



**General Certificate of Education**

**Design and Technology  
(Electronic Products)**

**Higher (3541)**

**Final Version**

**Mark Scheme**

*2008 examination - June series*

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## Question 1

(a)	Qualified response, e.g.		
	Visit local car parts store (Halfords) make notes on features of products		
	Simple response, e.g.		
	Visit local car parts store (Halfords)		
	Second method must be different, possible responses are:		
	Search for information on Internet via on line shops ('research on internet' only 1 mark)		
	Survey motorists to see what products are used	2 x 1 mark 2 x 1 mark	(4 marks)
(b)	Qualified response, e.g.		
	conduct a survey of motorists to see which they feel are successful	2 marks	
	Simple response, e.g.		
	conduct survey		
	Other methods might include: field testing of products, checking with emergency services or AA / RAC, etc.	1 mark	(2 marks)
(c)	Any five <b>different</b> appropriate statements can be credited, e.g.		
	<ul style="list-style-type: none"> <li>• Weatherproof / waterproof</li> <li>• On/off or trigger switch</li> <li>• Automatic light / dark sensor</li> <li>• Battery powered</li> <li>• Robust casing</li> <li>• Lightweight for ease of carrying</li> <li>• Stable once in place</li> <li>• LEDs visible to approaching motorists</li> </ul>	5 x 1 mark	(5 marks)
		<b>Total</b>	<b>11 marks</b>

**Question 2**

(a)	Specific name of a suitable material (e.g. acrylic, HIPS, Aluminium, Mild steel, etc.)	2 marks	
		Or	
	General material (metal or plastic)	1 mark	
	Clear design which increases base size or base weight to make stable	2 marks	
		Or	
	Limited detail to the design	1 mark	
	Feasible design, either through notes or sketches, which shows how it is suitable for storing in the car	2 marks	
		Or	
	Limited detail in the design	1 mark	(6 marks)
(b)	LEDs in visible position	1 mark	
	Not at edge	1 mark	
	An appropriate method of holding the LED – clip, bezel, etc.	2 marks	
		Or	
	Or Interference fit	1 mark	
	Appropriate position of switch	1 mark	
	Method of accessing the case	1 mark	
	Access to the case is secure	1 mark	
	LDR indicated	1 mark	
	Appropriate position for the LDR (not on front surface)	1 mark	
	Detailed and suitable method of holding the LDR in relation to the material for the case	2 marks	
		Or	
	Limited or very basic information	1 mark	
	All materials and components labelled	2 mark	
		Or	
	Some materials and components labelled	1 mark	(13 marks)
QoC	Clear, detailed sketch(s) with full annotation	3 marks	
	Clear sketch(s) with some annotation	2 marks	
	Limited detailed	1 mark	(3 marks)
<b>Total</b>		<b>22 marks</b>	

**Question 3**

(a)	LEDs	1 mark	<i>(1 mark)</i>
(b)	LDR	1 mark	<i>(1 mark)</i>
(c)	Op Amp	1 mark	<i>(1 mark)</i>
(d)	Astable	1 mark	<i>(1 mark)</i>
(e)	Op Amp	1 mark	<i>(1 mark)</i>
(f)	Analogue signal – any reference to constantly varying signal or value	1 mark	
	Digital signal – any reference to clean on / off signal or square wave	1 mark	<i>(2 marks)</i>
(g)	Analogue – any varying waveform	1 mark	
	Digital – must be a square waveform	1 mark	<i>(2 marks)</i>
(h)	Analogue signal has lots or many values	1 mark	
	Logic gates only deal with two states	1 mark	<i>(2 marks)</i>
		<b>Total</b>	<b>11 marks</b>

**Question 4**

- |     |   |        |           |
|-----|---|--------|-----------|
| (a) | Pin 6 – Output (O/P)  | 1 mark |           |
|     | Pin 2 – Inverting Input or inverting I/P                            | 1 mark |           |
|     | Pin 3 – Non-inverting Input or non-inverting I/P                    | 1 mark | (3 marks) |
| (b) | (i) Resistor connected between pin 2 and 9V line                    | 1 mark |           |
|     | Resistor connected between pin 2 and 0V line                        | 1 mark |           |
|     | Values are equal  | 1 mark |           |
|     | Any value between 10K and 100K (inclusive)                          | 1 mark | (4 marks) |
|     | (ii) 10K resistor directly connected to pin 3                       | 1 mark |           |
|     | in R1 position  | 1 mark |           |
|     | LDR directly connected to pin 3 (correct symbol – must show arrows) | 1 mark |           |
|     | In R2 position  | 1 mark | (4 marks) |
| (c) | Variable resistor or potentiometer                                  | 1 mark | (1 mark)  |
| (d) | High / Large or similar meaning                                     | 1 mark |           |
|     | Higher / greater or similar meaning                                 | 1 mark |           |
|     | High, 9V or 7V  | 1 mark | (3 marks) |
| (e) | Formula: $V_s = R_2 \times V / (R_1 + R_2)$                         | 1 mark |           |
|     | Substitute values: $V_s = 100 \times 9 / (10 + 100)$                | 1 mark |           |
|     | Correct answer – 8.2 or 8.1   | 1 mark |           |
|     | Correct units – V or Volts  | 1 mark | (4 marks) |
- N.B** incorrect values, give answer of 0.82V or 0.81V. lose only 1 mark for wrong values

