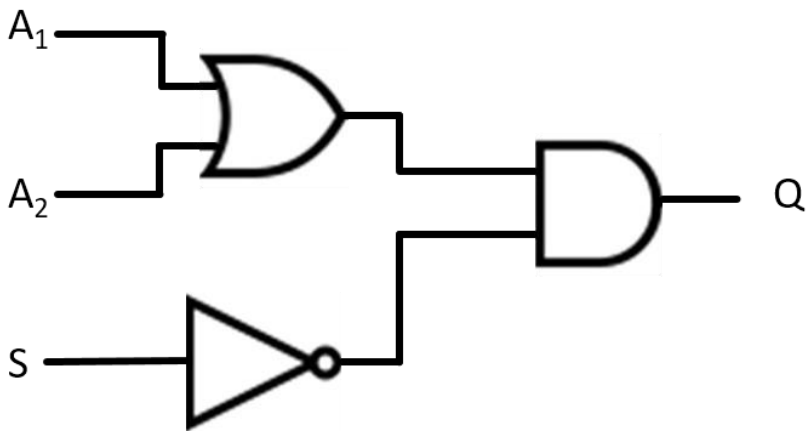
<table>
<tr>
<td>01</td>
<td>1</td>
<td>Mark is for AO1 (understanding)

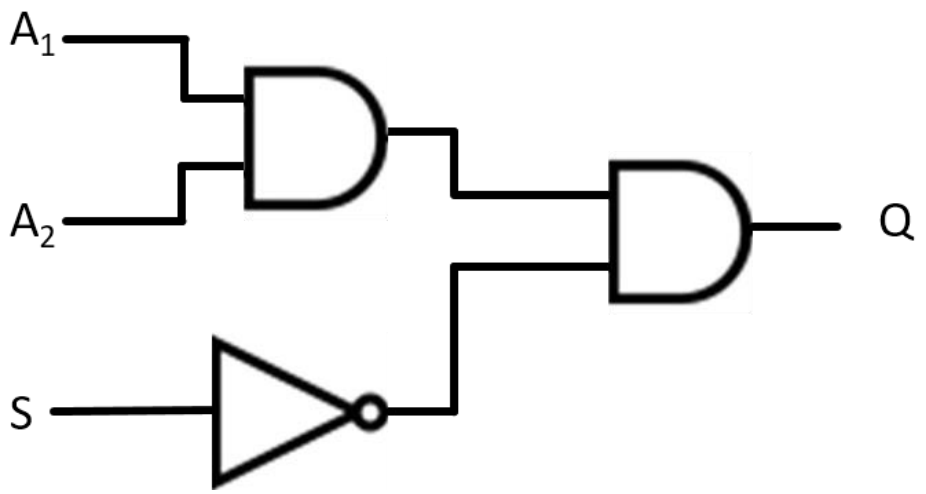
Only reward if column A AND B is completely correct;

<table>
<tr><th>A</th><th>B</th><th>A AND B</th></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>

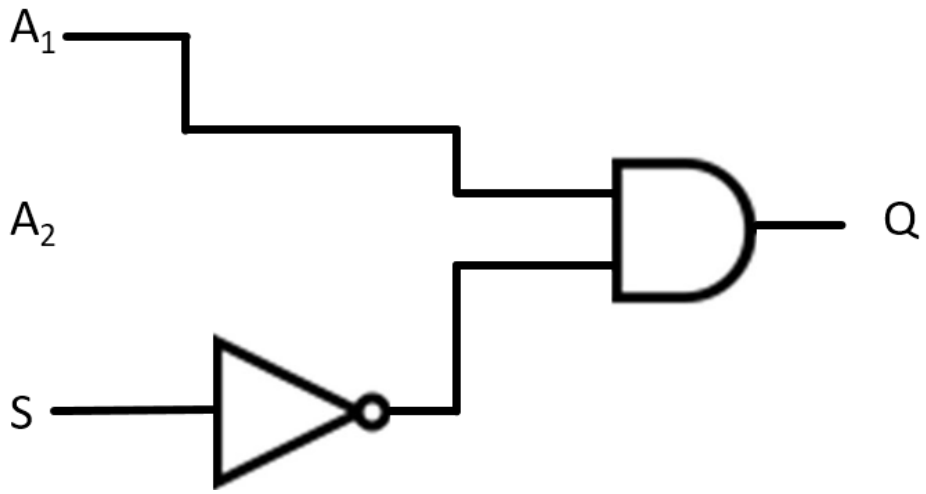
A. F,F,F,T//false, false, false, true//off, off, off, on
I. Case and minor spelling mistakes</td>
<td>1</td>
</tr>
</table>

