ANSWERS LOGIC GATE

Answer 1

Question	Answer	Marks
5(a)	**1 mark** for each pair of correct answers (shaded)	4

A	B	C	Working space	X
0	0	0		0
0	0	1		1
0	1	0		1
0	1	1		0
1	0	0		1
1	0	1		1
1	1	0		0
1	1	1		0

Question	Answer	Marks
5(b)	**1 mark** for name, **1 mark** for symbol, **1 mark** for truth table	3

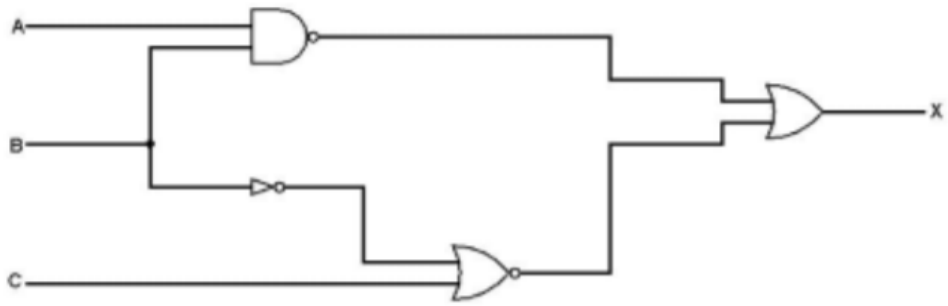
- NAND

Input		Output
A	B	
0	0	1
0	1	1
1	0	1
1	1	0

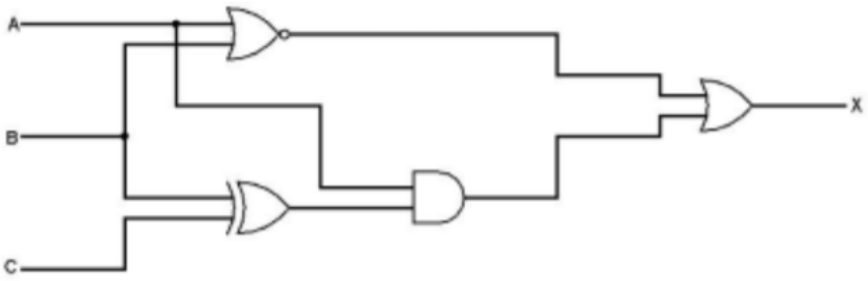
- NOR

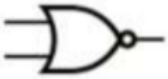
Input		Output
A	B	
0	0	1
0	1	0
1	0	0
1	1	0

Answer 2

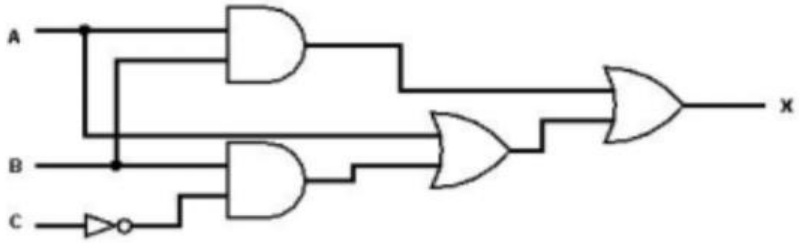
Question	Answer	Marks
3	**1 mark** for each correct gate X = NOT (A AND B) OR NOT (NOT B OR C)  	**4**
4(a)(i)	**1 mark** only e.g. • Read about the languages she will be using • Visits the office prior to starting • Speaks to her manager about concerns	**1**

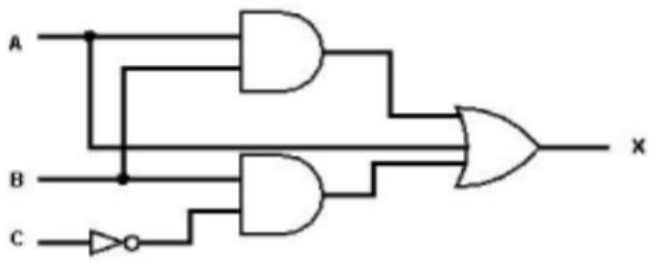
Answer 3

Question	Answer	Marks
3(a)	**1 mark** per correct gate • A NOR B • B XOR C • A AND (B XOR C) • Final OR  	**4**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(b)</td><td>1 mark for each correct pair of answers (4 shaded sections)
<table>
<tr><th>A</th><th>B</th><th>C</th><th>Working Space</th><th>X</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td></td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td></td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td></td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td></td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td></td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td></td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td></td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td></td><td>0</td></tr>
</table></td><td>4</td></tr>
<tr><td>3(c)</td><td>1 mark for name, 1 mark for symbol matching the name
NAND 
NOR  </td><td>2</td></tr>
</table>

Answer 4

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>6(a)</td><td>1 mark per gate The OR gates may be re-sequenced
 

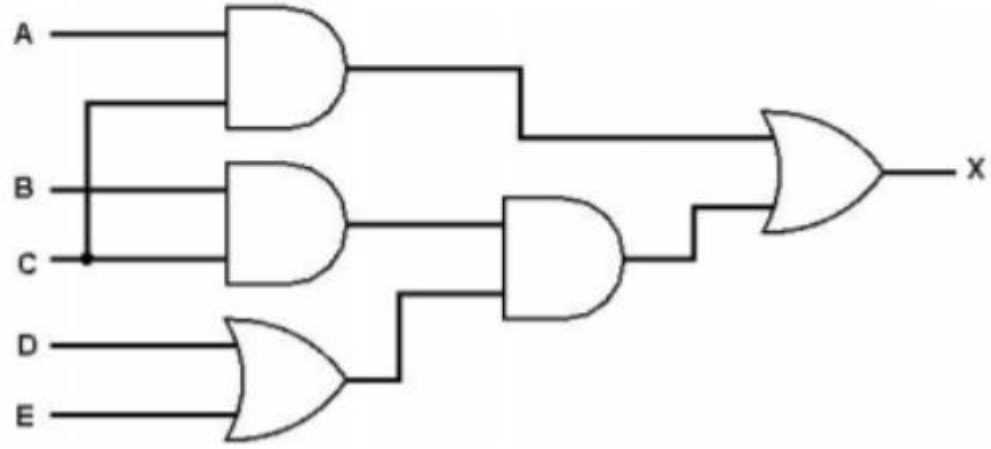
Alternatively: 3-input OR gate
1 mark for first three gates, and 2 marks for 3-input OR gate
 
