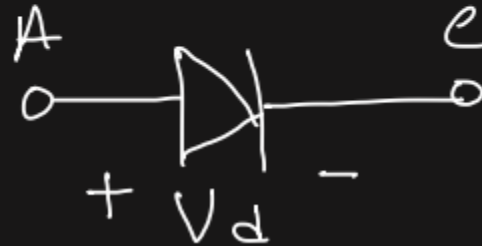
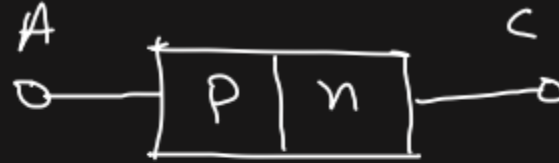


# Lecture 6

# Diodes



- Non-linear devices
- Electrical Valves : Permits current flow in one direction only
- Semiconductor devices, consists of a pn junction
- 2 terminals : Anode (A) and Cathode (C)
- Current flow direction: From Anode to Cathode
- Voltage across diode,  $V_d = V_a - V_c$ ; Where,  $V_a$  = Anode voltage,  $V_c$  = Cathode voltage

OR

$$Y = A + B$$

✓

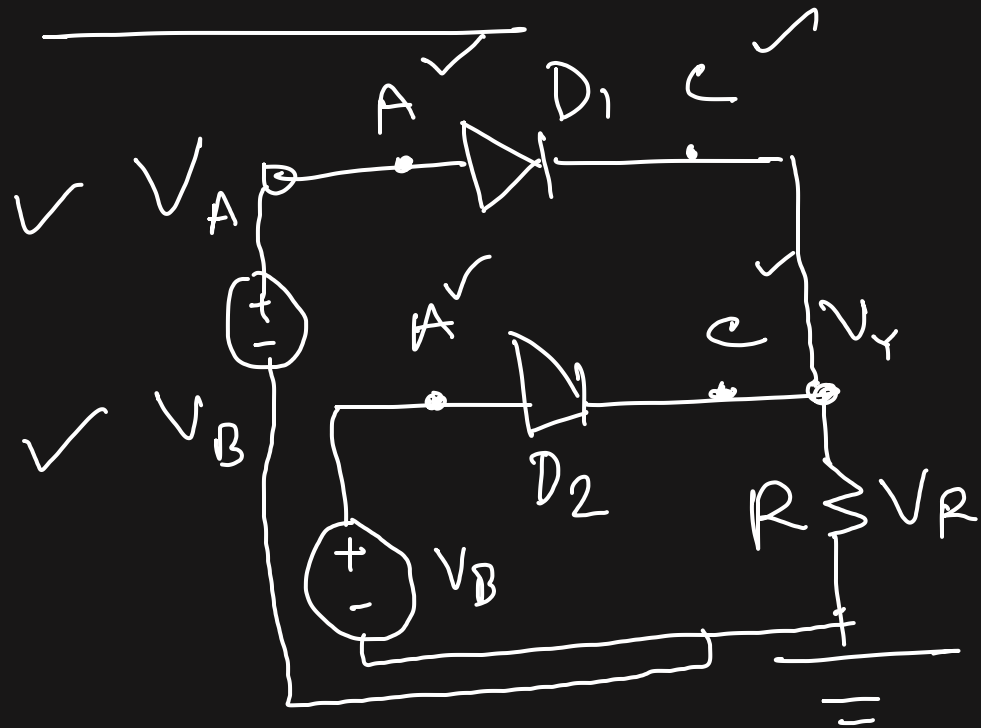
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

