

## **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 2014**

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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.

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Question		Answer	Mark	Guidance
1		C	1	
2		A	1	
3		B	1	
4		B	1	
5		A	1	
6		Refuse	1	Only
7		Any of: SMA (Nitinol), Polymorph, thermo-chromic dye, QTC.	1	Not acrylic.
8		May contain Toxic/hazardous chemicals or lead / mercury / cadmium / copper (heavy metals).	1	Reference to toxic, any known e-waste or explained source of 'fumes'. Not 'harmful'.
9		Reference to tables of anthropometric data. Direct measuring/researching the human body or parts of the human body, references to measuring.	1	Not 'survey' or 'questionnaire'
10		Life Cycle Analysis	1	
11		False	1	
12		False	1	
13		True	1	
14		False	1	
15		True	1	
16	(a)	Any of: <ul style="list-style-type: none"> <li>• LCD display / 7 segment display / digital timer</li> <li>• Dual timing dials</li> <li>• Hinged lid/plastic cover</li> <li>• Control buttons</li> <li>• Connections for hoses / two outlets</li> <li>• A clock / display</li> <li>• Day/night options</li> <li>• Easy to grip dials / rounded corners</li> <li>• Large text for increased visibility</li> <li>• Easy to understand controls</li> </ul>	3	Allow direct reference to control of flow RATE.
	(b)	Any of: <ul style="list-style-type: none"> <li>• Solar power</li> <li>• Use rechargeable cells</li> </ul>	2	Allow wind power, although unlikely! Do not allow H.E.P. Not mains electricity unless qualified as 'green-sourced'.

Question		Answer	Mark	Guidance
		<ul style="list-style-type: none"> <li>• Fit super-capacitor</li> <li>• Optimise circuitry for minimum current drain</li> <li>• Use latching (magnetic) solenoids</li> </ul>		MUST refer to power, not aesthetics or ergonomics.
	<b>(c) (i)</b>	Re-cycling, tertiary recycling, correct bin at tip, bin in supermarket, return to vendor.	<b>1</b>	Allow legitimate alternatives.
	<b>(d)</b>	Any of: <ul style="list-style-type: none"> <li>• So customer can see what the product looks like</li> <li>• Water/shower and dust proof so good 'as new' even after being on display for months</li> <li>• Can't be tampered with/have parts lost or stolen</li> <li>• Fast packaging of items for manufacture</li> <li>• Strong and durable compared to cardboard alternatives</li> <li>• Complex shape</li> </ul>	<b>2</b>	Nothing cost related. Stronger, durable should be qualified. Not 'as it can be recycled'.
	<b>(e)</b>	Any combination of: <ul style="list-style-type: none"> <li>• Uses fossil fuel / oil / coal derived product for manufacture</li> <li>• Increased greenhouse gas emissions / global warming contribution</li> <li>• Does not degrade in the environment</li> <li>• Needs sorting before recycling</li> <li>• May emit fumes/poisonous gases if burnt</li> <li>• May harm wildlife</li> <li>• May spoil habitats</li> </ul>	<b>3</b>	Reasoned response including 3 reasons for full marks. Allow full marks for 1 or 2 points which have been well explained.
	<b>(f)</b>	Sketches and notes to show useful information such as: Recycling code for plastic(s) used Water based non-toxic ink FSC approved wood-pulp source Recycle logo / mobius loop Kitemark, CE, BS, Disposal, WEEE, Type of batteries	<b>3</b>	Appropriate information relating to the function, care, operation and disposal of the item.

