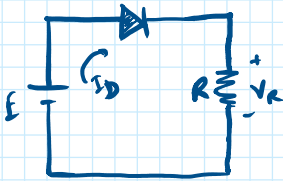


6. Series, Parallel, Series - Parallel Diode Configuration

14 September 2023 08:24

SERIES DIODE CONFIGURATION WITH A RESISTOR

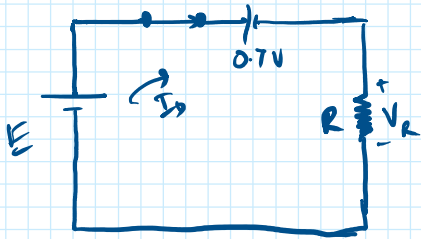
Forward bias



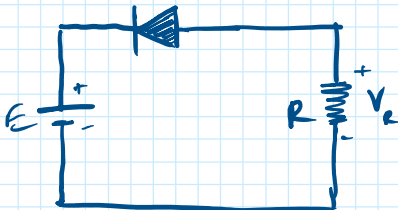
$$V_R = E - 0.7 \text{ (for Si diode)}$$

$$V_R = E - V_{knee}$$

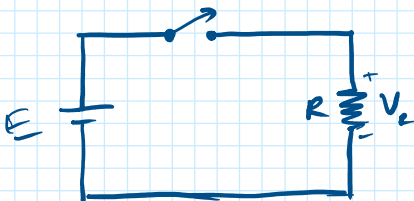
$$I_D = \frac{V_R}{R}$$



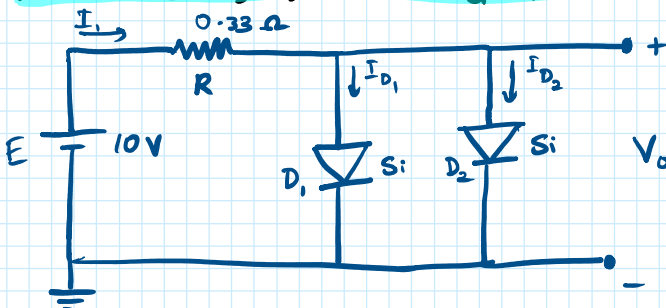
Reverse bias



$$I_D = 0$$



PARALLEL DIODE CONFIGURATION WITH A RESISTOR



NOTE:

Voltage drop across all diodes in parallel is the same; current is divided

$$I_1 = I_{D1} + I_{D2}$$

$$V_o = 0.7 \text{ V} \quad \left\{ \text{silicon diode voltage drop} \right.$$

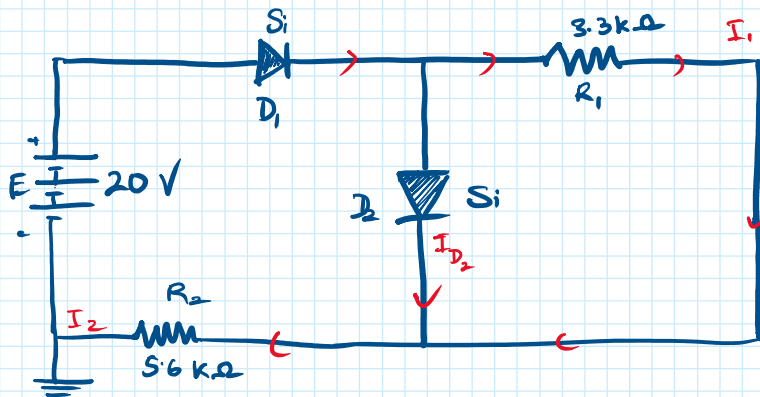
$$I_1 = \frac{V_R}{R} = \frac{10 - 0.7}{0.33 \times 10^3} = \frac{9.3}{0.33 \times 10^3} = 28.18 \times 10^{-3} \text{ A}$$

$$I_1 = \frac{V_z}{R} = \frac{10 - 0.7}{0.33 \times 10^3} = \frac{9.3}{0.33 \times 10^3} = 28.18 \times 10^{-3} \text{ A}$$

$$I_{D_1} = I_{D_2} = \frac{I_1}{2} = \frac{28.18 \times 10^{-3}}{2} = 14.09 \times 10^{-3} \text{ A}$$

identical diodes

SERIES-PARALLEL DIODE CONFIGURATION



Hint: Note that both diodes are forward biased.

