



GCSE MARKING SCHEME

AUTUMN 2020

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

INTRODUCTION

This marking scheme was used by WJEC for the 2020 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 2020 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

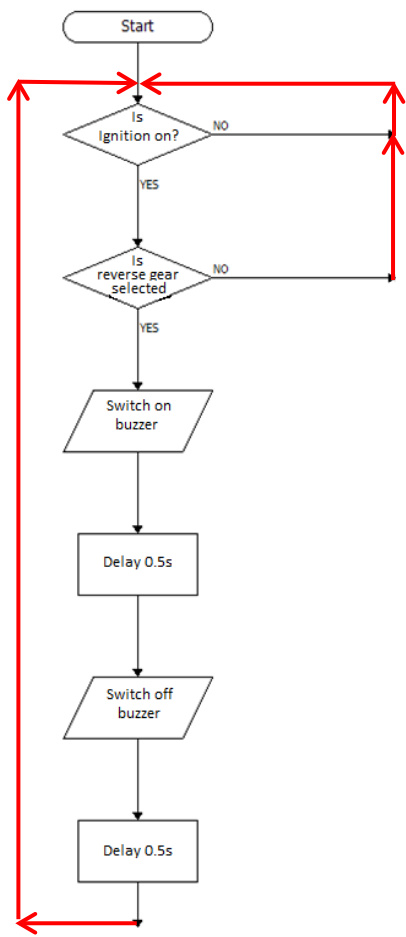
A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide 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.

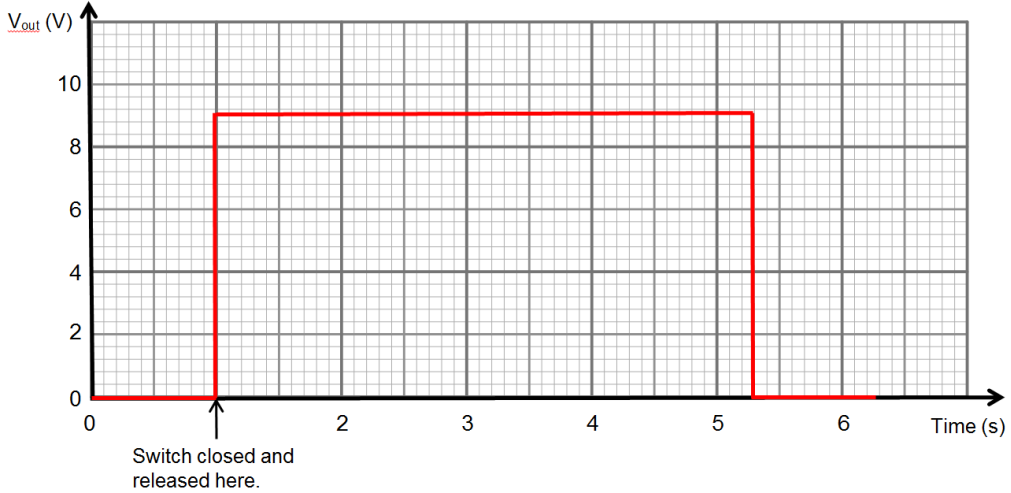
Marking abbreviations

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

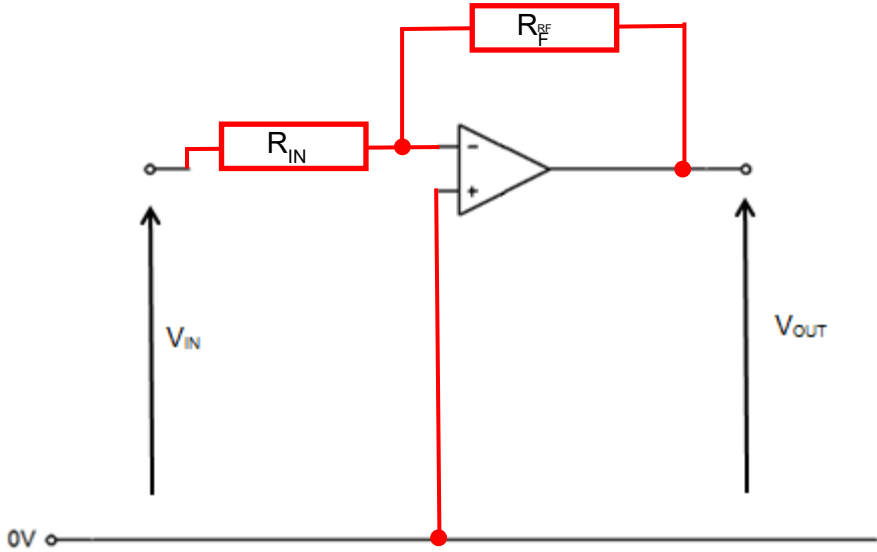
cao	=	correct answer only
ecf	=	error carried forward

