GCSE MARKING SCHEME

AUTUMN 2021

GCSE
ELECTRONICS – COMPONENT 1
C490UA0-1

INTRODUCTION

This marking scheme was used by WJEC for the 2021 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

AUTUMN 2021 MARK SCHEME

COMPONENT 1 – DISCOVERING 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

<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="6">1.</td><td rowspan="2">(a)</td><td>(i)</td><td>F</td><td>1</td><td></td><td></td><td></td><td></td></tr>
<tr><td>(ii)</td><td>C</td><td>1</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">(b)</td><td>(i)</td><td>B</td><td>1</td><td></td><td></td><td></td><td></td></tr>
<tr><td>(ii)</td><td>E</td><td>1</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">(c)</td><td>(i)</td><td><table><tr><td>B</td><td>A</td><td>Q</td></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table></td><td>1</td><td></td><td></td><td></td><td></td></tr>
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<tr><td colspan="3"></td><td>Question 1 total</td><td>6</td><td>0</td><td>0</td><td>6</td><td>0</td></tr>
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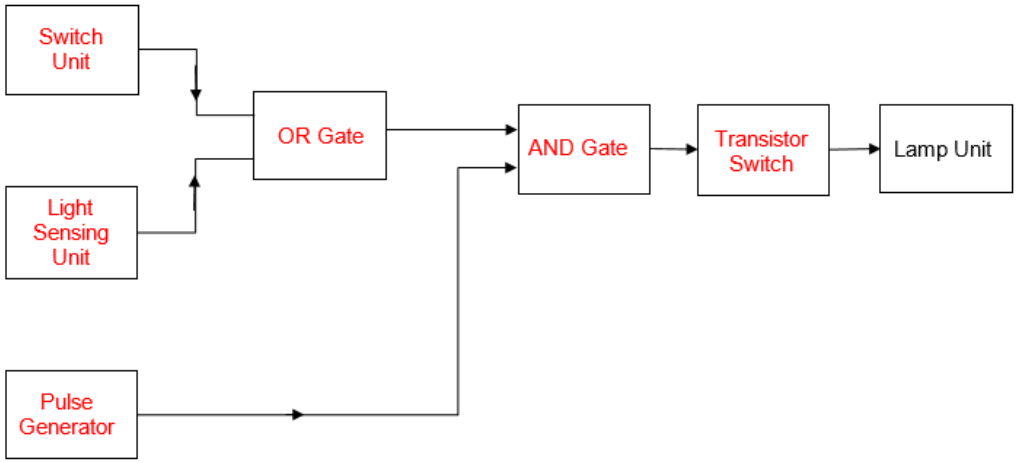
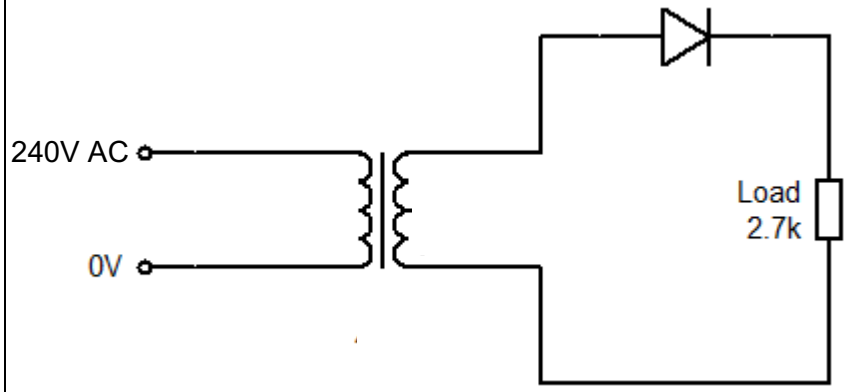
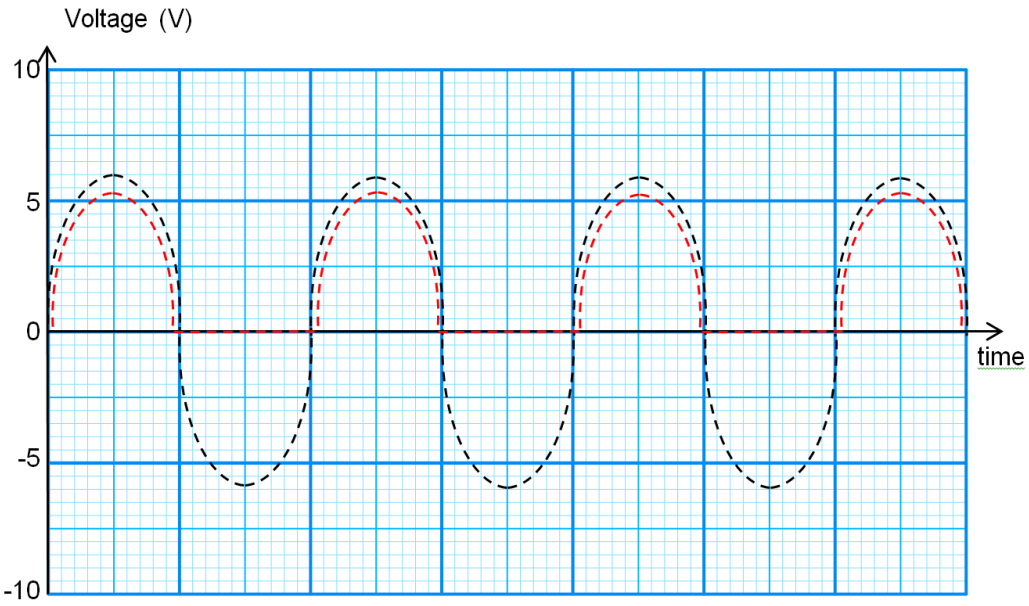
<tr><td>2.</td><td>(a)</td><td></td><td>
<table>
<tr><th>Input sub-systems</th><th>Processing sub-systems</th><th>Output sub-systems</th></tr>
<tr><td>Temperature sensing unit</td><td>OR gate</td><td>Buzzer unit</td></tr>
<tr><td>Switch unit</td><td>Transistor switch unit</td><td>Solenoid unit</td></tr>
<tr><td>Light sensing unit</td><td>Delay unit</td><td></td></tr>
<tr><td></td><td>Comparator unit</td><td></td></tr>
</table>
1 mark per correct column</td><td>3</td><td></td><td></td><td>3</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td> 