Question	Part	Marking guidance	Total marks
01	2	**3 marks for AO2 (apply)** Max 2 marks if not fully correct (the fully correct answer is given in example 1). Mark A if A_1 and A_2 are the inputs to an OR gate; Mark B if S is the only input into a NOT gate; Mark C if Q has a single output connection from an AND gate; **Example 1 (Fully correct answer)**  **R.** Incorrect symbols **See next page for partially correct answers**	3

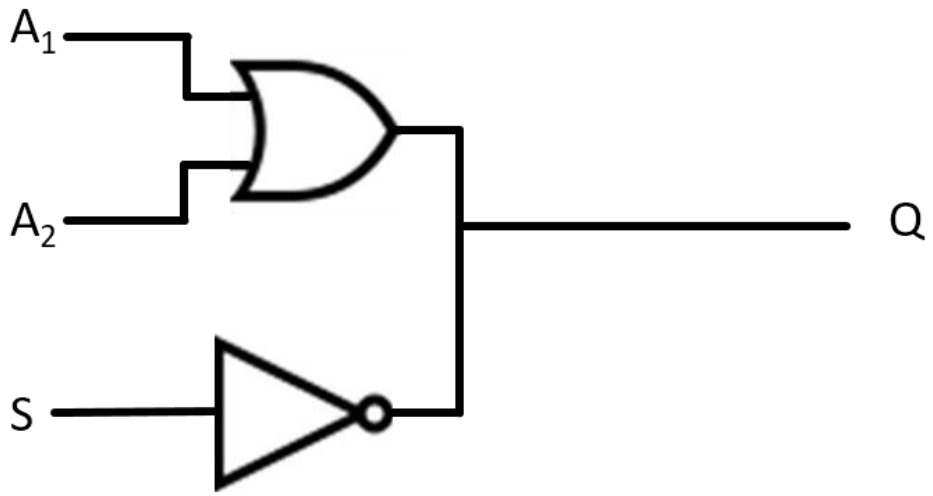
Example 2 (Marks B and C)



Example 3 (Marks B and C)

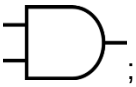


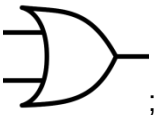
Example 4 (Marks A and B)



Question	Part	Marking guidance	Total marks
02	1	**Mark is for AO2 (apply)** NOT;	1

02	2	**Mark is for AO2 (apply)** AND;	1

02	3	**Mark is for AO2 (apply)**  ; **I.** all labels	1

02	4	**Mark is for AO2 (apply)**  ; **I.** all labels	1

02	5	**3 marks for AO2 (apply)** 1 mark for correct column **X AND Y**; 1 mark for correct column **NOT X**; 1 mark for correct **OR** of the answers given in the column **X AND Y** and the column **NOT X** even if the answers for **X AND Y** and **NOT X** are incorrect; The correctly completed table is: **X** | **Y** | **X AND Y** | **NOT X** | **(X AND Y) OR (NOT X)** 0 | 0 | 0 | 1 | 1 0 | 1 | 0 | 1 | 1 1 | 0 | 0 | 0 | 0 1 | 1 | 1 | 0 | 1 **A.** follow through from previous columns	3

02	6	**Mark is for AO2 (apply)** **D** A1 AND A3; **If more than one lozenge shaded then mark is not awarded**	1

