



GCE AS MARKING SCHEME

SUMMER 2025

**AS
ELECTRONICS – COMPONENT 1
B490U10-1**

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

**EDUQAS AS ELECTRONICS - COMPONENT 1
PRINCIPLES OF ELECTRONICS**

SUMMER 2025 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.

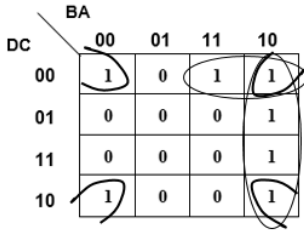
Marking abbreviations

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)	$V_1 = 12 - 9 = 3 \text{ V} \quad (1)$	1			1	
		(ii)	$I_1 = \frac{3 \text{ (ecf)}}{2} \quad (1) = 1.5 \text{ mA} \quad (1)$		2		2	1
		(iii)	$I_2 = 4 - 1.5 \text{ (ecf)} = 2.5 \text{ mA} \quad (1)$ $R_1 = \frac{3 \text{ (ecf)}}{2.5 \text{ (ecf)}} = 1.2 \text{ k}\Omega \quad (1)$		2		2	2
	(b)	(i)	$12 - 0.7 = 11.3 \text{ V} \quad (1)$ Either $11.3 \times \frac{4.7}{3.3 + 4.7} \quad (1) = 6.6 \text{ V} \quad (1)$ $V_{\text{OUT}} = 6.6 + 0.7 = 7.3 \text{ V} \quad (1)$ OR $\frac{11.3}{3.3 + 4.7} = 1.4125 \text{ mA} \quad (1)$ $3.3 \times 1.4125 = 4.66 \quad (1) \quad \text{or} \quad 4.7 \times 1.4125 = 6.64 \quad (1)$ $V_{\text{OUT}} = 12 - 4.66 = 7.3 \text{ V} \quad (1) \quad 6.64 + 0.7 = 7.3 \text{ V} \quad (1)$	2	2		4	3
		(ii)	$V_{\text{OUT}} = 12 \text{ V} \quad (1)$		1		1	
			Question 1 total	3	7	0	10	6

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
2	(a)		$D = A + B \quad (1)$ $E = \overline{B}.C \quad (1)$ $Q = \overline{(A + B)}. \overline{B}.C \quad (1)$ or $Q = \overline{(A + B)} + \overline{B}.C$ or $Q = \overline{(A + B)} + (B + \overline{C})$ or $Q = \overline{A}. \overline{B} + (B + \overline{C})$ or $Q = \overline{A}. \overline{B} + \overline{B}.C$		3		3	3
	(b)		$Q = \overline{(A + C)} + \overline{C}. \overline{B} \quad (1)$ $Q = \overline{C}. \overline{A} + \overline{C} + B \quad (1)$ $Q = \overline{C} + B \quad (1)$ or $Q = \overline{C}. \overline{B} + A.C. \overline{B} \quad (1)$ $Q = \overline{C}. \overline{B} \quad (1)$ $Q = \overline{C} + B \quad (1)$		3		3	3
	(c)		 Minimum grouping (2x4 and 1x2) (1) One correct term from groups chosen (1) $Q = \overline{D}. \overline{C}. B + B. \overline{A} + \overline{C}. \overline{A} \quad (1)$ Equation matching incorrect map – ecf (2)	2	1		3	3
Question 2 total				2	7	0	9	9

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
3	(a)		$R = \frac{1}{fC}$ (1) re-arrange equation $= \frac{1}{0.5 \times 4.7 \times 10^{-6}}$ (1) $= 425.5 \text{ k}\Omega$ (1)	1	2		3	3
	(b)		D and B selected (1) NAND gate used (1) Output of Logic gate to Reset (1)	3			3	
	(c)	(i)	$V_R = 5 - 2.1 = 2.9 \text{ V}$ (1) $I = \frac{2.9}{220}$ (1) $= 13.2 \text{ mA}$ (1)	1	2		3	2
		(ii)	$5 \times 13.2 \text{ (ecf)}$ (1) $= 66 \text{ mA}$ (1)		2		2	2
	(d)		Segment c		1		1	
Question 3 total				5	7	0	12	7

