GCSE MARKING SCHEME

SUMMER 2019

ELECTRONICS - COMPONENT 1
C490UA0-1

INTRODUCTION

This marking scheme was used by WJEC for the 2019 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

EDUQAS GCSE ELECTRONICS

COMPONENT 1 – Discovering Electronics

SUMMER 2019 MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (except for the extended response question).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

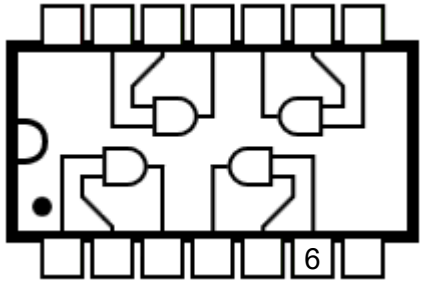
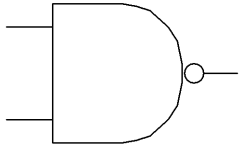
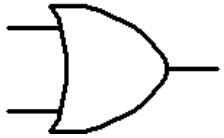
Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statement.

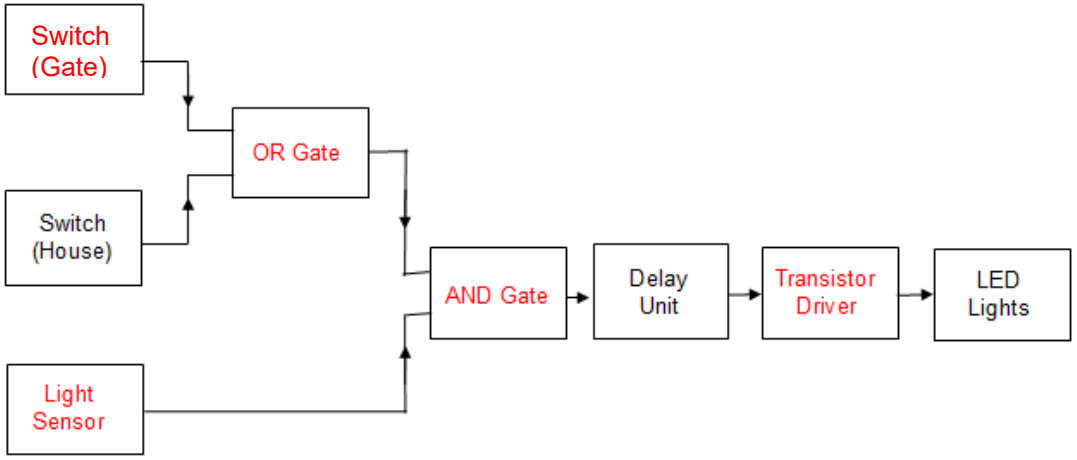
Marking abbreviations

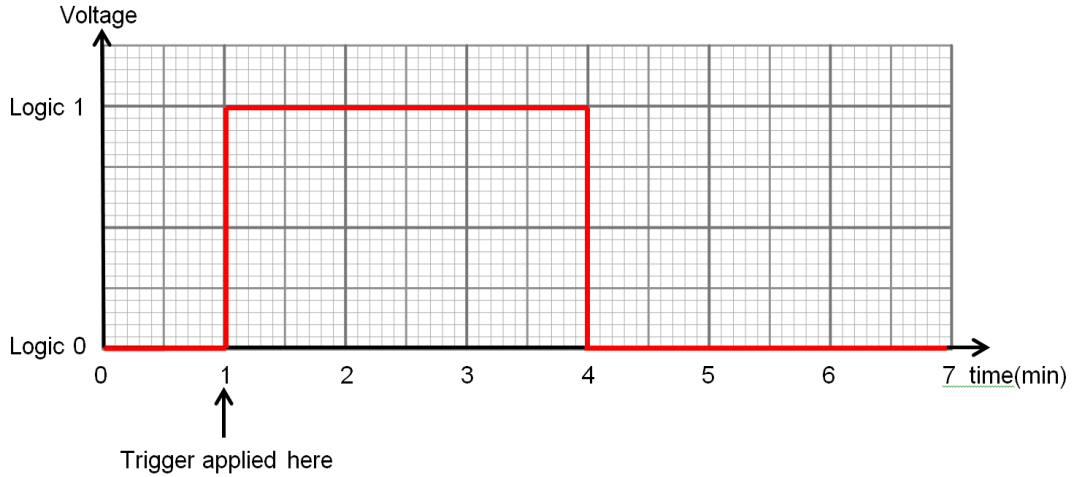
The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

