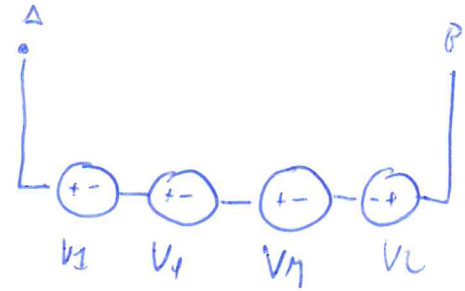
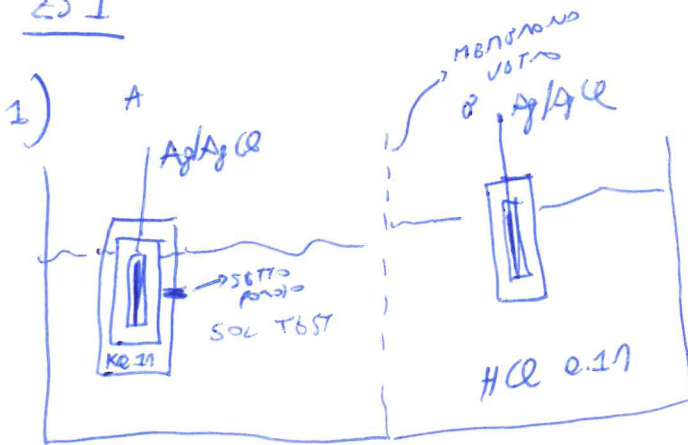


ES 1



$$V_{AB} = V_1 + V_2 + V_3 - V_4$$

↳ trascrizione

$$V_1 = 0.22 - 0.0256 \ln [Cl^-] = 0.22 V$$

$$V_2 = 0.22 - 0.0256 \ln [0.1] = 0.22 V + 0.059 V$$

- 0.059 V

$$V_3 = E_0 + 0.0256 \ln [H^+] = E_0 - 0.059 pH = 0.00 V - 0.059 pH$$

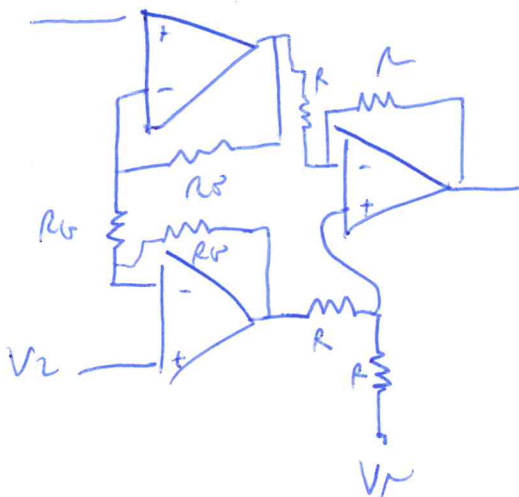
↳  $-\frac{RT}{F} \ln(0.1) = 0.059 V$

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

$$V_{AB} = -0.059 pH$$

CIRCUITO → SUGGERE  
CON AZIONE

V3



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

$$A = 1 + 2 \frac{R_2}{R_1}$$

2)

$$V_{out} = 0 \quad pH = 7$$

SPECIFICATO

$$S = -0.59 \text{ V/pH} \quad (\text{NOTO SCO})$$

PER OTTENERE LA S VOLUTA NON USO "INVERTIRE" LA VOLT

⇒ COLLEGO

$$A \rightarrow 2$$

$$p \rightarrow 1$$

$$V_{out} = AV_{in} + V_R = A(-0.059 \text{ pH}) + V_R$$

~~$$S = -A \cdot 0.059 = -0.59 \Rightarrow A = \frac{0.59}{0.059} = 10$$~~

$$S = -A \cdot 0.059 = -0.59 \Rightarrow A = \frac{0.59}{0.059} = 10$$

$$A(-0.059 \cdot 7) + V_R = 0 \quad V_R = A \cdot 7 \cdot 0.059$$

$$R_0 = 9 \text{ k}\Omega$$

$$4.13 \text{ V}$$

$$A = 10 = 1 + 2 \frac{R_F}{R_G}$$

$$2 \frac{R_F}{R_G} = 9$$

$$R_G = \frac{2 R_F}{9} = 2 \text{ k}\Omega$$

$$\boxed{\begin{array}{l} V_R = 4.13 \text{ V} \\ R_G = 2 \text{ k}\Omega \\ R_F = 9 \text{ k}\Omega \end{array}}$$

3)

$$V_{out} = S \text{ pH} + 0$$

$$V_{out} = S \text{ pH} + 0$$

$$\boxed{\text{pH} = \frac{V_{out} - 0}{S}}$$

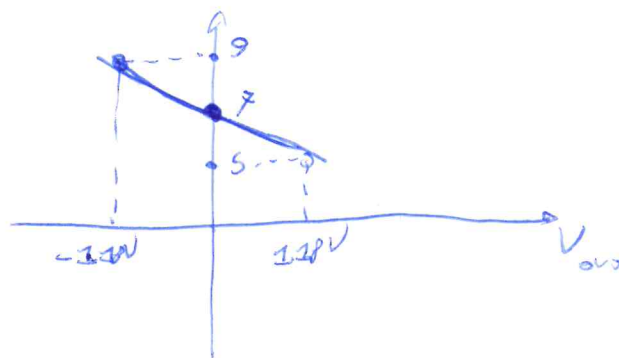
$$\text{pH} = 9 \quad V_{out} = 3.18 \text{ V}$$

$$\text{pH} = 5 \quad V_{out} = 1.18 \text{ V}$$

~~$$S = 0.59 \text{ pH}$$~~

$$S = 0.59 \text{ pH}$$

$$0 = 4.13 \text{ V}_{\text{pH}}$$



4) VEDERE TEORIA