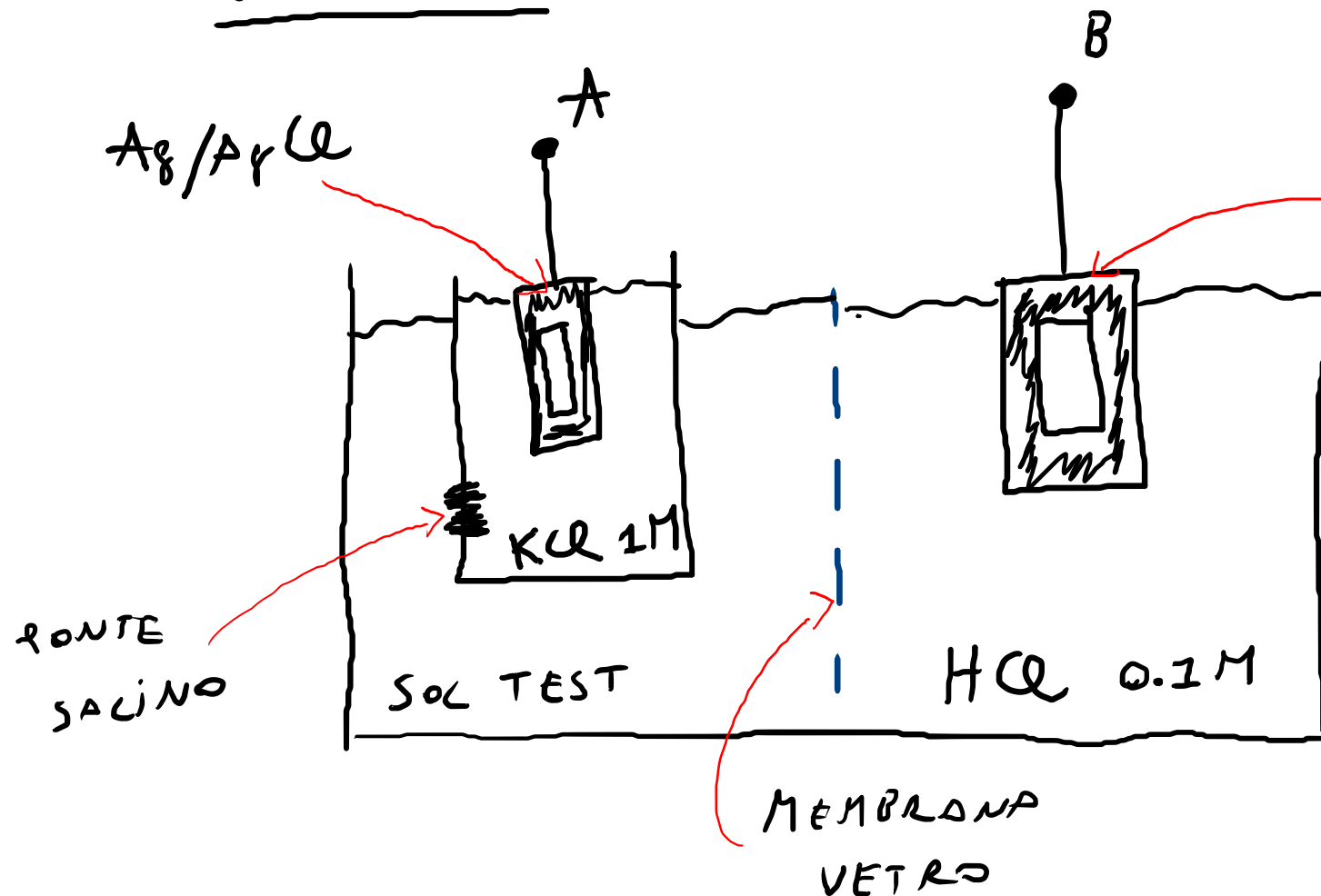
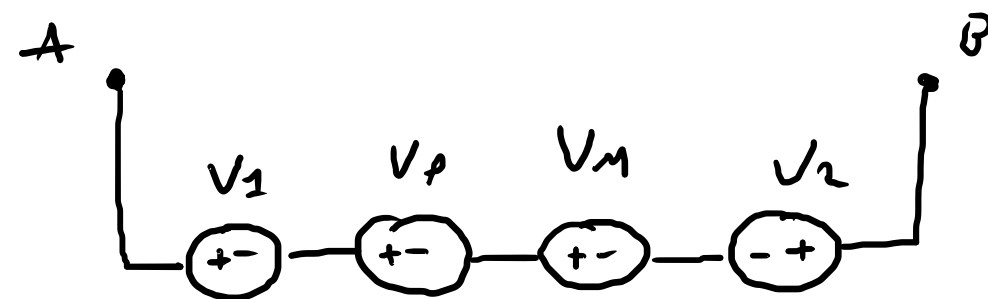