0 → Low state → 0V  
1 → HIGH " → 5V

V <sub>A</sub>	V <sub>B</sub>	V <sub>Y</sub>
0	0	0
0	5	5
5	0	5
5	5	5

OR

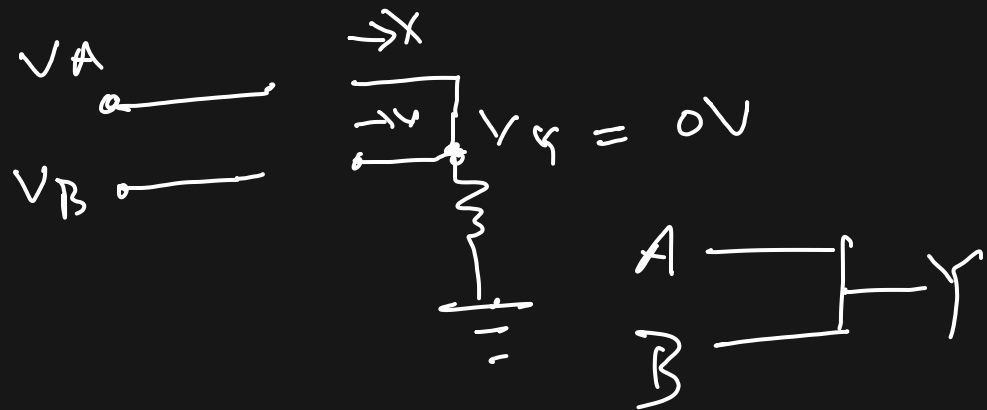
Circuit



Case 1°.  $V_A = V_B = 0V$

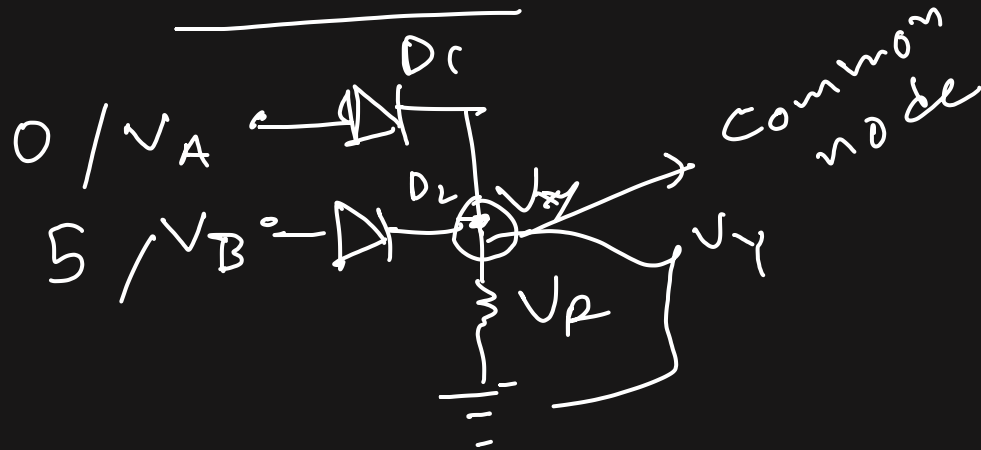
$D_1$  : OFF / Reverse Bias

$D_2$  : OFF / Reverse Bias



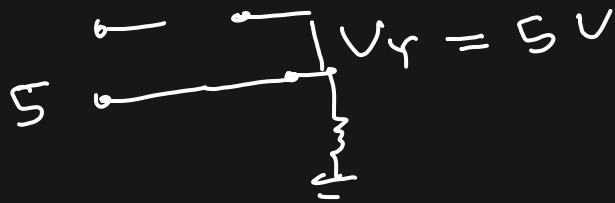
Resistance,  $R \rightarrow$  pull down resistance

## Case 2

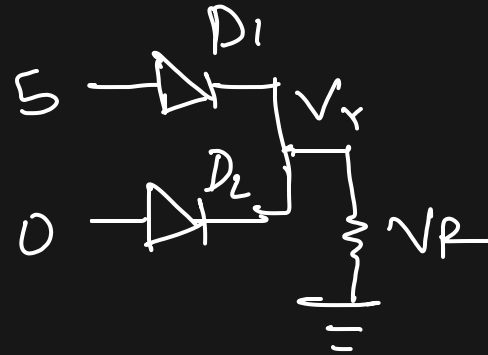


$D_1$  : OFF / R.B.

