OCR
Oxford Cambridge and RSA

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 2018

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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.

Annotations

Annotation	Meaning
BP	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.
L1	Level 1
L2	Level 2
L3	Level 3
SEEN	Noted but no credit given
	Tick

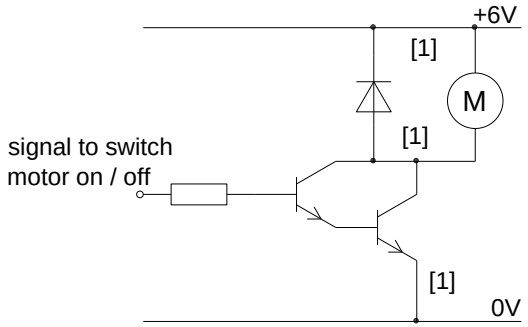
Question			Answer	Mark	Guidance
1			**(c)**	**1**	
2			**(c)**	**1**	
3			**(b)**	**1**	
4			**(d)**	**1**	
5			**(c)**	**1**	
6			The Earth's core, or information about the decay of radioactive minerals resulting in heat under the earth's crust	**1**	Accept 'activity in rocks' Not 'heat'. Not 'volcano'. – too vague.
7			Any of: • Landfill • Burning • Littering	**1**	Allow other legitimate answers
8			Primary	**1**	
9			Planned or built-in obsolescence	**1**	Allow for misspelling
10			Ergonomics	**1**	
11			False	**1**	
12			False	**1**	
13			True	**1**	
14			True	**1**	
15			False	**1**	
16	**(a)**		Any of: • Waterproof • Shock/impact resistant • Transparent/see-through • De-mountable via fitting • Positive closure clip • Operating button(s)	**3**	**Allow:** Moveable / adjustable Secure mount to helmet Aerodynamic Fit any helmet Lightweight Compact
	(b)		Environmental benefits, any of: • No disposal of primary cells • Toxic material not put in landfills • Less energy used to recharge than to remanufacture • Often have a higher capacity than primary • Can be re-used 100-1000 times • Reduction in single-use batteries made	**2**	Must be an environmental benefit, i.e. not cost

Question			Answer	Mark	Guidance
	(c)		Parts identified as per question: • B • A • G • F	4	
	(d)		A safety line of some sort, fishing line, braided cord, strong string, stainless steel braided wire.	1	Accept any valid alternative. Not a safety suggestion like 'don't catch it in a dangerous situation'. Must retain camera, i.e. Not impact resistant case
	(e)		Features shown may include: Hard outer shell for protection [1] Soft packing for interior [1] Holes / shapes of parts cut out [1] Extra / desirable features [1] Named materials / processes [1]	[4]	Any 4 marks from 5.

Question			Answer	Marks	Guidance	
					Content	Levels of response
	(f)*		Candidates should use examples when illustrating their points. Answers should relate to these examples rather than generic text explaining the process. Answers should relate how CAM would enable quicker prototyping with greater accuracy. Comments about saving materials are valid if reasonably qualified but catch-alls like 'quicker' or 'cheaper' are not worthy unless qualified. • CAD / CAM • computer simulation to show how parts interact • rapid prototyping of parts to make working prototype e.g. 3D printing. • Appropriate use of IT.	6	Maximum of 2 marks for short bullet point list	**Level 3 (5-6 marks)** Thorough explanation, with examples, showing a clear understanding of how using CAD / CAM can reduce development time. 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. **Level 2 (3-4 marks)** Adequate explanation, possibly with examples, showing a sound understanding of how using CAM can reduce development time. 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 **Level 1 (1-2 marks)** Basic explanation, possibly without examples, showing some understanding of how using CAM can reduce development time. There will be little or no use of specialist terms. Answers may be ambiguous or disorganised or 'list like'. Errors of grammar, punctuation and spelling may be intrusive. **(0) response worthy of no marks**