PUNTO 1



Ag/AgCl



$$V_{AB} = V_1 + \cancel{V_p} + V_m - V_2$$

V_p E' TRASCURABILE (POTENTE SAGINO)

$$V_1 = E^{\circ}_{Ag/AgCl} - 0.025 \cancel{\ln} ([Cl^-]) = 0.22V$$

$$V_m = -0.059 pH - \frac{RT}{F} \ln(0.1) = -0.059 pH + 0.1 V$$

$$V_2 = E^{\circ}_{Ag/AgCl} - \frac{RT}{F} \ln(0.1) = 0.22V + 0.1V$$

$$V_{AB} = 0.22V - 0.059 \text{ pH} + 0.1V - 0.22V - 0.1V$$

$$\Rightarrow \underline{V_{AB} = -0.059 \text{ pH}}$$

PUNTO 2

SPECIFICHE

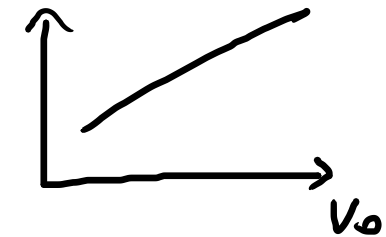
$$V_0 (\text{pH} = 7) = 0$$

$$S = 1.18 \frac{V}{\text{pH}}$$

$$S > 0 \Rightarrow$$

CARATTERISTICA