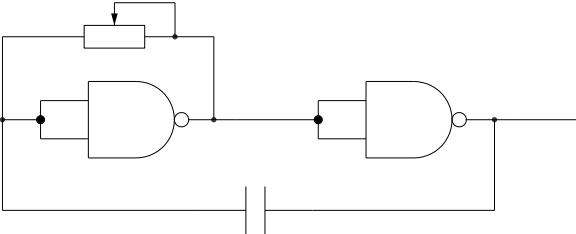
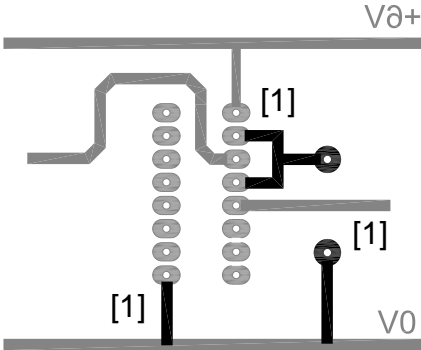
Question		Answer	Marks	Guidance	
				Content	Levels of response
	(g)	<p>Candidates should identify examples Where electronics can save energy such as CFLs, LED lighting, occupancy / movement monitors, in fact any reasonable sensing of a parameter be it light, heat or moisture and then acting on that parameter using electronics.</p> <p>Water saving can be simple statements like only fill the kettle with what you need to boil, so saving energy and water, through to a logical expansion of the unit pictured in Fig.1 which combines both to control water usage.</p>	6	<p>Maximum of 2 marks for short bullet. General comments such as 'shower instead of bath' can be credited. For full marks answers should refer to how electronics can contribute to saving water <b>and</b> energy.</p>	<p><b>Level 3 (5-6 marks)</b> Thorough explanation, showing a clear understanding of how electronics can influence and control our energy and water consumption. There will 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, showing an understanding of how electronics can influence and control our energy and water consumption. 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, showing some understanding of how electronics can influence and control our energy and water consumption. There will be little or no use of</p>

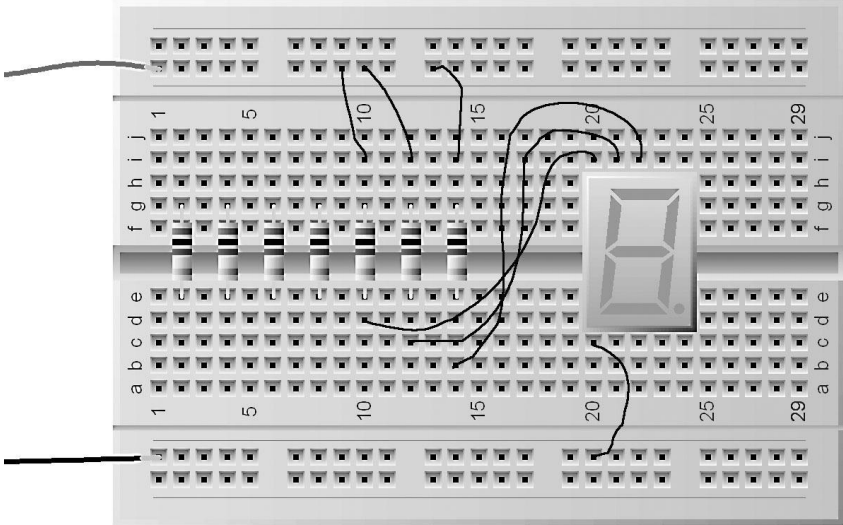
Question			Answer	Marks	Guidance	
					Content	Levels of response
						specialist terms. Answers may be ambiguous or disorganised or 'list like'. Errors of grammar, punctuation and spelling may be intrusive. <b>(0) response worthy of no marks</b>
				<b>Question 16 total</b>	<b>20</b>	
				<b>Section A Total</b>	<b>35</b>	

Question			Answer	Mark	Guidance
17	(a)	(i)	<p>Accurate methods of marking could be:</p> <ul style="list-style-type: none"> <li>• CAD drawing printed and then glued or taped to surface</li> <li>• Use of template or pattern to draw around</li> <li>• Centre punch, dividers, scribe.</li> </ul> <p>1 mark for suitable method.</p>	[1]	<p>Allow mark for use of compass</p> <p>Allow reference to <b>engraving outline</b> using CAM</p> <p>No mark for laser <b>cutting</b></p>
		(ii)	<p>The flats are there to prevent rotation [1] Because the key will need some force to turn it there is a good chance that the switch would rotate [1] The potentiometer spindle will rotate easily so there is less chance of it moving in the hole [1]</p> <p>2 marks for explanation that includes two valid points or two marks for one point explained in depth.</p>	[2]	<p>Allow mark for the potentiometer having a pin to prevent it rotating</p>
		(iii)	<p>Description could include:</p> <ul style="list-style-type: none"> <li>• Centre punch for drilling</li> <li>• Hole drilled to suitable size for core, between (flats)</li> <li>• File used to enlarge hole to line</li> <li>• Keyswitch tried for fit and adjustments made.</li> </ul> <p>2 x 1 marks for stages. 1 mark for correct name of a suitable tool.</p>	[3]	<p>No mark for use of pillar drill or punch tool</p> <p>Marks must relate to <b>cutting</b> and <b>shaping</b> the hole</p> <p>Allow other valid stages or methods of producing hole.</p> <p>Maximum of one mark for drilling out to thread diameter</p>
		(iv)	<p>Advantages of punch tool could be:</p> <ul style="list-style-type: none"> <li>• Repeatable accurate shape</li> <li>• Clean edges</li> <li>• Only one process involved so faster</li> <li>• Easily automated process for batch production.</li> </ul> <p>2 x 1 marks</p>	[2]	<p>Quicker / faster / easier must be qualified for mark</p>
	(b)	(i)	<p>7 x 0.2 stranded wire is more flexible and less likely to break than single core.</p>	[1]	

