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# **GCSE MARKING SCHEME**

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**SUMMER 2022**

**GCSE  
ELECTRONICS – COMPONENT 2  
C490U20-1**

## **INTRODUCTION**

This marking scheme was used by WJEC for the 2022 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.

**GCSE ELECTRONICS**  
**SUMMER 2022 MARK SCHEME**  
**COMPONENT 2 – APPLICATION OF ELECTRONICS**

**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

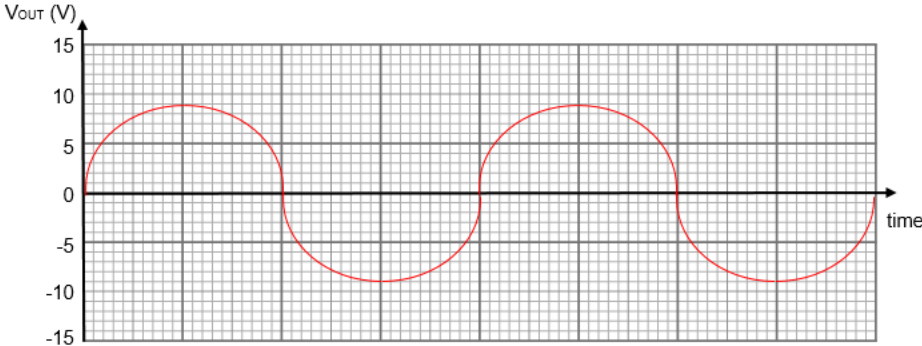
The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only  
ecf = error carried forward

Question		Marking details	Marks available				
			AO1	AO2	AO3	Total	Maths
1.	(a) / (b)	<pre> graph TD     Start([Start]) --&gt; D1{Is door closed?}     D1 -- NO --&gt; D1     D1 -- YES --&gt; P1[/Lock door/]     P1 --&gt; P2[/Open water valve/]     P2 --&gt; D2{Is water level correct?}     D2 -- NO --&gt; D2     D2 -- YES --&gt; P3[/Close water valve/]     P3 --&gt; P4[/Switch on heater/]     P4 --&gt; D3{Is water at 50 degrees?}     D3 -- NO --&gt; D3     D3 -- YES --&gt; P5[/Switch off heater/]     P5 --&gt; End([Continue to the rest of the program])           </pre> <p>(a) 6 Correct Program instructions = 5 marks; 5 Correct Program instructions = 4 marks; 4 Correct Program instructions = 3 marks; 3 Correct Program instructions = 2 marks; 2 Correct Program instructions = 1 mark</p> <p>(b) 3 Correct links – 3 x 1 mark</p>	5	3		8	
		<b>Question 1 total</b>		<b>5</b>	<b>2</b>	<b>0</b>	<b>8</b>

Question		Marking details	Marks available					
			AO1	AO2	AO3	Total	Maths	
2	(a)	<p>Trigger circuit containing Push-to-break switch and resistor between power rails – 1 mark  Correct orientation of trigger circuit – 1 mark  Correct connection of trigger circuit to Pin 2 – 1 mark  {Push to make in correct orientation = 2 marks}  Correct orientation of timing circuit – 1 mark  Correct connection of timing circuit to Pin 6/7 – 1 mark</p>						
	(b)	(i)	$T = 1.1RC$ ----- (1 - Formula) $R = \frac{T}{1.1 \times C}$ ----- (1 - Rearrangement) $R = \frac{20}{1.1 \times 330 \times 10^{-6}}$ ----- (1 - Substitution) $R = 55096.4\Omega \cong 55.1k\Omega$ ----- (1 - Answer)	1	3		4	4
		(ii)	56kΩ ecf (i)	1			1	

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
	(c)	(i)	4 3 0 $\Omega$	3			3	0
		(ii)	$P = I^2R$ ----- (1 – Formula) $P = (15 \times 10^{-3})^2 \times 430$ ----- (1 – Substitution / 1 – Multiplier) $P = 0.09675W = 96.75mW$ ----- (1 – Answer)	2	2		4	4
<b>Question 2 total</b>				<b>10</b>	<b>5</b>	<b>2</b>	<b>17</b>	<b>8</b>