</td><td>5</td></tr>
</table>

Question	Answer	Marks
6(b)	**1 mark** for each pair of rows (shaded)	4

A	B	C	Working Space	X
0	0	0		0
0	0	1		0
0	1	0		1
0	1	1		0
1	0	0		1
1	0	1		1
1	1	0		1
1	1	1		1

Answer 5

Question	Answer	Marks
3(a)	**1 mark** for each gate • A **AND** C • B **AND** C • D **OR** E • (B AND C) **AND** (D OR E) • Final **OR**	5

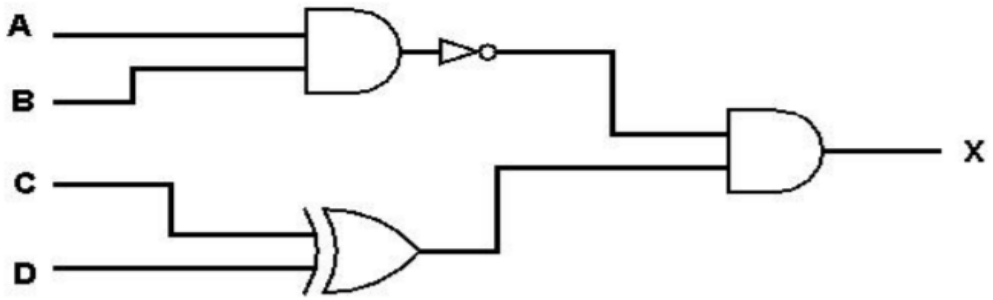


Question	Answer	Marks
3(b)	**1 mark** for each pair of correct rows	4

A	B	C	Working space	X
0	0	0		0
0	0	1		1
0	1	0		1
0	1	1		0
1	0	0		0
1	0	1		1
1	1	0		0
1	1	1		1

Answer 6

Question	Answer	Marks
2(a)	**1 mark** per gate	4



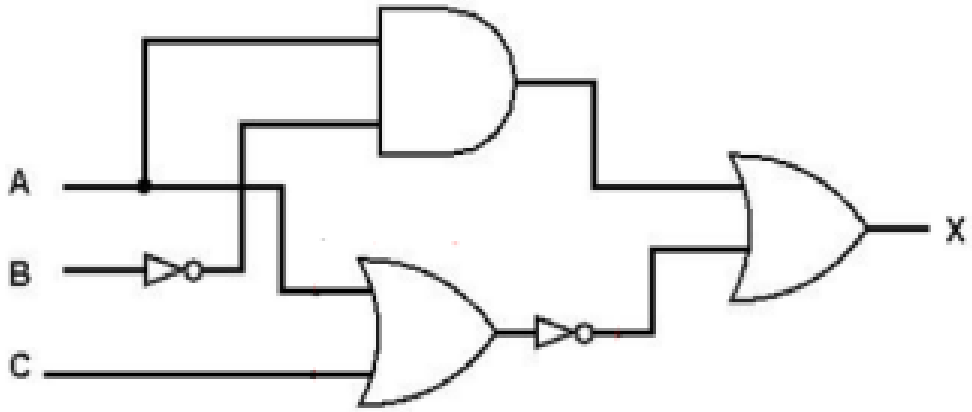
Question	Answer	Marks
2(b)	**1 mark** for each pair of answers	4

A	B	C	Working space	X
0	0	0		1
0	0	1		1
0	1	0		1
0	1	1		1
1	0	0		1
1	0	1		1
1	1	0		1
1	1	1		0

Answer 7

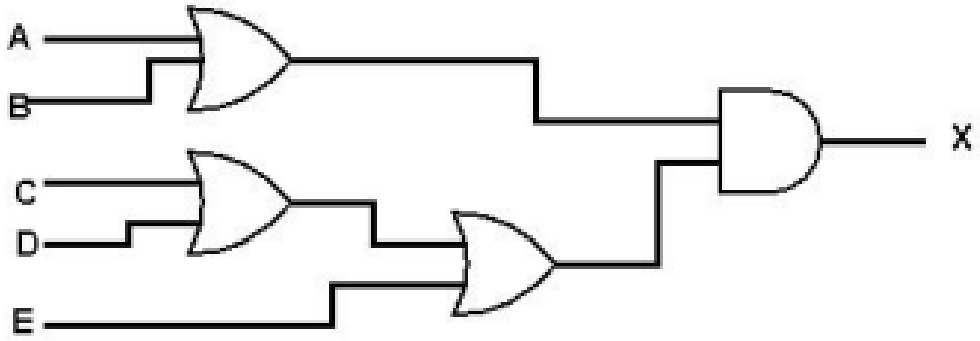
<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(a)</td><td>1 mark for each correct gate

• A OR C
• NOT(A OR C)
• NOT B
• A AND NOT B
• Final OR

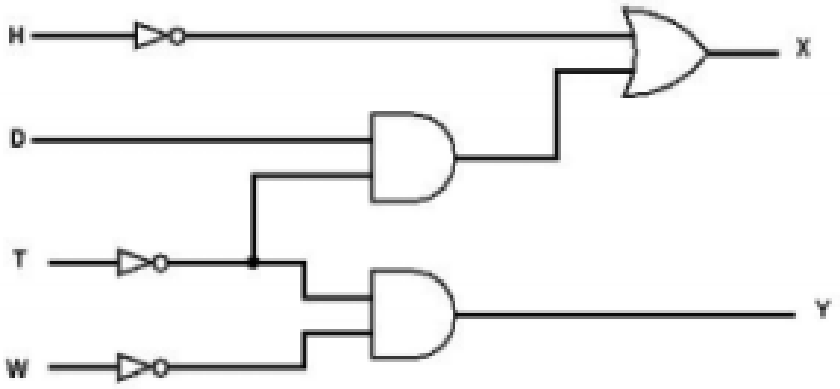
 
</td><td>5</td></tr>
<tr><td>5(b)</td><td>1 mark for each pair of rows

<table>
<tr><th>A</th><th>B</th><th>C</th><th>Working space</th><th>X</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td></td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td></td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td></td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td></td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td></td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td></td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td></td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td></td><td>0</td></tr>
</table></td><td>4</td></tr>
</table>