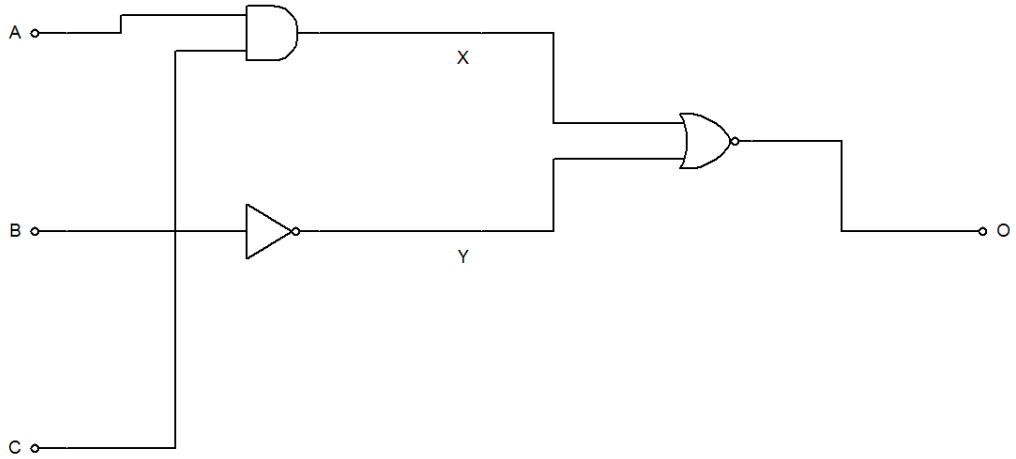
1 mark for each correct box</td><td></td><td>1</td><td>5</td><td>6</td><td></td></tr>
<tr><td colspan="3"></td><td>Question 2 total</td><td>3</td><td>1</td><td>5</td><td>9</td><td>0</td></tr>
</table>

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
3.	*(a)*	(i)	I_1 = 30-10 = 20mA		1		1	1
			I_3 = 20+10 = 30mA		1		1	1
		(ii)	$V = IR$ *(1 – Formula)* $V_3 = I_3 \times R_3$ $V_3 = 30mA \times 100$ *(1 – Substitution)* $V_3 = 3V$ *(1 – Answer)*	1	2		3	3
		(iii)	$V_S = V_1 + V_3$ $V_1 = V_S - V_3$ *(Formula and manipulation = 1)* $V_1 = 12 - 3$ $V_1 = 9V$ *(Answer = 1)*	1	1		2	2
		(iv)	$V = IR$ $R = \frac{V}{I}$ *(1 – rearrangement)* $R = \frac{12}{30mA}$ *(1 – Substitution)* $R = 400\Omega$ *(1 – Answer)*	1	2		3	3

