

## Diode Circuits

### Example

Calculate  $V_0$

$$V = 0.7 + I_D R_1 + 0.7 + I_D R_2$$

$$V - 0.7 - 0.7 = I_D (R_1 + R_2)$$

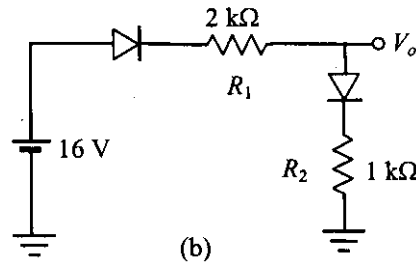
$$I_D = [V - (0.7 + 0.7)] / (R_1 + R_2)$$

$$I_D = 14.6 / (2000 + 1000)$$

$$I_D = 4.9 \text{ mA}$$

$$V_0 = 0.7 + I_D R_2$$

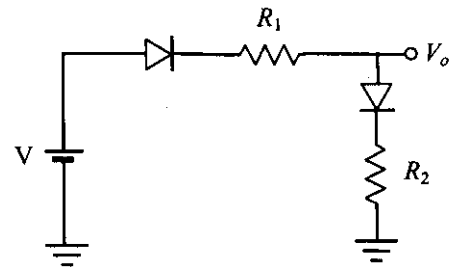
$$V_0 = 0.7 + 0.0049 \times 1000 = 0.7 + 4.9 = 5.6 \text{ V}$$



### Exercise

Calculate  $V_0$  for  $V = 15 \text{ V}$ ,  $R_1 = 2200 \Omega$ ,  $R_2 = 3300 \Omega$

Answer:  $I_D = 2.5 \text{ mA}$     $V_0 = 8.9 \text{ V}$



### Example

Calculate  $V_0$

$$+15 = 0.7 + I_D R_1 + 0.7 + I_D R_2 - 5$$

$$20 - 0.7 - 0.7 = I_D (R_1 + R_2)$$

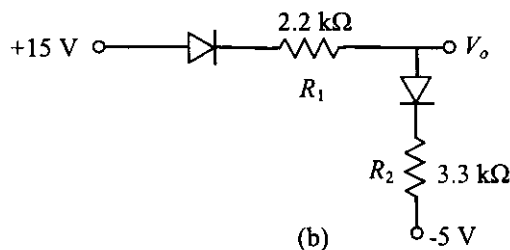
$$I_D = 18.6 / (R_1 + R_2)$$

$$I_D = 18.6 / (2200 + 3300)$$

$$I_D = 3.38 \text{ mA}$$

$$V_0 = 0.7 + I_D R_2 - 5.0$$

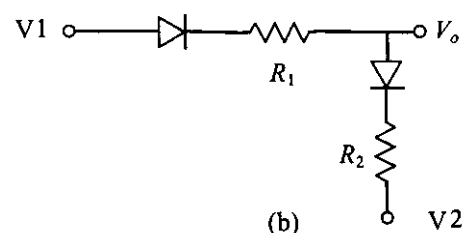
$$V_0 = 0.7 + 0.00338 \times 3300 - 5.0 = 0.7 + 11.2 - 5.0 = 6.9 \text{ V}$$



### Exercise

Calculate  $V_0$  for  $V_1 = +10 \text{ V}$     $V_2 = -5 \text{ V}$   
 $R_1 = 1100 \Omega$     $R_2 = 2200 \Omega$

Answer:  $I_D = 4.1 \text{ mA}$     $V_0 = 4.8 \text{ V}$



## Diode Circuits - continued

**Example** (Refer to the Diode Circuit Lecture Notes)

Calculate the Current  $I_D$

1. Remove Diode (Replace by  $V_{TH}$ )

For Voltage Divider  $V_{TH} = V [ R_2 / (R_1 + R_2) ]$

$$V_{TH} = 16 [ 4700 / (5100 + 4700) ] = 7.67 \text{ V}$$

2. Short  $V_{source}$  ( $R_1$  in parallel with  $R_2$ )

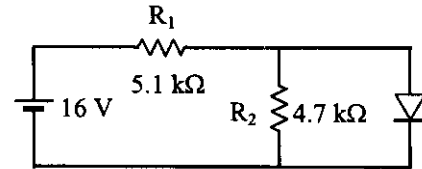
$$R_{EQ} = (R_1 \times R_2) / (R_1 + R_2)$$

$$R_{EQ} = (5100 \times 4700) / (5100 + 4700) = 2446 \Omega$$

3. Redraw with  $V_{TH}$ ,  $R_{EQ}$ , Diode

$$V_{TH} = I_D R_{EQ} + V_D \quad I_D = (V_{TH} - V_D) / R_{EQ}$$

$$I_D = (7.67 - 0.7) / 2446 = 2.85 \text{ mA}$$



### Alternative Solution Method

$$V_{R2} = V_D = 0.7 \text{ V}$$

$$I_{R2} = V_{R2} / R_2 = 0.7 / 4700 = 0.15 \text{ mA}$$

$$I_{R1} = (V - V_{R2}) / R_1 = (16.0 - 0.7) / 5100 = 3.0 \text{ mA}$$

$$I_{Total} = I_{R1}$$

$$I_D = I_{Total} - I_{R2} = 3.00 - 0.15 = 2.85 \text{ mA}$$

### Exercise

Calculate the Current  $I_D$

Answer:  $I_D = 4.9 \text{ mA}$     $V_D = 0.7 \text{ V}$