Question	Answer	Mark	Guidance
(ii)	<p>order of processes</p>	[4]	One mark for each stage in the correct sequence in soldering the connections
(c)	Lowest value 1.6MΩ, (1,600,000Ω) highest value 2.4MΩ (2,400,000Ω)	[2]	
	<b>TOTAL</b>	<b>[15]</b>	



Question	Answer	Mark	Guidance
18 (a) (i)	Piezo ultrasonic tweeter, 1 mark	[1]	
	(ii) Device has the highest frequency range [1]. Top range is well above human hearing range [1]. 1 mark for suitable reason.	[1]	Allow ecf – 1 mark for waterproof if applied to first two speakers
(b) (i)	 <p>1 mark for symbol, 1 mark for correct position in circuit.</p>	[2]	Allow either potentiometer or variable resistor symbol. Allow mark for variable capacitor if in correct place.
	(ii) The decade counter will divide the original frequency by ten [1] This will allow the resulting sound to be heard [1].	[2]	
	(iii) 1 mark for functional method e.g. LED connected to output, oscilloscope used. Logic probe applied to output. Each correct connection shown, signal [1] and 0V [1].	[3]	
(c) (i)	Suitable sensor would be PIR, pressure mat [1]	[1]	No mark for Motion Sensor
	(ii) 4011B quad 2 input NAND gate [1] 4081B quad 2 input AND gate [1]	[2]	
	(iii) 	[3]	Pins 13 and 15 may go to 0V with separate tracks. Suitable path without shorting for 3 marks.
<b>TOTAL</b>		<b>[15]</b>	

Question	Answer	Mark	Guidance
<p>19 (a) (i)</p>		<p>[4]</p>	<p>Each segment taken through resistor to positive rail, 1 mark. Common cathode to 0V rail, 1 mark. Marks to only be awarded for correct connection of the number '7'.</p>
<p>(ii)</p>	<p>Advantages could be:</p> <ul style="list-style-type: none"> <li>• Lower cost of building circuit</li> <li>• No components damaged</li> <li>• Variety of breadboard sizes available</li> <li>• Image can be zoomed</li> <li>• Large variety of components available</li> <li>• Reliability of connections</li> </ul> <p>2 x 1 marks for valid advantages</p>	<p>[2]</p>	<p>No marks for reference to quicker.</p>
<p>(b)</p>	<p>Voltage calculated <math>6 - 1.95 = 4.05V</math>, 1 mark Substitution into formula <math>R = 4.05 / 0.015</math>, 1 mark Resistance is <math>270\Omega</math>, 1 mark</p>	<p>[3]</p>	<p>3 marks for correct answer with no working. Units not needed for final answer. Allow mark for substitution into formula as <math>R = 4.05 / 15</math></p>

Question		Answer	Marks	Guidance	
				Content	Levels of response
	(c)*	<p>Uses of RFID devices could include:</p> <ul style="list-style-type: none"> <li>• <b>Tracking items</b> in factories</li> <li>• Pet <b>recognition</b> / cat flaps</li> <li>• Pet <b>identification</b> details</li> <li>• Hospital use, keeping track of surgical instruments</li> <li>• Stock control in shops</li> <li>• Library books</li> <li>• <b>Security</b> of goods against theft</li> <li>• Electronic entry</li> </ul> <p><b>Comparison</b> should be made with traditional methods such as:</p> <ul style="list-style-type: none"> <li>• Bar codes which require line of sight to read them</li> <li>• Labels on dog collars</li> <li>• Library ticket system</li> <li>• Accuracy comparisons / operating frequencies / range of readers</li> </ul>	[6]		<p><b>Level 3 (5-6 marks)</b> Shows detailed understanding of uses of RFIDs along with benefits, drawbacks and some comparisons made with traditional solutions. Suitable 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 the use of RFIDs in real applications, some examples used. 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 (0-2 marks)</b> Shows limited understanding of the principles of RFIDs. 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>	[15]		

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