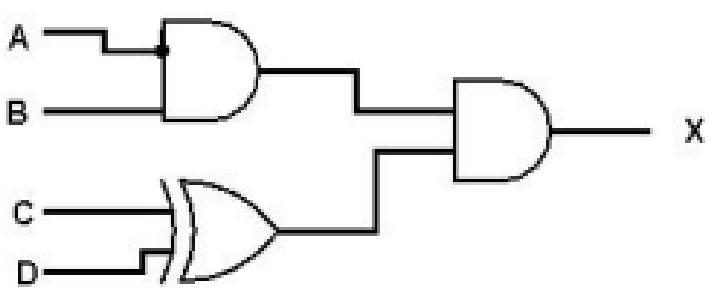
Answer 8

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(a)</td><td>1 mark per bullet:
• A OR B
• C OR D OR E
• Final AND
 
</td><td>3</td></tr>
<tr><td>4(b)</td><td>1 mark for each correct pair of rows
<table>
<tr><th>A</th><th>B</th><th>C</th><th>Working space</th><th>X</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td></td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td></td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td></td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td></td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td></td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td></td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td></td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td></td><td>1</td></tr>
</table></td><td>4</td></tr>
</table>

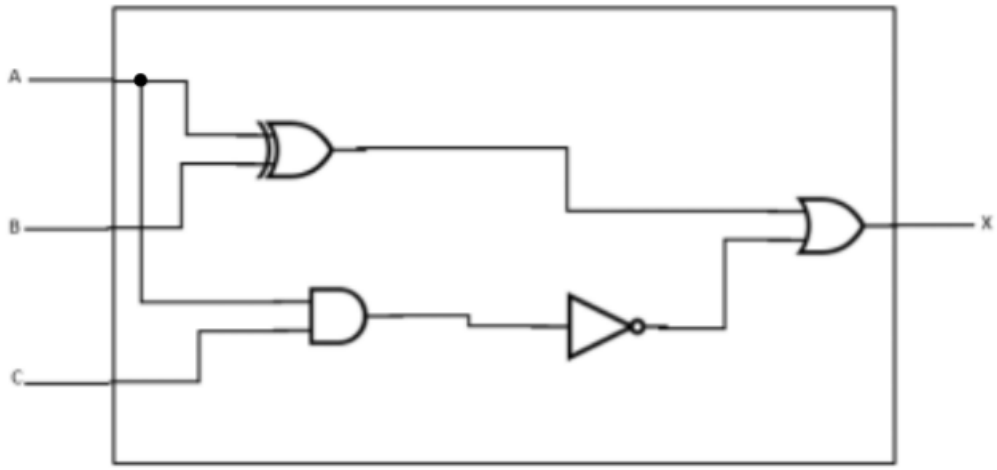
Answer 9

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>1 mark for each gate with the correct inputs.
Final two gates must also have the correct output.
 
</td><td>6</td></tr>
<tr><td>2(b)</td><td>One mark for each pair of rows.
<table>
<tr><th>A</th><th>B</th><th>C</th><th>Working space</th><th>X</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td></td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td></td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td></td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td></td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td></td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td></td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td></td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td></td><td>0</td></tr>
</table></td><td>4</td></tr>
</table>

Answer 10

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(a)</td><td>1 mark per correct gate with correct inputs
 
</td><td>3</td></tr>
<tr><td>5(b)</td><td>1 mark for each correct pair of lines
<table>
<tr><th>A</th><th>B</th><th>C</th><th>Working space</th><th>X</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td></td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td></td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td></td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td></td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td></td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td></td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td></td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td></td><td>0</td></tr>
</table></td><td>4</td></tr>
</table>

Answer 11

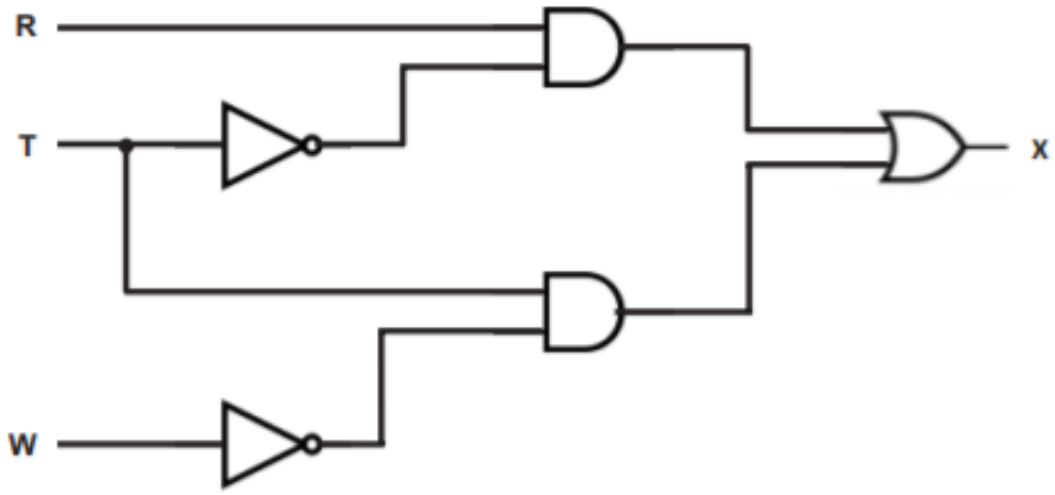
Question	Answer	Marks
8(a)	**1 mark** for each logic gate with the correct inputs 	**4**

Question	Answer	Marks
8(b)	**One mark** for each correct pair of lines	**4**

A	B	C	Working Space	X
0	0	0		1
0	0	1		1
0	1	0		1
0	1	1		1
1	0	0		1
1	0	1		1
1	1	0		1
1	1	1		0

Answer 12

5 (a) (i) One mark for each correct gate.



