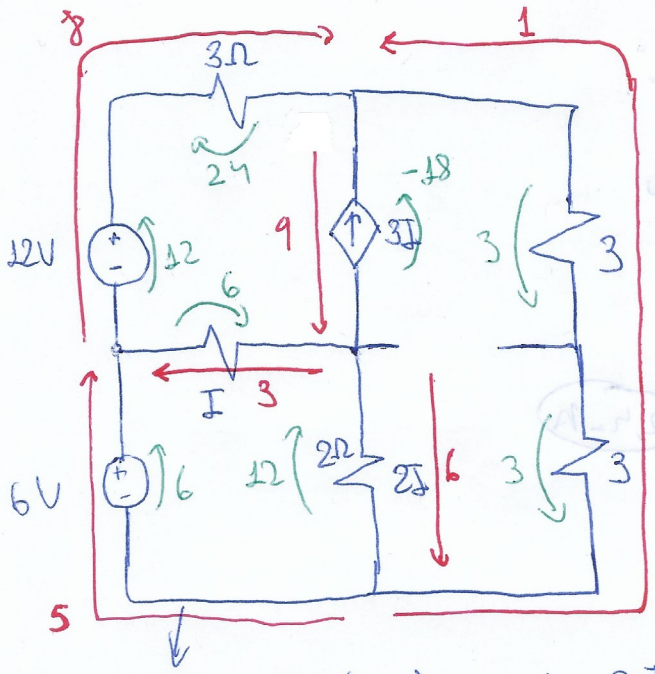


$18 = 3I_1 + (3+3)(3I + I_1)$

$18 = 3I_1 + 6(-9 + I_1)$

$\downarrow$

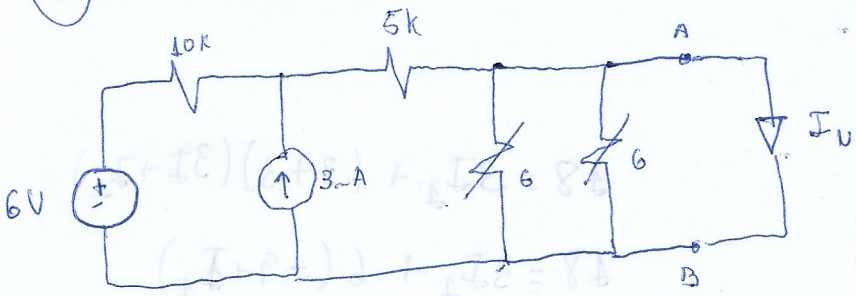
$I_1 = 72/9 = 8A$

$6 = 2I - 2\cdot(2I) \rightarrow 6 = -2I$

$I = -3A$

12V: $12 \cdot 8 = 96W$	Genera	288W	
6V: $6 \cdot 5 = 30W$	Genera		
$3I: (-18)\cdot(-9) = 162W$	Genera		
$3\Omega\uparrow: 3 \cdot 8^2 = 192W$	Consume	288W	0
$2\Omega\uparrow: 2 \cdot 3^2 = 18W$	Consume		
$2\Omega\downarrow: 2 \cdot 6^2 = 72W$	Consume		
3Ω / 3Ω: $3 \cdot 1^2 = 3W$	Consume		
	$3W$ Consume		

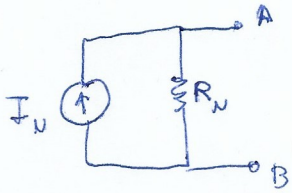
3



a)

$$6 = 10(I_N - 3) + 5I_N \rightarrow I_N = \frac{36}{15} = 2{,}4\,mA$$

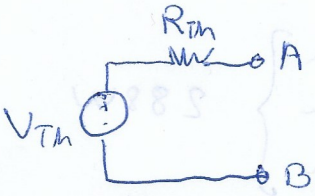
$$R_N = 6 \parallel 6 \parallel 15 = 3 \parallel 15 = 2{,}5\,K$$



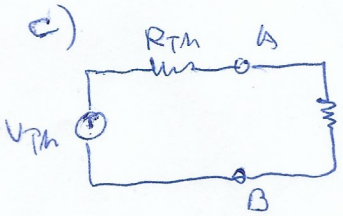
b)

$$V_{Th} = I_N \cdot R_N = 6V$$

$$R_{Th} = R_N = 2{,}5\,K$$



c)



$$I = \frac{V_{Th}}{R_{Th} + R}$$

$$P = R \cdot I^2 = R \cdot \frac{V_{Th}^2}{(R_{Th} + R)^2}$$

$$2 = R \cdot \frac{3{,}6}{(2{,}5 \cdot R)^2}$$

$$2(6{,}25 + 5R + R^2) = 36R$$

$$2R^2 + 10R - 36R + 12{,}50 = 0$$

$$2R^2 - 26R + 12{,}50 = 0$$

$$R = \begin{cases} 0{,}5\,K \\ 12{,}5\,K \end{cases}$$

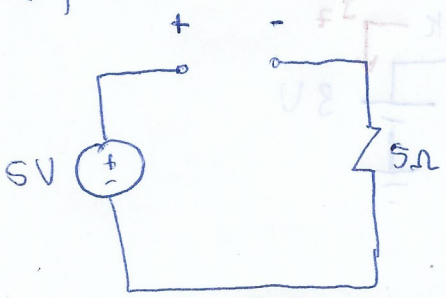
No es max porque

$$R \neq R_{Th}$$

$$P_{max} = \frac{V_{Th}^2}{4R_{Th}} = \frac{36}{4 \cdot 2{,}5} = 3{,}6\,mW$$

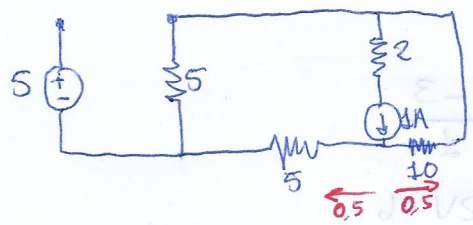
(4)

a)



