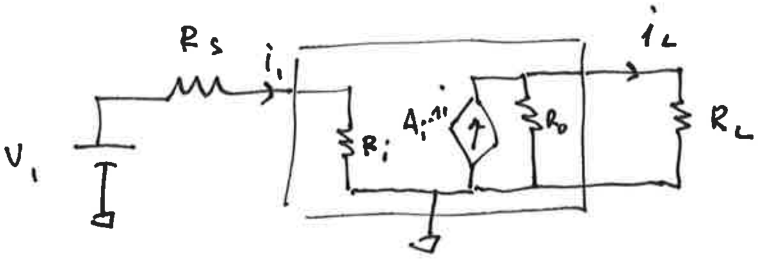
1)



← st. grening

a) $i_1 = \dfrac{v_1}{R_s + R_i}$; $i_L = A_i \cdot i_1 \cdot \dfrac{R_o}{R_o + R_L}$; $v_o = i_L \cdot R_L$

$$\Rightarrow \frac{V_o}{V_1} = A_i \cdot \frac{R_o \cdot R_L}{(R_o + R_L)(R_s + R_i)}$$

b) ideal: $R_o \to \infty$, $R_i \to 0$

$$\Rightarrow \frac{v_o}{V_1} = A_i \cdot \frac{R_L}{R_S}$$

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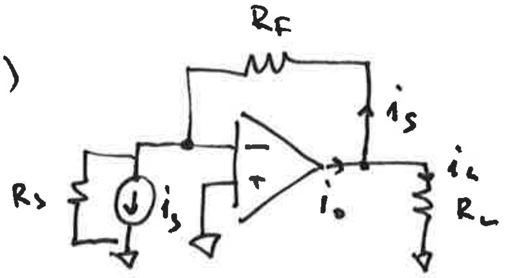
2) Vi behöver en $i \to v$ förstärkare.

a)



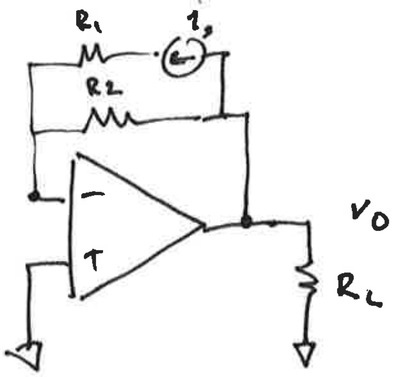
$v_o = + R_F \cdot i_s$ (om i_s enligt figur!)

$$\Rightarrow R_F = \frac{v_o}{i_s} = \frac{5}{0{,}1 \cdot 10^{-3}} = \underline{\underline{50\,k\Omega}}$$

b) $i_o \overset{\text{KCL}}{=} i_s + i_L = 0{,}1 \cdot 10^{-3} + \dfrac{5}{1000} = \underline{\underline{5{,}1\,mA}}$

2

3)



$$\boxed{\begin{matrix} V_n = V_p = 0 \\ i_n = i_p = 0 \end{matrix}}$$

Neg. återkoppling + $V_p = 0V$.

KCL på V_n : $\frac{0 - V_0}{R_2} - i_s = 0 \Rightarrow \underline{\underline{V_0 = -i_s \cdot R_2}}$

Kretsen är en typ av $i \to v$ förstärkare.

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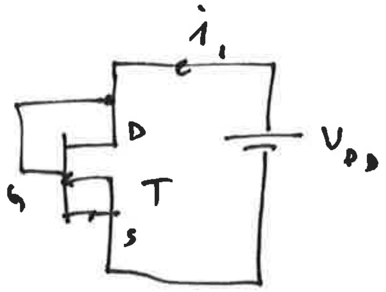
4) a)



$V_{DS} = V_{GS} = V_{DD} \Rightarrow$ T är ~~[illegible]~~ i mättnadsområdet

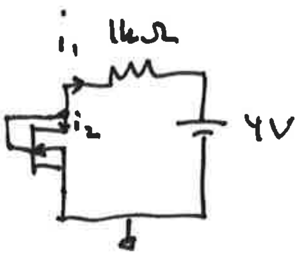
om $V_{DD} > V_{T0}$, ty: $V_{DS} \geq V_{GS} - V_T$

$\underline{\underline{V_{DD} \geq V_{DD} - V_T}}$

a) $i_1 \simeq 0A$, då $V_{DD} < V_{T0}$ (strypt mod)

b) $i_2 = K(V_{DD} - V_T)^2 = 10^{-3} \cdot (3-2)^2 = \underline{\underline{1mA}}$

c)