[5]

(ii) $\left(R.\bar{T}\right)+\left(T.\bar{W}\right)$ // (R AND NOT T) OR (T AND NOT W) [2]

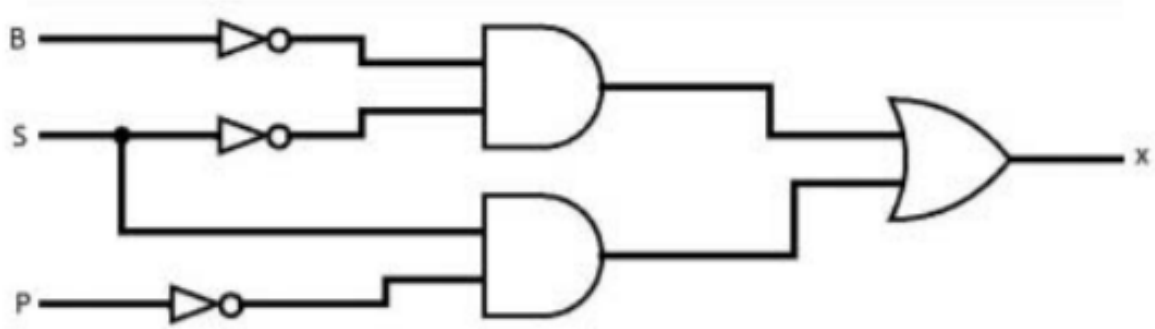
(iii) One mark for each pair of lines as shaded.

INPUT			Working space	OUTPUT X
R	T	W		
0	0	0		0
0	0	1		0
0	1	0		1
0	1	1		0
1	0	0		1
1	0	1		1
1	1	0		1
1	1	1		0

[4]

Answer 13

1 (a) ONE mark for each correct gate.



[6]

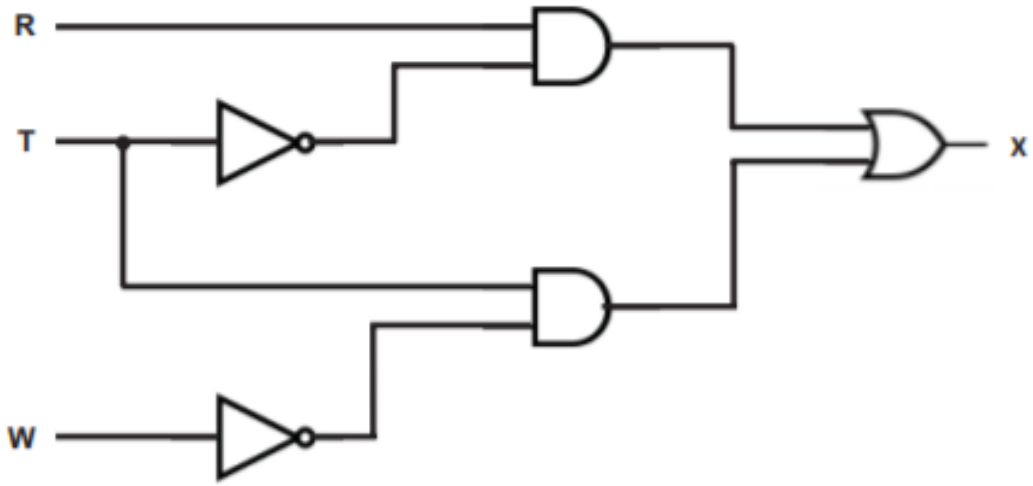
(b) ONE mark for each pair of rows.

B	S	P	Working space	X
0	0	0		1
0	0	1		1
0	1	0		1
0	1	1		0
1	0	0		0
1	0	1		0
1	1	0		1
1	1	1		0

[4]

Answer 14

5 (a) (i) One mark for each correct gate.



[5]

(ii) $(R.\bar{T})+(T.\bar{W})$ // (R AND NOT T) OR (T AND NOT W) [2]

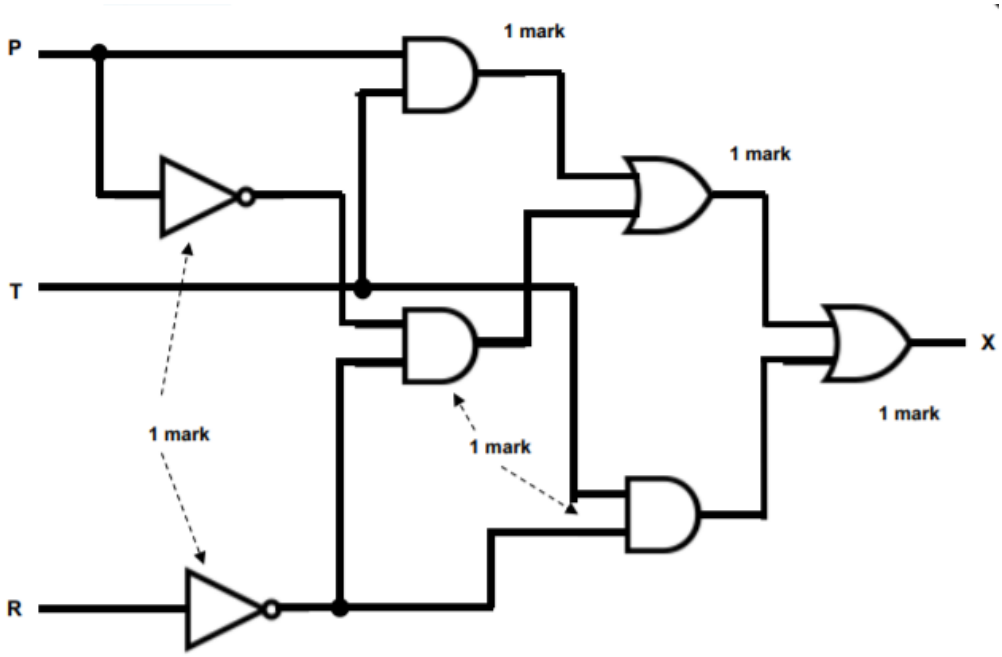
(iii) One mark for each pair of lines as shaded.

