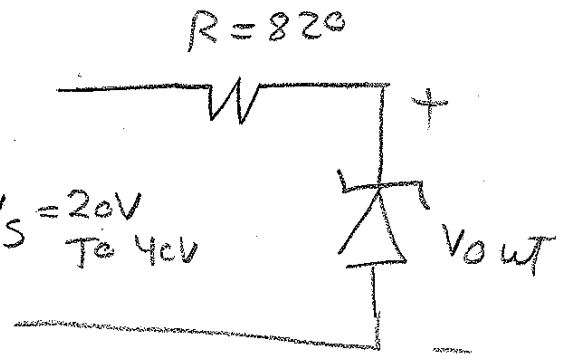
problem [1]

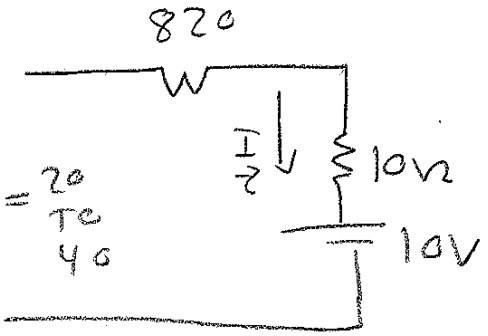
$V_z = 10V \quad r_z = 10\Omega$

Required
I_z @ $V_{s_{max}}$, $V_{s_{min}}$



$V_s = 20V > V_z \rightarrow$ diode in break down

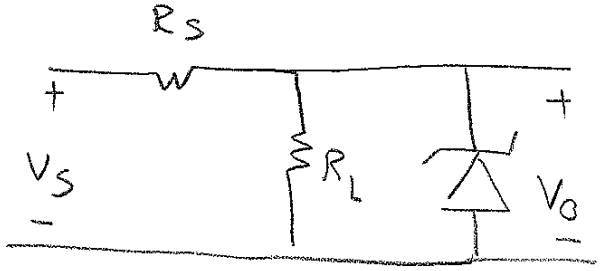
$$I_z = \frac{20 - 10}{820 + 10} = 11.9\,mA$$



$V_s = 40 > V_z \rightarrow$ diode in break down

$$I_z = \frac{40 - 10}{820 + 10} = 35.7\,mA$$

problem [2]

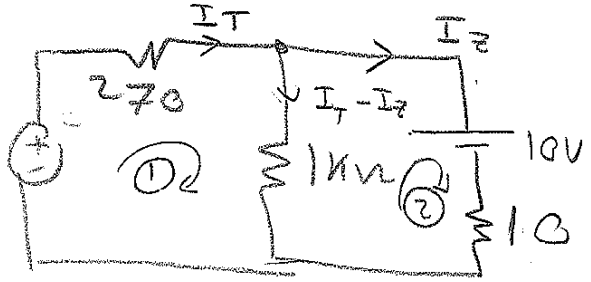


Given = $V_s = 18V$, $V_z = 10V$
$r_z = 10\Omega$, $R_s = 270\Omega$
$R_L = 1k\Omega$
Required = Is zener work in break down region & what is the value of zener current

Diode off

$$V_o = \frac{18 \times 1k}{1k + 270} = 14.17 > V_z$$

$\Rightarrow$ zener work in break down



loop ①

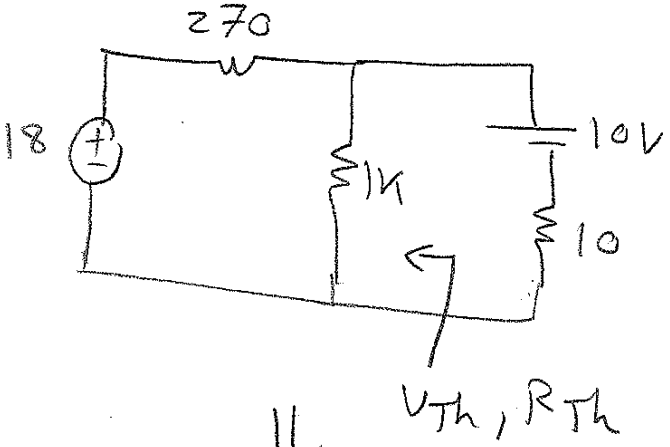
$$-18 + 270\,I_T + (I_T - I_z)\,1k = 0$$

