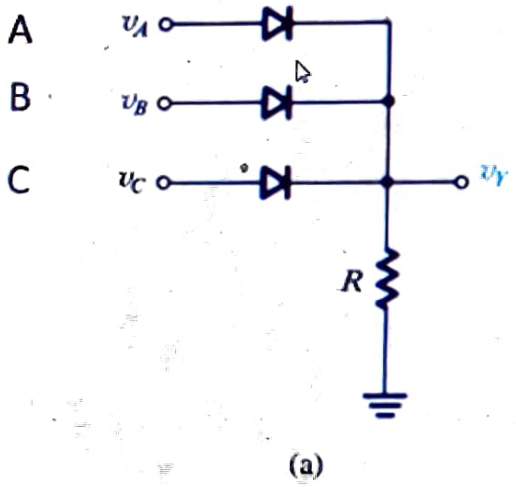
Application of Diodes: Logic Gates

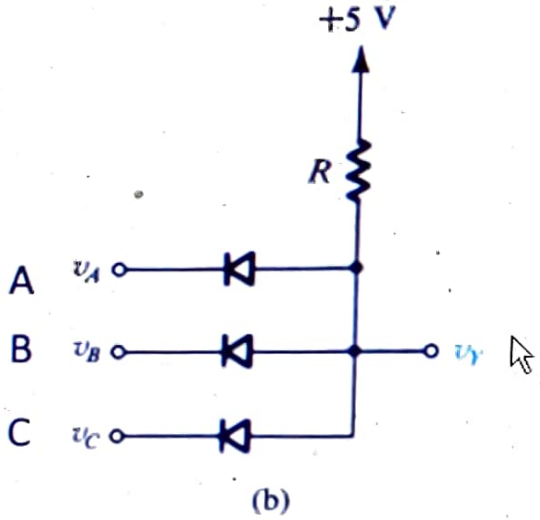
- The **logic OR function**
  - Y=A+B+C
- The **logic AND function**
  - Y=A·B·C

If

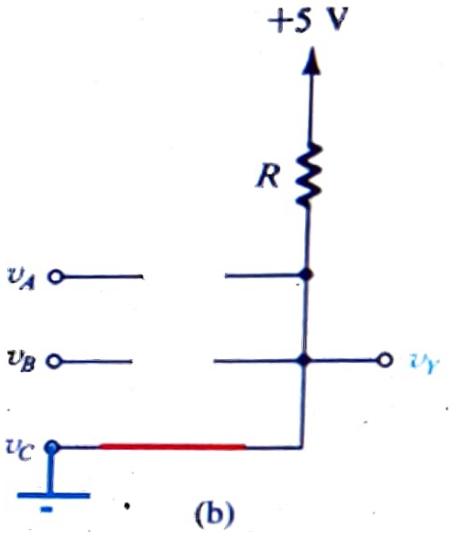
v_A Logic High, D_A is RB
v_B Logic High, D_B is RB
v_C Logic LOW, D_B is FB



(a)



(b)



(b)

Application of Diodes: Logic Gates

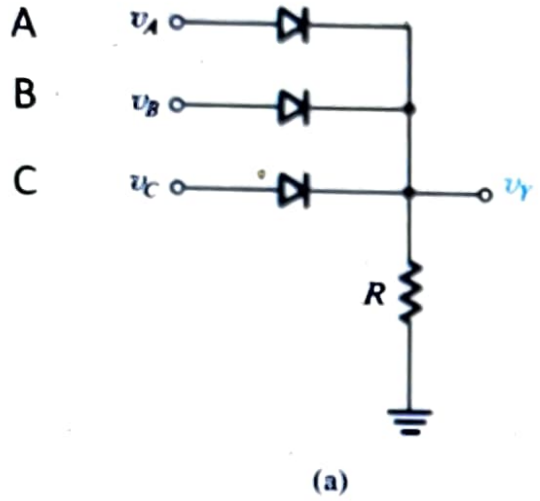
- The **logic OR function**
  - Y=A+B+C
- The **logic AND function**
  - Y=A·B·C