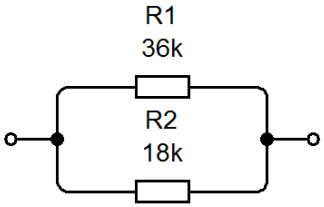
cao = correct answer only
ecf = error carried forward

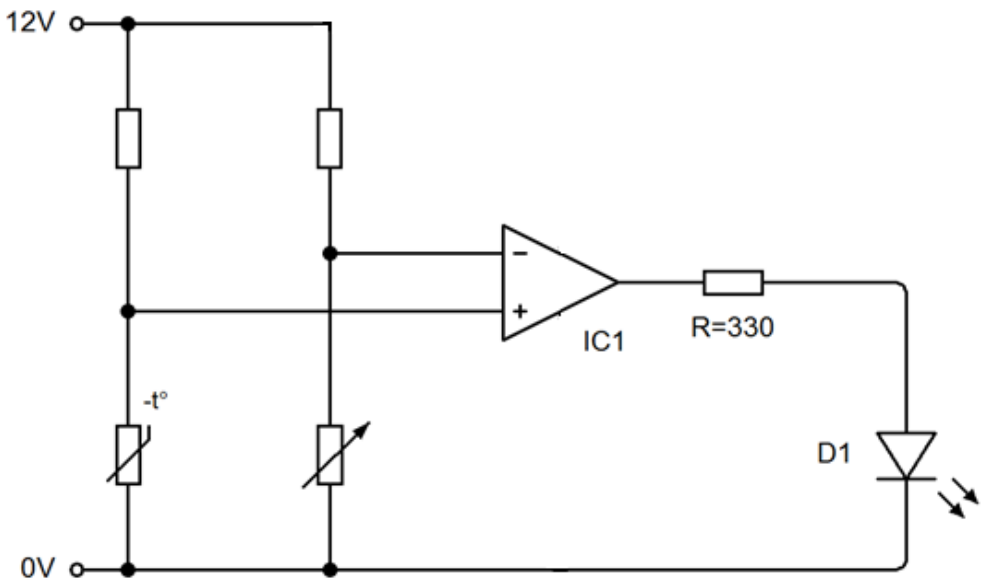
Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
1	*(a)*	i		1				
		ii	4	1				
		iii	2	1				
		iv	AND Gate	1				
	(b)	i	NAND gate (1)  (1) Note: Symbol must match the named gate not truth table. Do not accept symbols without clear input and output connections.	2				
		ii	OR Gate (1)  (1) Note: Symbol must match the named gate not truth table. Do not accept symbols without clear input and output connections.	2				
			Question 1 total	**8**	**0**	**0**	**8**	**0**

