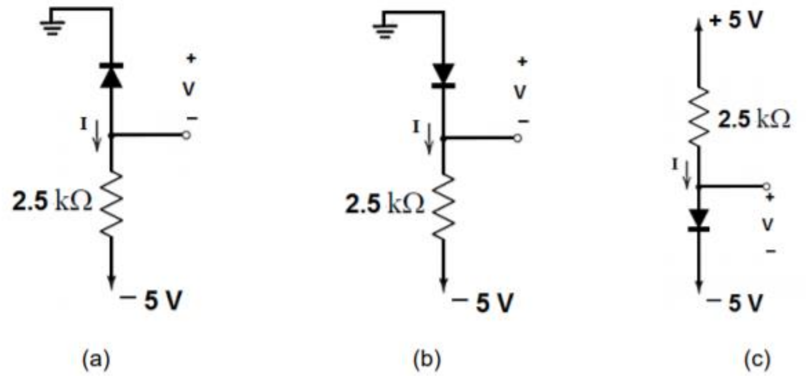
19EEE114 Electronic Circuits

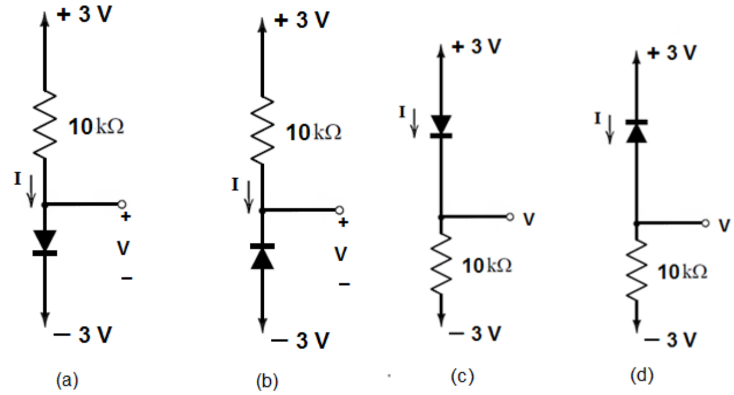
Assignment #1 **SOLUTION**

Q1. Find the values of I and V in the circuits shown below. Assume diodes to be ideal.



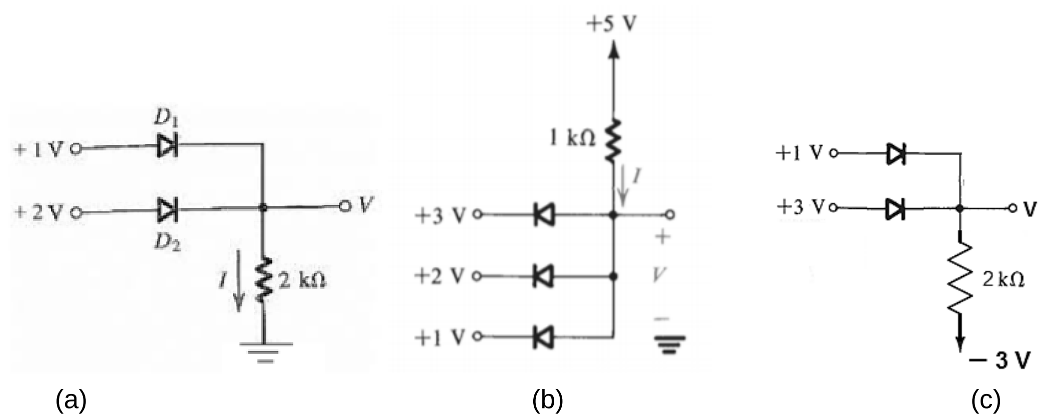
[Ans: (a) 0 mA, 5 V; (b) 2 mA, 0 V; (c) 4 mA, - 5 V]

Q2. For the circuits shown using ideal diodes find the values of voltage and current.



[Ans: (a) - 3V, 0.6mA; (b) 3V, 0 mA; (c) 3V, 0.6mA; (d) - 3V, 0 mA]

Q3. Determine I and V. Assume diodes to be ideal.