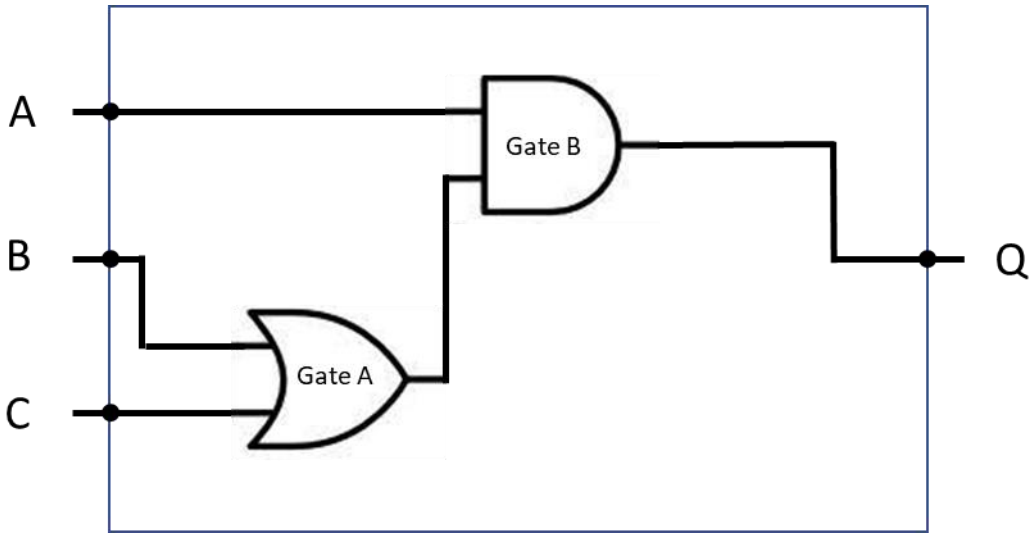
Qu	Part	Marking guidance	Total marks
03	1	**Mark is for AO1 (recall)** AND;	1
03	2	**3 marks for AO2 (apply)** 1 mark for one correct label; 2 marks for two correct labels; 3 marks for all correct labels; **Label** / **Logic Gate** L1 / NOT L2 / AND L3 / AND L4 / OR	3

04	1	**Mark is for AO1 (recall)** AND (gate);	1

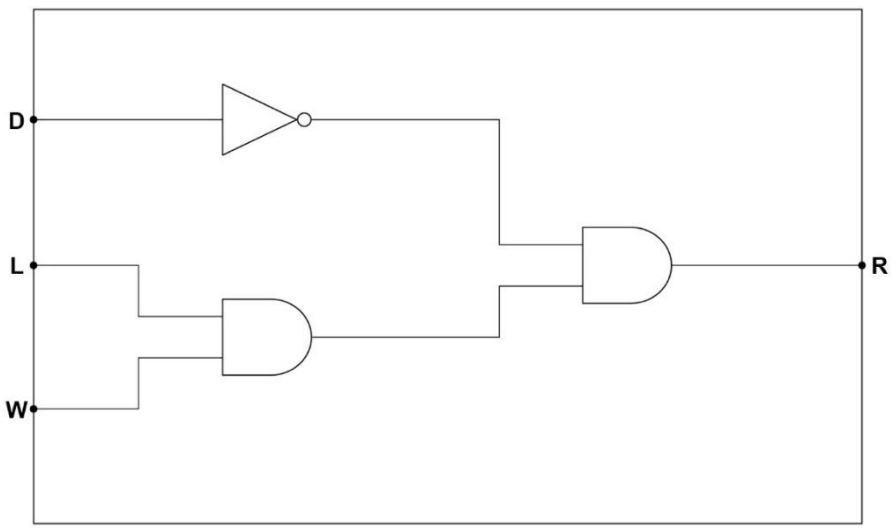
04	2	**Mark is for AO1 (recall)** OR (gate) ;	1

04	3	**Mark is for AO1 (recall)** 1 mark for any of the following: • A NOT gate is used to flip/invert/switch an input • The output will be the opposite of the input • 0s become 1 **and** 1's become 0s;	1