loop ②

$$-1k(I_T - I_z) + 10 + 10\,I_z = 0$$

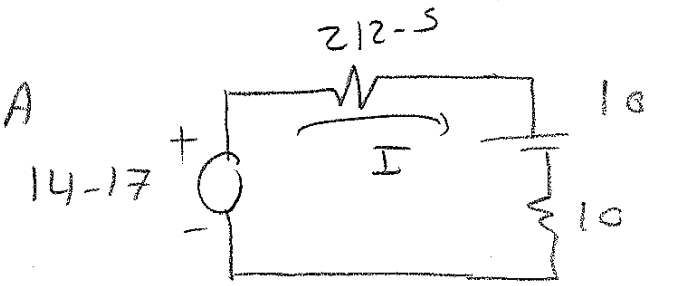
$I_T = 0.0289$ $\quad I_Z = 18.75\,mA$

another sol



$R_{Th} = 1K \,//\, 270$
$= 212.5\,\Omega$

$V_{Th} = \dfrac{18 \times 1K}{1K + 270} = 14.17\,V$



$I = \dfrac{14.17 - 10}{212.5 + 10} = 18.75\,mA$

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problem 3

Given: $V_{Z_0} = 6.7$, $r_Z = 20\Omega$

$I_{Z_{min}} = 0.2mA$, The Source voltage $V_S = 10$

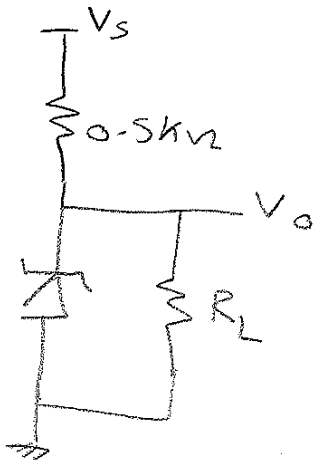
Required:

1- V_o at $R_L = \infty$

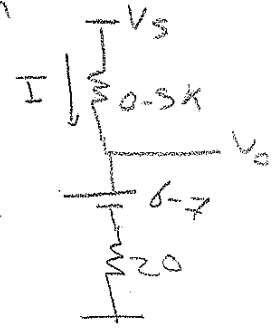
2- V_o at $R_L = 2K\Omega$

3- V_o at $R_L = 0.5K\Omega$

4- min R_L for which zener diode STILL operates in the breakdown



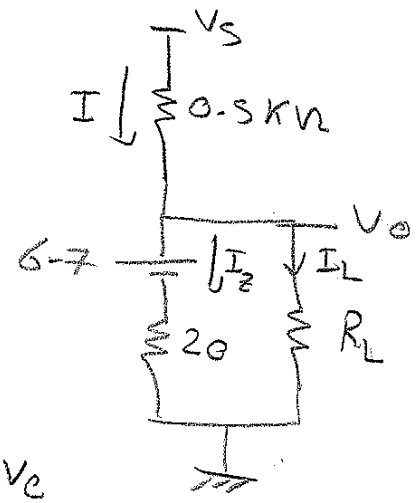
Sol = at $R_L = \infty$, assume zener in the break down



$V_o = 6.7 + 20\,I$, $\quad I = \dfrac{10 - 6.7}{0.5K + 20} = 6.346m > I_{Z_{min}}$ breakdown

$V_o = 6.8\,V$

a) $R_L = 2k\Omega$



assume zener breakdown

$V_o = R_L I_L$, $I = I_L + I_z = \frac{10 - V_o}{0.5k\Omega}$

$I_z = \frac{V_o - 6.7}{20}$

① $\Leftarrow \frac{10 - V_o}{0.5k\Omega} = \frac{V_o - 6.7}{20} + \frac{V_o}{(R_L)}$ → get V_o