INPUT			Working space	OUTPUT X
R	T	W		
0	0	0		0
0	0	1		0
0	1	0		1
0	1	1		0
1	0	0		1
1	0	1		1
1	1	0		1
1	1	1		0

[4]

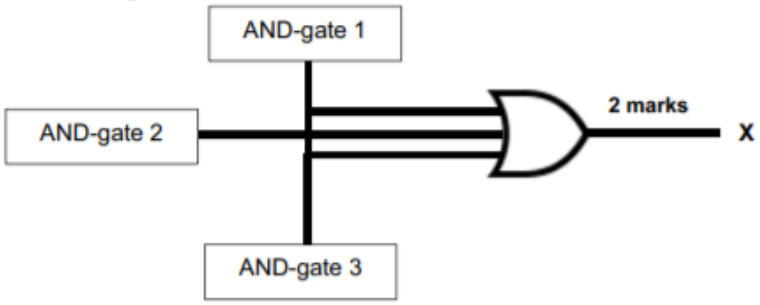
Answer 15

7 (a) since it is possible to simplify the original conditions, at least 3 possible answers exist for the logic circuit.

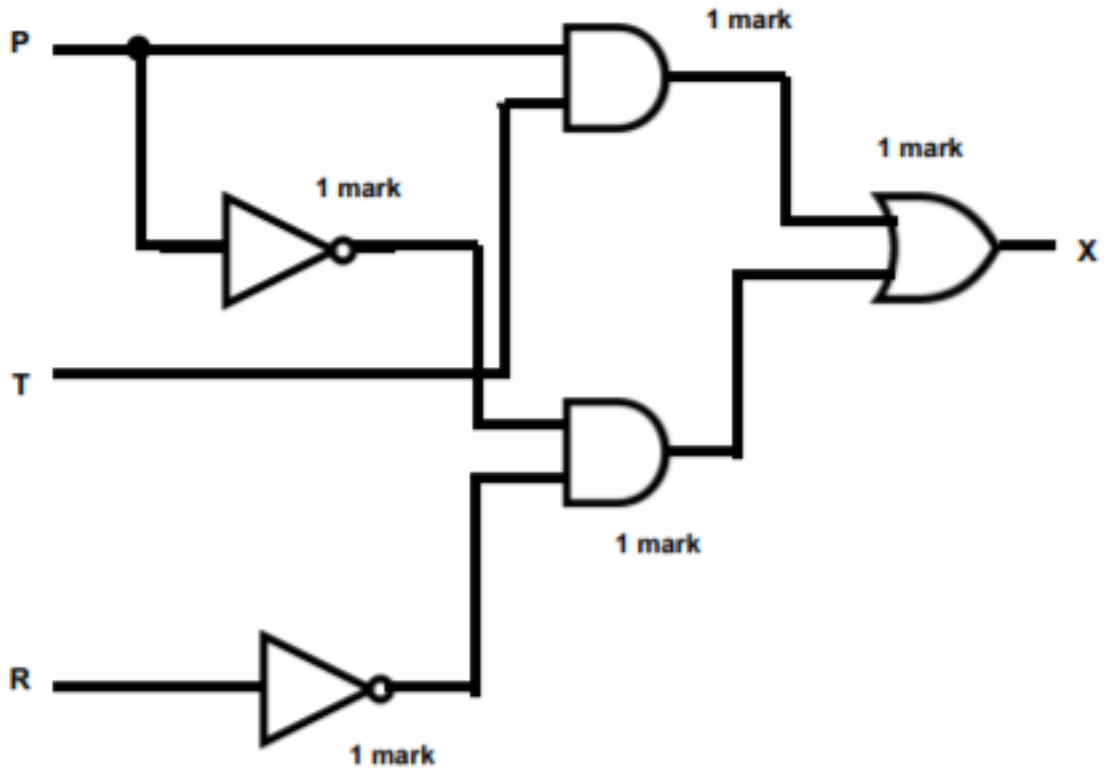


Note: input T has 2 cross overs that should not be connections

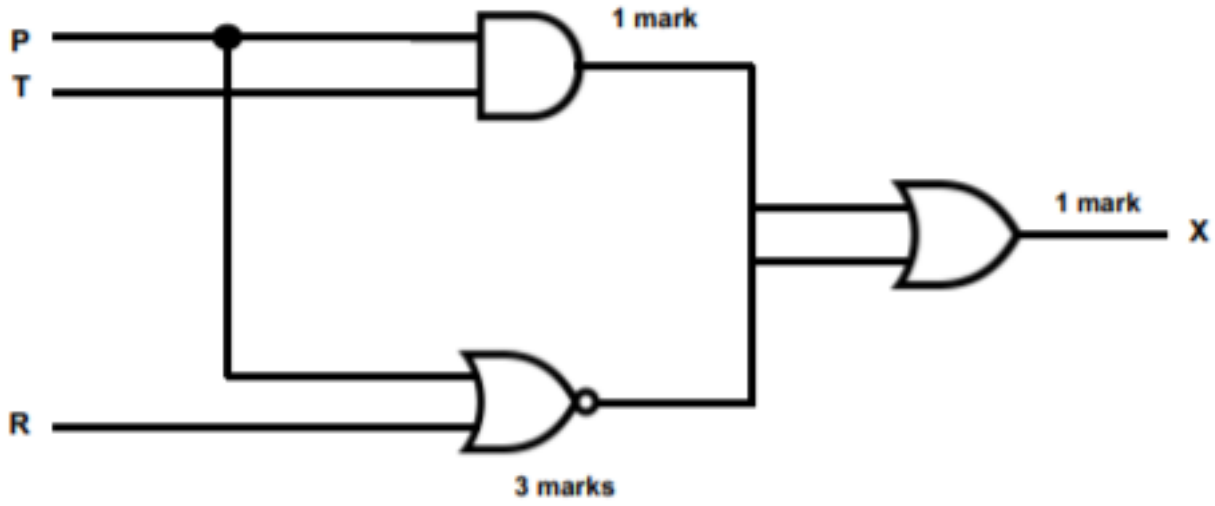
Note: it is possible to use a 3-input OR gate rather than the two 2-input OR gates on the top right:



Alternative solution 1:



Alternative solution 2:



