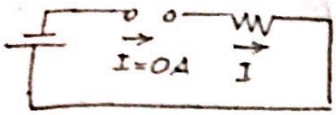
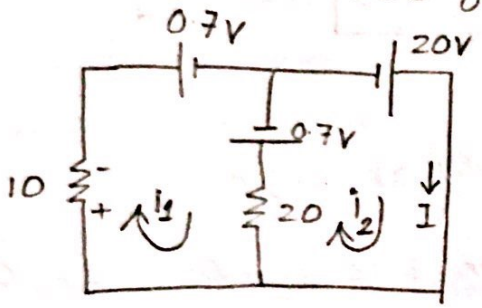
Chapter 2
Solution

5(a) Diode OFF (Reverse-biased)



As Diode OFF, $I = \boxed{0A}$

5(b) Both Diode ON (Forward-biased)



i_1 & i_2 ⇒ Mesh current.

KVL at Mesh 1, $10i_1 + 0.7V - 0.7V + 20(i_1 - i_2) = 0.$

$30i_1 - 20i_2 = 0. \quad \therefore i_1 = \frac{2}{3} i_2$

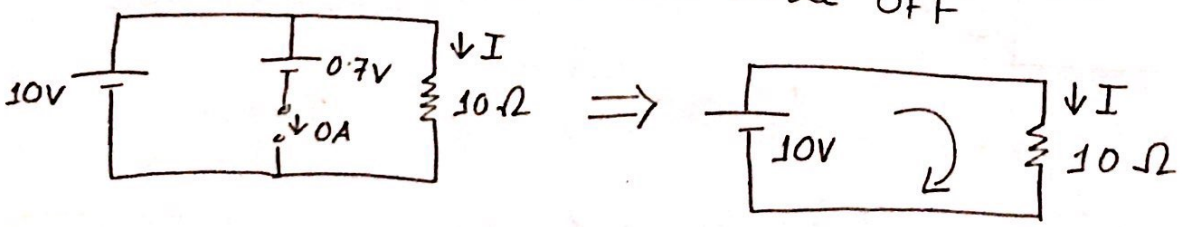
KVL at Mesh 2, $-20V + 20(i_2 - i_1) + 0.7V = 0.$

$20i_2 - 20i_1 = 19.3 \Rightarrow 20i_2 - 20 \times \frac{2}{3} i_2 = 19.3$

$\therefore i_2 = 2.895A \quad \therefore i_1 = \frac{2}{3} \times 2.895 = 1.93A.$

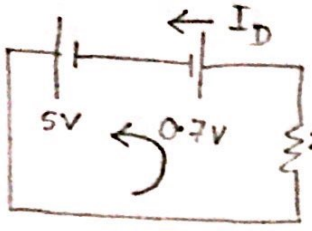
We can see from mesh 2, $I = i_2 = \boxed{2.895A}$

5(c) Top diode ON ; Bottom diode OFF



KVL ⇒ $-10V + 10 \times I = 0. \quad \therefore I = \frac{10}{10} = \boxed{1A}$

6(a) Diode ON.



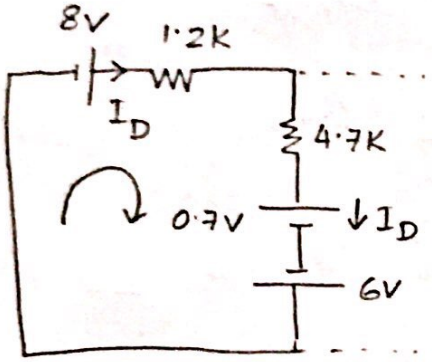
KVL, $-V_o + 0.7V - 5V = 0.$

$V_o = \boxed{-4.3\,V}$

Ohm's Law, $I_D = -\frac{V_o}{R}$, [(−) because I_D leaving (+)ve of resistor]