$D_2$  : ON / F.B

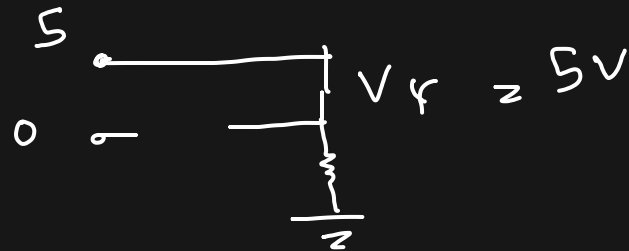


## Case 3

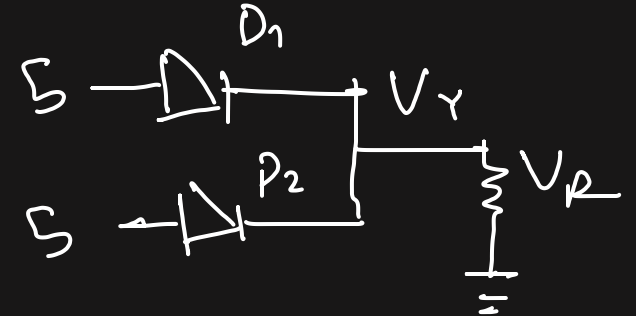


$D_1$  : ON / F.B

$D_2$  : OFF / R.B



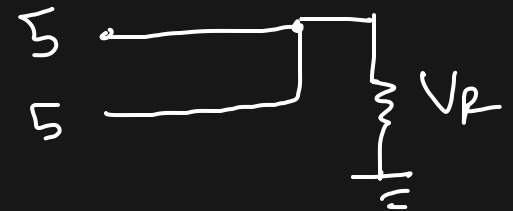
## Case 4



$D_1$  : ON / F.B

$D_2$  : ON / F.B

$V_Y = 5V$



# AND

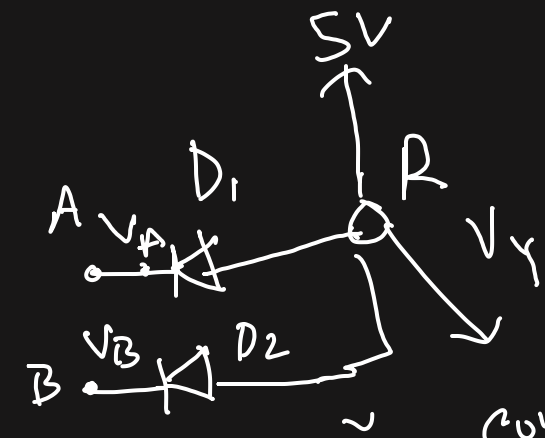
$$Y = A \cdot B$$

## Truth Table

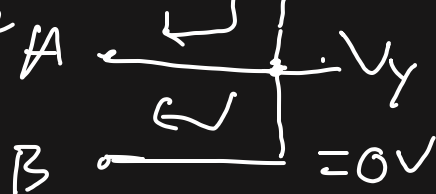
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

$V_A$	$V_B$	$V_Y$
0	0	0
0	1	0
1	0	0
1	1	1

# Circuit



Common  
no dc



$$\therefore V_Y = 0V$$

(1)

## Case 1

$$V_A = V_B = 0V$$

$D_1$ : ON/F.B.

$D_2$ : ON/F.B.

## Case 2

$$V_A = 5V,$$

$$V_B = 0V$$

$D_1$ : OFF/R.B.

$D_2$ : ON



(2)

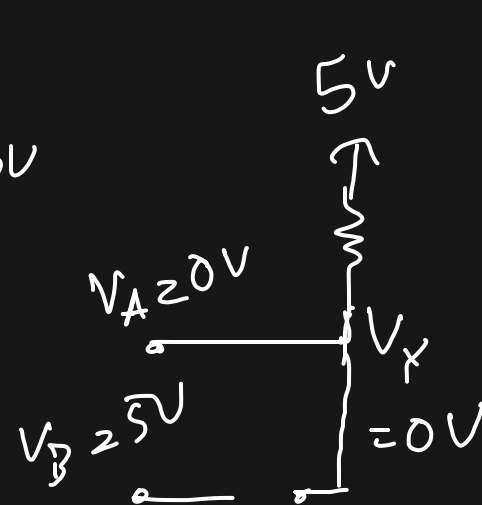
## Case 3

$$V_B = 5V,$$

$$V_A = 0V$$

$D_1$ : ON/F.B.