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
	(b)		Brown (1) Black (1) Brown (1) Gold	3			3	0
			Question 3 total	**6**	**7**	**0**	**13**	**8**

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
4.	*(a)*		 1 mark for both components 1 mark for series connection	2				

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
	(b)		 Half wave rectified output – 1 mark Peak 0.7V less than transformer output - 1 mark		2			1
			Question 4 total	**2**	**2**	**0**	**4**	**1**

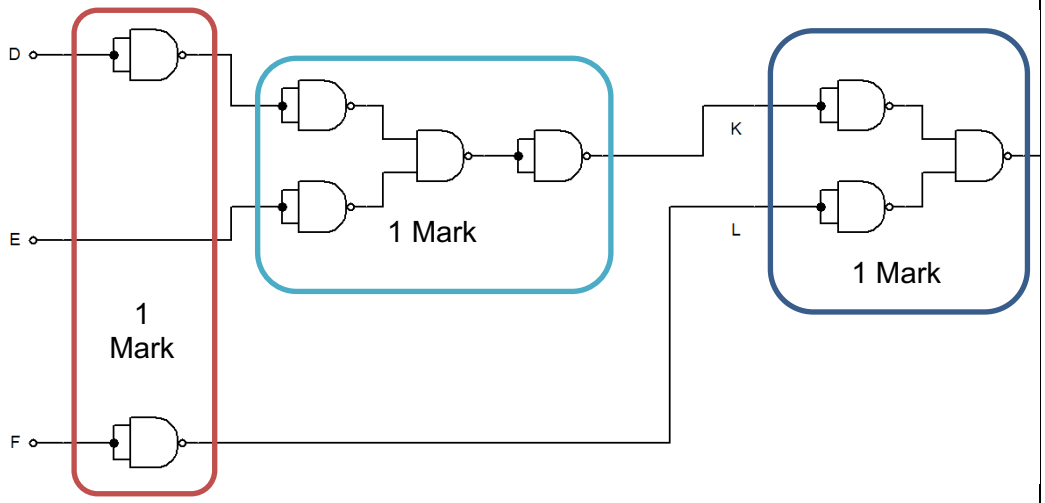
Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
5.	*(a)*	(i)	 i. X connected to output of AND gate with A and C as the inputs - (1) ii. Y connected to the output of NOT gate with B as the input – (1) iii. Output O connected to the output of NOR gate with inputs X and Y – (1)	3			3	

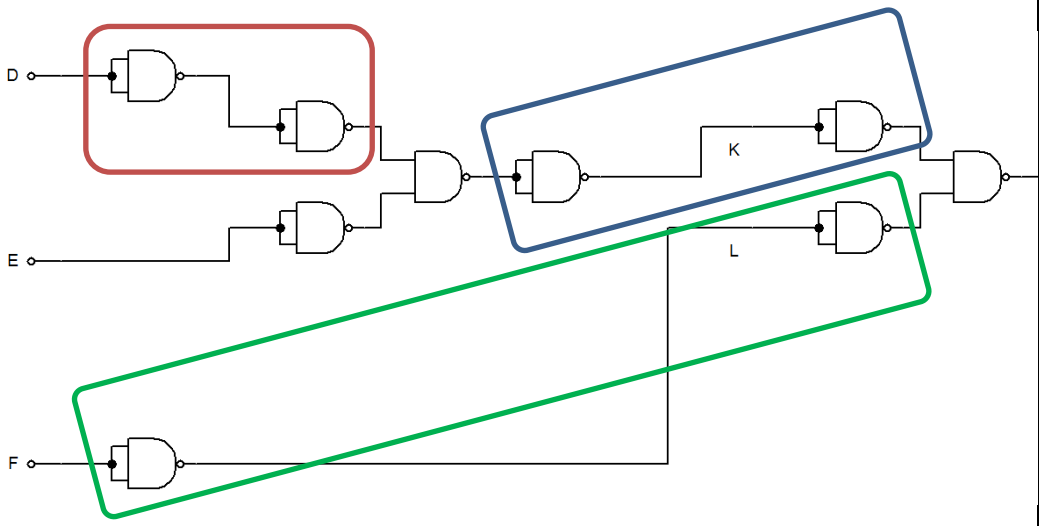
Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
		(ii)						