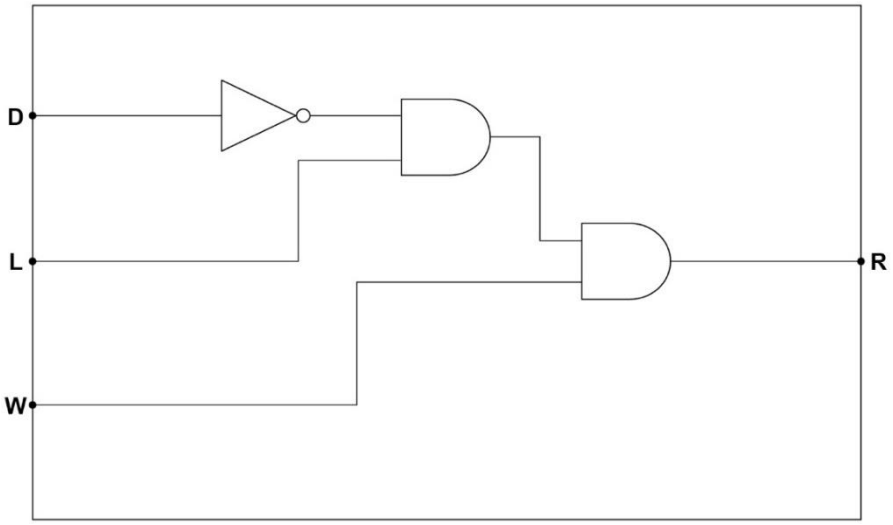
04	4	**3 marks for AO2 (apply)** INPUTS / A AND B / C OR D / D OR E A B C D E F 0 0 0 0 0 0 0 0 1 0 1 1 0 1 0 0 0 0 0 1 1 0 1 1 1 0 0 **0** **0** **0** 1 0 1 0 1 1 1 1 0 1 **1** **1** 1 1 1 **1** **1** **1** 1 mark for column D correct 1 mark for column E correct 1 mark for column F correct **A.** Follow through for column F based on incorrect but complete columns D or E	3

05		**3 marks for AO2 (apply)**  • **OR Gate**, with correct symbol used, with **TWO inputs** from B and C; • **AND Gate**, with correct symbol used, with **TWO inputs** from A and Gate A (even if Gate A is an incorrect gate); • Output from Gate B is the only connection to Q (even if Gate B is an incorrect gate);	3

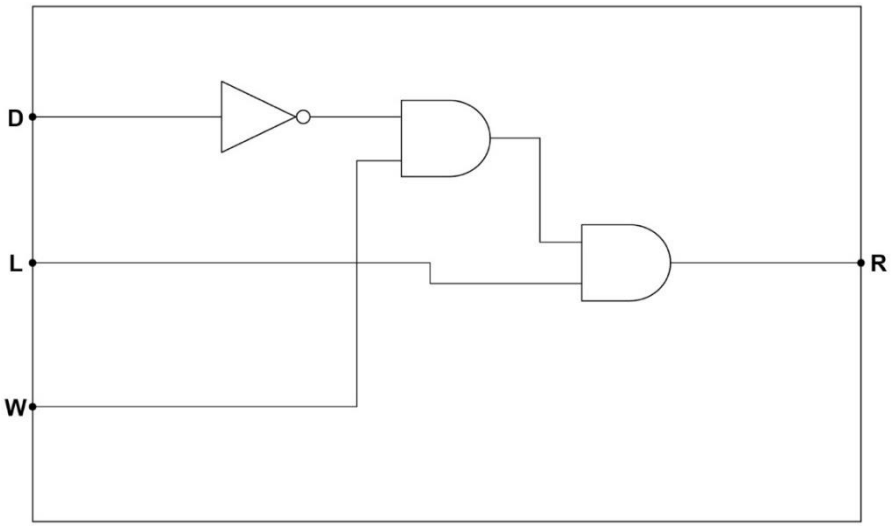
Qu	Part	Marking guidance	Total marks
06	1	**Mark is for AO1 (understanding)** **A** | **B** | **A XOR B** 0 | 0 | 0 0 | 1 | 1 1 | 0 | 1 1 | 1 | 0 **1 mark** for correct column **A XOR B**; **A.** F / FALSE / False / Off instead of 0 **A.** T / TRUE / True / On instead of 1 **R.** if correct outputs but mix of styles given eg F, T, T, 0.	1

