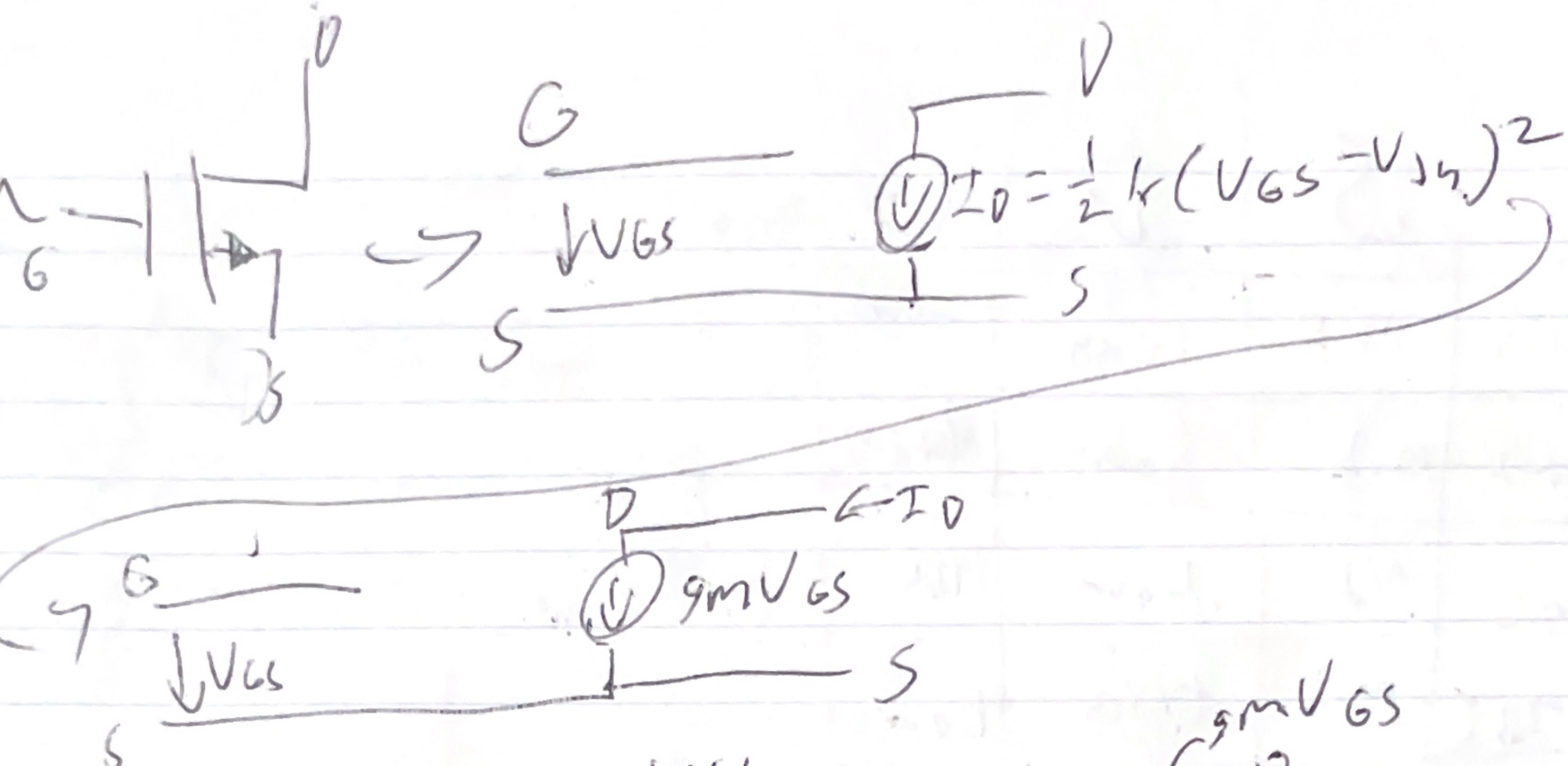