C	B	A	X	Y	Q
0	0	0	0	1	0
0	0	1	0	1	0
0	1	0	0	0	1
0	1	1	0	0	1
1	0	0	0	1	0
1	0	1	1	1	0
1	1	0	0	0	1
1	1	1	1	0	0

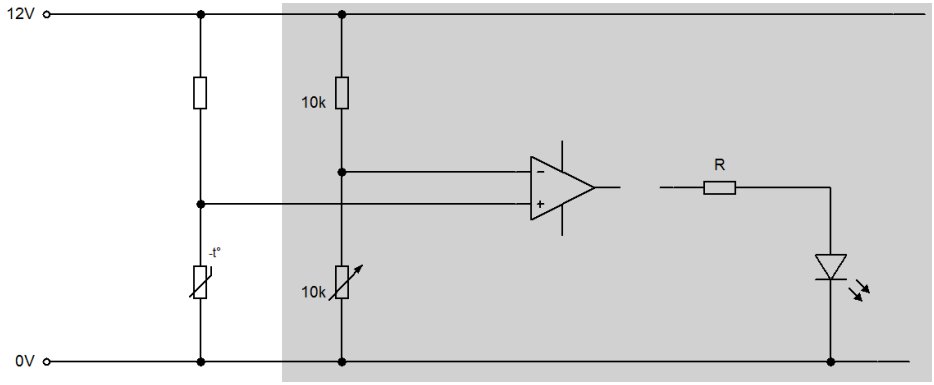
1 mark for each correct column.

							3		3	

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
	(b)	(i)		3			3	

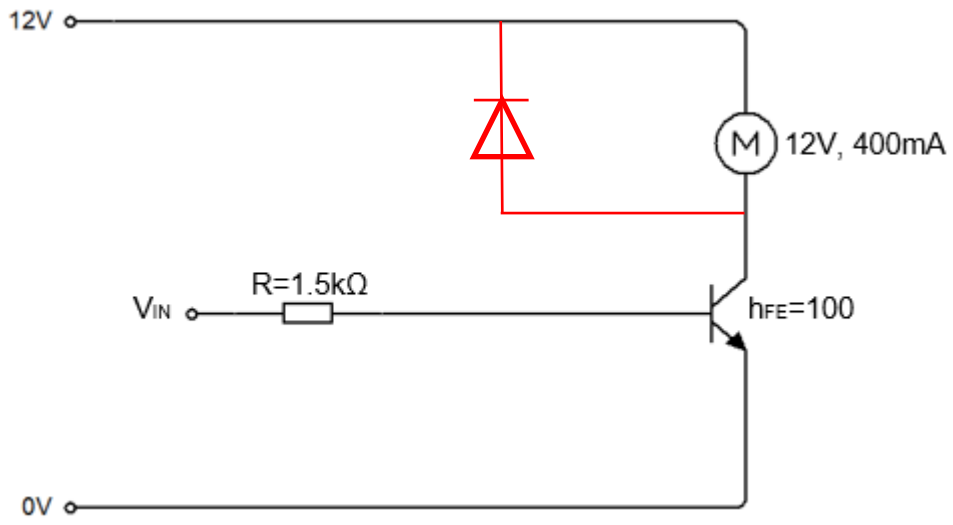
Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
		(ii)	 3 Pairs of redundant gates identified = 2 marks 1 Pair of redundant gates identified = 1 mark		2		2	

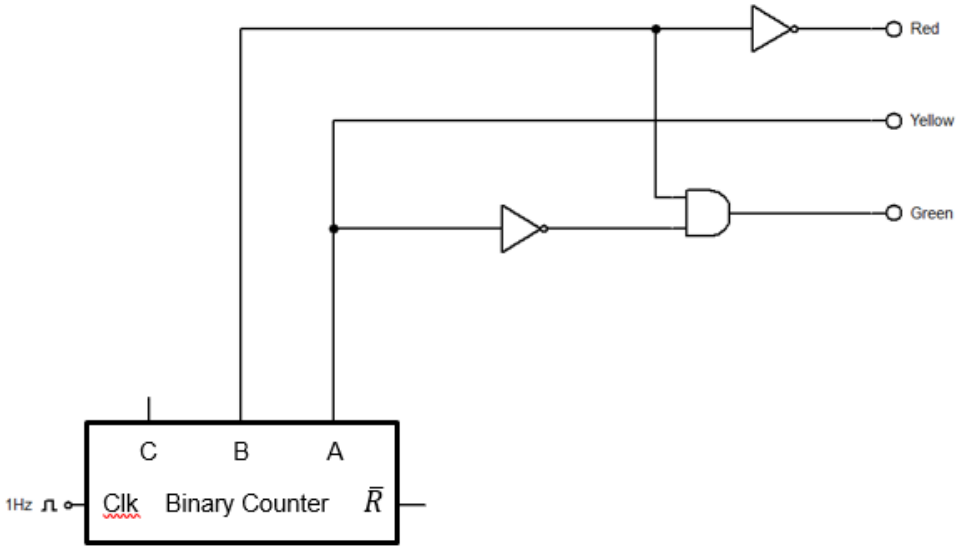
Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
	(c)	(i)	Many automotive systems are controlled by microcontrollers – examples are • The engine • the anti-lock brakes, • cruise control, • intelligent lights • windscreen wipers Any similar system – 1 mark		1			
		(ii)	More flexible than a hard wired circuit since a microcontroller can be repeatedly reprogrammed (1) additional clarification e.g. to change delay on wiper blades, different speeds for cruise control etc. (1)		2			
			Question 5 total	**6**	**8**	**0**	**14**	**0**