If

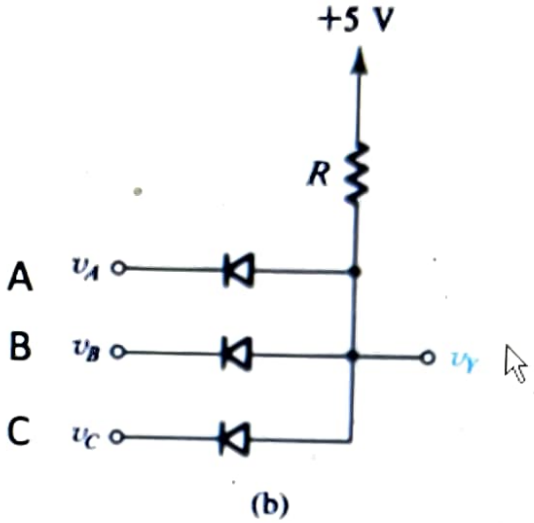
v_A Logic High, D_A is RB

v_B Logic High, D_B is RB

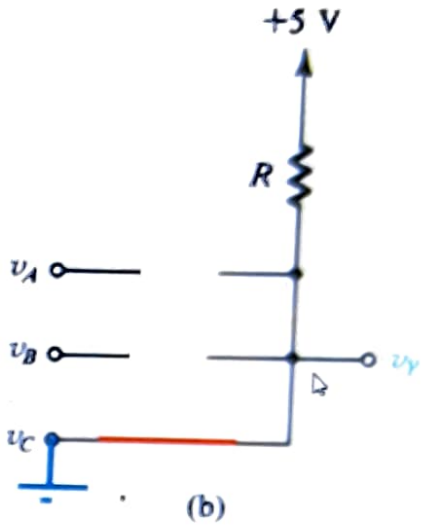
v_C Logic LOW, D_C is FB



(a)

