

# **Design and Technology**

General Certificate of Secondary Education

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

## **Mark Scheme for June 2012**

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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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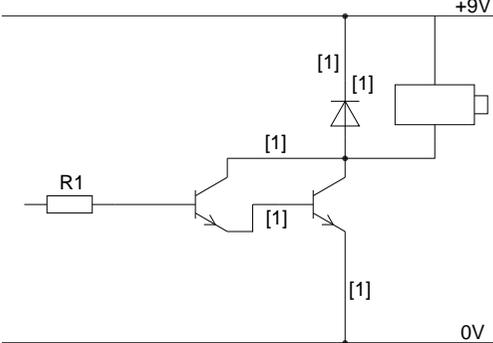
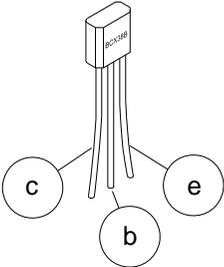
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Question		Answer	Marks	Guidance
	(c)	<p>Explanation should include:</p> <ul style="list-style-type: none"> <li>• Moving parts are not in contact</li> <li>• Will not be affected by oxidation / dirt on contacts</li> <li>• Will provide a clean switching signal</li> <li>• Increased reliability of signal</li> <li>• Will last longer because no contact between surfaces.</li> </ul> <p>2 marks for two points included in explanation. Allow 2 marks for detailed explanation of one point.</p>	2	Allow <b>more accurate</b> readings. No mark for cost related reason.
2	(a)	(i)		
		(i)	1	Allow mark for either point.
		(ii)	2	Allow excessive tinning of track.
	(b)	<p>1 mark for each correctly named symbol. 3 x 1 marks.</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>double insulation</p> </div> <div style="text-align: center;">  <p>radiation</p> </div> <div style="text-align: center;">  <p>laser hazard</p> </div> </div>	3	

Question	Answer	Marks	Guidance
(c*)	<p>Discussion should include some of the following points:</p> <ul style="list-style-type: none"> <li>• A risk assessment for any new material should be carried out before it is widely used</li> <li>• Companies using the materials must comply with regulations</li> <li>• Some of the risks may be long term, particularly with nanomaterials with reference to size of particles being used</li> <li>• Individual workers must read the risk assessment before using materials</li> <li>• Manufacturers of adhesives must make COSHH data available</li> <li>• Procedures must be monitored to ensure that risks are not ignored.</li> <li>• Identification of PPE measures</li> <li>• Working environment considerations.</li> </ul>	6	<p><b>Level 3 (5 – 6)</b>  Clear discussion comparing what should happen and what can happen if the threats to health are ignored. Mention of risk to individual workers and to those in near environment. Reference to at least <b>one</b> product as an example. 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)</b>  Adequate discussion, showing understanding of the risk assessment procedures. At least <b>two</b> specific points mentioned including <b>one</b> specific risk from a material. 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 structures format. There may be occasional errors in spelling, punctuation and grammar.</p> <p><b>Level 1 (1– 2) marks</b>  Basic comments discussing some of the hazards involved in using solders / adhesives, etc. At least <b>one</b> of the above points mentioned. There will be little or no use of specialist terms. Answers may be ambiguous or disorganised. Errors of spelling, punctuation and grammar may be intrusive. Maximum of 2 marks for a bullet pointed list with no further detail.</p>

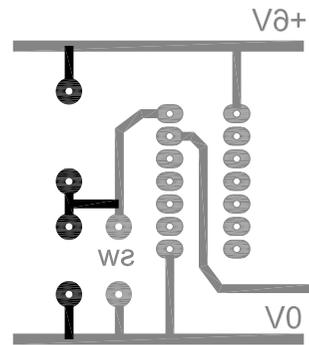
Question	Answer	Marks	Guidance
3 (a)	Transistors can be used in the output stage for <b>switching</b> or <b>amplification</b> .	1	Allow reference to higher current requirement of output
3 (b) (i)	Emitter to base, 1 mark. Collectors connected and joined to solenoid, 1 mark. Emitter of second transistor to 0V, 1 mark. 	3	Collectors of both transistors must be connected to the solenoid for 1 mark.  Ignore the position of the diode for this part
	(ii) Diode symbol correct, 1 mark. Orientation correct, 1 mark.	2	Diode must be in a suitable position to gain either mark
	(iii) One leg of transistor correctly marked, 1 mark. All legs correct, 2 marks. 	2	