**Total 19 marks**

**Question 5**

(a)	Pulse Generator	1 mark	(1 mark)
(b)	Pin 7 to between R1 and R2	1 mark	
	<b>Either</b>		
	Pin 2 and 6 joined together	1 mark	
	Pin 2/6 to between R2 and C1	1 mark	
	<b>Or</b>	Or	
	Pin 6 to between R2 and C1	1 mark	
	Pin 2 to between R2 and C1	1 mark	
	Pin 1 to 0V line	1 mark	
	<b>Either</b>		
	Pin 8 to 9V line	1 mark	
	Output from Op Amp to pin 4	2 marks	
	<b>Or</b>	Or	
	Output from Op Amp to pin 8	1 mark	
	Output from Op Amp to pin 4	1 mark	(7 marks)
QoD	Straight lines – vertical and horizontal	1 mark	
	Clear connections	1 mark	(2 marks)
(c)	(i) Reference to on / off for different times	1 mark	
	Reference to on time longer than off time	2 marks	(2 marks)
	(ii) Formula: $T_h = 0.693 \times (R_1 + R_2) \times C$	1 mark	
	Substitute values: $T_h = 0.693 \times (10K + 22K) \times 10 \mu F$	1 mark	
	Answer = 0.22	1 mark	
	Units – seconds or s	1 mark	(4 marks)
		<b>Total</b>	<b>16 marks</b>

### Question 6

- |     |       |   |        |           |
|-----|-------|---|--------|-----------|
| (a) | (i)   | Pin 16 to 9V line                             | 1 mark |           |
|     |       | Pin 8 to 0V line                              | 1 mark | (2 marks) |
|     | (ii)  | LED 1 to pin 2                                | 1 mark |           |
|     |       | LED 2 to pin 4                                | 1 mark |           |
|     |       | LED 3 to pin 7                                | 1 mark |           |
|     |       | LED 4 to pin 10                               | 1 mark |           |
|     |       | LED 5 to pin 1                                | 1 mark | (5 marks) |
|     | (iii) | Pin 5 to pin 15                               | 1 mark | (1 mark)  |
|     | (iv)  | Astable Output to pin 14                      | 1 mark | (1 mark)  |
| QoD |       | Clear lines and connections                   | 1 mark | (1 mark)  |
| (b) |       | Pull down resistor keeps pin 15 low or at 0Vs | 1 mark |           |
|     |       | Until pin 15 receives a high signal           |        |           |
|     |       | Or  |        |           |
|     |       | Stops pin 15 floating and triggering falsely  | 1 mark |           |
|     |       | Or words to that affect                       |        | (2 marks) |

**Total 12 marks**



**Question 7**

(a)	Decision on Input 3 high	1 mark	
	Feedback to start if No	1 mark	
	Correct position or sequence	1 mark	
	Compare Input 1 (Yes/No decision)	1 mark	
	Less than or equal to 75	1 mark	(5 marks)
(b)	Output 4 on (output 2 off could be here as well)	1 mark	
	For 0.25s	1 mark	
	Output 4 off, output 2 on	1 mark	
	For 0.25s	1 mark	
	Output 2 off, output 0 on	1 mark	
	For 0.25s	1 mark	
	Output 0 off, output 2 on	1 mark	
	For 0.25s, output 2 off (could be shown at start)	1 mark	
	Repeats	1 mark	
	10 times	1 mark	(10 marks)
	Reference to LEDs not credited		
(c)	Output 0, 2, 4 on (accept all outputs on)	1 mark	
	For 0.5s	1 mark	
	Output 0, 2, 4 off (accept all outputs off)	1 mark	
	For 0.5s	1 mark	
	Repeat 5 times	1 mark	(5 marks)
(d)	Feedback in correct place	1 mark	
	To start of process	1 mark	(2 marks)
		<b>Total</b>	<b>22 marks</b>

**Question 8****(a) Quality of response answer:**

Detailed response considering both positive and negative aspects 4 to 6 marks

Limited response or a response to only one aspect 1 to 3 marks

Examples of possible suggestions:

Positive points

- Improve road safety
- Reduce speed / maintain speed limits
- Help prevent accidents
- Reduce injuries in accidents
- Prevent accident black spots

Negative points

- Perceived as threatening by motorists
- Can distract drivers
- Causes anxiety / stress in drivers
- Cost of installation & use
- Excessive braking
- Less police patrol cars on the road
- Less chance of catching serious incidents, e.g. drink driving

*(6 marks)*

**(b) Quality of response answer:**

Detailed response suggesting innovative uses of technology. 4 to 6 marks

Limited response just referring to use of cameras to replace mirrors 1 to 3 marks

Examples of possible suggestions:

- Cameras to replace mirrors – reduced size reduced drag
- Multiple cameras looking down and back on each door
- Rear view camera to see behind trailer unit – a major blind spot
- Monitor on dashboard showing multi-screen images
- Heads up display on wind screen in front of driver
- External links of camera images – better security/safety

*(6 marks)*

**Total 12 marks**  
**Total for Paper 125 marks**