R_L = 2k

$V_o = 6.76$ ✓

$I_z = 3.1\,mA > I_{z_{min}} \Rightarrow$ break down ✓

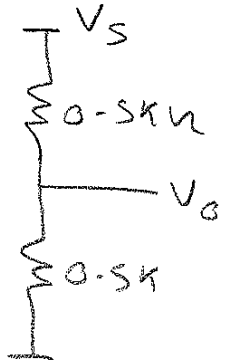
a) $R = 0.5k\Omega$

Subs in (1) with new value of R_L assuming zener in break down

$V_o = 6.57$, $I_z = -6.3\,mA < I_{zmin}$

diode is off

$V_o = \frac{10 \times 0.5k}{1k} = 5V$



d) For min R_L, I_{zmin} is Required to make diode in break down

$V_{omin} = I_L R_L = V_{z_o} + I_{z_{min}} r_z$

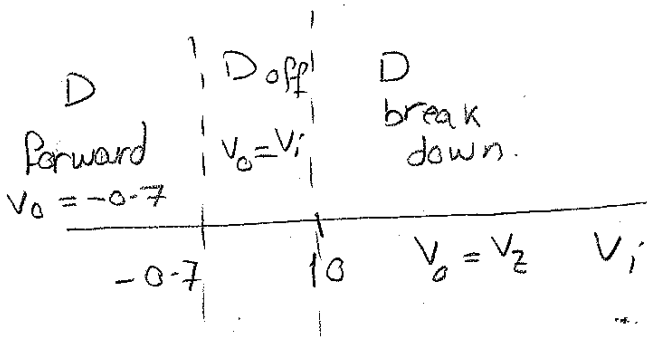
$= 6.7 + 0.2m \times 20 = 6.704$

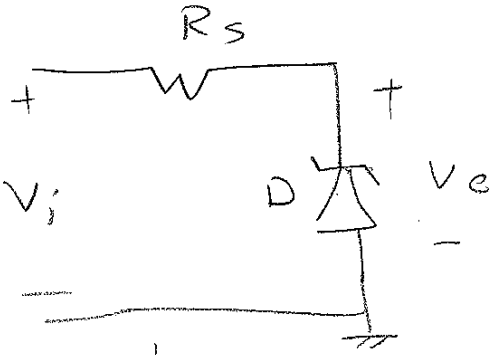
$I_L = I - I_{z_{min}} = \frac{10 - V_{omin}}{0.5k} - 0.2m = 6.39\,mA$

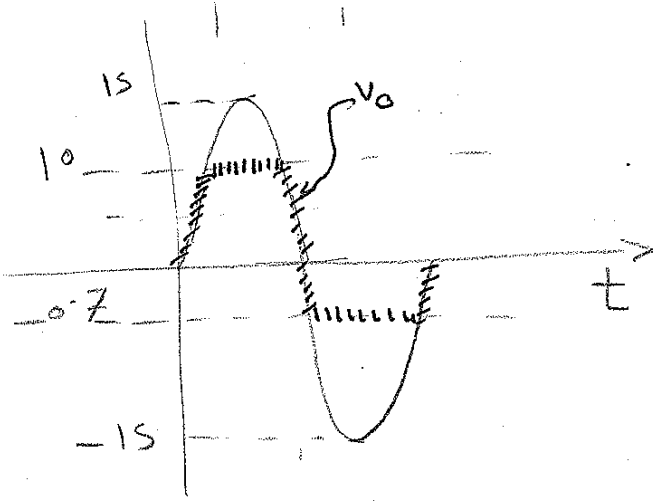
$R_{L_{min}} = \frac{6.704}{6.39m} = 1.048k\Omega$

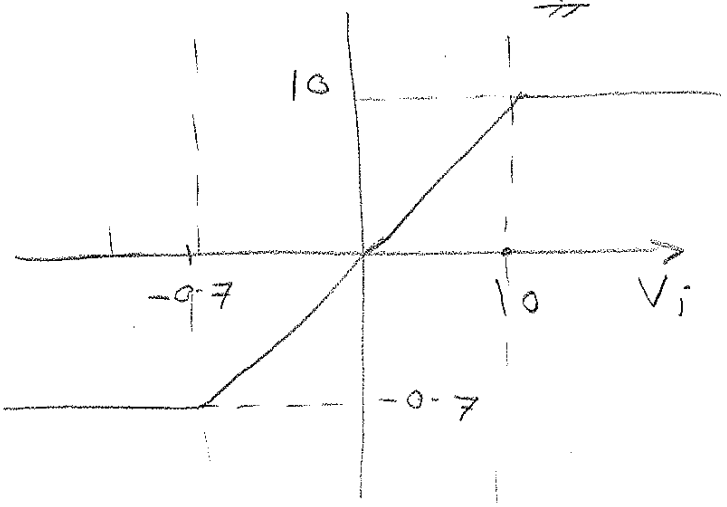
Problem [4]