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
1	(a)		<pre> graph TD Start([Start]) --> Ignition{Is Ignition on?} Ignition -- NO --> Exit1[] Ignition -- YES --> Gear{Is reverse gear selected?} Gear -- NO --> Exit2[] Gear -- YES --> Buzzer[/Switch on buzzer/] Buzzer --> Delay1[Delay 0.5s] Delay1 --> BuzzerOff[/Switch off buzzer/] BuzzerOff --> Delay2[Delay 0.5s] Delay2 --> End[] </pre> Correct Program = 1 mark; Correct Decisions = 1 mark; Output / Process in correct boxes = 1 mark	3			3	

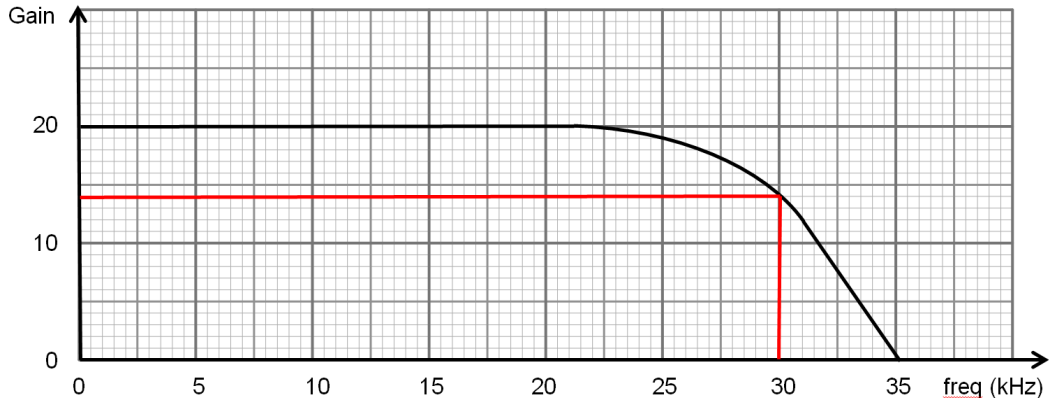
Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
	(b)		 <pre> graph TD Start([Start]) --> Ignition{Is Ignition on?} Ignition -- NO --> Ignition Ignition -- YES --> Gear{Is reverse gear selected?} Gear -- NO --> Gear Gear -- YES --> Buzzer[/Switch on buzzer/] Buzzer --> Delay1[Delay 0.5s] Delay1 --> BuzzerOff[/Switch off buzzer/] BuzzerOff --> Delay2[Delay 0.5s] Delay2 --> Ignition </pre> 1 mark for each correct link	3			3	
Question 1 Total				6	0	0	6	0

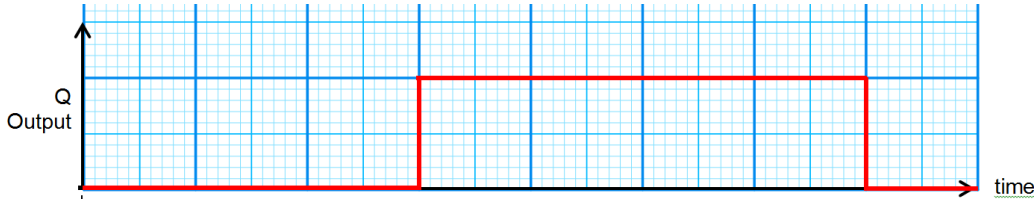
Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
2	(a)		 Appropriate scale added to x-axis -1 Correct pulse duration from start - 1 Correct maximum amplitude – 1	1	2		3	3
	(b)	(i)	3cm x 2V/cm = 6V		1		1	1
		(ii)	I. 2cm x 5ms = 10ms		1		1	1
			II. 3cm x 5ms = 15ms		1		1	1