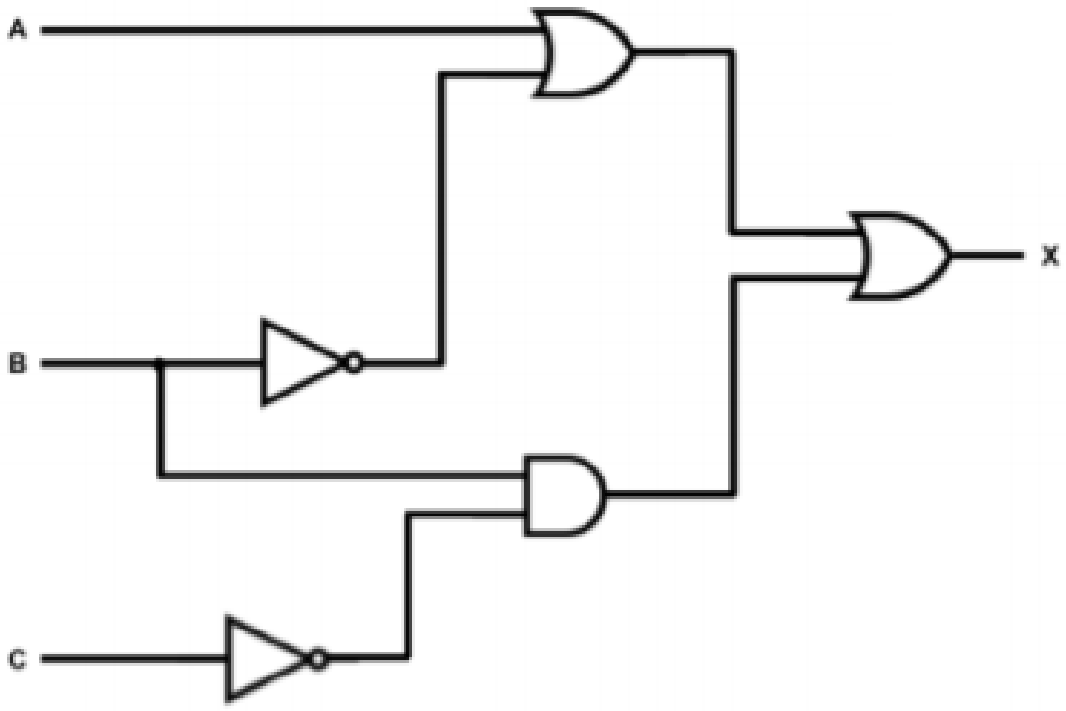
(b)

P	T	R	Workspace	X	
0	0	0		1	} 1 mark
0	0	1		0	
0	1	0		1	} 1 mark
0	1	1		0	
1	0	0		0	} 1 mark
1	0	1		0	
1	1	0		1	} 1 mark
1	1	1		1	

[4]

Answer 16

6 (a)



[5]

(b)

A	B	C	working	X	
0	0	0		1	} 1 mark
0	0	1		1	
0	1	0		1	} 1 mark
0	1	1		0	
1	0	0		1	} 1 mark
1	0	1		1	
1	1	0		1	} 1 mark
1	1	1		1	

[4]

(c) ((A is NOT 1 AND B is 1) OR (B is NOT 1 OR C is 1)) AND C is NOT 1

< – – – – – 1 mark – – – – – > < – – – – – 1 mark – – – – – > < – – – – – 1 mark – – – – – >

NOTE: all brackets may not be shown – but check answer still correct

Alternatives include:

((NOT A AND B) OR (NOT B OR C)) AND NOT C

$(\overline{A} . B + (\overline{B} + C)) . \overline{C}$

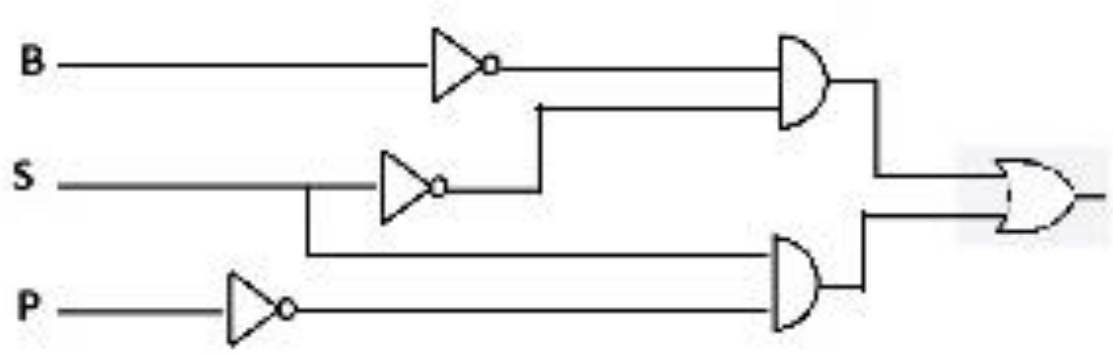
NOTE: expressions may be reversed but still OK

(e.g. NOT C AND ((NOT A AND B) OR (NOT B OR C))

NOT C AND ((NOT B OR C) OR (NOT A AND B)) and so on) [3]

Answer 17

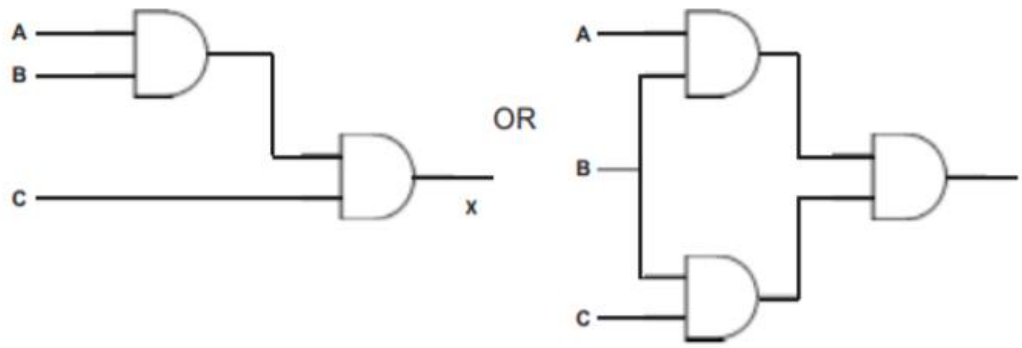
B	S	P	X
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0