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
4	(a)		Correct use of parallel capacitor equation = 20 nF (1) Use of series equation $\frac{1}{C} = \frac{1}{20 \text{ (ecf)}} + \frac{1}{10}$ or $\frac{10 \times 20}{10 + 20}$ (1) Overall $C = \frac{20}{3} = 6.7 \text{ nF}$ (1)	2	1		3	2
	(b)		Indicative Content: AO1 allocation: Draws the circuit for a monostable based on a 555 timer and includes triggering switch sub-system (3 marks) AO3 allocation: Analyses the specification and calculates suitable component values to fulfil the required time delay within the permitted tolerance (3 marks) • Correctly draws the monostable circuit based on the 555-timer, including the RC network • Draw a switch and resistor to trigger the monostable connected to pin 2 • Correct orientation of components (switch to 0V) • Selects and uses the equation $T = 1.1RC$ • Calculates R correctly • Identifies resistor from E24 as 82kΩ • Checks for 5% tolerance and makes relevant comments concerning component tolerances. (Examples might include cumulative effects of individual tolerance; likelihood of much greater tolerance of electrolytic capacitor than resistors; tolerance might change due to component aging etc.)	3		3	6	2

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
	(b)		5-6 marks Circuit diagram completely correct and logical steps to the calculation of component values clearly shown, including calculation of tolerance. A suitable pair of component values selected. 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 Important connections to 555 shown correctly (e.g. pins 6,7,2,8 and 1) Possible error in triggering sub-system. Selects and uses correct equation but errors in multipliers or use of E24 values. 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 Some attempt is made to draw the circuit diagram but there are significant errors with pin allocation or component omissions. Some attempt at calculations but errors in the use of the equation and/or multipliers is evident. 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 attempt made or no response worthy of credit.					
			Question 4 total	5	1	3	9	4

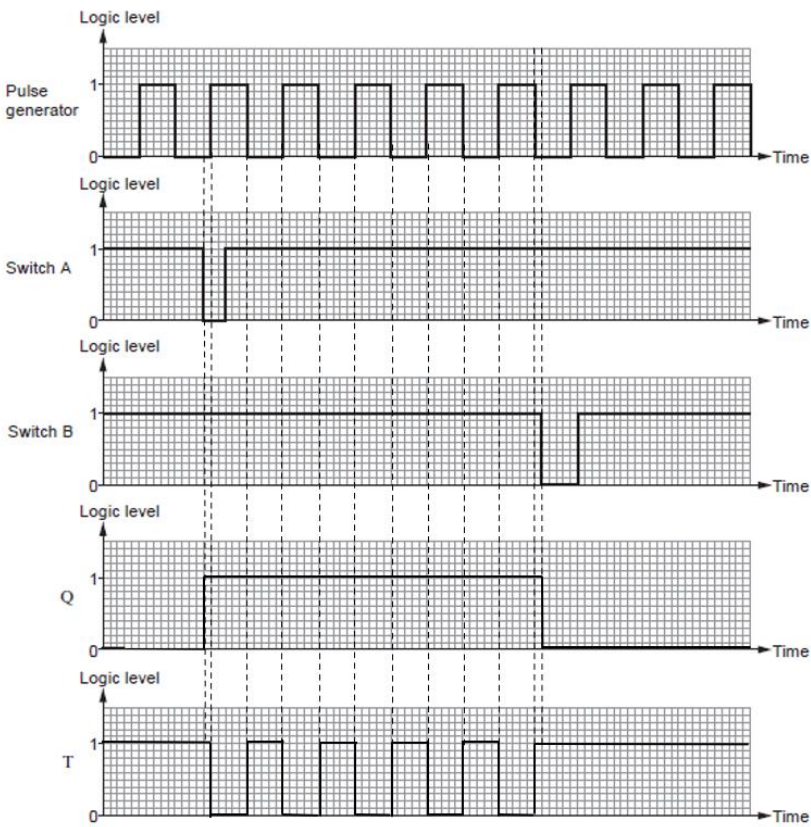
Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
5			<pre> graph TD START([START]) --> D1{Are the headlights on?} D1 -- No --> DB1[1 mark decision box] D1 -- Yes --> D2{Is it raining?} D2 -- No --> DB2[1 mark decision box] D2 -- Yes --> P1[/Turn on water pump/] P1 --> P2[Wait 3 s] P2 --> P3[/Turn off water pump/] P3 --> P4[Set Count = 0] P4 --> P5[Call sweep] P5 --> P6[Count = Count+1] P6 --> D3{Is Count = 5?} D3 -- No --> DB3[1 mark decision box] D3 -- Yes --> P7[Delay 5 minutes] P7 -- 1 mark flow line --> P5 </pre>			5	5	
Question 5 total				0	0	5	5	0