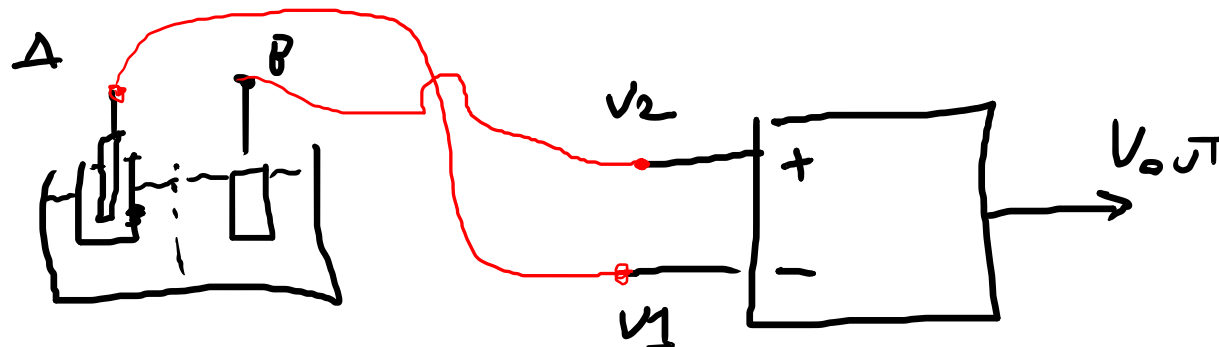
CRESCENTE
E LINEARE



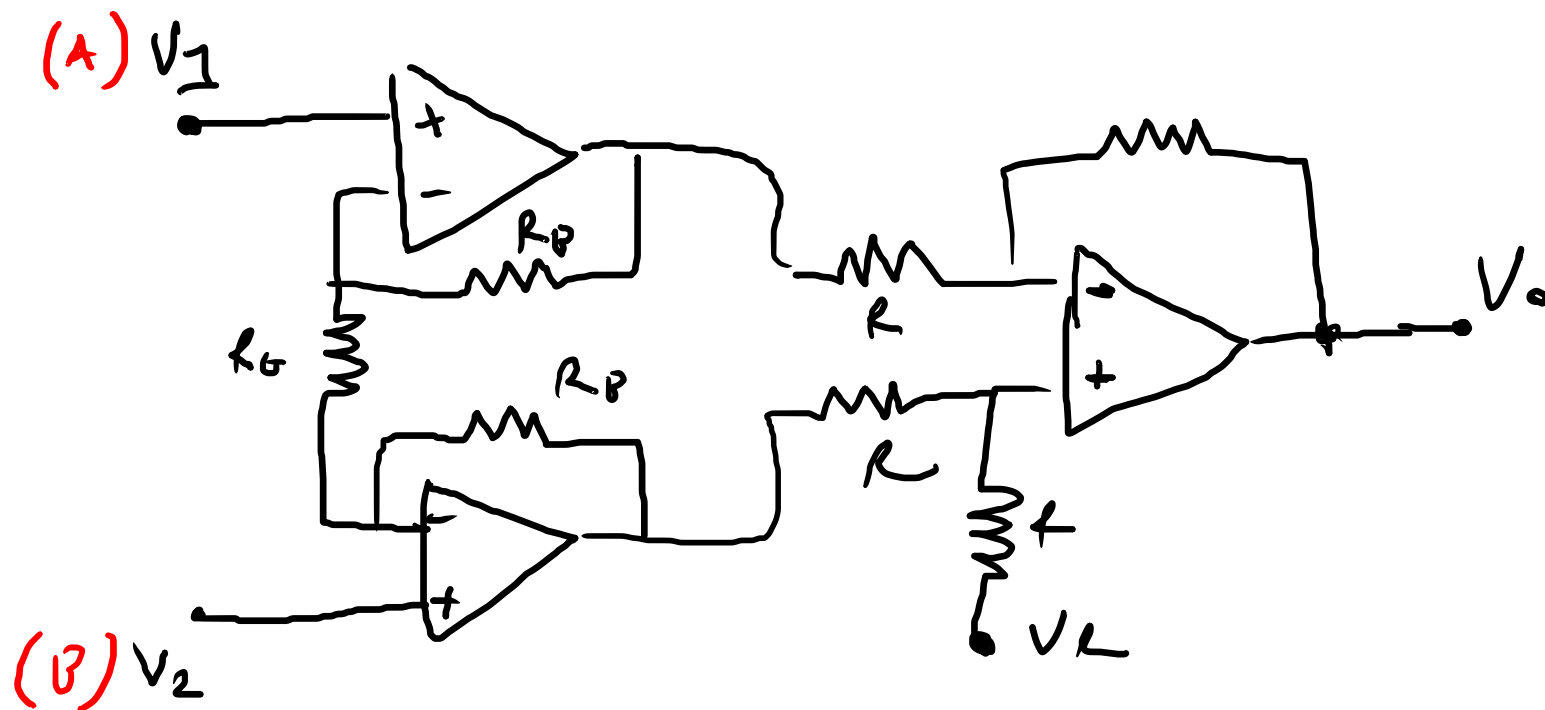
\Rightarrow

PER AVERRE

$$S > 0$$



$A - V_1$
 $B - V_2$



$$V_0 = A(V_2 - V_1) + V_R$$

PER LA RISOLUZIONE
VEDERE ESERCITAZIONE

24/7/19

$$V_0 = A V_{BA} + V_R = -A V_{AP} + V_R$$

$$V_0 = +A \cdot 0.05V + V_R$$

$$S = A \cdot 0.05V$$

$$A = \frac{S}{0.05V} = \frac{1.18}{0.05V} = 20$$

$$A = 1 + 2 \frac{R_P}{R_G}$$

$$R_P = \underline{100 K\Omega}$$

$$1.18 \times 7 + V_R = 0$$

$$\underline{V_R = -8.26V}$$

$$R_G \leq \underline{10.5 K\Omega}$$

punto 3

$$V_o = S \cdot pH + 0$$