Answer 18

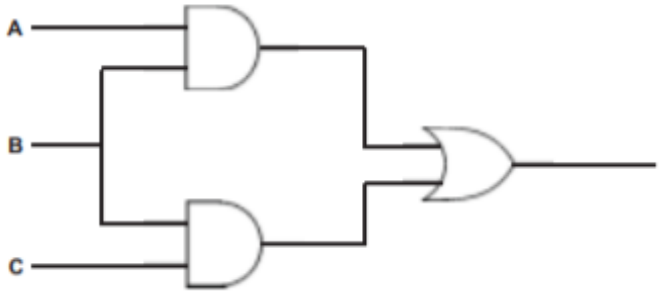
8 (a) 2 marks per part
IF candidate uses 2 gates mark from 2 gate diagram if draws 3 gates mark from 3 gate diagram for all 3 parts

(i) (allow correct alternatives)



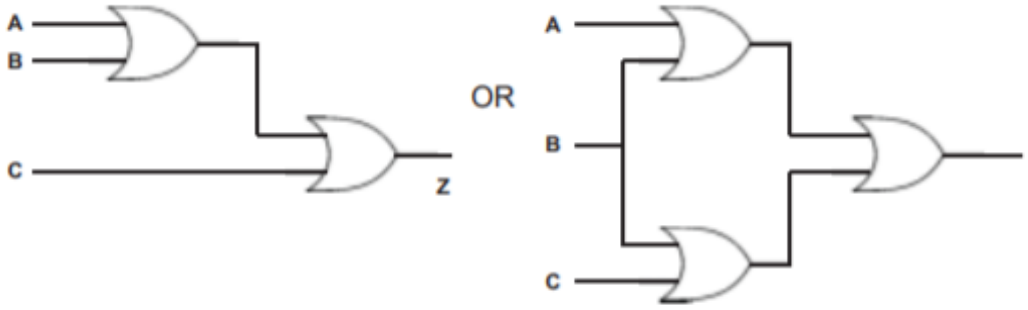
[2]

(ii)



[2]

(iii) (allow correct alternatives)



[2]

(b)

A	B	C	X	Y	Z
0	0	0	**0**	**0**	**0**
0	0	1	**0**	**0**	**1**
0	1	0	**0**	**0**	**1**
0	1	1	**0**	**1**	**1**
1	0	0	**0**	**0**	**1**
1	0	1	**0**	**0**	**1**
1	1	0	**0**	**1**	**1**
1	1	1	**1**	**1**	**1**

2 marks 2 marks 2 marks

(–1 mark for each error in each column) [6]

Answer 19

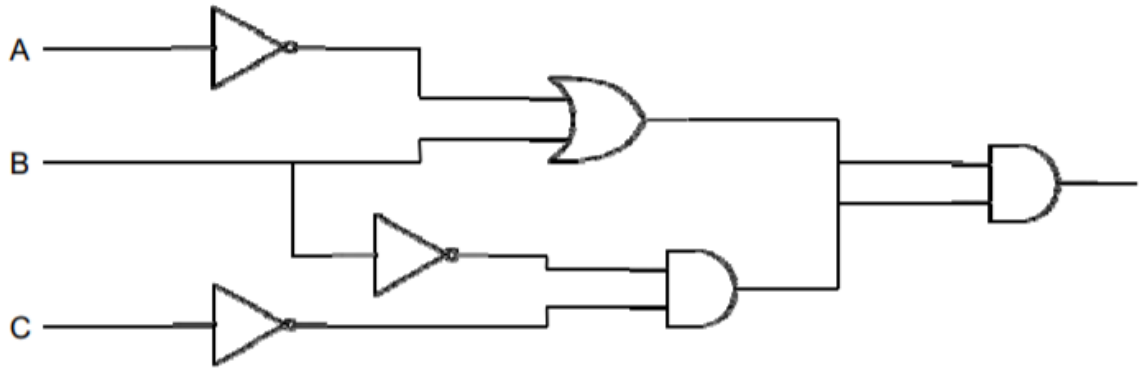
8 (a)

A	B	C	X
0	0	0	**1**
0	0	1	**1**
0	1	0	**0**
0	1	1	**0**
1	0	0	**0**
1	0	1	**1**
1	1	0	**0**
1	1	1	**0**

1 mark
1 mark
1 mark
1 mark

[4]

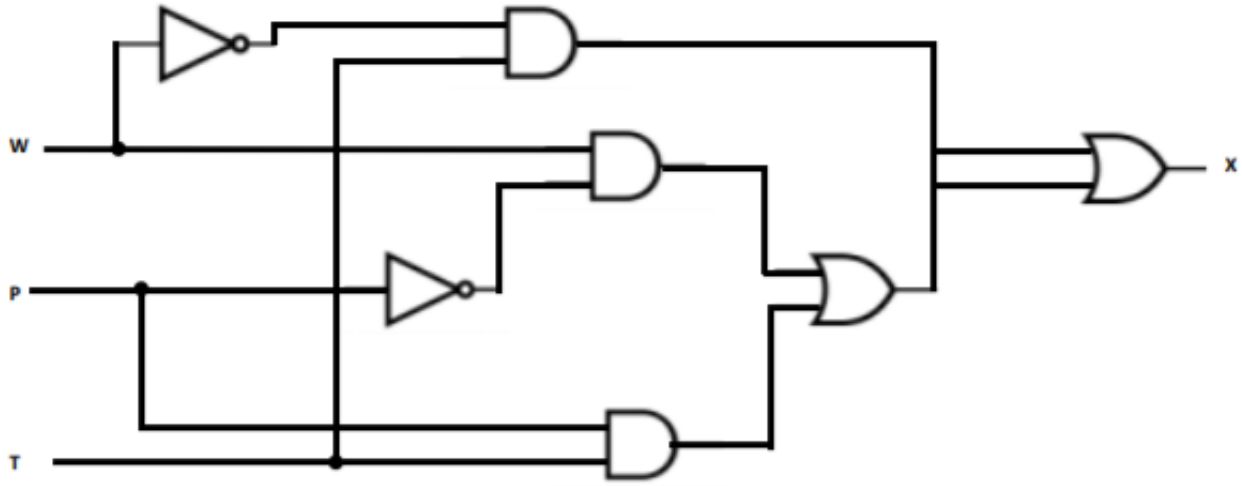
(b) 1 mark per correct logic gate in correct position