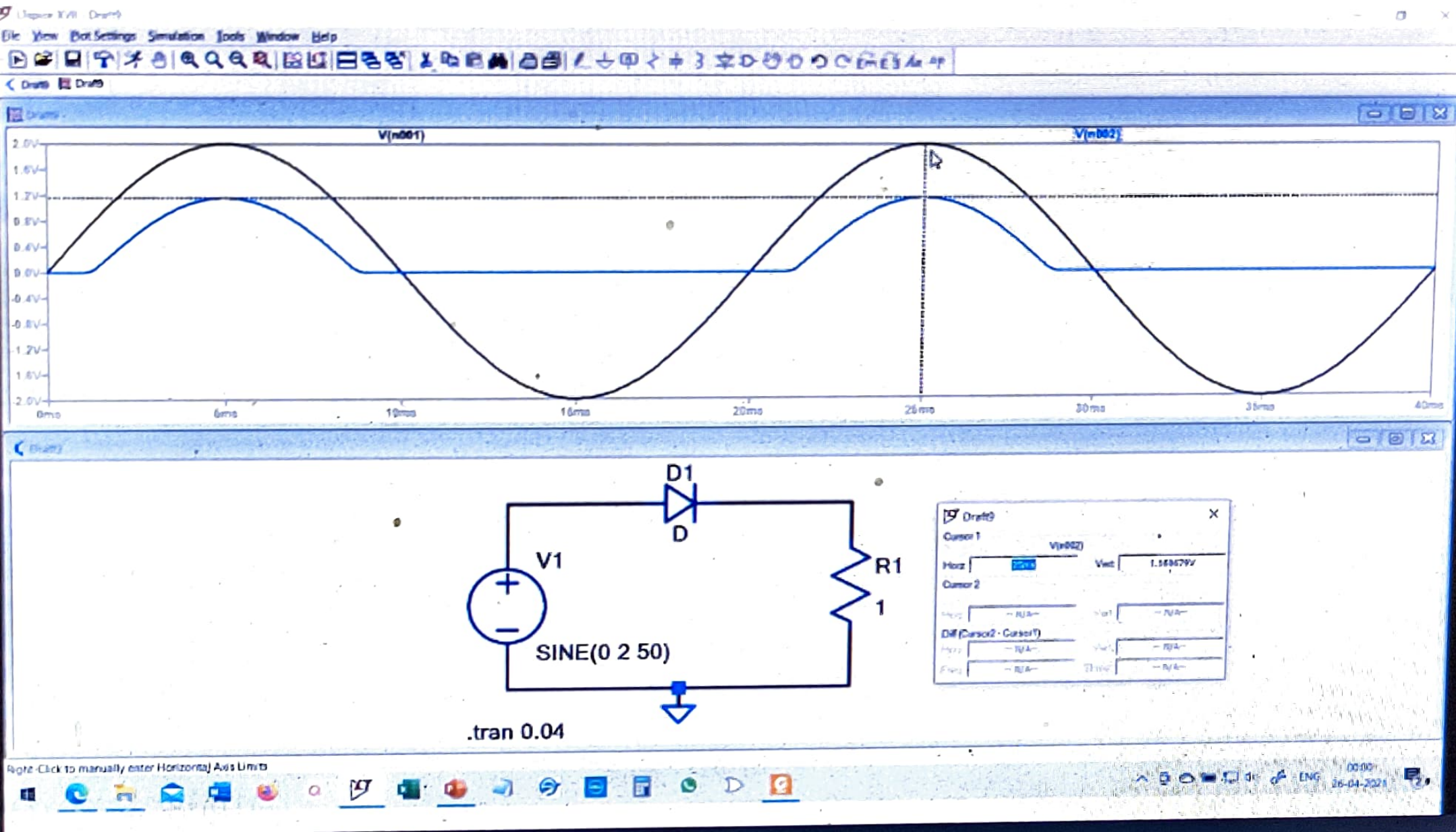


(b)



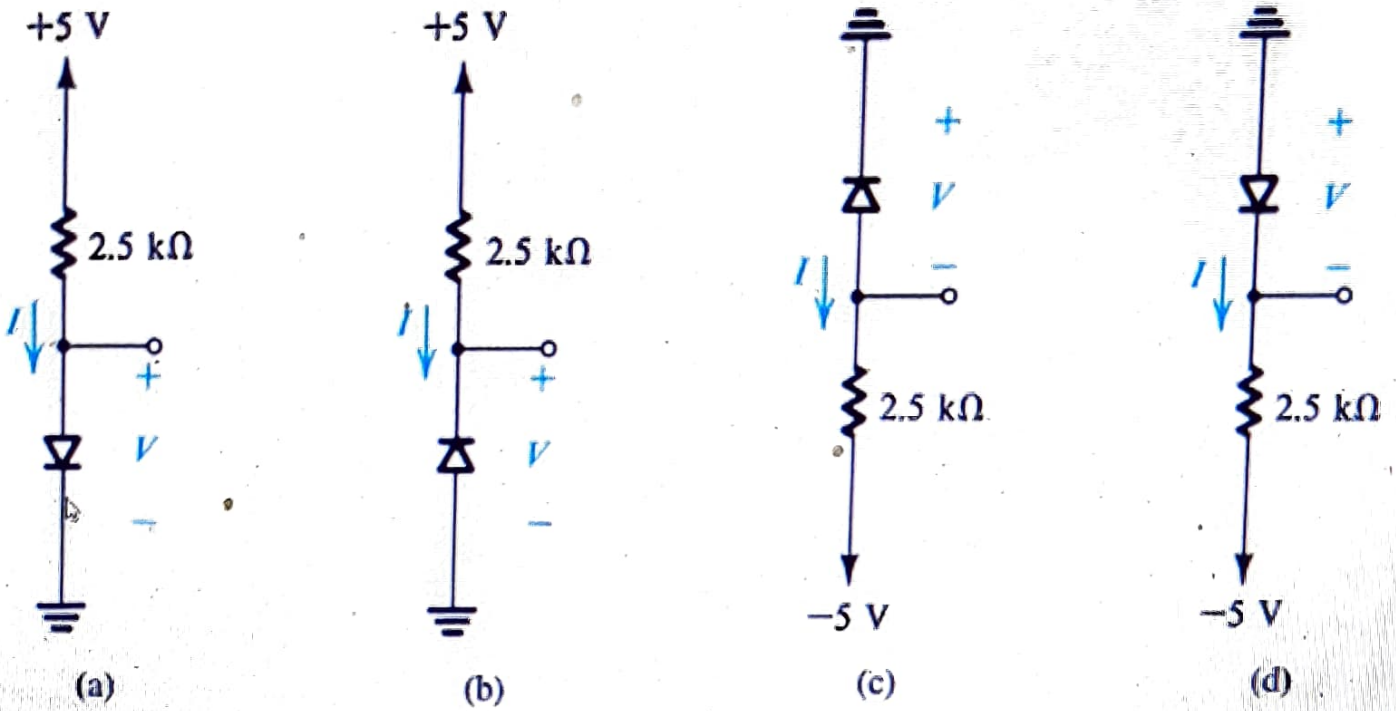
(b)