BLANK PAGE

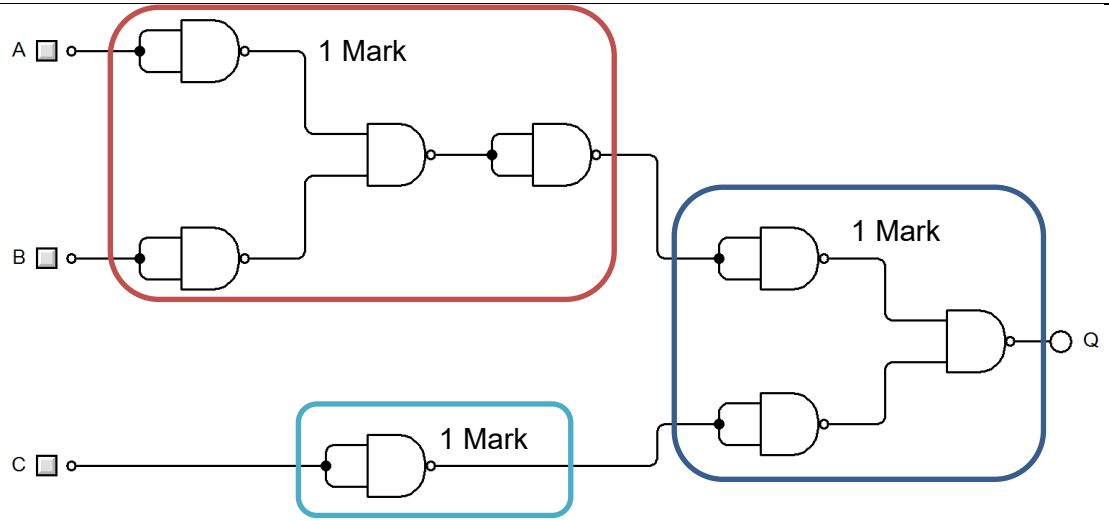
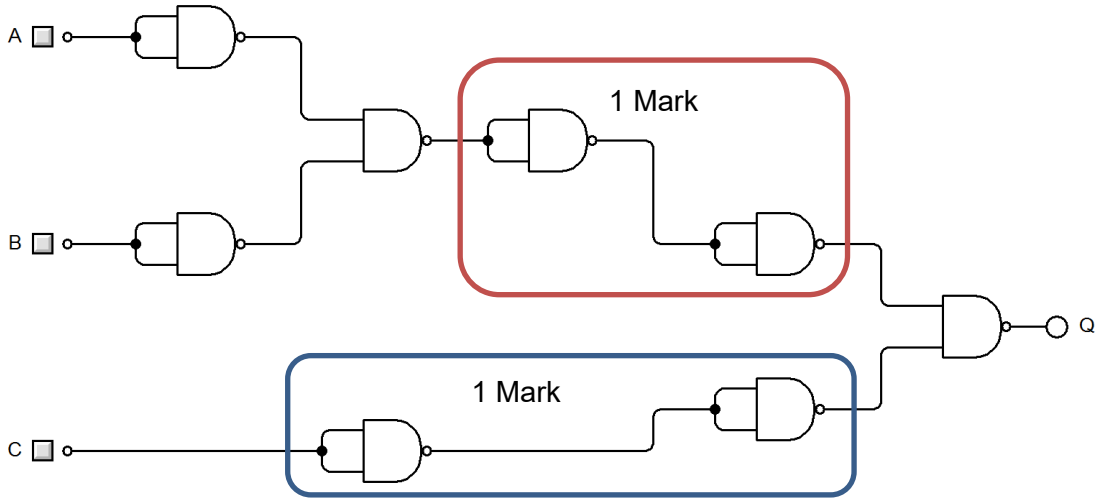
Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
2	*(a)*		<table><tr><th>Sensing subsystems</th><th>Signal processing</th><th>Output subsystems</th></tr><tr><td>Temperature sensing unit</td><td>Delay unit</td><td>Buzzer Unit</td></tr><tr><td></td><td>Or Gate</td><td>Motor Unit</td></tr><tr><td></td><td>Comparator unit</td><td></td></tr></table> 1 mark per correct column	3			3	
	(b)		 1 mark for each correct box			5	5	

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
	(c)		 Mark first Logic 0 – 1 Transition at 1 minute – 1 mark Mark first Logic 1 – 0 Transition at 4 minutes – 1 mark Logic 0 & 1 levels correct – 1 mark	1	2		3	
			Question 2 total	**4**	**2**	**5**	**11**	**0**

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
3	*(a)*		Circuit B	1			1	
	(b)		 Parallel circuit with two external connections with 1 correct value = 1 mark		2		2	
	(c)	i	I_1 = 10-2 = 8mA Do not accept 8 I_2 = 10mA Do not accept 10 V_1 = 6-4 = 2V Accept 2	3			3	2
		ii	$V = IR$ *(1 – Formula)* $R = \frac{V}{I}$ *(1 – Rearranging)* $R = \frac{4}{2}$ *(1 – Substitution)* $R = 2k\Omega$ *(1 – Answer)*	1	3	0	4	4
	(d)		9 (1) 1 (1) 00 (1) Accept 9.1kΩ for 3 marks	3				
			Question 3 total	**8**	**5**	**0**	**13**	**6**