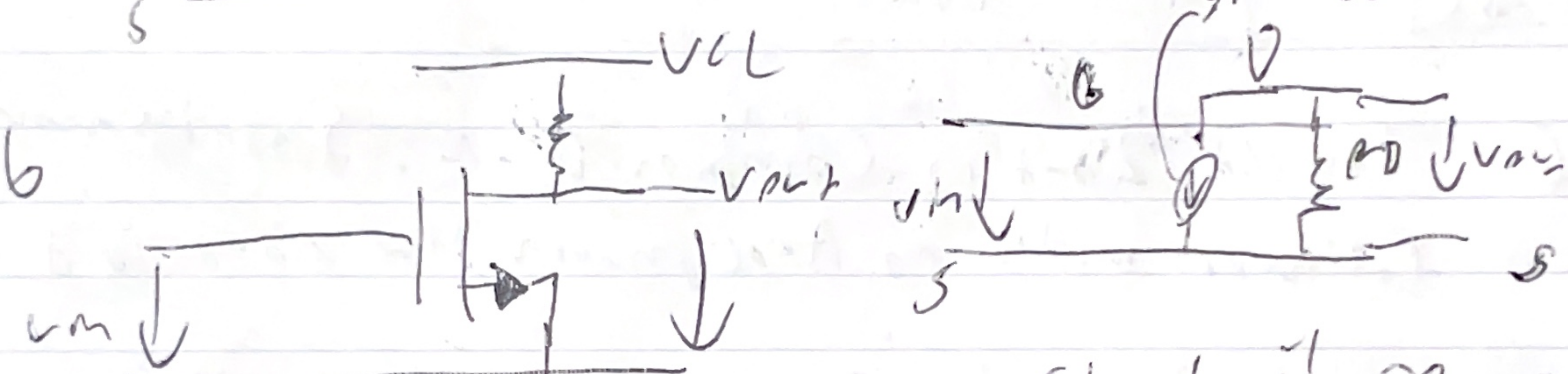
1a