Potential drop in Diode



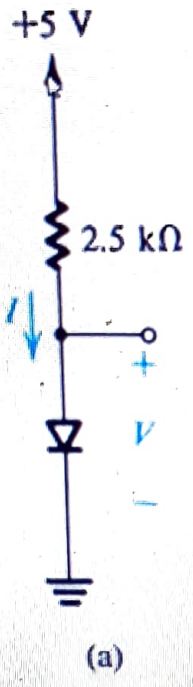
Find V and I

- Assume ideal diodes



Find V and I

- Assume ideal diodes



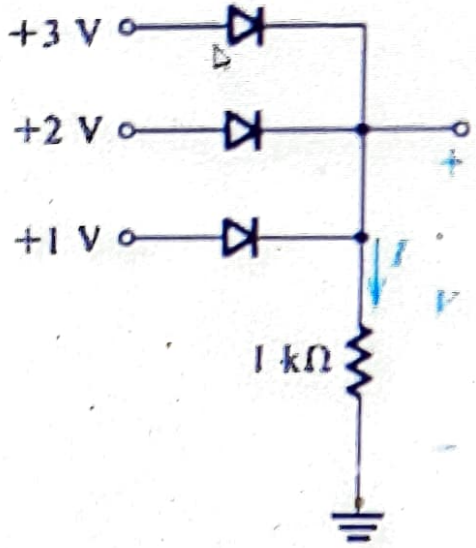
(a)

Diode is FB, Therefore short circuit, V = 0 V

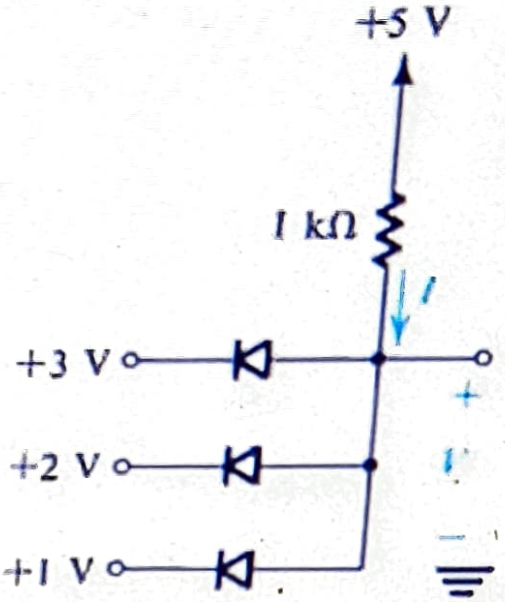
$$I = \frac{5-0}{2.5k} = 2\,\text{mA}$$

Find V and I

- Assume ideal diodes



(e)



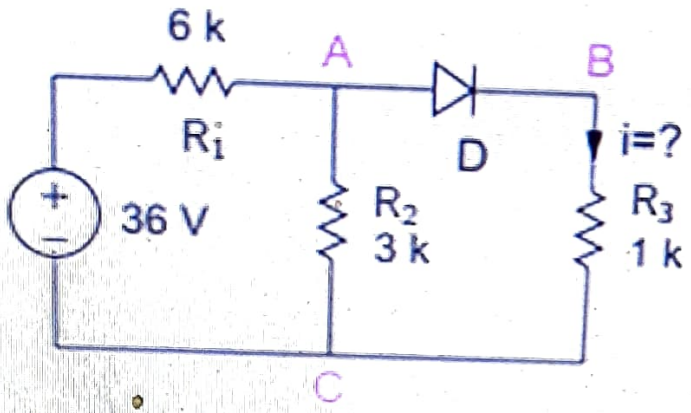
(f)