Qu	Part	Marking guidance	Total marks
06	2	**3 marks for AO2 (apply)** Maximum of **two** marks (if not fully correct) from: • **D** is always the only input to a NOT gate with correct symbol used; • AND gate with two correct inputs with correct symbol used; • **R** is always the only output from a second AND gate with correct symbol used;	3
		Example 1  	

Example 2



Example 3



R. incorrect symbols

Qu	Part	Marking guidance	Total marks
06	3	**Mark is for AO2 (apply)** **C** $(W . D) + (D . L) + (W . L)$; **R.** if more than **one** lozenge shaded	1

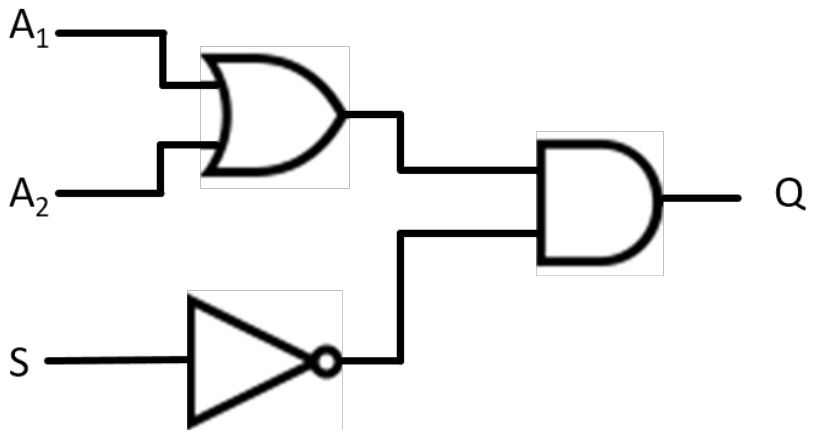
Qu	Part	Marking guidance	Total marks
06	4	**3 marks for AO2 (apply)** $\overline{D}.\overline{L}.W$ // $W.(\overline{D+L})$ // $(\overline{D}.W).(\overline{L}.W)$;;; **2 marks** if fully correct but using different notation, eg NOT D AND NOT L AND W;; W AND NOT (D OR L);; (NOT D AND W) AND (NOT L AND W);; Maximum of **two** marks (if not fully correct) from: • **1 mark** for using Boolean operator symbols throughout the expression; (**for this year only**) • **1 mark** for $W+(\overline{D.L})$; • **1 mark** for $\overline{D}+\overline{L}+W$; • **1 mark** for $(\overline{D}+W)+(\overline{L}+W)$;	3

Qu	Part	Marking guidance	Total marks
07	1	**Mark is for AO1 (recall)** **Mark as follows:** 1 mark if column A XOR B is correctly completed; **A.** F / FALSE / False / Off instead of 0 **A.** T / TRUE / True / On instead of 1	1