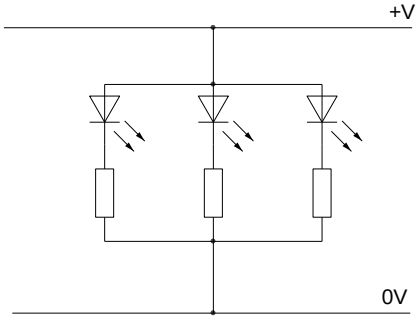
Section B

Question			Answer	Mark	Guidance
17	(a)	(i)	Two benefits of surface mount components could include: • Allows smaller circuit board/two sided board • Easier assembly using component placing machines • Lower in height than through hole components. 2 x 1 marks for valid benefits	2	
		(ii)	One problem given with surface mount components could include: • Not easy to use hand assembly methods • Difficulty in placing components accurately • Reworking of faulty boards not easy.	1	
	(b)	(i)	Correct substitution into formula, [1] Current for minimum voltage, **111 (mA)** or 0.111 (A) [1] Current for maximum voltage, **333 (mA)** or 0.333 (A) [1]	3	
		(ii)	The maximum current in the circuit must be within the range of any output device such as a transistor. [1] There is no way of knowing exactly the voltage that will be applied by the user so a range is given and circuit components should be chosen to suit that range. [1]	2	
	(c)		Method could include: • a strap going around the motor, screwed down to the base • a block with rectangular cutout for motor, screwed to base • a clamp from one side only • holes to allow cable ties to secure the motor. 1 mark for functional method, 1 mark for preventing any movement / twisting of the motor, 1 mark for fixing being reversible / motor can be removed.	3	Allow any other valid method. Allow a fully written description / annotated notes or combination of notes and sketches

Question			Answer	Mark	Guidance
	(d)	**(i)**		**3**	Motor and diode cathode connected to +6V, 1 mark. Collector to diode anode and motor, 1 mark. Emitter to 0V, 1 mark.
		(ii)	**BCX38C**	**1**	BCX38C is the only transistor rated with an Ic large enough for the motor. It is also the only Darlington transistor
18	**(a)**	**(i)**	Description may include: • Contacts are connected • Switch is released and contacts are no longer connected. 1 mark for each valid point in the description, 2 x 1 marks.	**2**	
		(ii)	**Contact bounce** will cause missed numbers in the count.	**1**	Allow anything related to contact bounce, e.g. small spark when contacts close.
		(iii)	**NAND** gate	**1**	
		(iv)		**1**	Column for output **Q** completed correctly, 1 mark.

Question			Answer	Mark	Guidance
			<table><tr><th>A</th><th>B</th><th>Q</th></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table>		
		(v)	The bistable output will remain stable until it is changed i.e. it has two stable states. When the bistable is set the output Q = 1 and the output $\overline{Q}$ = 0. When the bistable is reset the opposite occurs at the output, Q = 0 $\overline{Q}$ = 1. To set a NAND bistable set is connected to 0V then back to +V. To reset the bistable reset is connected to 0V and then back to +V.	**2**	Clear understanding of the action 2 marks, single point noted, 1 mark.
		(vi)	The 10K resistors are to ensure the the set and reset input are connected normally high. The switch will then connect each one low in turn when it is operated. The resistors can be called ‘pull up’ resistors’.	**1**	

Question			Answer	Mark	Guidance
	(b)	(i)	● ○ ○ ○ = 8 ○ ● ○ ● = 5 ● ● ○ ○ = 12	2	1 mark for each row correct.
		(ii)	Connection between pins 11 and 12 can be removed by cutting the track with a scalpel and then lifting unwanted section of track or it can be removed by drilling with a drill bit large enough to remove the track, 1 mark. To add a connection, holes can be drilled next to the pad and next to the track, 1 mark. A piece of connecting wire can be inserted, bent over to touch the track and pad and then soldered into position, 1 mark.	3	Allow any other valid methods, three stages described, 1 mark for each valid stage.
	(c)		Benefits of using a ribbon cable connector will include: • All cables are connected in one go • Very much quicker than individual connections • Less chance of damaging the ribbon cable. • Neater than soldering individual wires in the ribbon cable • Pins can be fitted into PCB and soldered faster then individual wires can. 2 x 1 marks for valid benefits.	2	

Question			Answer	Marks	Guidance
19	(a)		Circle around **mobile phone battery**, 1 mark. Circle around **capacitor**, 1 mark.	**2**	No marks if more than two items have circles.
	(b)	(i)	LEDs in parallel, 1 mark, LED anodes connected to +V, 1 mark LED cathodes connected to 0V, 1 mark. 	**3**	Allow other valid was of connecting, e.g. individual LEDs connected from +V to 0V.
	(b)	(ii)	With a parallel connection if one LED fails the other two will still light.	**1**	
	(c)		Sensor for: Heat, thermistor, allow dedicated IC, e.g. LM334Z, LM35, 1 mark. Light, LDR, phototransistor, photodiode, 1 mark Sound, microphone, 1 mark, allow ultrasonic transducer.	**3**	

Question			Answer	Marks	Guidance	
					Content	**Levels of response**
	(d)*		Answers could include the following points: • Printable circuits • CAD simulations used when designing • Conversion from schematic design to PCB layout • Flexible circuits • Electronic testing • Battery technology • Rapid prototyping, 3D printing • Miniaturisation of products	**6**		**Level 3 (5-6 marks)** Shows detailed understanding of modern technology when designing electronic products with new materials and construction methods. 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. **Level 2 (3-4 marks)** Shows some understanding of modern technology when designing electronic products with new materials and construction methods. There will be some use of specialist terms although theses 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. **Level 1 (1-2marks)** Shows limited understanding of modern technology when designing electronic products with new materials and construction methods. 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. **0** Response worthy of no marks.

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553