$$20 - 0.7 - 0.7 - 5.6(I_2) = 0$$

$$-5.6I_2 = -20 + 0.7 + 0.7$$

$$I_2 = 3.321 \times 10^{-3} \text{ A}$$

$$I_1 = \frac{V_{D_1}}{R_1} = \frac{0.7}{3.3 \times 10^3} = 0.212 \times 10^{-3} \text{ A}$$

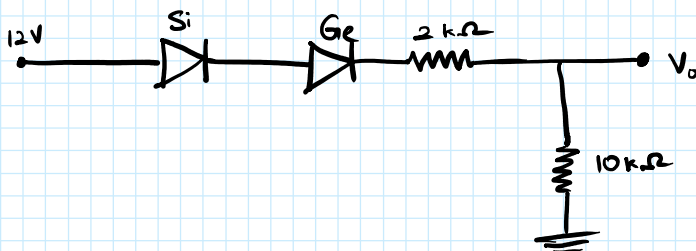
$$I_2 = I_1 + I_{D_2}$$

$$3.321 \times 10^{-3} = 0.212 \times 10^{-3} + I_{D_2}$$

$$I_{D_2} = 3.109 \times 10^{-3} \text{ A}$$

PROBLEMS

Q: Determine the level of \$V_o\$

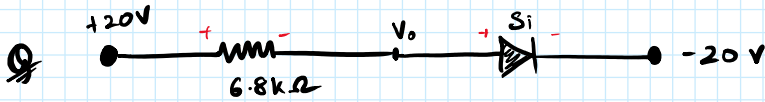


Soln

$$12 - 0.7 - 0.3 - 2 \times 10^3(I) - 10 \times 10^3(I) = 0$$

$$-12 \times 10^3(I) = -11$$

$$I = 0.916 \times 10^{-3}$$



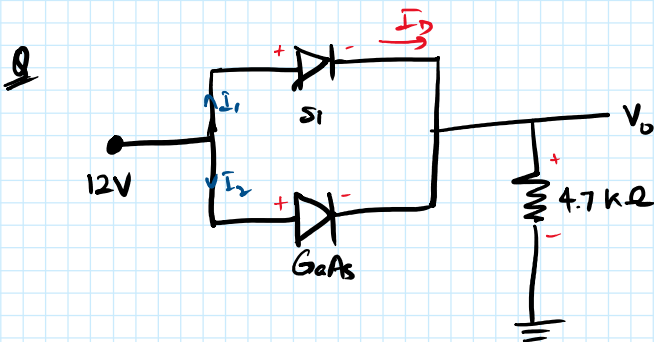
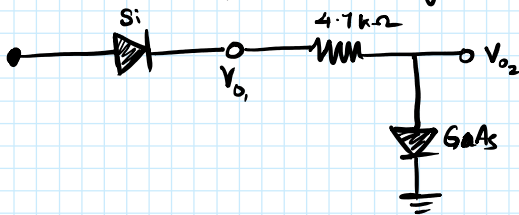
$$40 - 6.8kI - 0.7 = 0$$

$$I = \frac{39.3}{6.8 \times 10^3} = 5.78 \text{ mA}$$

$$V_o = 20 - 6.8(5.78 \times 10^{-3})$$

$$= 20 - (39.304 \times 10^{-3}) = 20 - 0.0393 = \underline{\underline{19.961 \text{ V}}}$$

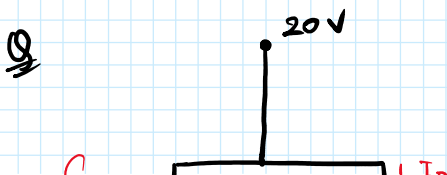
Q. Determine V_{o1} and V_{o2} for the networks

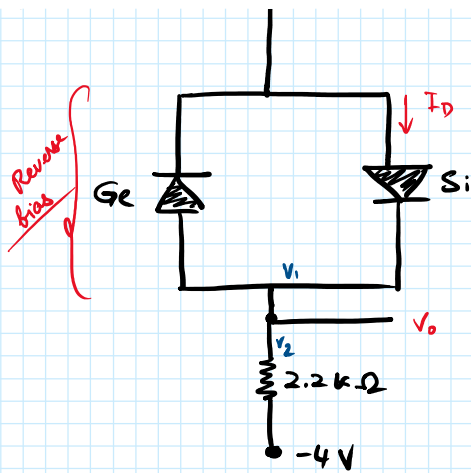


$$V_o = 12 - 0.7 = 11.3 \text{ V}$$

$$12 - 0.7 - 4.7(I) = 0$$

$$I = \frac{11.3}{4.7 \times 10^3} = \underline{\underline{2.404 \times 10^{-3} \text{ A}}}$$