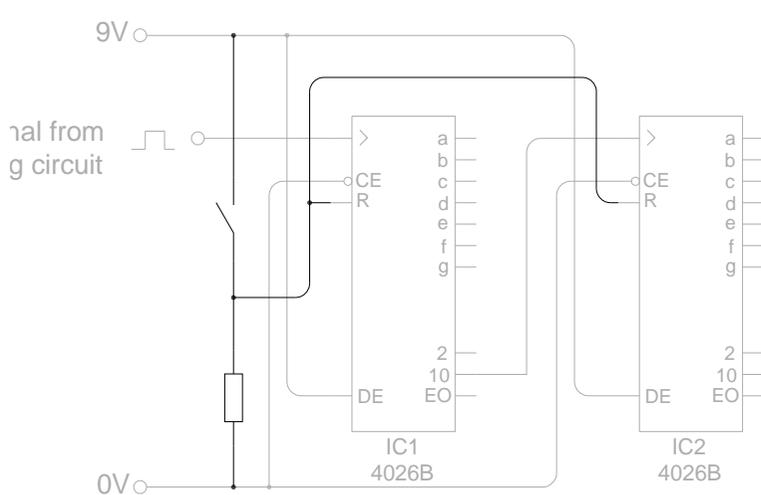
Question	Answer	Marks	Guidance
(c)	<p><b>Either method can be chosen</b>, advantages for each are:</p> <p>For lettering:</p> <ul style="list-style-type: none"> <li>• Will apply to a particular transistor but alternative with a different pinout can be used</li> <li>• Some transistors can have a different casing shape</li> <li>• Very clear if the type of transistor is known.</li> </ul> <p>For shape</p> <ul style="list-style-type: none"> <li>• No knowledge of electronics is necessary when assembling</li> <li>• Letters may be distorted on screen layer, shape should not be</li> <li>• Letters may be too small to read, shape is a lot larger.</li> <li>• Fault can be identified after placement</li> <li>• Faster to assemble</li> </ul> <p>2 x 1 marks.</p>	2	<p>For 2 marks both advantages must refer to the same method.</p> <p>Maximum 1 mark if no indication of method chosen.</p>
(d)	<p>Benefits of transistors from nanotechnology to include:</p> <ul style="list-style-type: none"> <li>• Energy efficiency will lead to lower power consumption, power sources lasting longer and reduction in running costs</li> <li>• More features available on mobile phones, MP3 players etc.</li> <li>• Products environmentally friendly because of decrease in power consumption</li> <li>• Reduced size of products, smaller casings, less materials used.</li> </ul> <p>2 marks for two points included in description.</p>	2	<p>Reference to existing product(s) needed for 2 marks. Allow 2 marks for detailed description of one point.</p> <p>No mark for repeating question i.e. reference to more energy efficient.</p>

Question		Answer	Marks	Guidance
4	(a)	<p>Sketches / notes could show:</p> <ul style="list-style-type: none"> <li>• Avoiding the cable rubbing against side of case in the areas of hole Grommet used in hole</li> <li>• Strain relief of cable at point where connection to the circuit is made</li> <li>• Wires threaded through holes for strain relief</li> <li>• Cable ties either side of hole.</li> </ul> <p>Use of recognised workable method 1 mark, clarity of detail given, 1 mark.</p>	2	
	(b)	<p>Diode placed in series with either positive or 0V connection to the battery.</p> <p>Diode shape correct, 1 mark. Orientation of the diode, 1 mark</p>	2	Allow LED symbol.
	(c)	<p>Instruction for assembly of the ribbon cable and plug are:</p> <ul style="list-style-type: none"> <li>• Cable to be threaded through the hole correct side up</li> <li>• Cable to be at 90° to the plug to avoid wires being connected to wrong pin</li> <li>• Plug / cable assembly to be correct when notch is fitted into socket</li> <li>• Pressure on plug top to be even so that all connections are made.</li> </ul> <p>2 x 1 marks for any two valid instructions.</p>	2	Allow mark for other valid instruction.