$I_D = -\frac{-4.3\,V}{2.2k\Omega} = \boxed{+1.955mA}$

6(b) Diode ON



KVL (clock-wise) at left

$-8V + (1.2k)I_D + (4.7k)I_D + 0.7V - 6V = 0.$

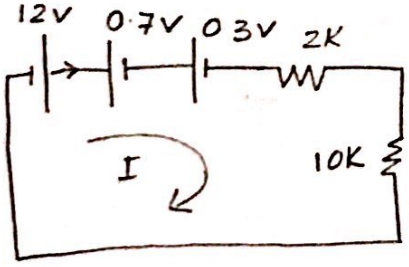
$I_D = \frac{8+6-0.7}{1.2K+4.7K} = \boxed{2.25\,mA}$

KVL (clock-wise) again

$-8V + (1.2k)I_D + V_o = 0.$

$\therefore V_o = 8V - (1.2k)\times(2.25mA) = \boxed{5.3V}$

7(a) Both Diode ON.



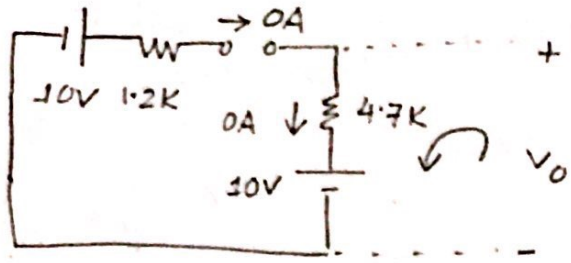
KVL (clock-wise)

$-12V + 0.7V + 0.3V + (2K)I + (10K)I = 0.$

$I = \frac{12V - 1V}{2K + 10K} = .916mA.$

Ohm's Law, $V_o = +I \times 10K = 0.916mA \times 10K\Omega = \boxed{9.16\,V}$

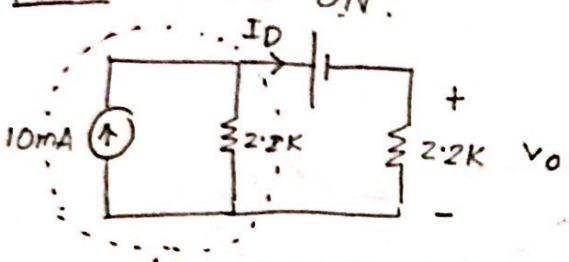
7(b) Silicon Diode OFF



KVL, $-V_o + (0A \times 4{\cdot}7K) + 10V = 0.$

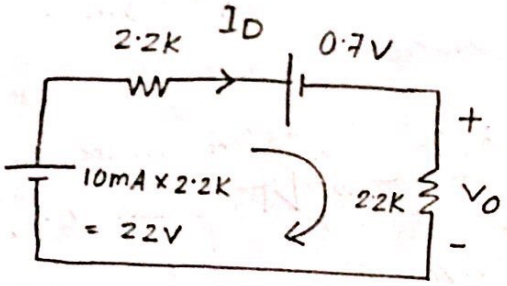
$\therefore V_o = \boxed{10V}$

8(a) Diode ON.



↳ Source Transformation

$\Rightarrow$

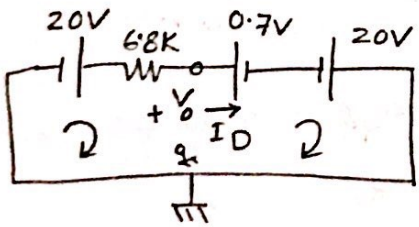


KVL at clock-wise, $-22V + (2{\cdot}2k)I_D + 0{\cdot}7V + (2{\cdot}2k)I_D = 0.$

$\therefore I_D = \dfrac{22V - 0{\cdot}7V}{2{\cdot}2K + 2{\cdot}2K} = \boxed{4{\cdot}84A}$