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
4	*(a)*		Thermistor	1			1	
	(b)	i	 Resistor and Thermistor in series across power supply and connected to non-inverting input (1) Orientation of components (1)		2		2	
		ii	The variable resistor allows the temperature at which the LED lights to be adjusted.	1			1	
	(c)		$P = I^2R$ (1 – Formula) $P = (30 \times 10^{-3})^2 \times 330$ (1 – Substitution) $P = 0.297W$ (1 – Answer)	1	2		3	3
	(d)	i	Voltage across V = I x R = 30mA x 330 (1) = 9.9V (1)	1	1		2	1
		ii	Voltage across LED = 12-9.9 = 2.1V (1)		1		1	1
		iii	Only LED with V_F = 2.1V and I_F = 30mA is Yellow LED (1) Mark can only be awarded if (i) and (ii) correct		1		1	
			Question 4 total	**4**	**7**	**0**	**11**	**5**

<table>
<tr><th colspan="3" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="5">Marks available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th></tr>
<tr><td rowspan="3">5</td><td rowspan="3">(a)</td><td>i</td><td>$X = \bar{C}$ Do not accept NOT C</td><td></td><td>1</td><td></td><td>1</td><td>1</td></tr>
<tr><td>ii</td><td>$Y = \overline{A + B}$ or $Y = \bar{A}.\bar{B}$ Do not accept NOT A OR B</td><td></td><td>1</td><td></td><td>1</td><td>1</td></tr>
<tr><td>iii</td><td>$Q = \bar{C} + \overline{A + B}$ or $\bar{C} + (\overline{A + B})$ or $\bar{C} + \bar{A}.\bar{B}$ $do\ not\ accept$ $Q = X + Y$
ecf for incorrect X and Y only if in terms of A, B and C.</td><td></td><td>1</td><td></td><td>1</td><td>1</td></tr>
<tr><td></td><td>(b)</td><td></td><td>
<table>
<tr><th>C</th><th>B</th><th>A</th><th>X</th><th>Y</th><th>Q</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
</table>
1 mark per correct column – e.c.f. for Q if X or Y incorrect.</td><td></td><td>3</td><td></td><td>3</td><td></td></tr>
</table>

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
	(c)	i		3				
		ii		2	0			
			Question 5 total	**5**	**6**	**0**	**11**	**3**

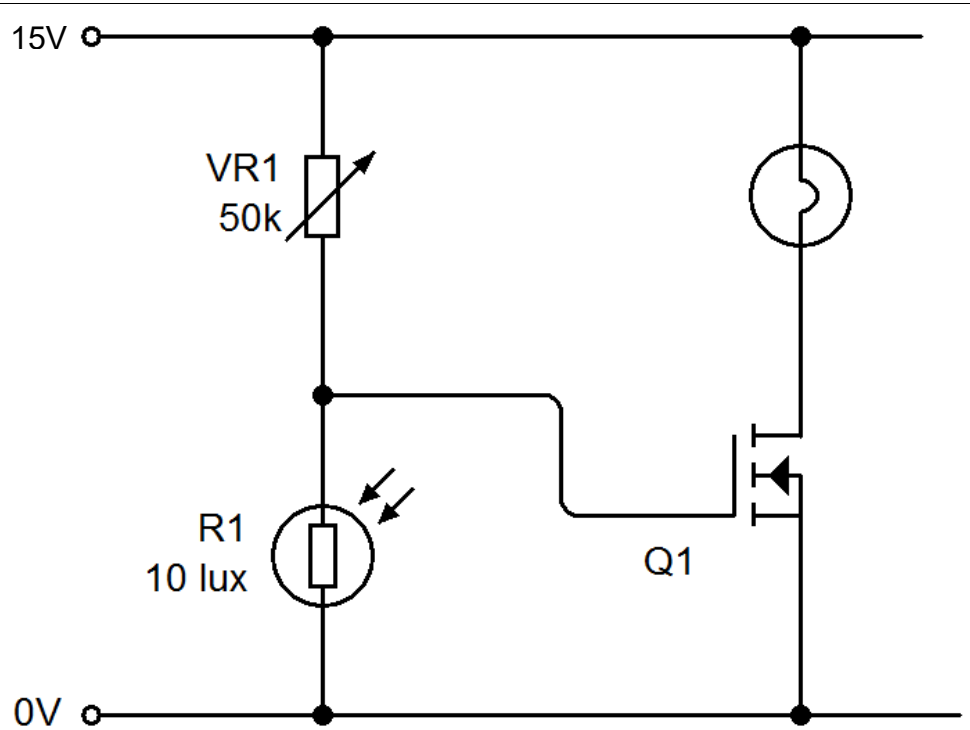
Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
6	*(a)*		$P = VI$ (1 – Formula) $P = 9 \times 500 \times 10^{-3}$ (1 – Substitution) $P = 4.5W$ (1 – Answer)	1	2		3	3
	(b)	i	At saturation $V_{transistor}$ = 0V, I_C = 500mA (1 by statement or substitution) $I_c = I_b h_{FE}$ (1 - formula) $I_b = \frac{I_c}{h_{FE}} = \frac{500}{200}$ (1 - rearrangement) $I_b = 2.5\ mA$ (1 - answer)	1	3		4	3
		ii	$V_{R1} = I \times R = 2.5 \times 10^{-3} \times 1.2 \times 10^{3} = 3V$ (1) ecf from b(i)		1		1	1
		iii	$V_{input} = V_{R1} + V_{BE} = 3 + 0.7 = 3.7V$ (1) ecf from b(ii)		1		1	1
			Question 6 total	**2**	**7**	**0**	**9**	**8**