$$20 - 0.7 - 2.2k(I) - 4 = 0$$

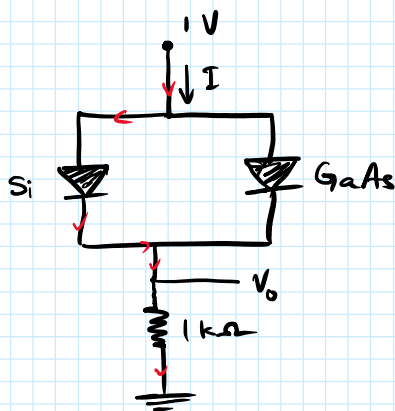
$$-2.2k I = -15.3$$

$$I = \frac{15.3}{2.2k} = 6.945 \times 10^{-3} \text{ A}$$

$$V_o = 20 - 0.7 = 19.3 \text{ V}$$

$$I_D = \frac{20 - (-4) - 0.7}{2.2k} = \frac{24 - 0.7}{2.2 \times 10^3} = \underline{\underline{10.59 \times 10^{-3} \text{ A}}}$$

Q $I, V_o = ?$



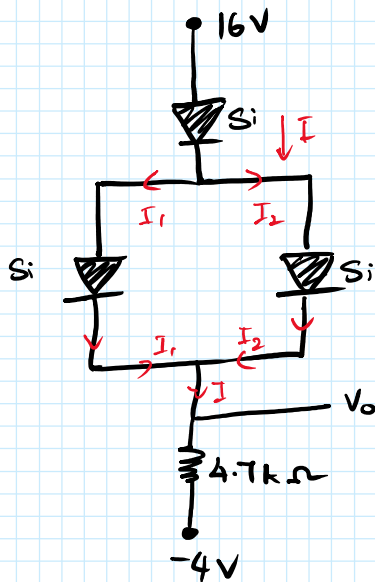
$$V_o = 1 - 0.7 = \underline{\underline{0.3 \text{ V}}}$$

$$1 - 0.7 - 10^3 I = 0$$

$$I = 0.3 \times 10^{-3} \text{ A}$$

$$= \underline{\underline{0.3 \text{ mA}}}$$

Q



$$V_o = 16 - 0.7 - 0.7 = \underline{\underline{14.6 \text{ V}}}$$

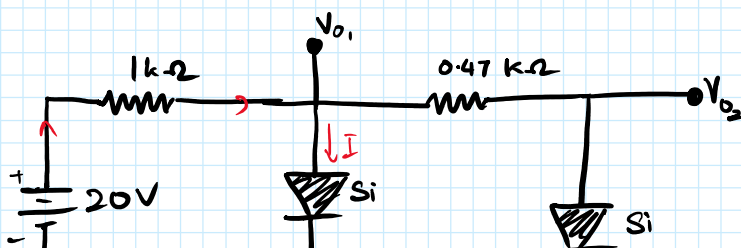
$$20 - 0.7 - 0.7 - 4.7k(I) = 0$$

$$I = \frac{18.6}{4.7 \times 10^3}$$

$$= \underline{\underline{3.957 \text{ mA}}}$$

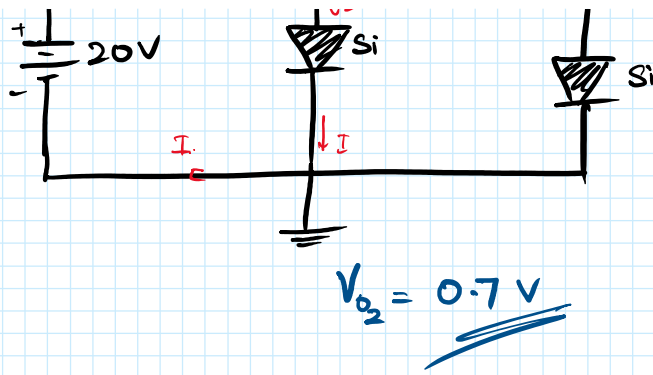
$$I_1 = I_2 = \underline{\underline{1.978 \text{ mA}}}$$

Q



$$20 - 1kI - 0.7 = 0$$

$$I = \underline{\underline{19.3 \text{ mA}}}$$



$$I = \underline{\underline{19.3 \text{ mA}}}$$

$$V_{o1} = 20 - 10^3 (19.3 \times 10^{-3})$$

$$= \underline{\underline{0.7 \text{ V}}}$$