[6]

Answer 20

6 (a)



(corresponds to: [W = 1 AND P = NOT 1] OR [T = 1 AND P = 1] OR [W = NOT 1 AND T = 1])

1 mark for each correct logic gate in correct position – **[7]**

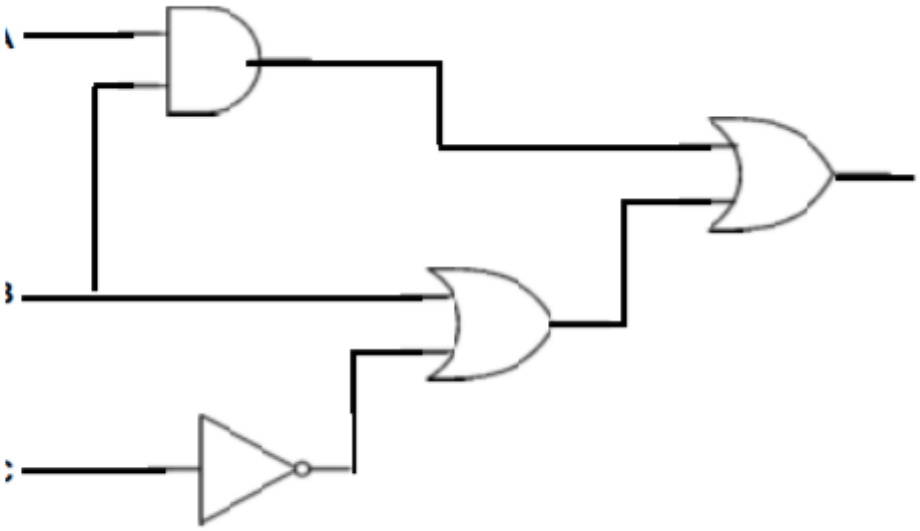
(b)

input W	input P	input T	output X	
0	0	0	**0**	1 mark
0	0	1	**1**	
0	1	0	**0**	1 mark
0	1	1	**1**	
1	0	0	**1**	1 mark
1	0	1	**1**	
1	1	0	**0**	1 mark
1	1	1	**1**	

[4]

Answer 21

9 (a) 1 mark for each correct logic gate (accept other logic gate nomenclature)



If a candidate has only one input to AND gate or an OR gate they lose the mark for that gate

[4]

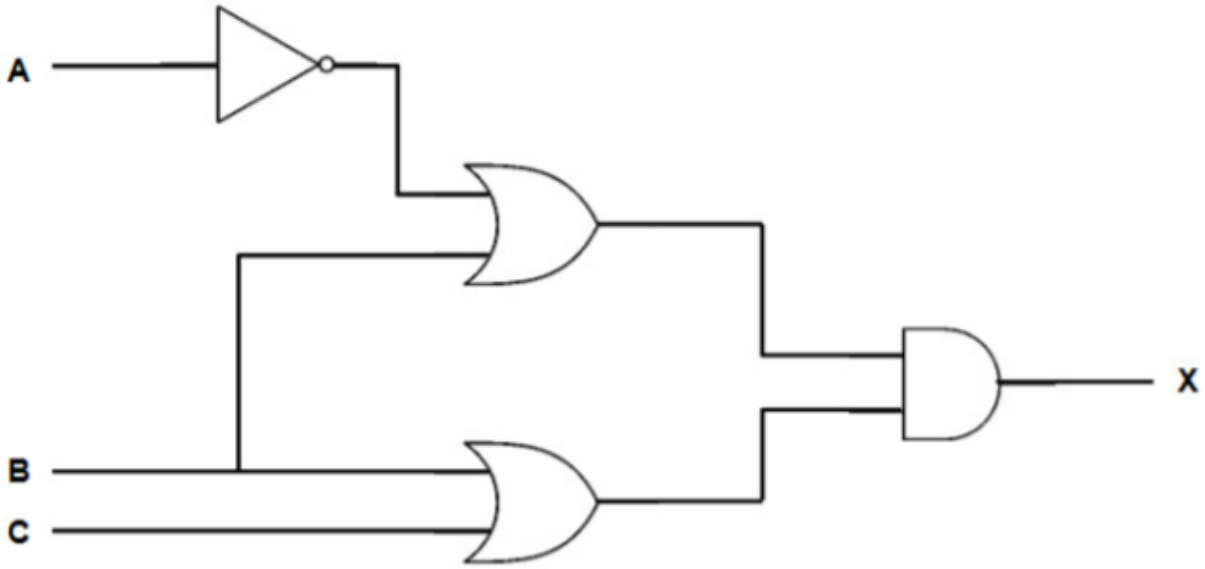
(b)

A	B	C	X
0	*0*	*0*	1
0	*0*	*1*	0
0	*1*	*0*	1
0	*1*	*1*	1
1	*0*	*0*	1
1	*0*	*1*	0
1	*1*	*0*	1
1	*1*	*1*	1

[4]

Answer 22

4 **(a)** 1 mark for each correct logic gate



[4]

(b)

A	B	C	X	
0	*0*	*0*	0	1 mark
0	*0*	*1*	1	
0	*1*	*0*	1	1 mark
0	*1*	*1*	1	
1	*0*	*0*	0	1 mark
1	*0*	*1*	0	
1	*1*	*0*	1	1 mark
1	*1*	*1*	1	

[4]

Answer 23

9 **(a)**

A	B	X
0	0	**1**
0	1	**0**
1	0	**0**
1	1	**0**

(1 mark for the 1,0 and 1 mark for 0, 0) [2]

(b)

A	B	C	D	Y
0	0	**0**	**1**	**0**
0	1	**1**	**0**	**0**
1	0	**1**	**1**	**1**
1	1	**1**	**0**	**0**

(1 mark for each row). [4]