BLANK PAGE

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
7			**Indicative Content:** The program does not meet the specification. There are several errors within the program that will prevent the correct mixing of the paint. The program starts correctly opening all three valves for 20 seconds, equivalent to 20ml of pigment being dispensed, before closing them all. The next “Wait 1s” command is required to ensure that the valves have fully closed. The next section opens valves 2 & 3 which is correct for a further 20 seconds equivalent to 20ml of Yellow and Blue pigment being added but no Red. The Yellow and Blue valves are then closed correctly. The next “Wait 1s” command is required to ensure that the valves have fully closed. In the final section of the program the Blue valve is opened correctly, however the time is set to 20s equivalent to 20ml of pigment when only 10ml is now required having already dispensed 40ml of blue. Therefore, this time delay should be 10s. Finally, at the end of the program Valve 3 is closed which corresponds to the Yellow Valve which is already closed and the Blue valve remains open. **5-6 marks** Recognition that the specification is not met with detailed analysis and description of **all** issues identified in the indicative content. *There is a sustained line of reasoning which is coherent, substantiated and logically structured. The information included in the response is relevant to the argument.*	0	1	5	6	

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
7			**3-4 marks** Recognition that the specification is not met with some analysis and description of at least **three** issues identified in the indicative content. *There is a line of reasoning which is partially coherent, supported by some evidence and with some structure. Mainly relevant information is included in the response but there may be some minor errors or the inclusion of some information not relevant to the argument.* **1-2 marks** Recognition that the specification is not met with minimal analysis and description of up to **two** issues identified in the indicative content. *There is a basic line of reasoning which is not coherent, supported by limited evidence and with very little structure. There may be significant errors or the inclusion of information not relevant to the argument.* **0 marks** No recognition that the specification is not met with no analysis or description of **any** issues identified in the indicative content. *Response not creditworthy or not attempted.*					
			Question 7 total	**0**	**1**	**5**	**6**	**0**

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
8	*(a)*	i	Accept 240000Ω to 250000Ω (or 240kΩ to 250kΩ) Do not accept 240 to 250.	1			1	1
		ii	$V_{OUT} = \frac{R_2}{R_1+R_2} \times V_{IN}$ (1 – equation) $V_{OUT} = \frac{250}{62.5+250} \times 15$ (1 – substitution) $V_{OUT} = 12.0V$ (1 – answer)	1	2		3	3
	(b)		V_{OUT} decreases	1			1	
	(c)	i	$I_D = g_M(V_{GS} - 3)$ (1 – equation) $g_M = \frac{I_D}{(V_{GS}-3)}$ (1 – rearrangement) $g_M = \frac{6}{12-3}$ (1 - substitution) $g_M = 0.667S$ (1 – answer)	1	3		4	3

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
	(c)	ii	 MOSFET correctly connected – 1 Mark Lamp in Drain – 1 Mark		2		2	
			Question 8 total	**4**	**7**	**0**	**11**	**7**
			TOTAL	**35**	**35**	**10**	**80**	**29**