$$V_o = S \cdot pH + \underset{\substack{\downarrow \\ 0}}{V_R}$$

$$S = 1.18 \text{ V/pH}$$

$$0 = V_R = -8.26 \text{ V}$$

CURVA
TALOTUND

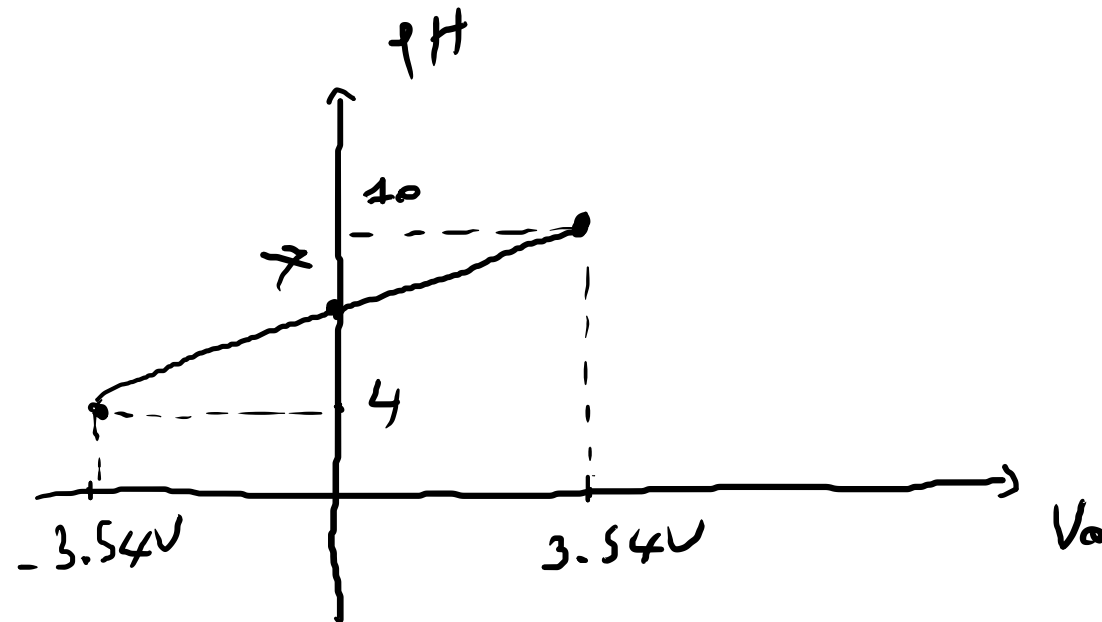
$$\rightarrow pH = \frac{V_o - 0}{S}$$

$$pH = 4$$

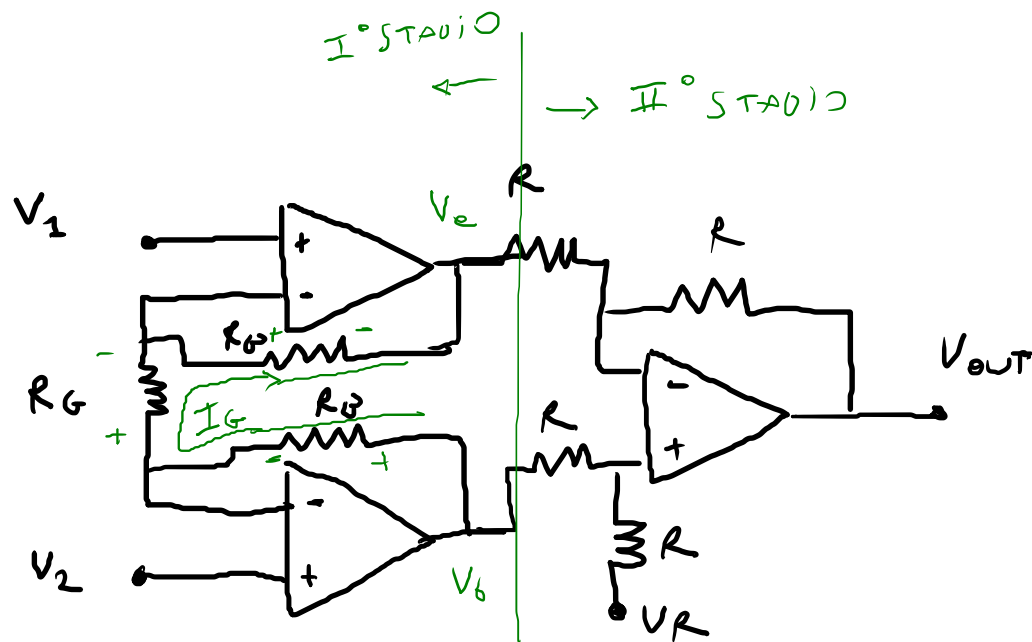
$$V_o = S \cdot 4 + 0 = -3.54 \text{ V}$$

$$pH = 10$$

$$V_o = S \cdot 10 + 0 = -3.54 \text{ V}$$



Risoluzione circuito



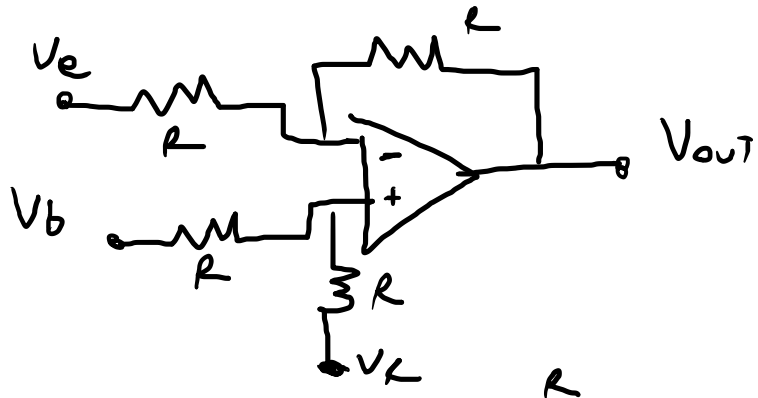
RISOLUZIONE CIRCUITO

$$\left. \begin{aligned} V_e &= V_1 - R_0 I_G \\ V_b &= V_2 + R_0 I_G \end{aligned} \right\} I^{\circ} \text{ STADIO I}$$