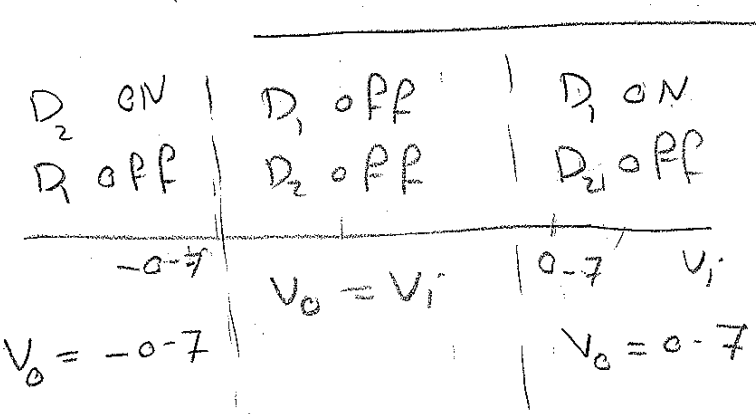
Find V_o as fn in V_i, Draw V_o Vs V_i, sketch time dependent o/p signal for each of the three cases given = $V_i = 15 \sin \omega T$, $V_z = 10$, $V_{th} = 0.7$

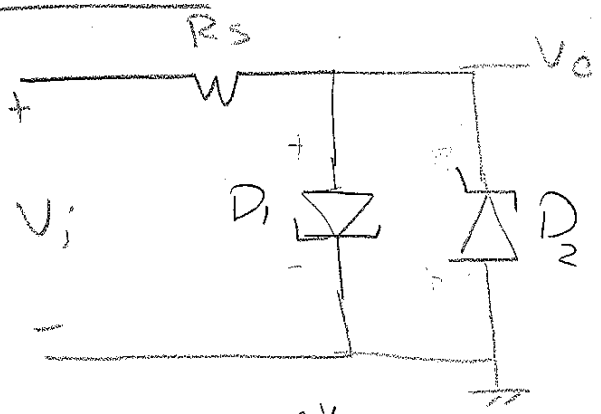


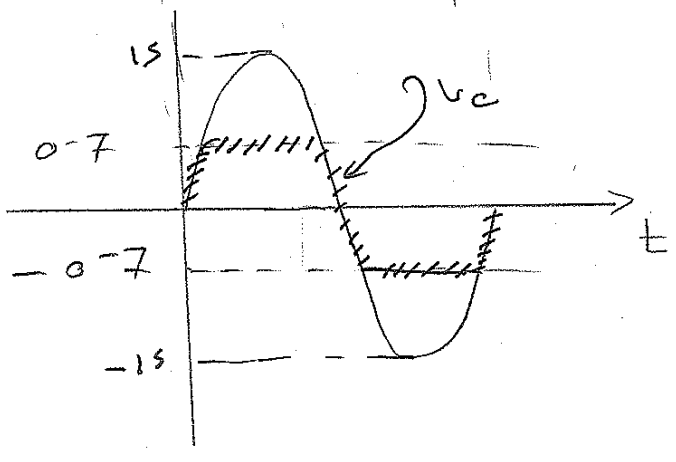


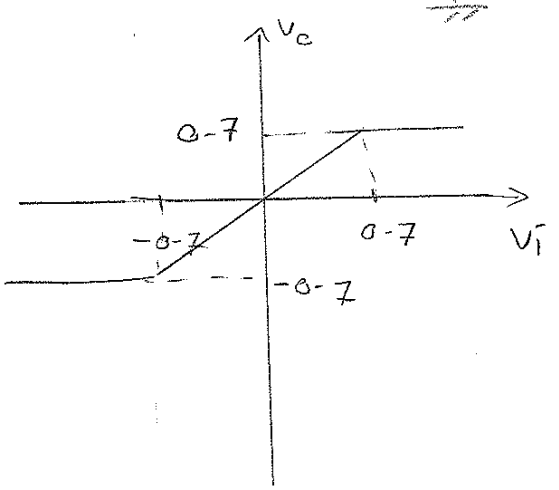












D_2 breakdown, D_1 forward	D_1 off, D_2 off	D_1 breakdown, D_2 off
-10^{-7}	$V_o = V_i$	10^{-7} V_i
$V_o = -10^{-7}$		$V_o = 10^{-7}$