

The diagrams are below:

⇒ NAND gate.



⇒ Bubbled OR gate.

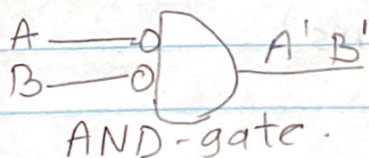
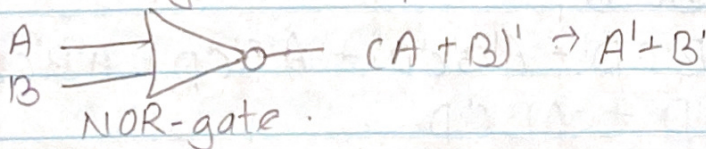
11. The NOR gate is the same as Bubbled AND gate (i.e. OR gate with complemented inputs).

Explain with the de Morgan's law. Draw diagram.

⇒ According to De-Morgan's first theorem, NOR gate is equivalent to a bubbled AND gate. The boolean expression for a bubbled AND gate can be expressed by the equation shown below for NOR gate, the eqn is:- $Z = \overline{A+B} \rightarrow Z = (A+B)'$
For bubbled AND gate, $\rightarrow Z = \overline{A.B} \rightarrow Z = A'.B'$
As the NOR gate and bubbled gates are interchangeable i.e. both gates have exactly identical outputs for the same set of inputs. Therefore the equation can be written as:-

$$\overline{A+B} = \overline{A.B} \quad (A+B)' = A'.B'$$

The diagrams are given below:-



AND-gate.