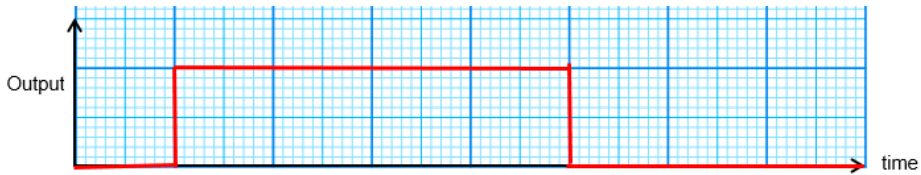
Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
3.	(a)	(i)	$Gain = -\frac{R_F}{R_{IN}}$ ----- (1 – Formula) $Gain = -\frac{75k}{3k} = -25$ ----- (1 – Substitution & Answer)	1	1		2	1
		(ii)	$Gain = -\frac{75k+100k}{3k}$ ----- (1 – calculation of max resistance = 175kΩ) $Gain = -58.33$ ----- (1 – Answer)		2		2	2
	(b)	(ii)	 <p>Inverted Output – 1 mark            Same Frequency – 1 mark            Correct amplitude (9.0V) – 1 mark</p>	1	2		3	2

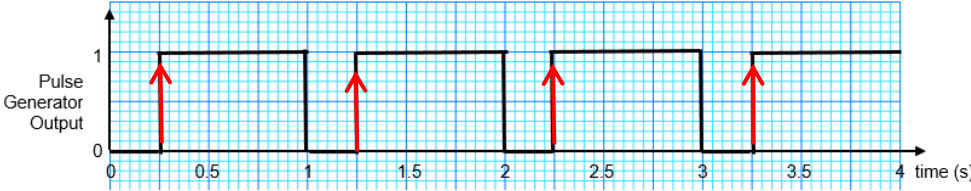
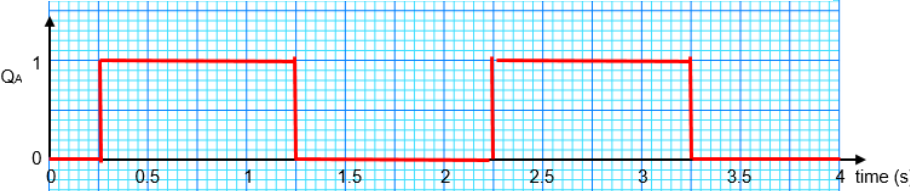
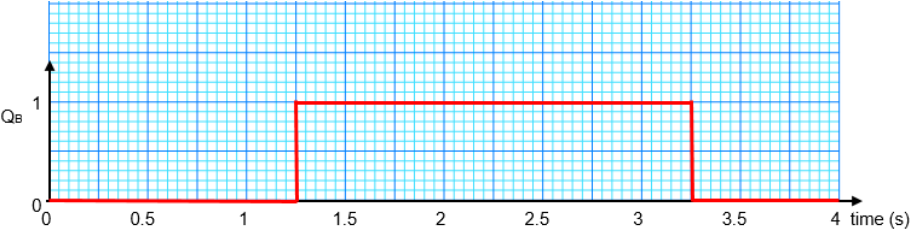


Question		Marking details	Marks available				
			AO1	AO2	AO3	Total	Maths
	(c)	$Gain = -\frac{V_{OUT}}{V_{IN}}$ ----- (1 – Formula) $V_{IN(Max)} = -\frac{V_{OUT(Max)}}{Gain(Max)}$ ----- (1 – Rearrangement) $V_{IN(Max)} = -\frac{14}{-58.33}$ ----- (1 – Substitution {14÷a(ii)}) $V_{IN(Max)} = 0.24V = 240mV$ ----- (1 – Answer) ecf (a)(ii)	1	3		4	3
		<b>Question 3 total</b>	<b>3</b>	<b>8</b>	<b>0</b>	<b>11</b>	<b>8</b>