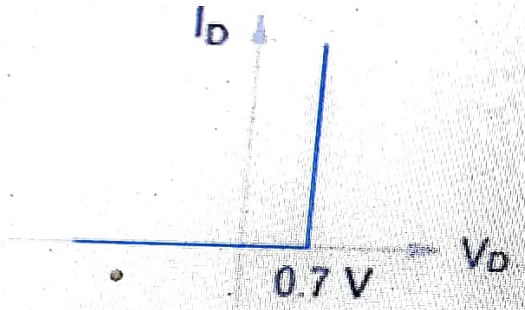
$$V = 3V$$

$$I = \frac{3}{1k} = 3\,mA$$

Diode circuits

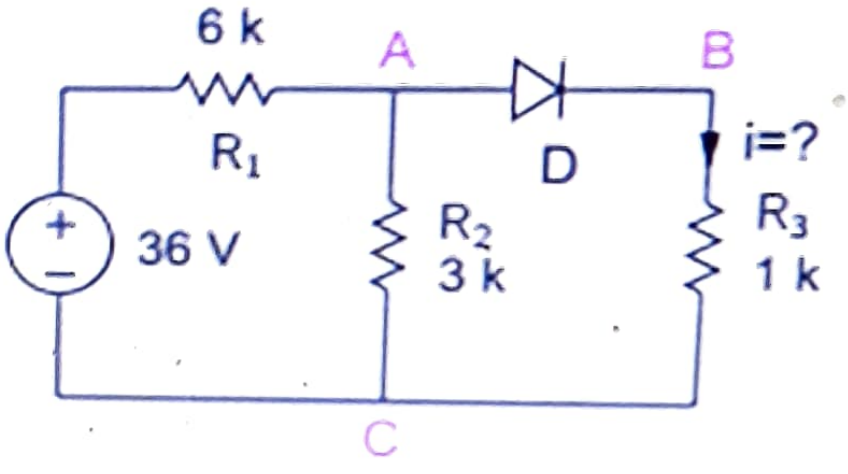
- Find current ‘i’