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
			III. Period = 10ms + 15ms = 25ms – 1 mark $f = \frac{1}{T} \dots\dots\dots (1)$ $f = \frac{1}{25ms} = 40Hz \dots\dots\dots (1)$	1	2		3	3
Question 2 Total				2	7	0	9	9

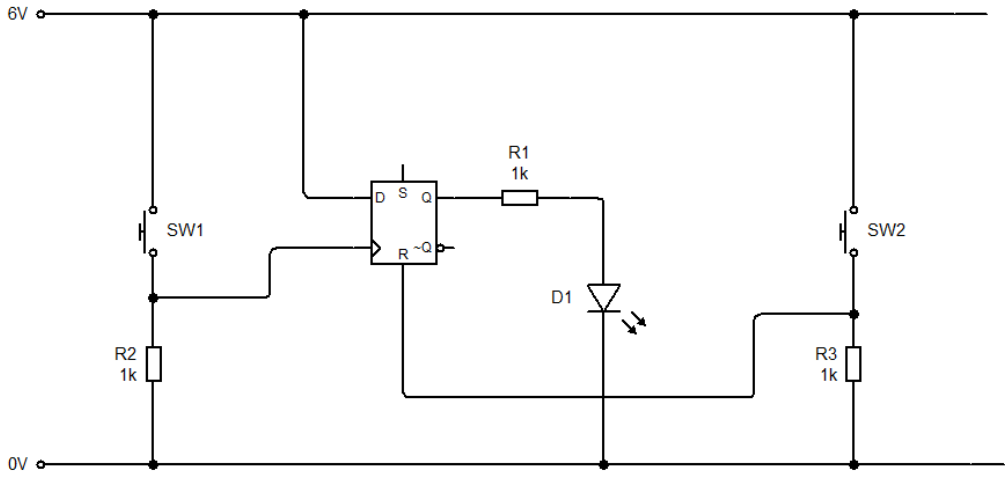
Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
3.	(a)	(i)	 R_F from output to inverting input – (1) R_{IN} from inverting input to input – (1) Non-inverting input to 0V – (1)	1	2	0	3	
		(ii)	$Gain = -\frac{R_F}{R_{IN}}$ $-40 = -\frac{R_F}{R_1}$ (Formula & substitution – 1) $R_F = 40R_1$ (Rearrange and correct ratio – 1) e.g. $R_1 = 2k\Omega$, $R_F = 80k\Omega$ (Correct values $\geq 1k$ – 1)	1	0	2	3	3

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
	(b)	(i)	0.2V (1)		1		1	1
		(ii)	$V_{OUT} = 40 \times 0.2 = 8V$ – (1)	1			1	1
		(iii)	Sine wave with same frequency as V_{IN} – (1) Inverted - (1) Correct Amplitude – (1)	1	2		3	1
			Question 3 Total	4	5	2	11	6

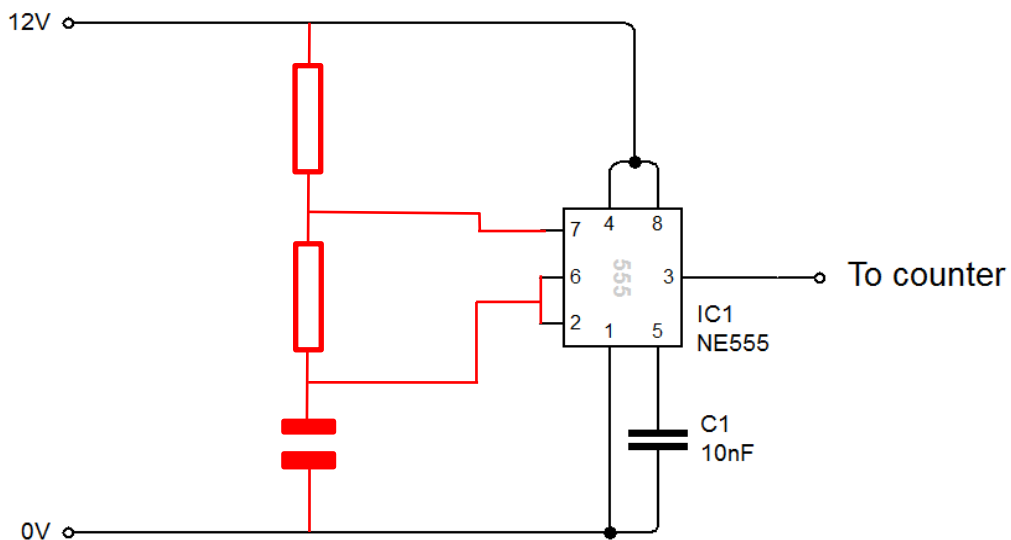
Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
4	(a)		20	1			1	
	(b)		 Gain of $0.7 \times 20 = 14$ (1) Appropriate lines drawn at gain = 14 (1) Bandwidth identified at 30kHz (1)	1	2		3	2
	(c)		Decreased (1) by half (1)		2		2	1
			Question 4 Total	2	4	0	6	3