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
6	(a)	(i)	All points correctly plotted (± 0.5 square) (2) Minus 1 for each incorrectly plotted point (minimum 0) Line of best fit drawn (1)		3		3	3
		(ii)	$R = 3.0 \text{ k}\Omega$ at 25°C (1) (tolerance $\pm 0.2 \text{ k}\Omega$)		1		1	1
	(b)	(i)	Potentiometer drawn connected to inverting input or voltage divider with one variable resistor. (1) A diode in parallel with the motor (1) Correct orientation of diode. (1)	3			3	
		(ii)	$V_{\text{IN}} = 24 \times \frac{3 \text{ (ecf)}}{3 + 5.1} \text{ (1)} = 8.9 \pm 0.4 \text{ V}$ (1)		2		2	2
	(c)		$V_{\text{M}} = 24 - 1.0 = 23 \text{ V}$ (1) $I_{\text{M}} = \frac{500}{23} \text{ (1)} = 21.7 \text{ mA} < 25 \text{ mA}$ (1) or $P = IV = 0.025 \times 23 = 0.575 \text{ W}$ (2) $0.575 \text{ W} > 0.5 \text{ W}$ (1) or $V = \frac{P}{I} = \frac{500}{25} = 20 \text{ V}$ (2) $20 \text{ V} < 23 \text{ V}$ (1) To gain 3rd mark must conclude that it is OK as actual current / power / voltage taken by fan is less than max circuit can provide.	1	1	1	3	2
			Question 6 total	4	7	1	12	8

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
7	(a)	(i)	LDR and resistor across supply rails. (1) LDR connected to 0V rail (1)	2			2	
		(ii)	$3.5 = 5 \times \frac{9.6}{9.6 + R}$ (1) Use of equation, ecf from (a) $9.6 + R = \frac{5 \times 9.6}{3.5} = 13.7$ (1) $R = 13.7 - 9.6 = 4.1 \text{ k}\Omega$ (1)	1	2		3	3
	(b)	(i)	The Schmitt inverter provides signal conditioning / avoid switching due to small fluctuations in light level. OWTTE.	1			1	
		(ii)	 Schmitt output: – starts and ends at 5V (1) – drops sharply 5V to 0V when light sensor rises to 3.5V (1) – rises sharply 0V to 5V when light sensor falls to 1.5V (1)	3			3	3

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
	(c)		NOR gate used (1)		1		1	
	(d)	(i)	Use of $I = \frac{P}{V} = \frac{6}{5}$ (1) re-arrangement and use of equation $= 1.2 \text{ A}$ (1)	1	1		2	2
		(ii)	$V_{GS} = \frac{I_D}{g_m} + 3$ (1) selects and re-arranges equation $V_{GS} = \frac{1.2 \text{ (ecf)}}{3.2} + 3$ (1) substitution ecf on 1.2 A $V_{GS} = 3.375 \text{ V} = 3.4 \text{ V}$ (1)	1	2		3	2
			Question 7 total	9	6	0	15	10