Ohm's Law, $V_o = +I_D \times 2{\cdot}2K = \boxed{10{\cdot}65V}$

8(b) Diode ON



KVL clock-wise, $-20V + (6{\cdot}8K)I_D + 0{\cdot}7V - 20V = 0$

$I_D = \dfrac{40V - 0{\cdot}7V}{6{\cdot}8K} = \boxed{5{\cdot}78\ mA}$

KVL at left, $-20V + 6{\cdot}8K \times I_D + V_o = 0.$

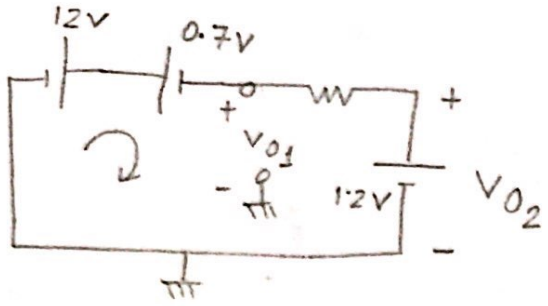
$\therefore V_o = 20V - 6{\cdot}8K \times 5{\cdot}78mA = -19{\cdot}3V$

KVL at right,

$-V_o + 0{\cdot}7 - 20V = 0.$

$V_o = \boxed{-19{\cdot}3V}$

9(a) Both Diode ON.

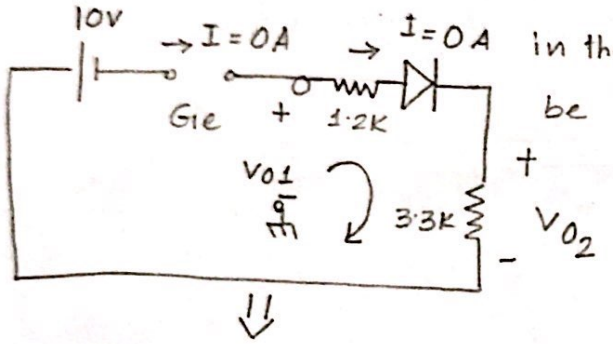


KVL at left, $-12V + 0.7V + V_{O1} = 0$.

$V_{O1} = 12V - 0.7V = \boxed{11.3V}$

$V_{O_2} = \boxed{1.2V}$

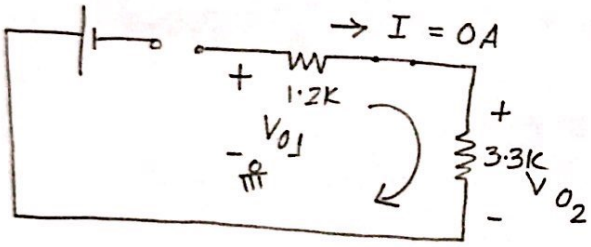
9(b) Gie Diode OFF.



in the Si Diode. As $I_{Si} = 0A$, V_{Si} will be 0V. So, it is short.

$V_{O_2} = I \times 3.3k\Omega = 0 \times 3.3k\Omega$

$= \boxed{0V}$

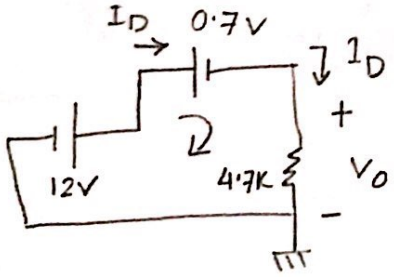


KVL at clock-wise,

$-V_{O1} + (1.2k) \times 0A + 3.3k \times 0A = 0$.

$V_{O1} = \boxed{0V}$

10(a) GaAs OFF, Si ON. As Voltage should be same in Parallel ckt.

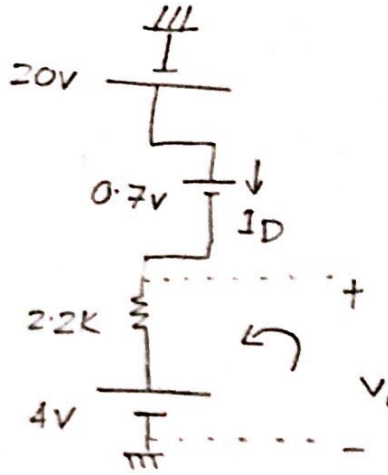


KVL, $-12V + 0.7V + V_O = 0$.