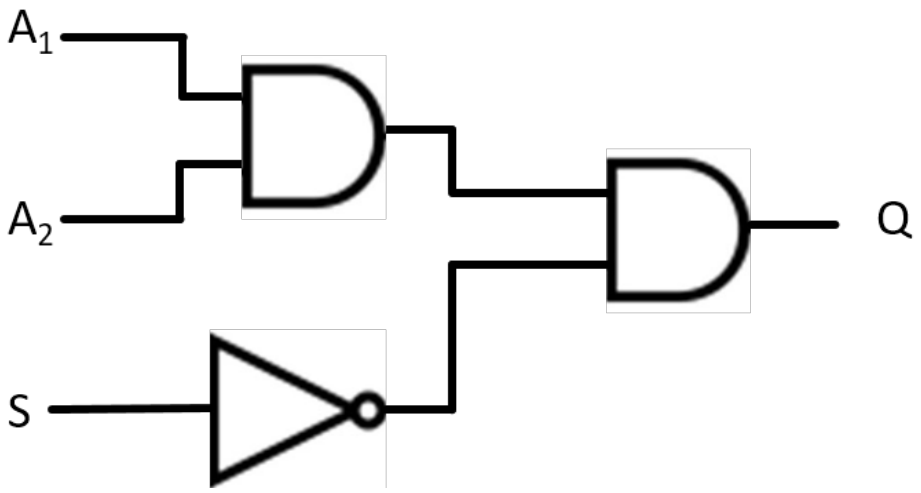
A	B	A XOR B
0	0	0
0	1	1
1	0	1
1	1	0

Qu	Part	Marking guidance	Total marks
07	2	**Mark is for AO1 (understanding)** AND (gate); **I.** case	1

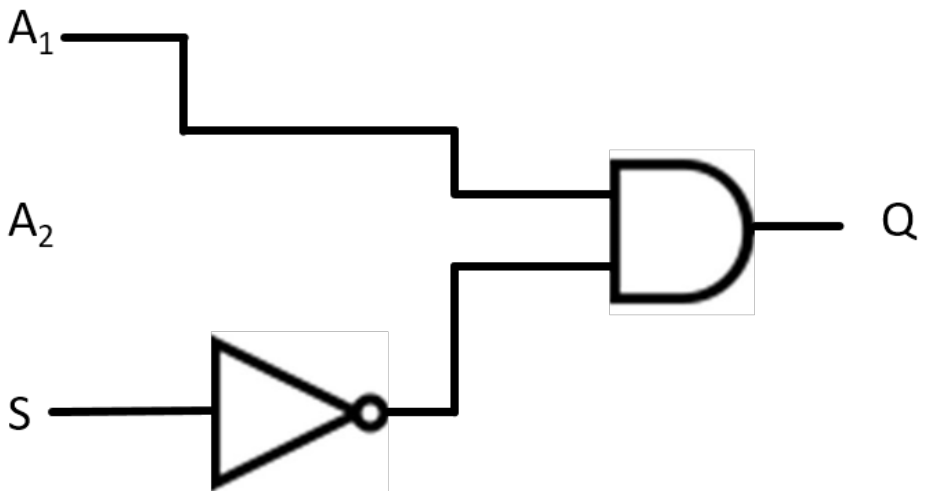
Qu	Part	Marking guidance	Total marks
07	3	**2 marks for AO2 (apply)** A.B + C // C + A.B;; **Mark as follows:** 1 mark for A.B or B.A; 1 mark for + C or C +; Examples of responses worth 1 mark: A.B.C mark is for A.B A + B + C mark is for + C (A.B).C mark is for A.B (A+B) + C mark is for + C **I.** brackets that don't change the value of the expression **I.** Case **A.** other commonly recognised symbols such as ¬ ∧ ∨ ~ **R.** if words used (eg AND, OR, NOT etc) **Max 1** if any errors.	2

Qu	Part	Marking guidance	Total marks
08	1	**Mark is for AO1 (understanding)** Only reward if column **A AND B** is completely correct; **A** | **B** | **A AND B** 0 | 0 | 0 0 | 1 | 0 1 | 0 | 0 1 | 1 | 1	1
08	2	**3 marks for AO2 (apply)** Max 2 marks if not fully correct (the fully correct answer is given in example 1). Mark A if A_1 and A_2 are the inputs to an OR gate; Mark B if S is the input to a NOT gate; Mark C if the output from an AND gate is Q; **Example 1 (Fully correct answer)**  **See next page for partially correct answers**	3