Question			Marking details	Marks available																																							
				AO1	AO2	AO3	Total	Maths																																			
8	(a)		Output of each NAND gate connected to input of other gate (1) $\bar{S}$ and $\bar{R}$ connected to spare input on each gate (1)	2			2																																				
	(b)		<table border="1"><thead><tr><th colspan="2">Switch position</th><th colspan="3">Logic levels</th></tr><tr><th>A</th><th>B</th><th>$\bar{S}$</th><th>$\bar{R}$</th><th>Q</th></tr></thead><tbody><tr><td>OPEN</td><td>OPEN</td><td>1</td><td>1</td><td>0</td></tr><tr><td>CLOSED</td><td>OPEN</td><td>0</td><td>1</td><td>1</td></tr><tr><td>OPEN</td><td>OPEN</td><td>1</td><td>1</td><td>1</td></tr><tr><td>OPEN</td><td>CLOSED</td><td>1</td><td>0</td><td>0</td></tr><tr><td>OPEN</td><td>OPEN</td><td>1</td><td>1</td><td>0</td></tr></tbody></table> Line 1 correct (1) Lines 2 and 3 correct (1) Lines 4 and 5 correct (1)	Switch position		Logic levels			A	B	$\bar{S}$	$\bar{R}$	Q	OPEN	OPEN	1	1	0	CLOSED	OPEN	0	1	1	OPEN	OPEN	1	1	1	OPEN	CLOSED	1	0	0	OPEN	OPEN	1	1	0	3			3	
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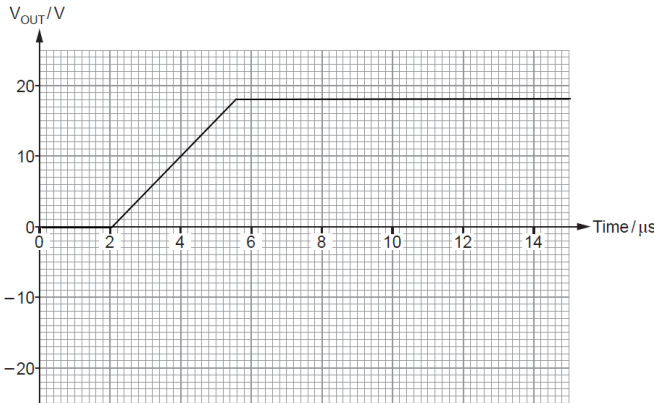
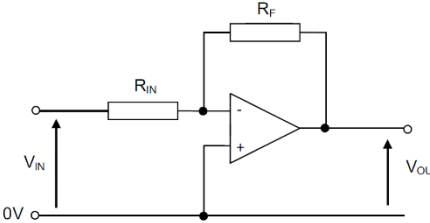
Question		Marking details	Marks available				
			AO1	AO2	AO3	Total	Maths
	(c)	 Pulse for Q between falling edge of A (1) ...and falling edge of B (1) T shows pulses when Q is logic 1 (1) Phase of pulses are antiphase (opposite) of pulse producer (1) (5 notches)	3	1		4	
	(d)	(i) D output of counter 1 connected to CLOCK of counter 2 or A and D connected to an AND gate with output to CLOCK of counter 2 (1)	1			1	
		(ii) Display 1 (1)	1			1	
Question 8 total			10	1	0	11	0

Question			Marking details	Marks available																																																																												
				AO1	AO2	AO3	Total	Maths																																																																								
9			Indicative Content: AO2 content: applies knowledge of binary counters, truth tables, logic gates and LED's (3 marks) AO3 content: analyses the circuit and uses appropriate method, such as truth table to determine whether or not the specification is met. Suggests any changes needed to fully meet the specification. (3 marks) Method: • Produces a truth table to analyse sequence • Correctly completes the counter sequence (D)CBA • Recognises output D is not required. This can be implied by a 3-input truth table. • Correctly completes the X,Y and Z outputs 1. using the sequence diagram OR 2. using the logic gates OR 3. using Boolean equations <table border="1"> <thead> <tr> <th colspan="3">Outputs from counter</th><th colspan="3">Required output sequence</th><th colspan="3">Circuit outputs</th></tr> <tr> <th>C</th><th>B</th><th>A</th><th>X</th><th>Y</th><th>Z</th><th>$X = \overline{B} + \overline{C}$</th><th>$Y = B$</th><th>$Z = \overline{A}$</th></tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr> <tr><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr> <tr><td>0</td><td>1</td><td>1</td><td>0</td><td>1</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>1</td><td>1</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr> </tbody> </table>	Outputs from counter			Required output sequence			Circuit outputs			C	B	A	X	Y	Z	$X = \overline{B} + \overline{C}$	$Y = B$	$Z = \overline{A}$	0	0	0	1	0	1	1	0	1	0	0	1	1	0	0	1	0	0	0	1	0	0	1	1	1	1	1	0	1	1	0	1	0	1	1	0	1	0	0	0	0	1	1	0	1	1	0	1	0	0	0	1	0	0					
Outputs from counter			Required output sequence			Circuit outputs																																																																										
C	B	A	X	Y	Z	$X = \overline{B} + \overline{C}$	$Y = B$	$Z = \overline{A}$																																																																								
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Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
			Evaluation: Whichever method is used some comparison is made leading to: • Y and Z are identified as correct • X is incorrect • Checks the resetting and find its meets specification. • Notes the current limiting resistor values are too high Changes to meet specification: • Replace OR gate with AND gate or use an OR gate for B and C then NOT or B and C to NOR gate Suggested resistor values which will allow the LEDs to light $<1k\Omega$ 5-6 marks Answer includes most of the bullet points above and all 3 sections are covered in the analysis. <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> 3-4 marks Answer includes at least half of the bullet points from at least 2 of the sections. <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>		3	3	6	

