check that socket outlet being used is RCD protected, look for PAT test sticker 1 mark for a valid precaution.	1	
		(iii)	The copper is used because of good heat conduction qualities, 1 mark Electro-plating will protect the copper from corrosive fluxes and resist oxidation, Prevent pitting of soldering iron tip, 1 mark. 2 x 1 marks.	2	

Question		Answer	Mark	Guidance
	(c) (i)	Benefits of modular components include: <ul style="list-style-type: none"> <li>• Reduced assembly time</li> <li>• Reduced design / testing needed</li> <li>• Reduced cost compared to discrete components</li> <li>• Fewer faults</li> <li>• Ease of replacement/upgrade of module</li> </ul> Ease of replacement if necessary, 2 x 1 marks.	<b>2</b>	Do not allow single word answers, 'cheap', 'easy' or similar without justification.
	(ii)	Important features will include: <ul style="list-style-type: none"> <li>• Wiring connections</li> <li>• Footprint on circuit board</li> <li>• Height above circuit board</li> <li>• Power consumption</li> <li>• Operating voltage</li> <li>• Fixing points available</li> </ul> 1 mark for each feature described, 3 x 1.	<b>3</b>	
		<b>TOTAL</b>	<b>15</b>	

Question		Answer	Mark	Guidance
18	(a)	<p>The following stages should be covered in the description:</p> <ul style="list-style-type: none"> <li>• Fitting mounting pillars into holes</li> <li>• Aligning the mounting pillars</li> <li>• Remove backing paper from self adhesive pad</li> <li>• Press into position on casing</li> </ul> <p>1 mark for each of two stages included in the description, 2 x 1 marks</p>	2	Allow 2 marks for a detailed description of one stage
	(b) (i)	<p>Factors could include:</p> <ul style="list-style-type: none"> <li>• Expected current flow in wire</li> <li>• Colour coding of connections</li> <li>• Expected movement</li> <li>• Heat resistance needed</li> </ul> <p>2 x 1 marks</p>	2	
	(ii)	<p>Method of strain relief shown or described, 1 mark Functional method used. 1 mark.</p>	2	
	(iii)	<p>Benefit of method <b>A</b> Insulated body, wires can be removed easily, will take more than one wire Benefit of method <b>B</b> Fast connection and disconnection, will not vibrate loose, wires don't become damaged when connecting and disconnecting Benefit of method <b>C</b> Fast connection and disconnection, low profile, small footprint.</p>	3	Do not allow the same benefit twice.

Question		Answer	Marks	Guidance	
				Content	Levels of response
	(c)*	<p>Benefits will include:</p> <ul style="list-style-type: none"> <li>• Ease of editing tracks and pads</li> <li>• Ability to autoroute</li> <li>• Readymade pad layouts for standard components</li> <li>• Designs can be transported electronically to a manufacturer</li> <li>• Testing of layout is possible with clear fault identification</li> <li>• Multi-layer boards can be designed and produced</li> <li>• Ease of storage for future use.</li> <li>• Allow reference to SMT and related equipment.</li> <li>• Automated ordering and stock control.</li> </ul> <p>Drawbacks will include:</p> <ul style="list-style-type: none"> <li>• Cost of software and hardware for manufacture</li> <li>• Possible faults with pad spacing / physical component sizes</li> <li>• Specialist training needed to operate the system</li> <li>• File formats may be incompatible with newer software.</li> </ul>	6	Answer must relate to PCB design test and manufacture, <b>not</b> circuit design	<p><b>Level 3 (5-6 marks)</b> Shows detailed appreciation of benefits and drawbacks of computer aided technology in PCB design and manufacture, balance between benefits and drawbacks; examples used. Specialist terms will be used appropriately and correctly. The information will be presented in a structured format. The candidate can demonstrate the accurate use of spelling, punctuation and grammar.</p> <p><b>Level 2 (3-4 marks)</b> Shows some understanding of computer aided technology in PCB design and manufacture There will be some use of specialist terms although these may not always be used appropriately. The information will be presented for the most part in a structured format. There may be occasional errors in spelling, punctuation and grammar.</p> <p><b>Level 1 (0-2marks)</b> Shows limited appreciation of computer aided technology in PCB design and manufacture. No examples used. There will be little or no use of specialist terms. Answers may be ambiguous or disorganised. Errors of grammar, punctuation and spelling may be intrusive.</p> <p><b>0</b> Response worthy of no marks.</p>
		<b>TOTAL</b>	<b>15</b>		

Question			Answer	Mark	Guidance
19	(a)	(i)	NOR gates, 1 mark	1	
		(ii)	The logic level is <b>high</b> or <b>logic 1</b>	1	
		(iii)	R1 is a pull down resistor (1) used to ensure that point <b>X</b> is always connected to a logic level, (1). The level of point <b>X</b> when the switch is not pressed is low (0), 1 mark.	2	Allow marks for understanding of need for point <b>X</b> to always be high or low, ( logic 0 or logic 1).
	(b)	(i)	Rearrangement of formula $R = t / 0.7 \times C$ , 1 mark $R = 5 / 0.7 \times 0.0001$ , 1 mark $R = 71,429\Omega$ accept a value between <b>71K</b> and <b>71K5</b> , 1 mark.	3	Allow 3 marks for correct answer with no working.
		(ii)		2	Marks can only be awarded for square pulse 5 second pulse, any position, 1 mark Amplitude +9V, 1 mark
	(c)	(i)	When the coil releases the latch the spring will return it to the locked position, 1 mark.	1	Allow marks for understanding shown.
		(ii)	The holes are slotted could be produced by <b>milling</b> or using a <b>punch tool</b> , 1 mark or drilling <b>and</b> filing to shape, 1 mark. Description of process / diagram, 1 mark.	2	

Question	Answer	Mark	Guidance
(d)		3	<p>From monostable output to pins 1,2, and 3, 1 mark.                      Pins 16,17 and 18 connected, 1 mark.                      Solenoid leads from pins 16,17and 18 to +9V or 0V, 1 mark.</p>
	<b>TOTAL</b>	<b>15</b>	

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