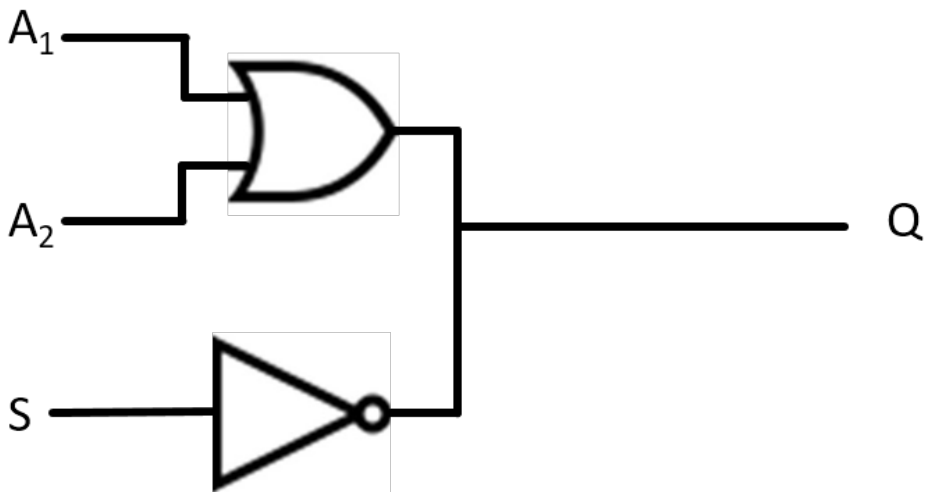
Example 2 (Marks B and C)



Example 3 (Marks B and C)



Example 4 (Marks A and B)



Question	Part	Marking guidance	Total marks
09	1	**Mark is for AO2 (apply)** **C** | A	B	Q
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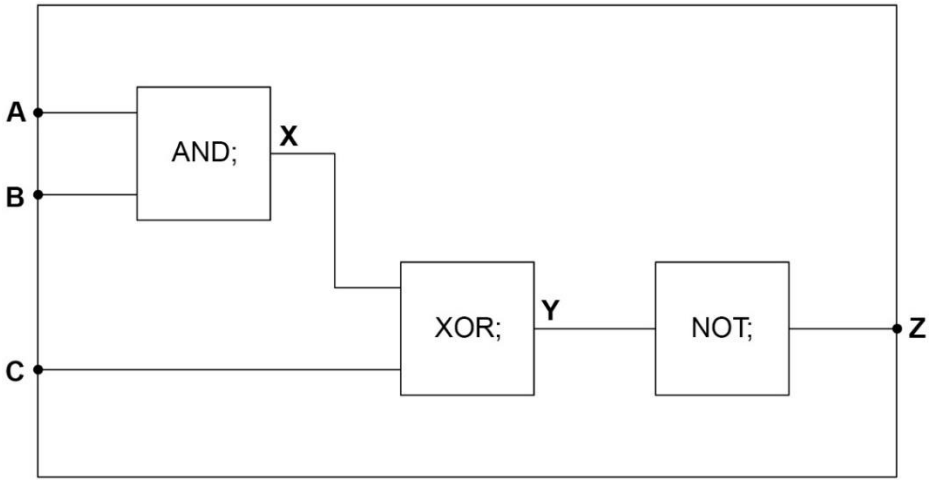
0	0	0
0	1	1
1	0	1
1	1	1 | **R.** If more than one lozenge shaded	1

Question	Part	Marking guidance	Total marks
09	2	**3 marks for AO2 (apply)** 1 mark for each correct logic gate name in the correct box  **A.** if the name is not inside the box, but it is clear which box the name refers to **R.** if logic gate symbols used instead of names	3

Question	Part	Marking guidance	Total marks
09	3	**3 marks for AO2 (apply)** **Note to examiners**: any alternative notations **must** be referred to a senior examiner. $\bar{A} + B.C$;;; If equation is not correct then award a **maximum of 2 marks** from the following: • Using the AND symbol . in between inputs **B** and **C**; • Using the OR symbol + in between input **A** and another gate; • Using the NOT symbol ¯ above input **A**; **I.** Parentheses unless they change the order of precedence eg $(\bar{A} + B).C$ is incorrect	3