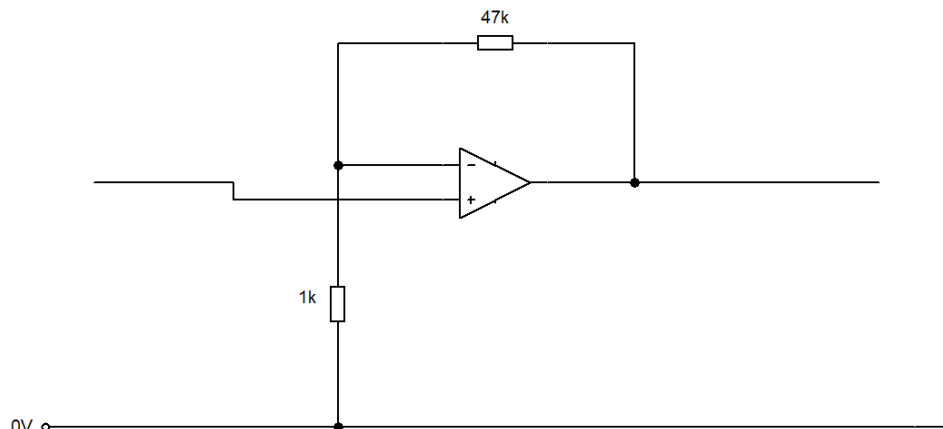
Question		Marking details					Marks available				
							AO1	AO2	AO3	Total	Maths
4.	(a)	<b>Clock Pulse</b>	<b>Blue</b>	<b>Green</b>	<b>Amber</b>	<b>Pink</b>	1	4		5	
		0	On	Off	Off	Off					
		1	Off	On	Off	Off					
		2	Off	Off	On	Off					
		3	On	Off	Off	Off					
		4	Off	Off	Off	On					
		5	Off	Off	Off	On					
		6	On	Off	Off	Off					
		7	Off	Off	On	Off					
		8	On	Off	Off	Off					
		9	Off	On	Off	Off					
		10	Off	Off	On	Off					
<p>1 mark for each correct column for pulses 0-7 (Max 4 marks)  1 mark for correct reset and corresponding outputs.  (ecf if rows 8-10 repeat rows 0-2)</p>											

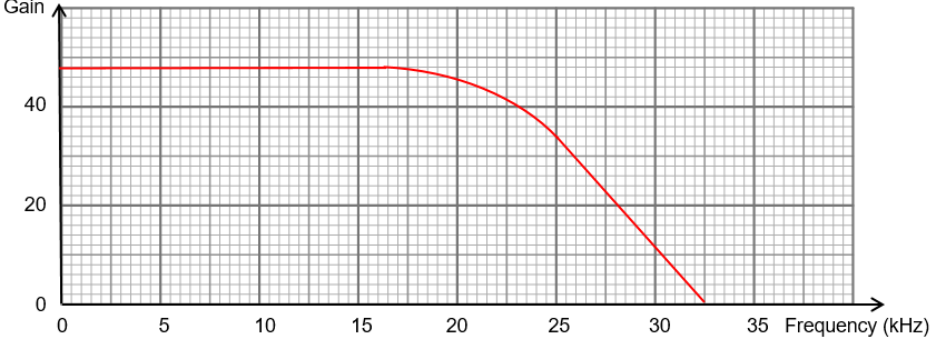
Question		Marking details	Marks available				
			AO1	AO2	AO3	Total	Maths
	(b)	<p>NAND gate selected – 1 mark  Gate output connected to Reset – 1 mark  Connection from Output 'C' to gate – 1 mark  Connection from Output 'D' to gate – 1 mark</p>	2		2	4	
<b>Question 4 total</b>			<b>3</b>	<b>4</b>	<b>2</b>	<b>9</b>	<b>0</b>

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
5.	(a)		 <p>Q starting low – 1 mark Two correct transitions – 1 mark each</p>	1	2	0	3	
	(b)	(i)	<p>Pulse Generator to Clock<sub>A</sub> input – 1 mark Q<sub>A</sub> bar to D<sub>A</sub> – 1 mark Q<sub>A</sub> bar to Clock<sub>B</sub> – 1 mark Q<sub>B</sub> bar to D<sub>B</sub> – 1 mark</p> <p>Any other connections – (-1) mark</p>	4			4	

Question		Marking details	Marks available				
			AO1	AO2	AO3	Total	Maths
	(ii)	<p>I. Any edge – 1 mark</p>  <p>II. <math>Q_A</math> starts at 0 – 1 mark, 4 correct transitions on rising edges – 2 marks / 1 correct transition – 1 mark</p>  <p>II. <math>Q_B</math> starts at 0 – 1 mark, 2 correct transitions on falling edges of <math>Q_A</math> – 2 marks</p> 	3	4		7	

