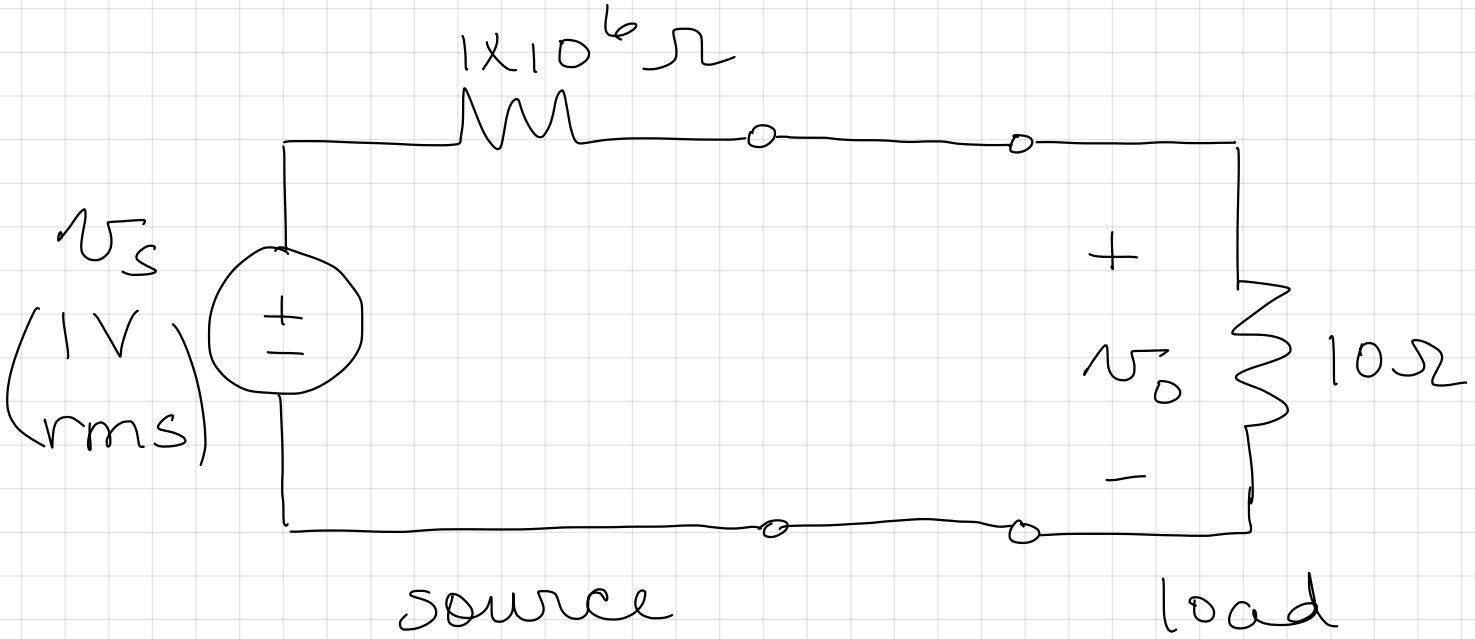
Ex

$v_s = 1\,V_{rms}$, $R_s = 1\,M\Omega$

$R_L = 10\,\Omega$



$$v_o = v_s \left(\frac{10}{10 + 1\times10^6} \right)$$

$$v_o = v_s \left(.999 \times 10^{-5} \right)$$

$$\cong 1V \left(10 \times 10^{-6} \right)$$

$$v_o \cong 10\,\mu V_{rms}$$

$$P_L = \frac{v_o^2}{10} = \frac{(10\times10^{-6})^2}{10} = 10^{-11}\,W$$

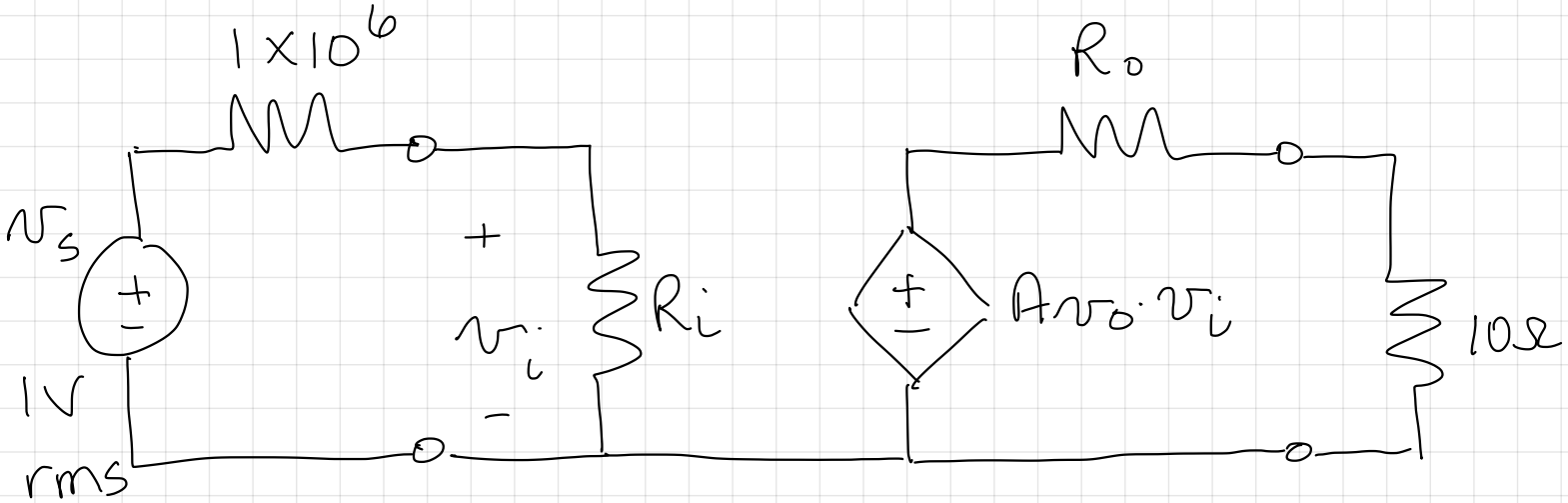
Remember max power transfer?

$$R_{TH} = R_L$$

$$1 \times 10^6 \ggg 10$$

severe mismatch

add amplifier in between source & load.



$A_{vo} = 1 \text{ V/V}$ $\quad R_i = 1\text{M}\Omega$

$R_o = 10\Omega$

$$\frac{v_o}{v_s} = A_{vo}\left(\frac{R_L}{R_L + R_o}\right)\left(\frac{R_i}{R_s + R_i}\right)$$

A_{vo}: 1 $\quad$ R_L: 10 $\quad$ R_o: 10 $\quad$ R_i: 1MΩ $\quad$ R_s: 1MΩ $\quad$ R_i: 1MΩ

$$\frac{v_o}{v_s} = (1)\left(\frac{1}{2}\right)\left(\frac{1}{2}\right)$$

$$\frac{v_o}{1V} = 0.25 \frac{V}{V}$$

$$v_o = 0.25 \text{ V rms}$$

$$P_L = \frac{v_o^2}{10} = \frac{(.25)^2}{10} = 6.25 \text{ mW}$$

$$A_v = \frac{v_o}{v_s} = \frac{0.25}{1} = 0.25 \frac{V}{V}$$

$$= -12.04 \text{ dB}$$

$$A_p = \frac{P_o}{P_i} = \frac{6.25 \times 10^{-3}}{(0.5)^2/1 \times 10^{-6}}$$

$$A_p = \frac{6.25 \times 10^{-3}}{0.25 \times 10^{-6}} = 25 \times 10^3 \frac{W}{W}$$