Question	Answer	Marks	Guidance
(d*)	<p>Benefits of battery power should include some of the following points:</p> <ul style="list-style-type: none"> <li>• Variety of voltages available</li> <li>• Standard physical sizes used globally</li> <li>• Batteries can be rechargeable</li> <li>• Safer when using power tools in damp conditions</li> <li>• Tools / equipment can be used anywhere, is portable</li> <li>• Low voltages safer to use.</li> </ul> <p>Drawbacks of battery power should include:</p> <ul style="list-style-type: none"> <li>• Toxic metals are still found in some batteries</li> <li>• Recycling and prevention of disposal in normal waste can be difficult</li> <li>• Ni Cad cells have memory which can prevent full charging</li> <li>• Power source needed for recharging</li> <li>• Cannot provide continuous use for power tools</li> <li>• Lithium ion batteries are expensive</li> <li>• Regular replacement / recharging of batteries required</li> <li>• Increased weight of product.</li> </ul>	6	<p><b>Level 3 (5 – 6)</b>  Clear discussion / description comparing types of battery and different pieces of equipment. Comparison to other power sources may be found.  Evidence of both benefits and drawbacks, with reference to at least <b>one</b> product as an example for full marks.  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)</b>  Adequate description, showing understanding of the use of battery power. At least two specific points mentioned including one benefit and one drawback.  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 structures format.  There may be occasional errors in spelling, punctuation and grammar.</p> <p><b>Level 1 (1 – 2) marks</b>  Basic comments describing either benefits or drawbacks.  At least <b>one</b> relevant point mentioned.  There will be little or no use of specialist terms.  Answers may be ambiguous or disorganised. Errors of spelling, punctuation and grammar may be intrusive.</p> <p>Maximum of 2 marks for a bullet pointed list with no further detail.</p>

Question			Answer	Marks	Guidance
5	(a)	(i)	Maximum number on a two digit LED display is <b>99</b> .	1	
		(ii)	Reason for debouncing should refer to contact bounce caused by switch contacts joining more than once and causing count to increase randomly.	1	Give mark for understanding shown.
		(iii)	Error 1 is resistor leg should be in the same column as capacitor / switch (D8). Error 2 is LED should be removed and replaced the right way round with flat towards 0V.	2	Accept either written versions of the errors or indication on the breadboard. Allow mark for reference to switch connection being incorrect.
	(b)	(i)	1 mark for resistor connections, 1 mark for capacitor connections. Resistor / capacitor junction to join pin 1 for both marks. 2 x 1 marks.	2	
		(ii)	Indicator to be either a figure 1 or a dot, next to pin 1 position.	1	Allow an outline with indication that could be used on a screen layer. Answer must clearly identify Pin 1.



Question	Answer	Marks	Guidance
(iii)	<p>Benefits of increased track width should include:</p> <ul style="list-style-type: none"> <li>• Less chance of accidental damage to tracks</li> <li>• Greater current carrying capacity</li> <li>• Less chance of errors during manufacture.</li> </ul> <p>2 x 1 marks for any two valid benefits.</p>	2	Allow faster board production / economical with chemicals.
(c)	<p>Reset pins connected , 1 mark.                      Resistor connecting resets to 0V, 1 mark.                      Switch connecting resets to +9V, 1 mark.                      3 x 1 marks.</p> 	3	Different routes for connections may be used.

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