

Design and Technology

General Certificate of Secondary Education

Unit **A514/01** Electronics: Technical Aspects of Designing and Making

Mark Scheme for January 2013

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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	Marks	Guidance												
1	(a)	<p>1 mark for each correct.</p> <table border="1"> <thead> <tr> <th>name</th> <th>symbol</th> <th>shape</th> </tr> </thead> <tbody> <tr> <td>NPN transistor</td> <td></td> <td></td> </tr> <tr> <td>diode</td> <td></td> <td></td> </tr> <tr> <td>LDR</td> <td></td> <td></td> </tr> </tbody> </table>	name	symbol	shape	NPN transistor			diode			LDR			3	For transistor name do not allow BC108 Allow 'transistor'.
name	symbol	shape														
NPN transistor																
diode																
LDR																
	(b) (i)	<p>Stage 1 design circuit Stage 2 design PCB Stage 3 manufacture PCB Stage 4 drill holes in PCB Stage 5 add components 1 mark for each 2 consecutive stage in correct order 3 marks for all correct.</p>	3	Consecutive stages need not be in correct position.												
	(ii)	<p>Explanation may contain the following points:</p> <ul style="list-style-type: none"> Ordering components can be carried out at any time after the circuit design stage To avoid having to wait for components they should be ordered early Some components may be out of stock/have a long lead time Some may be needed for prototyping the circuit. Some components may be in stock already. 	2	Clear explanation with two points mentioned 2 marks One point well explained of 2 marks, Simple list one or more points 1 mark												

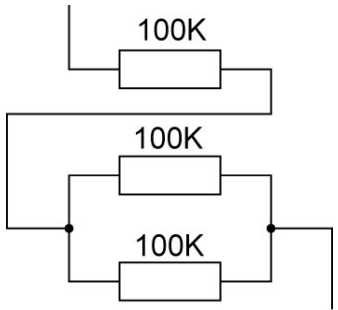
Question		Answer	Marks	Guidance
	(iii)	COSHH sheet is to give information on the potential hazards, what to do in case of incorrect use of substance and information on dangerous/toxic contents. 1 mark for understanding shown.	2	There must be reference to risk before marks can be awarded.
	(c)	Any two tools from: <ul style="list-style-type: none"> • Long nosed pliers • Wire strippers • Crimping tool • Soldering iron. 2 x 1 marks.	2	Allow pliers and wire cutters
Total			12	

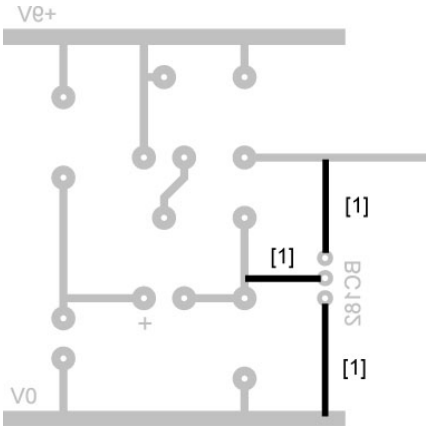
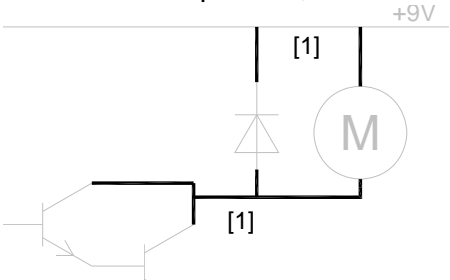
Question		Answer	Marks	Guidance
2	(a)	Explanation may contain the following points: <ul style="list-style-type: none"> • There are no parts to assemble (no soldering) • Minimum of movement between parts • Tactile quality of action • Lower assembly costs • Lower component cost • Less chance of switch bounce / arcing • Less to go wrong. 	3	Clear explanation with two points mentioned 3 marks One point well explained maximum of 2 marks, Simple list of points 1 mark. Allow ease of manufacture
	(b)	Properties of epoxy resin are: good insulator, heat resistant, waterproof, can be coloured if necessary, tough, shock proof and protects component, bonds to component. 2 x 1 marks for valid properties.	2	Allow any other valid properties
	(c)	IR light is not visible so the IR emitter cannot be used as an indicator.	1	

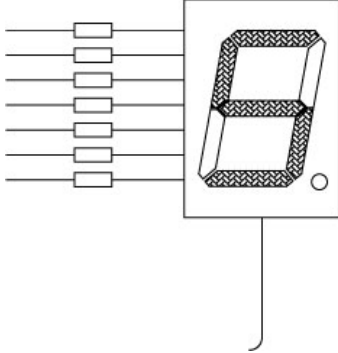
Question		Answer	Marks	Guidance	
				Content	Levels of response
	(d)*	<p>Discussion could include the following points:</p> <ul style="list-style-type: none"> • PPE will only protect the individual • How to ensure that all machine users wear PPE • Hygiene problems with some items eg ear defenders, protective shoes, visors, goggles • Ensuring that equipment is available and in working order • Assessing the risk of new machines • Guarding protects anyone in the vicinity • No volt release on electrically powered machines • Chuck guards on lathe • Dust extraction for machines against mask for workers • Training of users may not be checked. 	6		<p>Level 3 (5–6 marks) Shows detailed understanding of factors affecting risk and H&S and analyses most of the issues involved. 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>Level 2 (3–4 marks) Shows some understanding of factors affecting risk and H&S 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>Level 1 (0–2 marks) Shows limited understanding of factors affecting risk and H&S 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>0 Response worthy of no marks. grammar.</p>
		Total	12		