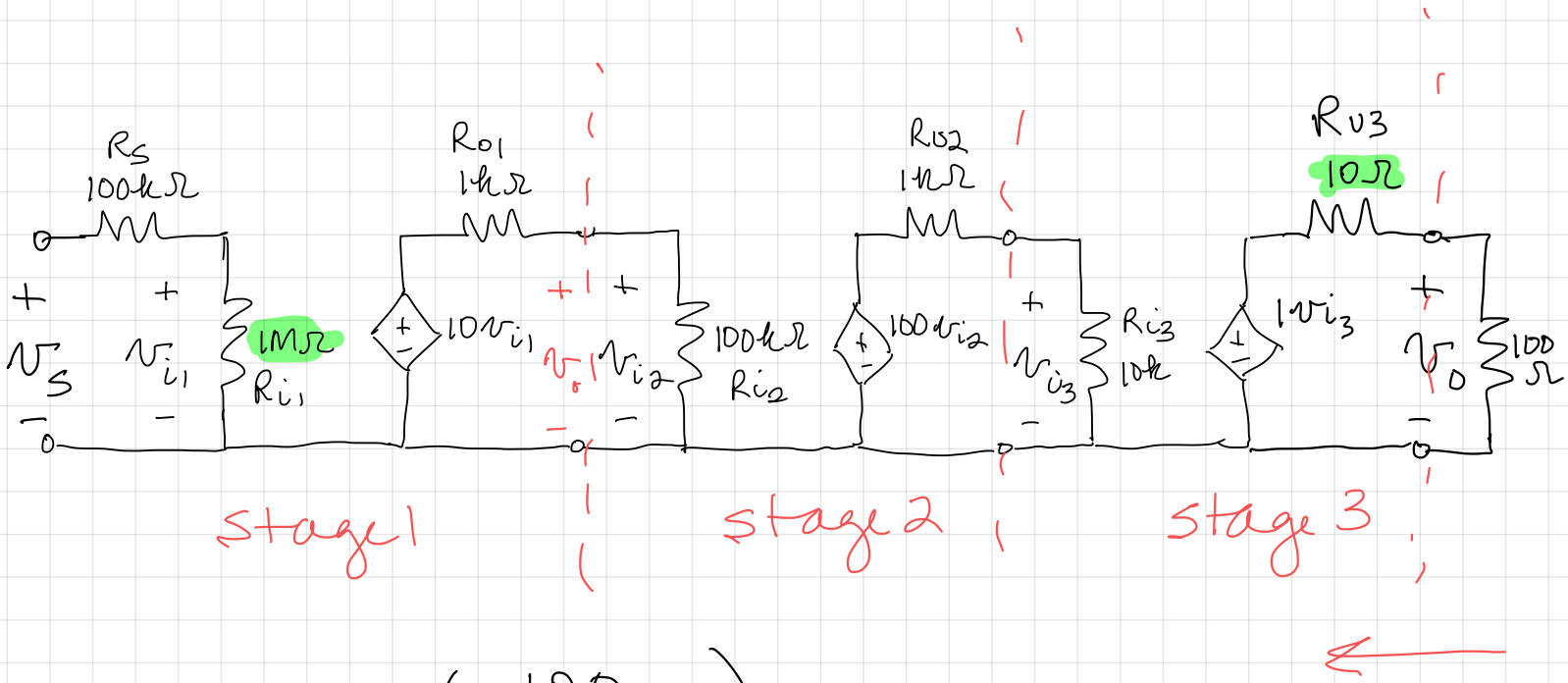
$$\alpha = 43.98 \text{ dB}$$

$V_S \Rightarrow R_S = 100 k\Omega \qquad R_L = 100\Omega$

stage 1 : $R_{i_1} = 1 M\Omega$
$R_{o_1} = 1 k\Omega$
$A_{vo1} = 10 V/V$
high input resistance

stage 2 : $R_{i_2} = 100 k$
$R_{o2} = 1 k\Omega$
$A_{vo2} = 100 V/V$
high gain

stage 3 : $R_{i_3} = 10 k\Omega$
$R_{o3} = 10\Omega$
$A_{vo3} = 1 V/V$
low output resistance.



$$v_o = 1 v_{i3} \left(\frac{100}{100+10} \right) = 0.91 v_{i3}$$

$$v_{i3} = 100 v_{i2} \left(\frac{10 \times 10^3}{10 \times 10^3 + 1 \times 10^3} \right) = 90.91 v_{i2}$$

$$v_{i2} = 10 v_{i1} \left(\frac{100 \times 10^3}{100 \times 10^3 + 1 \times 10^3} \right) = 9.90 v_{i1}$$

$$v_{i1} = v_s \left(\frac{1 \times 10^6}{1 \times 10^6 + 100 \times 10^3} \right) = 0.91 v_s$$

$$\frac{v_o}{v_s} = \left(\frac{v_o}{v_{i3}} \right) \left(\frac{v_{i3}}{v_{i2}} \right) \left(\frac{v_{i2}}{v_{i1}} \right) \left(\frac{v_{i1}}{v_s} \right)$$

$$= (0.91)(90.91)(9.90)(.91)$$

$$\frac{v_o}{v_s} = 745.29 \frac{V}{V}$$