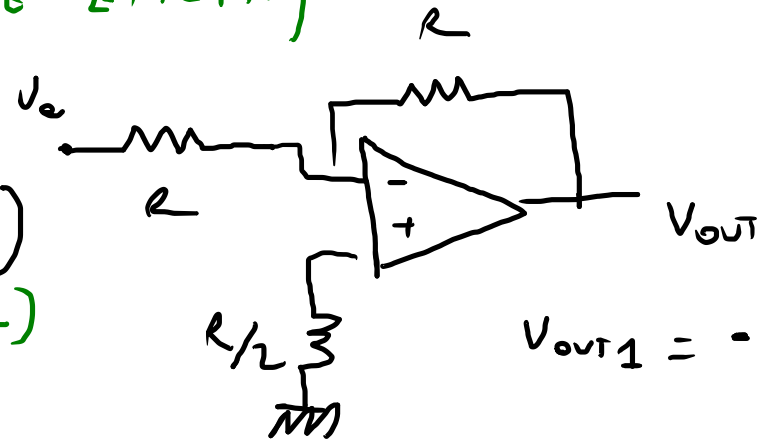
$$I_G = \frac{V_2 - V_1}{R_G}$$

II° STADIO

(SOVRAPPOSIZIONE EFFETTI)

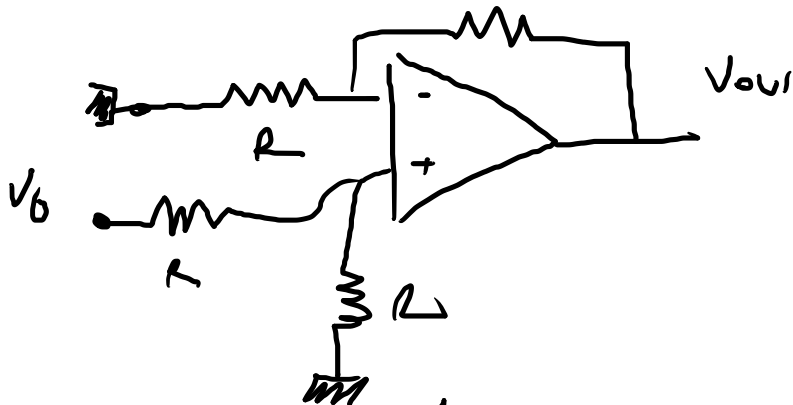


1)
(V_e)



$$V_{OUT1} = -V_e \frac{R}{R} = -V_e$$

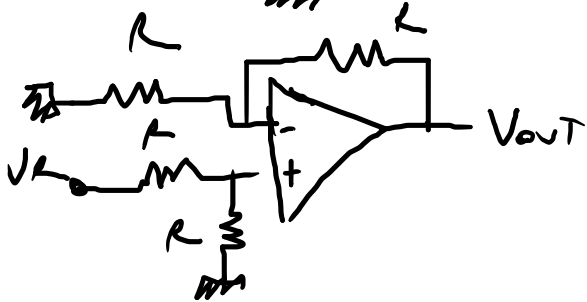
2)
(V_b)



$$V^+ = V_b / 2$$

$$V_{OUT2} = V_b / 2 \left(1 + R / R \right) = V_b$$

3)
(V_R)



$$V_{OUT3} = V_R \Rightarrow V_{OUT} = V_{OUT1} + V_{OUT2} + V_{OUT3}$$

$$\Downarrow$$

$$V_{OUT} = V_b - V_e + V_R$$

$$V_{out} = V_b - V_e + V_R \quad V_e = V_1 - R_P I_G$$

$$I_G = \frac{V_2 - V_1}{R_G}$$

$$V_b = V_2 + R_P I_G$$

$$\begin{aligned} V_{out} &= V_2 + R_P I_G - V_1 + R_P I_G + V_R = V_2 - V_1 + 2 R_P I_G + V_R \\ &= V_2 - V_1 + 2 R_P \frac{(V_2 - V_1)}{R_G} + V_R = (V_2 - V_1) \underbrace{\left(1 + 2 \frac{R_P}{R_G} \right)}_A + V_R \end{aligned}$$

\Rightarrow

$$V_{out} = A (V_2 - V_1) + V_R$$

$$A = 1 + \frac{2 R_P}{R_G}$$

(NOTE: $\rightarrow A > 0$)