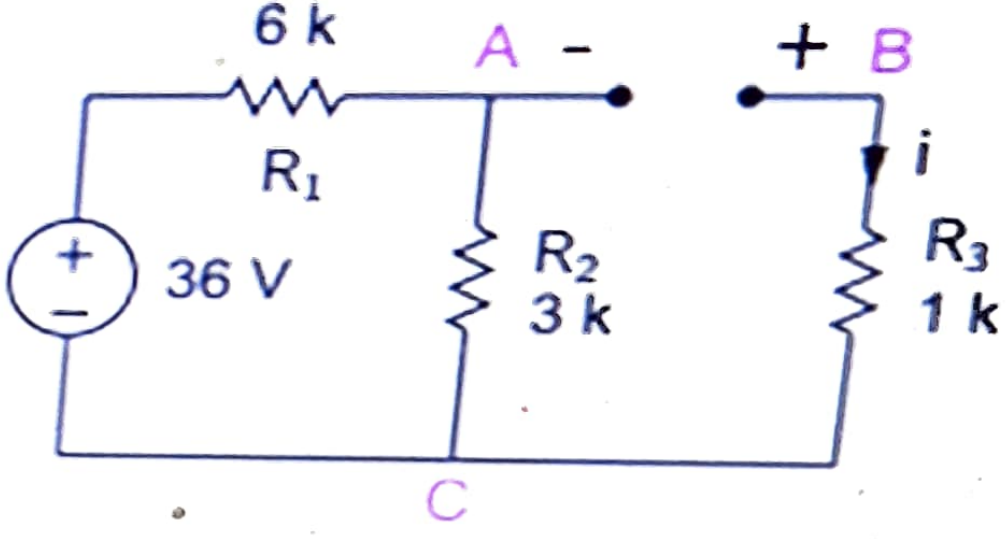




Diode circuits

- Case 1: Assume diode 'D' is OFF



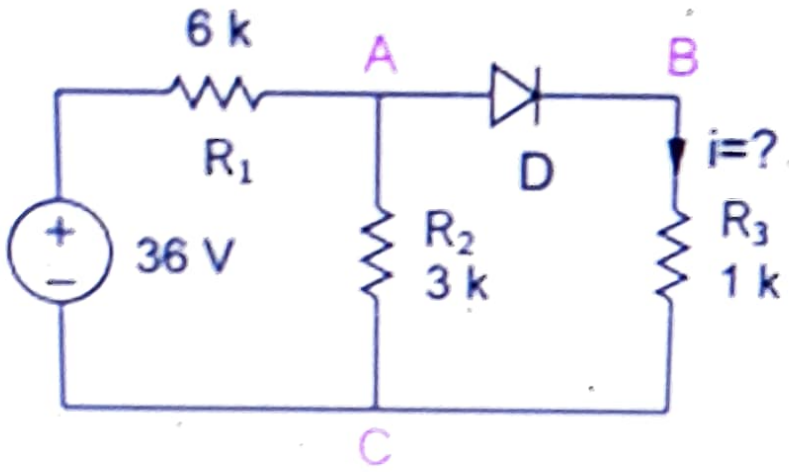


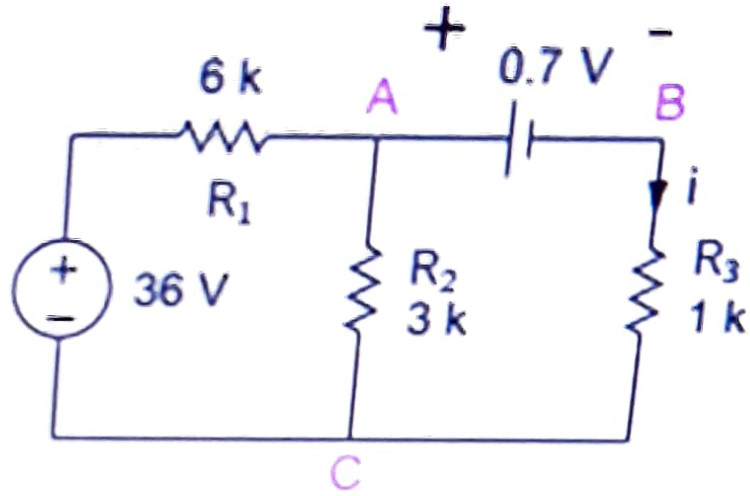
$$v_{AB} = \frac{3}{3+6} \times 36 = 12\ \text{V}$$

Assumption and solution are inconsistent, therefore diode is not OFF

Diode circuits

- Case 2: Assume diode 'D' is ON





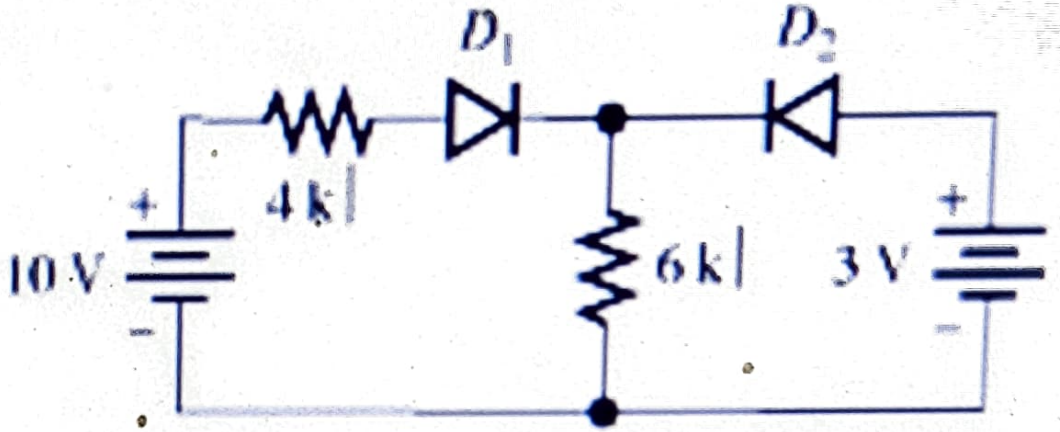
Using Nodal analysis

$$\frac{V_A - 36}{6K} + \frac{V_A}{3K} + \frac{V_A - 0.7}{1K} = 0 \Rightarrow V_A = 4.47\,\text{V}$$

$$i = 3.77\,\text{mA}$$

Assumption and solution are consistent, therefore diode is ON

- Find current flowing in 6kΩ resistor. Assume ideal diode model



- Find V and I. Assume diodes to be ideal.