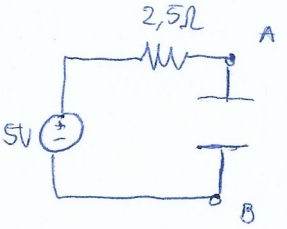
$V_c = 5V$

b)



$V_{AB} = V_{TH} = 7,5V$

$R_{AB} = 3,75\,\Omega$



$V_c(0^-) = 5V$

$V_c(0^+) = 5V$

$I_c(0^-) = 0A$

$I_c(0^+) = 667mA$

$V_c(\infty) = 5V$

$I_c(\infty) = 0A$

$E = 7,5V$

$V_c = 5V$

$R = 3,75\,\Omega$

$\tau = 3,75 \cdot 10^{-5}$

$$i_c(t) = \frac{E - V_c(0)}{R} e^{\frac{-t - t_0}{\tau}} \Rightarrow \frac{7,5-5}{3,75} = 667mA$$

c)

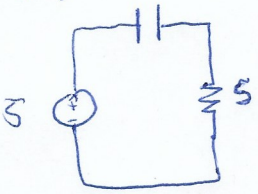
$V_c(0) = 5$
$V_c(\infty) = 7,5$
} $2,5V \xrightarrow[75\%]{} 1,875V + 5 = 6,875V$

$$6,875 = E - (E - V_c)\, e^{-t/\tau}$$

$$6,875 = 7,5 - (7,5-5)\, e^{-t/3,75 \cdot 10^{-5}}$$

$$t = 0,0519865$$

d)



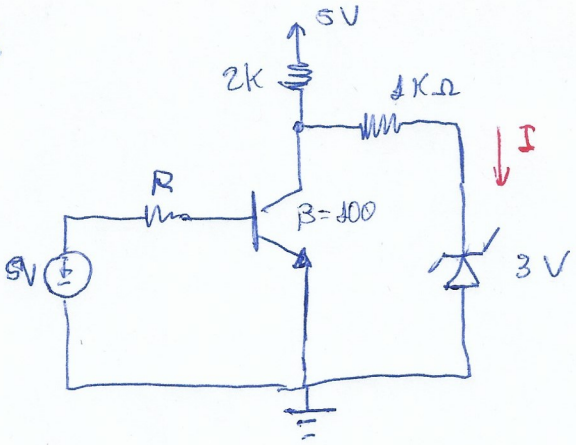
$V_c(0) = 7,5$
$V_c(\infty) = 5$
} $-2,5V \xrightarrow[75\%]{} -1,875V + 7,5 = 5,625$

$$5,625 = E - (E - V_c)\, e^{-t/\tau}$$

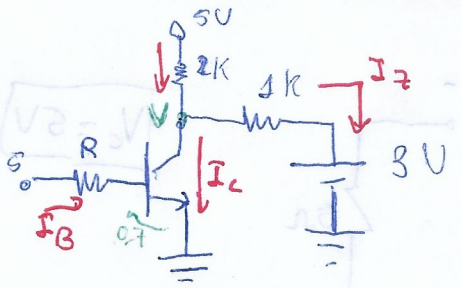
$$5,625 = 5 - (5 - 7,5)\, e^{-t/5 \cdot 10^{-3}}$$

$$t = 0,006938s$$

5



Z en Rup Trans Act



$$I_B = \frac{5-0,7}{R} \rightarrow I_C = \beta \cdot \frac{5-0,7}{R}$$

$$\frac{5-V}{2} = I_C + \frac{V-3}{1}$$

$$5 - V = 2I_C + 2V - 6$$

$$3V = 5 + 6 - 2I_C = 11 - 2 \cdot \beta \cdot \frac{4,3}{R}$$

$$V = \frac{11 - 2\beta \cdot \frac{4,3}{R}}{3}$$

$$I_Z = \frac{11 - 2\beta \cdot \frac{4,3}{R}}{3} - 3$$

$Z_z \rightarrow I_Z > 0 \rightarrow \frac{11 - 2\beta \cdot \frac{4,3}{R}}{3} > 3$

$$11 - 2\beta \cdot \frac{4,3}{R} > 9$$

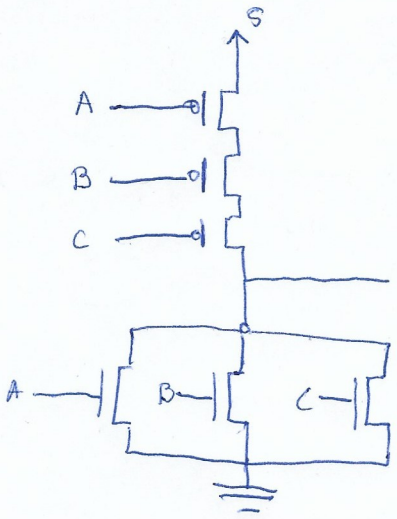
$$2\beta \frac{4,3}{R} < 2$$

$R > \beta \cdot 4,3 \rightarrow R > 430K \rightarrow$ Mmm

ZRUP

Trans Act $\rightarrow V_{CE} > 0 \rightarrow V_{CE} = V = \frac{11 - 2 \cdot 100 \cdot 4,3/430}{3} = 3V > 0$

(6) Familia CMOS



A	B	C	V
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0

NOR