Question			Answer	Marks	Guidance
3	(a)	(i)	3D views are used to: <ul style="list-style-type: none"> • visualise product • show mechanical feature • apply finishes, to place an object in contextual setting • export data to CNC machine. 1 mark for suitable reason	1	Allow other valid reasons for using 3D view.
		(ii)	2D views are produced to: <ul style="list-style-type: none"> • Export to laser cutter or other machine • Show dimensioning • Show assembly detail. 1 mark for suitable reason	1	Allow other valid reasons for using 2D view.
		(iii)	Explanation to include: <ul style="list-style-type: none"> • the finish produced • less stress on the acrylic • less chance of breakage • no marking out to be done • can all be done in one operation • more accurate as drill could slip. 2 marks for explanation that includes two valid points or one point clearly explained.	2	
		(iv)	Precaution could be safety related or relate to potential damage to the acrylic from spilled tensol. 1 mark for valid precaution	1	Must be a precaution for the mark not just the risk. Allow use of a COSHH data sheet. No mark for safety equipment unless specific.

Question		Answer	Marks	Guidance
	(b)	Vacuum forming advantages to include speed of process once the tool is made, machinery less expensive, rounded edges will result from well designed tool. 2 x 1 marks for description including 2 advantages.	2	Allow fewer stages in manufacture; BOD for quicker.
	(c)	2 marks for clear information on a functional method: Screw with nuts either side of the PCB Slotted fixing in the casing Washers used to pack PCB out.	2	1 mark for use of screws with no mention of height adjustment.
	(d) (i)	The stranded wire is more flexible and will allow movement without breaking. Stranded wire has a white stripe which can be used to identify polarity of connection. 1 mark for a valid reason.	1	
	(ii)	Soldering process description may include: <ul style="list-style-type: none"> • Tinning the wires • Positioning wires through holes • Using soldering iron to heat joint • Feeding solder into joint • Trimming excess wire • Polarity of wires. 2 marks for description that includes two stages.	2	Soldering process must be broken up into stages. Do not allow heating the soldering iron as a stage.
		Total	12	

Question			Answer	Marks	Guidance
4	(a)	(i)	Microphone, 1 mark.	1	
		(ii)	<p>Two resistors to be in parallel joined to the third in series.</p>  <p>1 mark for parallel connection, 1 mark for series connection.</p>	2	Allow 1 mark if all 3 resistors are connected in parallel
		(iii)	<p>It is difficult to simulate a suitable sound level to test the circuit, 1 mark. the variable resistor can be set accurately on a real circuit but setting on a simulated circuit may not match the real situation. Background noise will not be accounted for in a simulation.</p> <p>2 marks for clear understanding shown on drawbacks of simulated testing.</p>	2	Allow 1 mark for a valid point noted with no justification.

Question	Answer	Marks	Guidance
(b)	<p>1 mark for each track correct.</p> 	3	
(c) (i)	<p>Reason could be the larger voltage range that includes a 9V battery, only 1 input and 1 output are needed, no need to program, 1 mark for a valid reason.</p>	1	<p>Allow other valid functional advantages No marks for information taken from table without understanding shown</p>
	(ii)	1	<p>Allow other valid functional advantages</p>
(d)	<p>Collectors to diode to motor, 1 mark. Diode and motor to positive, 1 mark.</p> 	2	
Total		12	

Question		Answer	Marks	Guidance
5	(a) (i)	Segments shaded to show 5, 1 mark. 	1	
	(ii)	Common cathode means that all of the LED cathodes are joined internally; they must be connected to the 0V rail in the circuit. 2 marks for explanation that includes both points.	2	Allow marks for understanding shown
	(b) (i)	Circle around 25mA value on green column, 1 mark.	1	Allow any other method of indication, eg underlining or arrow.
	(ii)	Substitution and rearrangement of formula, $R = 5/0.025$, 1 mark. Correct answer, $R = 200 \text{ ohms}$, 1 mark.	2	

Question		Answer	Marks	Guidance	
				Content	Levels of response
	(c)*	<p>Areas for inclusion of ergonomics will include:</p> <ul style="list-style-type: none"> • Fit of the device to the hand/to fit a range of hand sizes • Size of buttons/controls/keys • Tactile quality of controls/'feel' • Brightness of display/screen/resistance to reflections • Ease of fitting recharging cable • Sound level when used as a phone • Sound level of ringtone/sounder on a phone • Should be intuitive to use • Ease of navigating menu system • Anthropometrics for the sizes to be applied 	6		<p>Level 3 (5–6 marks) Shows detailed understanding of ergonomics and related factors and analyses most of the issues involved. 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>Level 2 (3–4 marks) Shows some understanding of ergonomics and related factors. 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>Level 1 (1–2 marks) Shows limited understanding of ergonomics and related factors. 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>0 Response worthy of no marks. grammar.</p>
		Total	12		

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