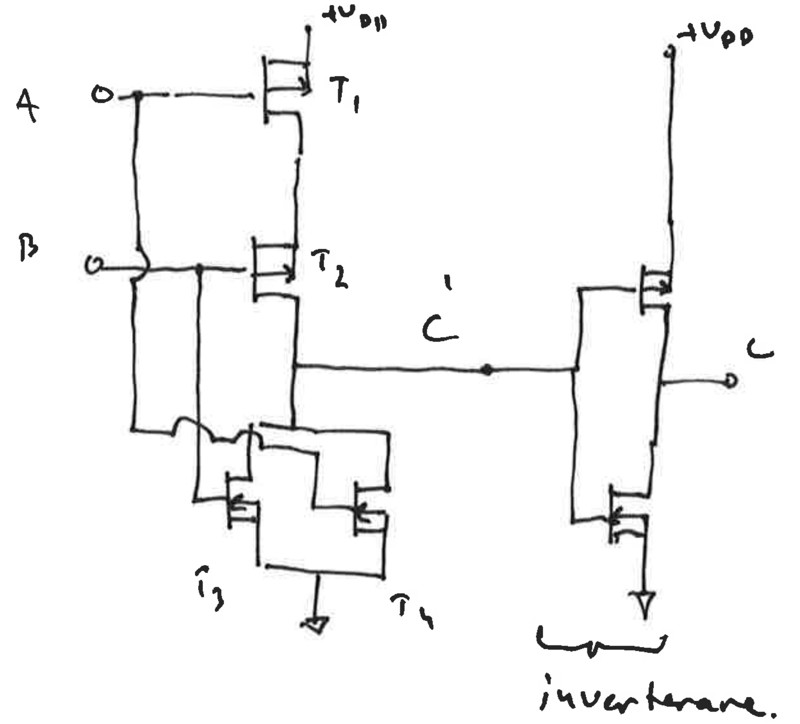
KCL på V_1 : $\frac{(4 - V_1)}{1000} = \underbrace{10^{-3}}_{K}(V_1 - \underbrace{2}_{V_{T0}})^2$

$\boxed{\text{ej } V_1 = 0}$

$\Rightarrow (4 - V_1) = (V_1 - 2)^2 = V_1^2 + 4 - 4V_1$

$\Rightarrow V_1^2 - 3V_1 = 0 = V_1(V_1 - 3) = 0 \Rightarrow \underline{\underline{V_1 = 3V}}$

5)



$C = \overline{C'}$

A	B	C'
0	0	1
0	1	0
1	0	0
1	1	0

← T_1 & T_2 på. T_3, T_4 Av

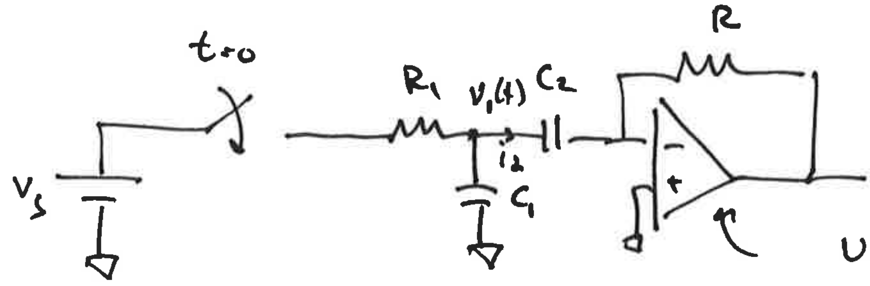
T_1 eller T_2 av T_3 eller T_4 på.

a)

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

OR-grind.

6)

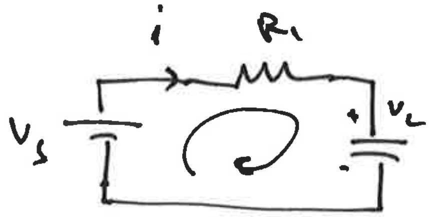


$U_p = V_n$: $V_p = 0 \Rightarrow V_n = 0$

$i_p = i_n = 0$

a) C_2 och C_1 är båda kopplade till 0V.

$\Rightarrow$



$C = C_1 \| C_2 = C_1 + C_2$

KVL: $-V_s + i \cdot R_1 + V_c(t) = 0$ $\qquad i(t) = C \cdot \frac{dU_c}{dt}$

$\Rightarrow RC \cdot \frac{dU_c}{dt} + U_c = V_s \Rightarrow \underbrace{V_c' + \frac{V_c}{\tau}}_{\text{int. faktor } e^{t/\tau}} = \frac{V_s}{\tau} \qquad \tau = RC$

$$(V_c \cdot e^{t/\tau})' = \frac{V_s}{\tau} \cdot e^{t/\tau}$$

$$\Rightarrow V_c(t) \cdot e^{t/\tau} - \overset{=0}{V_c(0)} = V_s(e^{t/\tau} - 1)$$

$$\underline{V_1 = V_c(t) = V_s(1 - e^{-t/\tau}) \quad , \quad \tau = R(C_1 + C_2)}$$

b) C_2, R och OP:n utgör en derivator. $V_2 = -RC_2 \cdot \frac{dV_1}{dt}$

V_2 fås annars genom: $i_2 = C \cdot \frac{dV_1(t)}{dt}$, $\quad V_0 = -R \cdot i_2 = -RC_2 \cdot \frac{dV_1}{dt}$

$$\Rightarrow V_2(t) = -R \cdot C_2 \cdot \frac{d}{dt}\left(V_s(1 - e^{-t/\tau})\right) = \underline{\underline{+\frac{R \cdot C_2 \cdot V_s}{\tau} e^{-t/\tau}}}$$