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
5	(a)		 Q starting low – 1 mark Two correct transitions – 1 mark each	1	2	0	3	
	(b)	(i)	Pulse Generator to Clock input – 1 mark Q bar to D – 1 mark Any other connections – (-1) mark	2			2	
		(ii)	I. 100 Hz – 1 mark II. 200 Hz – 1 mark		2		2	1

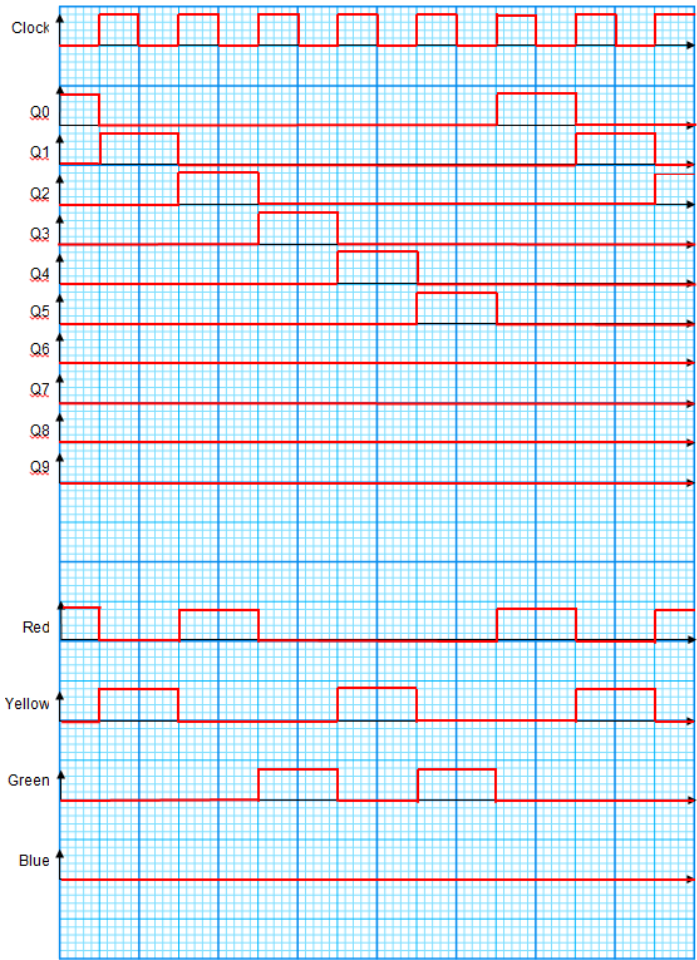
Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
		(iii)	I. Any edge – 1 mark Pulse generator output 1 0 Time II. Q starts at 1 – 1 mark 3 correct transitions – 2 marks/1 correct transition – 1 mark Q output 1 0 Time III. Q bar is exact inverse of Q – 1 mark Q-bar output 1 0 Time	3	2		5	

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
	(c)		 D input connected to 6V – 1 SW1 connected in series with pull down resistor – 1 SW2 connected in series with pull down resistor – 1 Junction of SW1 and pull down resistor connected to clock input – 1 Junction of SW2 and pull down resistor connected to reset input – 1	3	0	2	5	1
Question 5 Total				9	6	2	17	1