Question		Marking details	Marks available						
			AO1	AO2	AO3	Total	Maths		
	(c)	(i)	Space time = 0.25s			1		1	1
		(ii)	Mark Time = 0.75s			1		1	1
		(iii)	$\frac{T_{ON}}{T_{OFF}} = \frac{R_1 + R_2}{R_2}$ ----- (1 – Equation) $\frac{0.75}{0.25} = \frac{R_1 + 10}{10}$ ----- (1 – Substitution) ecf (i)&(ii) $3 \times 10 = R_1 + 10$ ----- (1 Rearrangement)  $30 - 10 = R_1$  $20 = R_1$  $R_1 = 20k\Omega$ ----- (1 Answer)		1	3		4	4
<b>Question 5 total</b>			<b>9</b>	<b>11</b>	<b>0</b>	<b>20</b>	<b>6</b>		

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
6.	(a)	(i)	 <p>Feedback resistor from Output to inverting input – 1 mark Resistor from inverting input to 0V – 1 mark Input to non-inverting input, and output to output – 1 mark</p>			3	3	
		(ii)	$Gain = 1 + \frac{R_F}{R_1}$ $48 = 1 + \frac{R_F}{R_1} \text{ (Formula \& substitution - 1)}$ $48 - 1 = \frac{R_F}{R_1}$ $R_F = 47R_1 \text{ (Rearrange and correct ratio - 1)}$ $R_1 = 1k\Omega, R_F = 47k\Omega \text{ (Correct values >1k - 1)}$	1	0	2	3	3

Question		Marking details	Marks available				
			AO1	AO2	AO3	Total	Maths
	(b)	 <p>Max Gain = 48 – 1 mark Gain of 33.6 at 25kHz – 1 mark Gain falls off to 0 after 25kHz – 1 mark</p>	1	2		3	2
		<b>Question 6 total</b>	<b>2</b>	<b>2</b>	<b>5</b>	<b>9</b>	<b>5</b>



Question		Marking details	Marks available				
			AO1	AO2	AO3	Total	Maths
7.		<p><b>Indicative content:</b></p> <p>The student has correctly configured <math>S_1</math> to provide a rising edge at the clock input of the D-Type flip flop. When pressed however there will be no change to the Q output as the D input has been connected to the 0V line. It should be connected to the 9V line so that a logic 1 is transferred to the Q output when the clock goes high. The student has correctly configured <math>S_2</math> to provide a rising edge when <math>S_2</math> is pressed to reset the D-Type flip flop. The LED however will never light as a 10k<math>\Omega</math> resistor in series with it will reduce the current to such a small level that the LED will not light. Typical values for current limiting resistors are between 470<math>\Omega</math> and 820<math>\Omega</math>.</p> <p><b>5-6 marks</b> Candidates have evaluated the specification fully e.g. all parts of the specification considered against the given circuit, justifying values and connection of components in the design and given a comprehensive description of changes that should be made. Description has a logical thought process and presentation.</p> <p><i>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.</i></p> <p><b>3-4 marks</b> Candidates have evaluated most of the specification e.g. two of the three parts of the specification with the given circuit, justification of values and connection of components in the design may be less clear and given a brief description of changes that should be made. Description has a reasonable thought process and presentation.</p> <p><i>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.</i></p>					

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
			<p><b>1-2 marks</b> Candidates have evaluated little of the specification e.g. one of the three parts of the specification with the given circuit, justification of values and connection of components in the design may be weak and limited description of changes that should be made. Description has a random presentation.</p> <p><i>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.</i></p> <p><b>0 marks</b> No evaluation of circuit against specification or any statement of value.</p> <p><i>Response not creditworthy or not attempted.</i></p>	3	2	1	6	2
			<b>Question 7 total</b>	<b>3</b>	<b>2</b>	<b>1</b>	<b>6</b>	<b>2</b>
			<b>Paper total</b>	<b>35</b>	<b>35</b>	<b>10</b>	<b>80</b>	<b>34</b>