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
			1-2 marks Some attempt is made to produce a truth table and the data entered is partially correct and/or 10kΩ resistor values commented on. <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 <i>No attempt made or no response worthy of credit.</i>					
			Question 9 total	0	3	3	6	0

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
10	a		Minimum $V_{IN} = 1.9V$ (1) (range 1.85 – 1.95) $I_B = \frac{1.9 \text{ (ecf)} - 0.7}{1.5}$ (1) $I_B = 0.8 \text{ mA}$ (1)	1	2		3	3
	b		$I_C = \frac{6 - 0.2}{120} = 48.3 \text{ mA}$ (1) $h_{FE} = \frac{48.3}{0.8}$ (1) ecf either value $h_{FE} = 60.4$ (1)	1	2		3	3
			Question 10 total	2	4		6	6

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
11	(a)	(i)	Answer M: (1) calculation not required e.g. $18/5 = 3.6$; $18/7.5 = 2.4$		1		1	
		(ii)	Bandwidth = $\frac{GBP}{G} = \frac{3.6 \times 10^6}{200}$ (1) = 18 kHz (1) or 18000 or 0.018 MHz		2		2	2
	(b)		 Positive slope starting at 2μs (1) Correct gradient $5 \text{ V}\mu\text{s}^{-1}$ (1) Saturation at 18V (1)	3			3	
	(c)	(i)	 Feedback resistor between output and inverting input (1) Resistor between input and inverting input (1) Non-inverting input connected to 0V (1) Resistors in the ratio 40:1 (1) Correctly assigned and both $\geq 1\text{k}\Omega$ (1)	2		3	5	

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
		(ii)	Inverted saw tooth wave (1) Correct gradients (1) Peaks at $\pm 16V$ (1)	2	1		3	
			Question 11 total	7	4	3	14	2

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
12	(a)		Single diode in power line (1) Capacitor across power rails (1) Resistor labelled R_{LOAD} across power rails, in parallel with C (1)	3			3	
	(b)	(i)	Peak voltage = $13 \times \sqrt{2}$ (1) = 18.4 V (1)	2			2	2
		(ii)	$18.4 - 0.7 = 17.7 \text{ V}$ (1) ecf in ii and iii if full wave rectifier drawn in (a) $I_P = \frac{17.7}{220}$ (1) = 0.0805 A (1) (80 mA)		3		3	2
		(iii)	$C = \frac{I}{f V_r}$ (1) selects and re-arranges ripple equation = $\frac{0.0805 \text{ (ecf)}}{50 \times 3.7}$ (1) ecf on current from (ii) = $435 \times 10^{-6} \text{ F}$ (1) $4.35 \times 10^{-4} \text{ F}$ or $435\mu\text{F}$		3		3	3
			Question 12 total	5	6	0	11	7

Summary of marks allocated to assessment objectives

Question	AO1	AO2	AO3	TOTAL MARK	MATHS
1	3	7	0	10	6
2	2	7	0	9	9
3	5	7	0	12	7
4	5	1	3	9	4
5	0	0	5	5	0
6	4	7	1	12	8
7	9	6	0	15	10
8	10	1	0	11	0
9	0	3	3	6	0
10	2	4	0	6	6
11	7	4	3	14	2
12	5	6	0	11	7
Total	52	53	15	120	59