

# (DE3 -9) NAND Gate

## Aim of experiment

Examination of the operation of the NAND logic gate and compare the expected outputs to the truth tables for this device.

## Apparatus

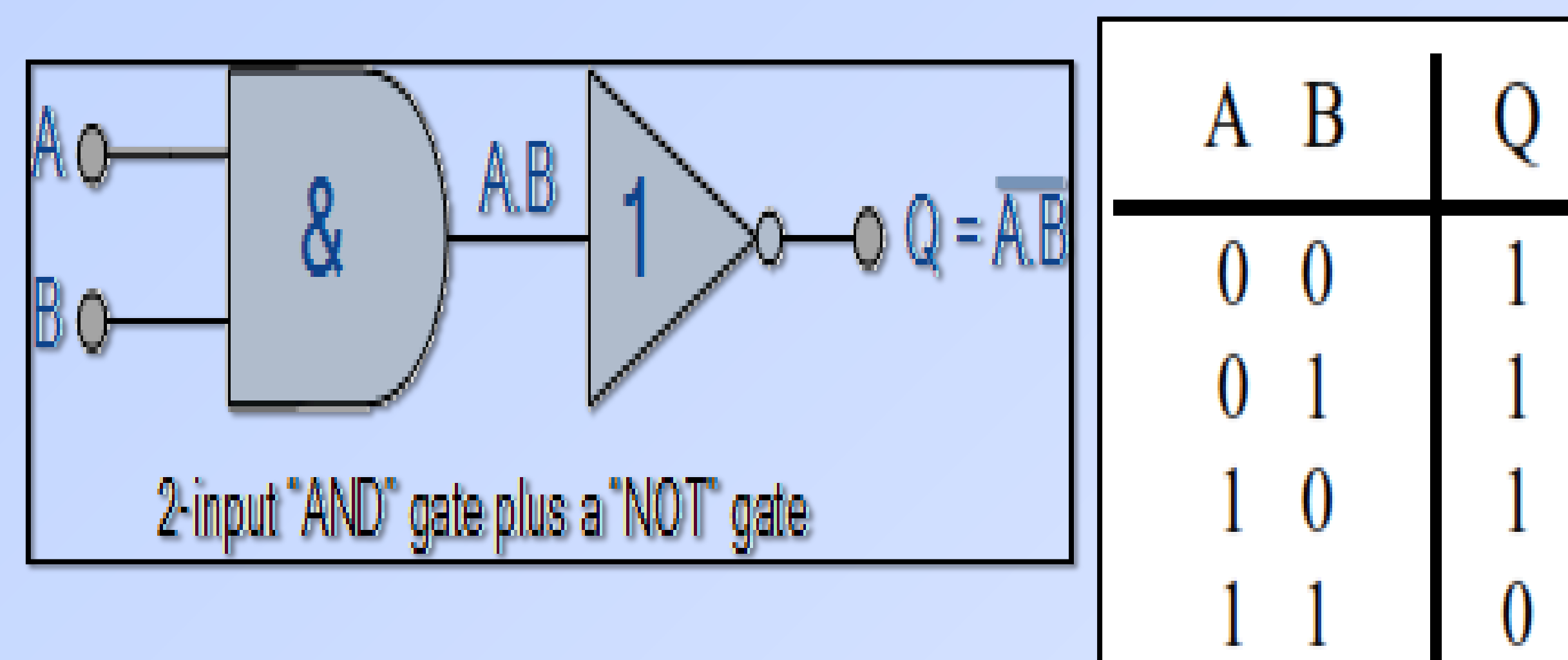
Prototyping Board– DC Power Supply 5V or 9V Battery – Light Emitting Diode (LEDs) – Digital ICs: 7400 NAND Gate – Connecting Wires.

## Theory of experiment

All logic gates have two or more inputs and one output. These logic gates accept digital logic levels on their inputs and will provide a digital logic level output which is dependent on the type of logic gate and the inputs applied to the gate. For the TTL logic family, any gate input that is not connected will be treated as if logic 1 is present on that input. The number of different possible combinations of inputs is  $2^n$  where  $n$  is the number of inputs. Therefore, four unique combinations of inputs are possible for a two input gate.

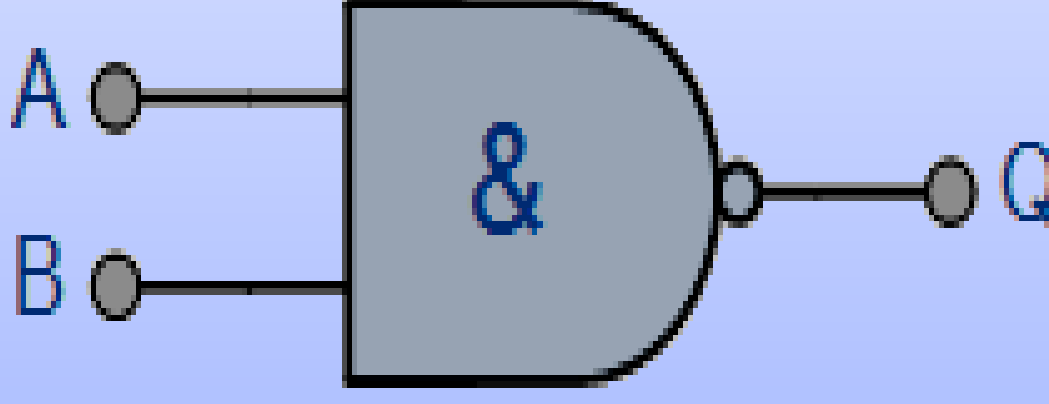
The NAND function is the complement of the AND function and the logic symbols have the inversion on the output. The NAND function provides logic 0 on the output only when both inputs are logic 1, and logic 1 output for all other combinations. The logic diagrams and the truth table are in *figure 1*. The Boolean Equation for a NAND gate is:

$$Q = \overline{A B}$$



**Figure 1.** Logic symbols and truth table for the NAND function

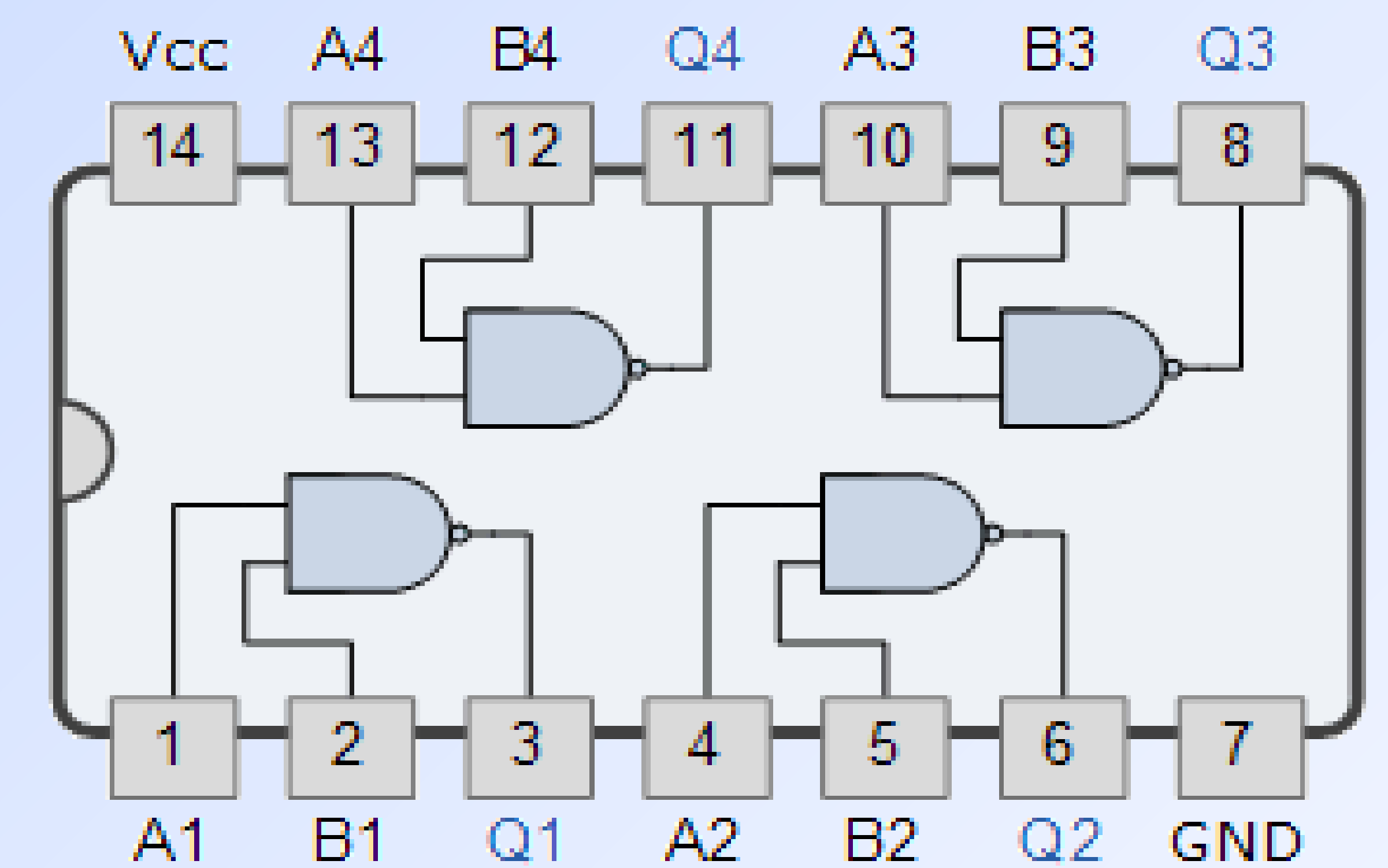
The NAND gate can generate by connect AND gate and NOT gate series as shown in *figure 2*.

Symbol	Truth Table		
 2-input NAND Gate	B	A	Q
	0	0	1
	0	1	1
	1	0	1
	1	1	0
Boolean Expression $Q = A.B$		Read as A AND B gives NOT Q	

**Figure 2.** equivalent circuits to NAND gate

## Procedures

1. Put the 7400NAND Gate shown in the Prototyping board.
2. Connect the pin 14 to 5 V and pin 7 to ground.
3. Connect pins 1 and 2 to input switches in Prototyping board, and connect pin 3 to output LED.
4. Change switches 1 and 2 on and off and show the output of LEDS.
5. Record the results in the following table.



## Results

Switch 1	Switch 2	LED output
0	0	
1	0	
0	1	
1	1	