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
6.	*(a)*		 Thermistor and resistor in series connected to non-inverting input – (1) Thermistor at bottom – (1)			2	2	0
	(b)	(i)	$V = IR$ $R = \frac{V}{I}$ *(1 – rearrangement)* $R = \frac{11.5-2.15}{19mA}$ *(1 – Substitution)* $R = 492.1\Omega$ *(1 – Answer)*	1	2	0	3	3
		(ii)	510Ω (1)	0	1	0	1	0
			Question 6 total	**1**	**3**	**2**	**6**	**3**

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
7.	*(a)*		$V_R = V_S - V_Z$ $V_R = 9 - 5.1$ $V_R = 3.9V$	1	0	0	1	1
	(b)		$I_z = I_R + I_L$ $I_Z = 300_{mA} - 280_{mA}$ *(1 – Substitution)* $I_z = 20_{mA}$ *(1 – Answer)*	1	1	0	2	2
	(c)	(i)	$I_Z = 300mA$	1	0	0	1	0
		(ii)	$P = IV$ (1 – Formula) $P = 300mA \times 5.1V$ (1 – Substitution) $P = 1.53W$ (1 – Answer)	1	2	0	3	2
			A 2W Zener diode should be used. (1 – Choice of power rating)	0	1	0	1	0
	(d)		5.1V (The output voltage is not affected by an increase in the supply voltage)	0	1	0	1	0
			Question 7 total	**4**	**5**	**0**	**9**	**5**

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
8.	*(a)*	(i)	$I_c = I_b h_{FE}$ (1 – formula) $I_b = \frac{I_c}{h_{FE}}$ (1 – formula manipulation) $I_b = \frac{400}{100}$ (1 - substitution) $I_b = 4mA$ (1 - answer)	1	3		4	4
		(ii)	$V = IR$ $V = 4mA \times 1.5k$ *(1 – Substitution)* $V_{1.2k} = 6V$ *(1 – Answer)*	1	1		2	2
		(iii)	$V_{IN} = V_{1.2k} + V_{BE}$ (1) $V_{IN} = 6 + 0.7 = 6.7V$ (1)	1	1		2	2
		(iv)	$P = IV$ (1- Formula) $P = 0.4 \times 12$ (1- Substitution) $P = 4.8W$ (1 – Answer)	1	2		3	3

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
	(b)		 Use of a diode in protection circuit = 1 mark Correct orientation of diode = 1 mark	2			2	
			Question 8 total	**6**	**7**	**0**	**13**	**11**

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
9.			**Indicative Content:** The circuit does not fully meet the specification. There are three errors to the design. i. The counter will never start, since the reset pin is active low – for this application a reset is not actually required since only 4 output patterns are required. ii. The Red output is incorrect – it needs to be $\bar{B}$, so a NOT gate is needed. iii. The Green output also incorrect – the inputs are correct, it just needs an AND gate instead of an OR gate. The correct solution is therefore as shown below: 					

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
			5-6 marks Recognition that the specification is only partially met with detailed analysis and description of **all** factors identified in the indicative content including correct elements and **all** the modifications required. *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.* **3-4 marks** Recognition that the specification is only partially met with some analysis and description of at least **two** factors identified in the indicative content including correct elements and **two** modifications required. *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 only partially met with minimal analysis and description of just **one** factor identified in the indicative content including correct elements and/or **one** modification required *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 only partially met with no analysis or description of **any** factors identified in the indicative content. *Response not creditworthy or not attempted.*	1	2	3	6	
			Question 9 total	**1**	**2**	**3**	**6**	**0**
			PAPER TOTAL	**35**	**35**	**10**	**80**	**28**