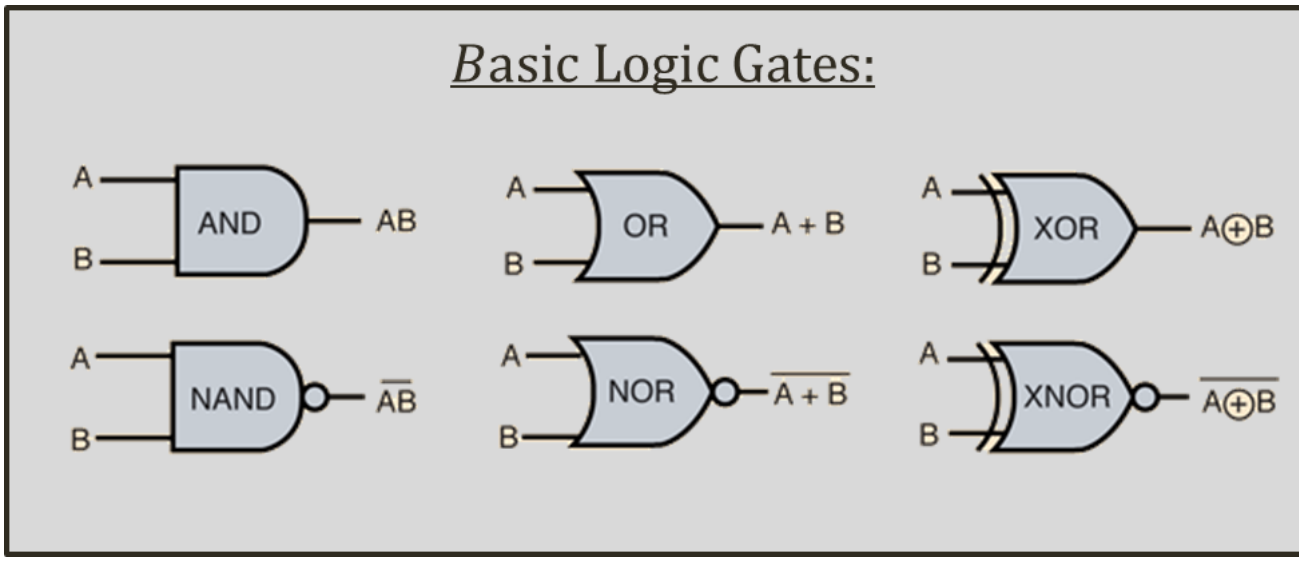
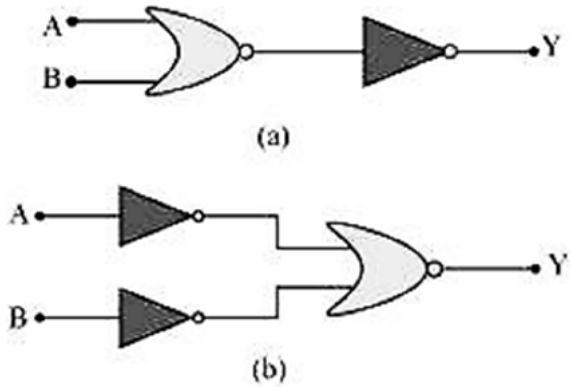
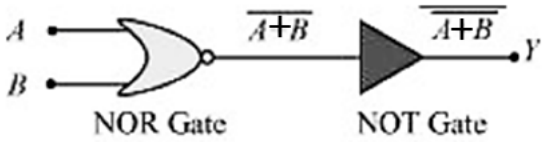
Physics Class 12 NCERT Solutions: Chapter 14 Semiconductor Electronics Materials Devices and Simple Circuits Part 4



Q: 15. You are given the two circuits as shown in figure. Show that circuit (a) acts as OR gate while the circuit (B) acts as AND gate.



(A) A and B are the inputs and , is the output of the given circuit. The left half of the given figure acts as the NOR Gate, while the right half acts as the NOT Gate. This is shown in the following figure.