$D_2$ : OFF/R.B.



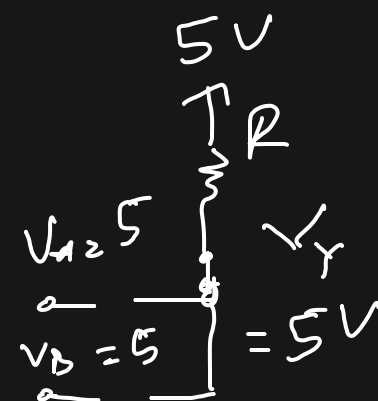
(3)

## Case 4

$$V_A = V_B = 5V$$

$D_1$ : OFF

$D_2$ : OFF

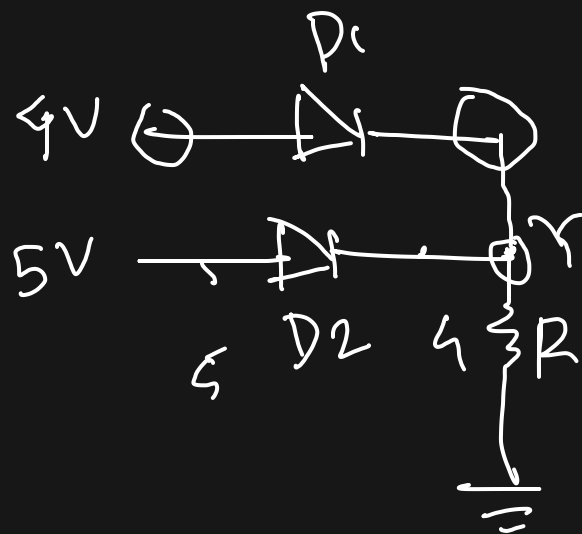


(4)

$R$  = pull-up resistor

# Different HIGH state voltages:

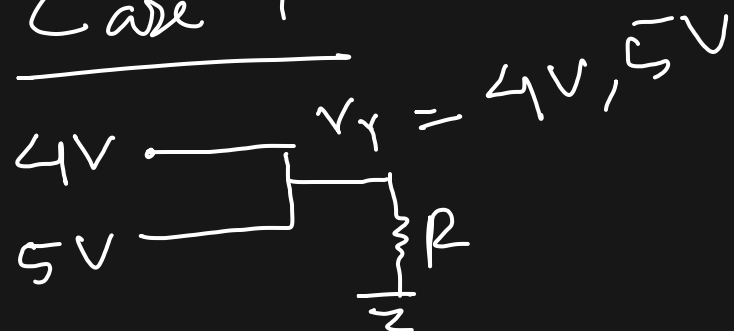
OR



Four combinations:

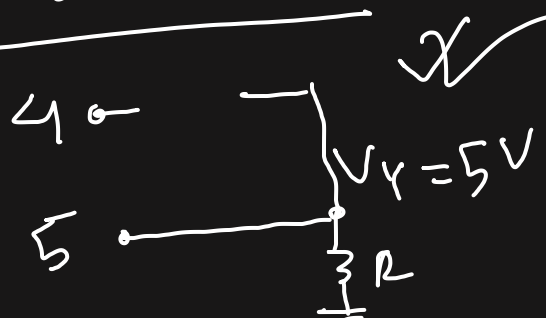
- 1)  $D_1, D_2 \rightarrow X$
- 2)  $D_1 \rightarrow \checkmark, D_2 \rightarrow X$
- 3)  $D_1 \rightarrow X, D_2 \rightarrow \checkmark$
- 4)  $D_1, D_2 \rightarrow \checkmark$