Question			Marking details							Marks available																																																																																																
										AO1	AO2	AO3	Total	Maths																																																																																												
6	(a)	(i)	<table><tr><th colspan="3">Counter Outputs</th><th colspan="6">Display Outputs</th></tr><tr><th>C</th><th>B</th><th>A</th><th>Block 1</th><th>Block 2</th><th>Block 3</th><th>Block 4</th><th>Block 5</th><th>Block 6</th></tr><tr><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table>									Counter Outputs			Display Outputs						C	B	A	Block 1	Block 2	Block 3	Block 4	Block 5	Block 6	0	0	0	1	1	1	1	1	0	0	0	1	0	1	1	1	1	0	0	1	0	0	0	1	1	1	0	0	1	1	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0					
			Counter Outputs			Display Outputs																																																																																																				
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1	1	1	0	0	0	0	0	0																																																																																																		
Correct display outputs – 1 mark							1		0	1																																																																																																
(ii)	Block 4 = $\bar{C}$								1	0	1	1																																																																																														
(iii)	Block 6 = $A.\bar{B}.C + \bar{A}.B.C$ $A.\bar{B}.C$ – 1 Mark $\bar{A}.B.C$ – 1 Mark Or operand – 1 Mark							1	2	0	3	3																																																																																														

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
	(b)		 2 resistors + capacitor in series - 1 mark. Orientation of resistors / capacitors - 1 mark Connection to pin 6/2 - 1 mark Connection to pin 7 - 1 mark	3	1	0	4	0

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
	(c)		$V = IR$ $R = \frac{V}{I}$ (formula & manipulation = 1) $R = \frac{12 - 1.85 - 1.85}{20 \times 10^{-3}}$ (substitution – 1) $R = 415\Omega$ (ideal answer - 1) $R = 430\Omega$ (Correct preferred value – 1; Do NOT accept 390Ω)	1	1	2	4	3
Question 6 Total				6	5	2	13	7

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
7	a		 Mark Allocation: • Timing for decade counter – 1 mark • Reset observed at Q6 – 1 mark • Q6-9 and Blue – no output – 1 mark • Red, Yellow, Green correct – 1 mark each	3	3		6	0
Question 7 Total				3	3	0	6	0

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
8.	(a)		$V_{OUT} = -R_F \left\{ \frac{V_1}{R_1} + \frac{V_2}{R_2} \right\} \dots \dots \dots (1 - Equation)$ $V_{OUT} = -100 \left\{ \frac{3}{10} + \frac{-5}{20} \right\} \dots \dots \dots (1 - Substitution)$ $V_{OUT} = -100\{0.3 - 0.25\} \dots \dots \dots (1 - Manipulation)$ $V_{OUT} = -5V \dots \dots \dots (1 - Answer)$	1	3		4	4
	(b)		The modified design is more useful because different amounts of the input signal can be passed into the mixer because of the potentiometer allowing anything from 0 to 100% of the input through to the mixer (1). Having a potentiometer on both inputs means that each input signal can be altered independently which can compensate for input 1 and 2 having different gains. (1)	2			2	
			Question 8 total	3	3	0	6	4

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
9.			Indicative Content: The student has correctly configured a 555 IC as a Monostable which will be triggered when the switch is pressed causing the light to be switched on. The time interval specified is 4 minutes or 240 seconds. Using the components specified the time delay will be $1.1 \times 220\text{k}\Omega \times 100\mu\text{F} = 24.2\text{s}$ which is far too short and needs to be 10x bigger so changing C to 1000μF would achieve this part of the specification. The output current capability of a 555 timer is a maximum of 200mA and therefore this cannot drive the floodlight directly. The light will not come on. A MOSFET or power transistor should be used as an interface between the output of the 555 timer and the floodlight to complete the design that lights the floodlight and will switch off when the timing period has expired. 5-6 marks Candidates have evaluated the specification fully e.g. all three statements considered against the given circuit, justifying values and selection of components in the design and given a comprehensive description of changes that should be made. Description has a logical thought process and presentation. <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>					

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
			3-4 marks Candidates have evaluated most of the specification e.g. two of the three statements with the given circuit, justification of values and selection 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. <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> 1-2 marks Candidates have evaluated little of the specification e.g. one of the three statements with the given circuit, justification of values and selection of components in the design may be weak and limited description of changes that should be made. Description has a random presentation. <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> 0 marks No evaluation of circuit against specification or any statement of value. <i>Response not creditworthy or not attempted.</i>					
			Question 9 total	0	2	4	6	2
			Paper Total	35	35	10	80	32