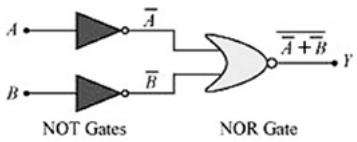
Hence, the output of the NOR Gate $= \overline{A+B}$

This will be the input for the Not Gate. Its output will be $\overline{\overline{A+B}} = A+B$

$\therefore Y = A+B$

Hence, this circuit functions as an OR Gate.

(B) A and B are the inputs and Y is the output of the given circuit. It can be observed from the following figure that the input that the inputs of the right half NOR Gate are the outputs of the two NOT Gates.

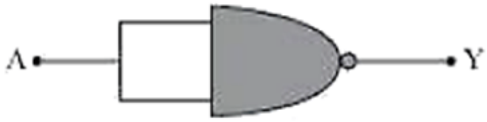


Hence, the output of the given circuit can be written as:

$Y = \overline{\overline{A}+\overline{B}} = \overline{\overline{A}}.\overline{\overline{B}} = A.B$

Hence, this circuit functions as an AND Gate.

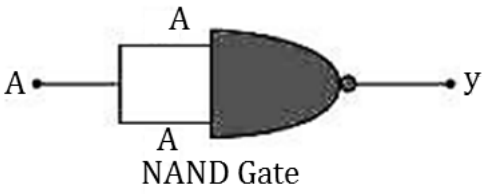
Q: 16. Write the truth table for a NAND gate connected as given in Figure.



Hence identify the exact logic operation carried out by this circuit.

Answer:

A acts as the two inputs of the NAND gate and Y is the output, as shown in the following figure.



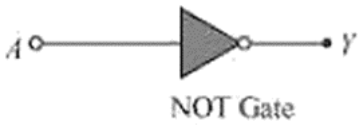
$$Y = \overline{A.A} = \overline{A} + \overline{A} = \overline{A}\ (i)$$

The truth table for equation (i) can be drawn as:

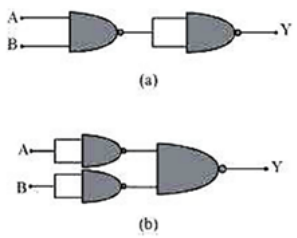
A	$Y\ (=\overline{A})$
0	
1	

Q_16_2_Truth Table for NAND Gate

This circuit functions as a NOT gate. The symbol for this logic circuit is shown as:



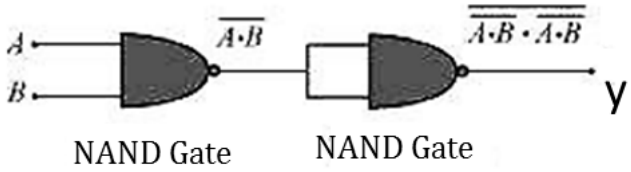
Q: 17. You are given two circuits as shown in figure, which consist of NAND gates. Identify the logic operation carried out by the two circuits.



Answer:

In both the given circuits, A and B are the inputs and Y is the output.

(A) The output of the left NAND gate will be $\overline{A.B}$. As shown in the following figure.

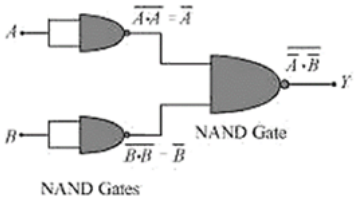


Hence, the output of the combination of the two NAND gates is given as:

$$Y = \overline{\left(\overline{A.B}\right).\left(\overline{A.B}\right)} = \overline{\overline{AB}} + \overline{\overline{AB}} = AB$$

Hence, this circuit functions as an AND gate.

(B) $\overline{A}$ is the output of the upper left of the NAND gate and $\overline{B}$ is the output of the lower half of the NAND gate, as shown in the following figure.



Hence, the output of the combination of the NAND gates will be given as:

$$Y = \overline{A}.\overline{B} = \overline{\overline{A}} + \overline{\overline{B}} = A + B$$

Hence, this circuit functions as an OR gate.