[Ans: (a) 1 mA, 2 V; (b) 4 mA, 1 V; (c) 3 V, 3 mA]

Q4. Consider a silicon diode with $\eta = 1.5$. Find the change in voltage if the current changes from 0.1 mA to 10 mA. **[Ans:172.5 mV]**

Q5. A silicon junction diode with $\eta=1$ has v =0.7 V at i =1mA. Find the voltage drop at i =0.1mA. **[Ans: 0.64]**

Q6. Find the value of the diode small-signal resistance r_d at bias current of 10 mA. Assume $\eta=1$. **[Ans: 2.5 Ω]**

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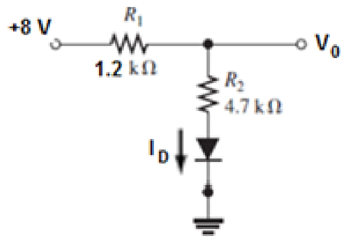
Assignment #1

SOLUTION

Q7. Determine I_D and V_0 for the following circuit.

(a)



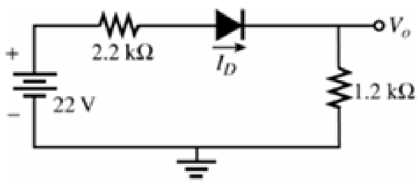
Sol:

Diode forward-biased,

$$I_D = \frac{8\text{ V} - 0.7\text{ V}}{1.2\text{ k}\Omega + 4.7\text{ k}\Omega} = \mathbf{1.24\text{ mA}}$$

$$V_o = V_{4.7\text{ k}\Omega} + V_D = (1.24\text{ mA})(4.7\text{ k}\Omega) + 0.7\text{ V} = \mathbf{6.53\text{ V}}$$

(b)



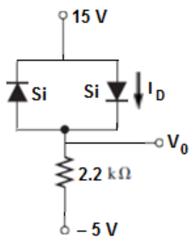
Sol:

Diode forward-biased

$$I_D = \frac{22\text{ V} - 0.7\text{ V}}{2.2\text{ k}\Omega + 1.2\text{ k}\Omega} = \mathbf{6.26\text{ mA}}$$

$$V_o = I_D(1.2\text{ k}\Omega) = (6.26\text{ mA})(1.2\text{ k}\Omega) = \mathbf{7.51\text{ V}}$$

(c)



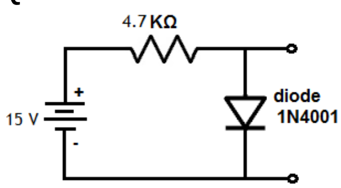
Sol:

Right diode forward-biased:

$$I_D = \frac{15\text{ V} + 5\text{ V} - 0.7\text{ V}}{2.2\text{ k}\Omega} = \mathbf{8.77\text{ mA}}$$

$$V_o = 15\text{ V} - 0.7\text{ V} = \mathbf{14.3\text{ V}}$$

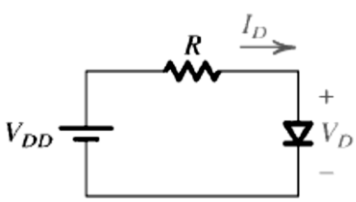
Q8. A silicon diode is used in the circuit as shown. Calculate the diode current.



Sol:

$V = I_DR + V_D \Rightarrow I_D = (15-0.7)/4.7 = 3.04$ mA

Q9. Determine the current I_D and the diode voltage V_D for the circuit shown with $V_{DD} = 5$ V and $R = 1$ kΩ. Assume that the diode has a current of 1 mA at a voltage of 0.7 V.



Sol:

assume that $V_D = 0.7$ V

$$I_D = \frac{V_{DD} - V_D}{R} = \frac{5 - 0.7}{1} = 4.3\text{ mA}$$

$$V_2 - V_1 = 2.3 V_T \log\frac{I_2}{I_1}$$

$$V_2 = V_1 + 0.06 \log\frac{I_2}{I_1}$$

Substituting $V_1 = 0.7$ V, $I_1 = 1$ mA, and $I_2 = 4.3$ mA results in $V_2 = 0.738$ V.