Case 1

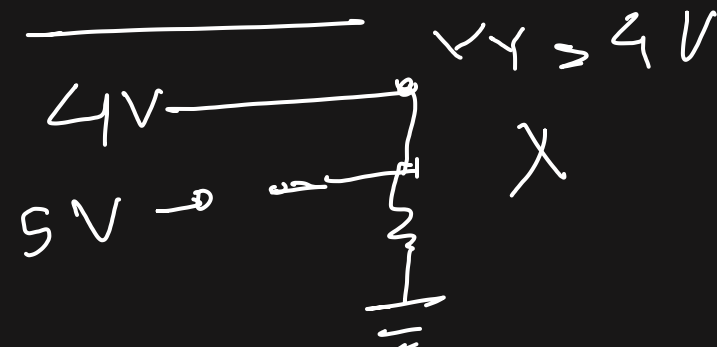


Not possible

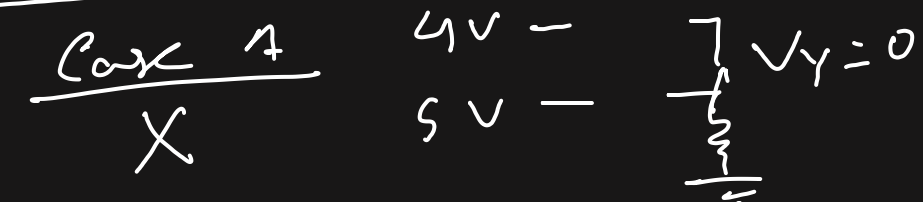
Case 2



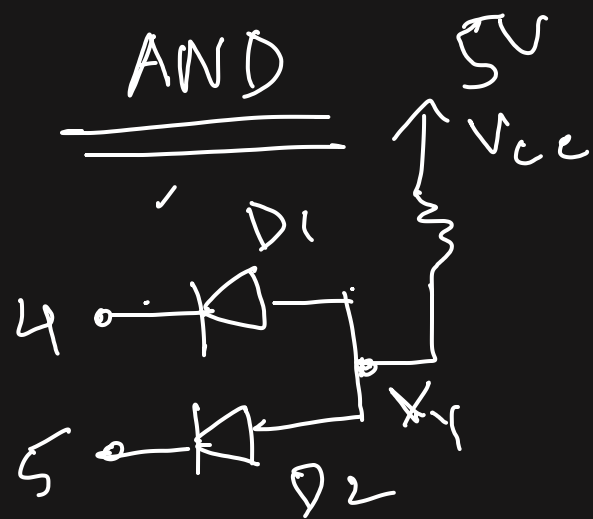
Case 3



Case 4







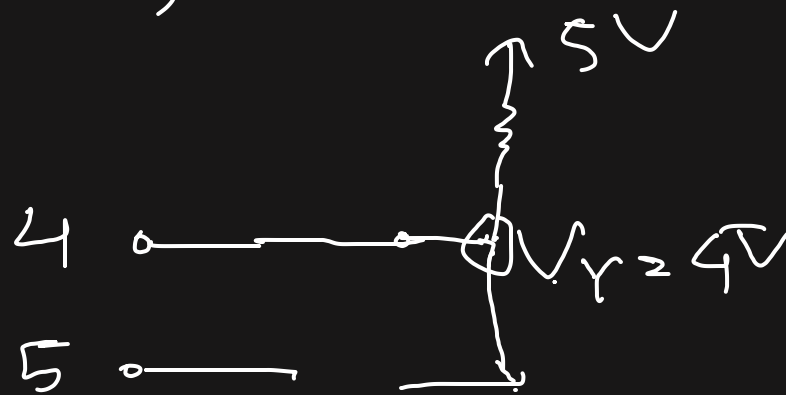
Four  $\rightarrow$  i)  $D_1, D_2 \rightarrow \times$

ii)  $D_1 \rightarrow \times, D_2 \rightarrow \checkmark$

iii)  $D_1 \rightarrow \checkmark, D_2 \rightarrow \times$

iv)  $D_1, D_2 \rightarrow \checkmark$

iii)



### Exercise

- 1) AND,  $V_A(\text{HIGH}) = 3V, V_B(\text{HIGH}) = 1V, V_{CC} = 3V$
- 2) OR,  $V_A(\text{HIGH}) = 3V, V_B(\text{HIGH}) = 4V, V_{CC} = 3V$