$V_O = \boxed{11.3V}$

$I_D = + \frac{V_O}{4.7K} = \boxed{2.404\ mA}$

10(b) Si Diode ON ; Ge OFF



KVL, $-20V + 0.7V + I_D \times 2.2K + 4V = 0.$

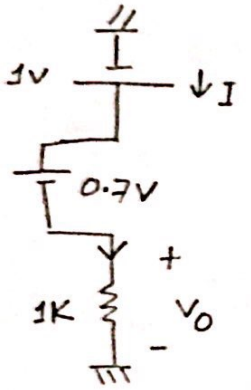
$$I_D = \frac{20V - 4V - 0.7V}{2.2K} = \boxed{6.9545mA}$$

V_o KVL, $-20V + 0.7V + V_o = 0.$ **OR** $-V_o + 2.2K \times I_D + 4V = 0$

$$\boxed{V_o = 19.3V}$$

$$\therefore V_o = \boxed{19.3\,V}$$

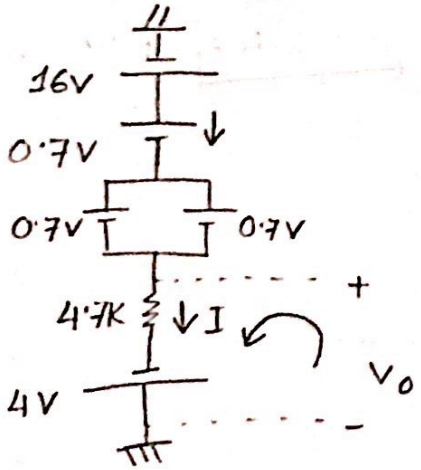
11(a) Si Diode ON ; GaAs OFF



KVL, $-1V + 0.7V + V_o = 0.$ $\therefore V_o = \boxed{0.3V}$

Ohm's Law, $V_o = +\ 1K \times I \Rightarrow I = \frac{0.3V}{1k\Omega} = \boxed{0.3mA}$

11(b) All the Diode ON.



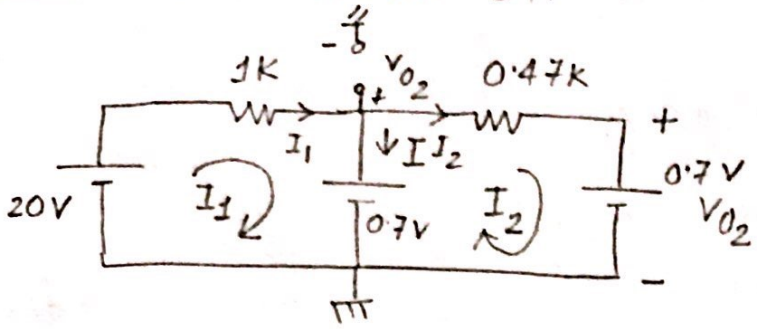
KVL, $-16V + 0.7V + 0.7V + V_o = 0$

$$V_o = \boxed{14.6V}$$

KVL inside, $-V_o + I \times 4.7K - 4V = 0.$ (V_o = 14.6V)

$$I = \frac{14.6V + 4V}{4.7K} = \boxed{3.96\,mA}$$

12 Both Diode ON



$V_{O_1} = \boxed{0.7V}$ [(+)ve of V_{O_1} connected to (+) of 0.7V
(−) of V_{O_1} & (−) of 0.7V both Ground]

$V_{O_2} = \boxed{0.7V}$

I_1 & I_2 mesh current.

Mesh 1 : $-20V + I_1 \times 1K + 0.7V = 0.$ $\therefore I_1 = 19.3\,mA$

Mesh 2 : $-0.7V + (0.47k) \times I_2 + 0.7V = 0.$ $\therefore I_2 = 0\,mA.$

KCL $\Rightarrow$ $I_1 = I + I_2 \Rightarrow I_1 = I$. $\therefore I = \boxed{19.3\,mA}$