1b

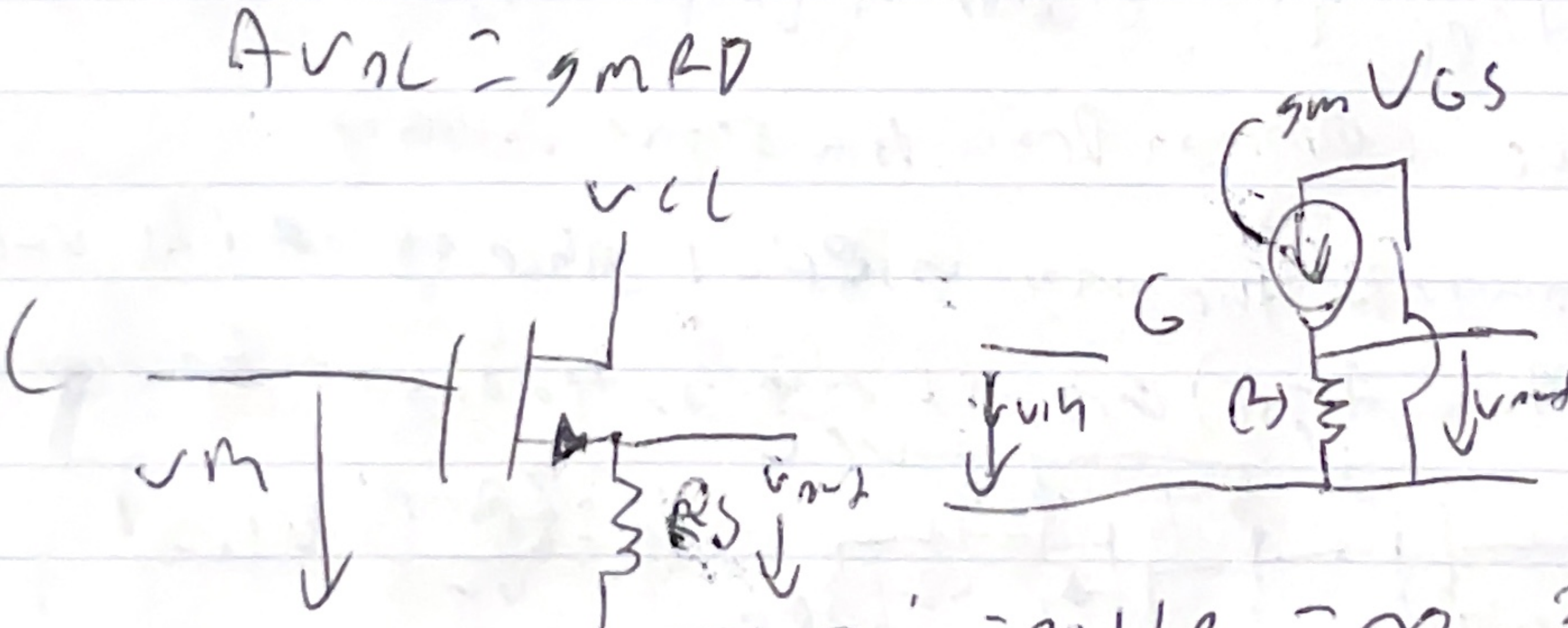


$z_{in} = R_1 || R_2$ $\quad R_1, R_2 = \infty$ $\quad \left(\frac{1}{\infty}+\frac{1}{\infty}\right)^{-1} = \frac{\infty}{2} = \infty$

$z_{out} = R_D$ $\quad A_{ISC} = g_m(R_1 || R_2) = \infty$

$A_{VOC} = g_m R_D$

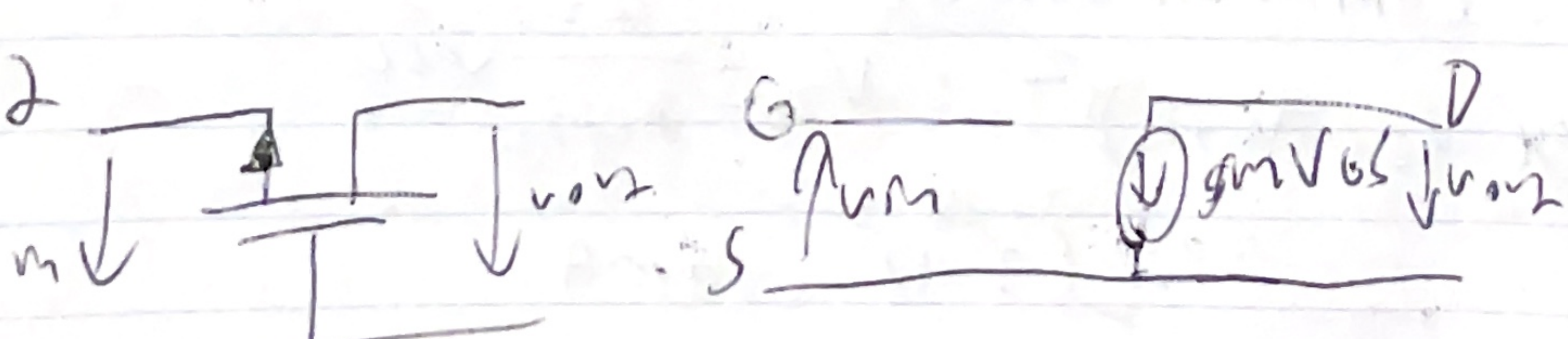
1c



$z_{in} = R_1 || R_2 = \infty$ $\quad z_{out} = R_S$

$A_{ISC} = g_m(R_1 || R_2) = \infty$ $\quad A_{VOC} = \frac{g_m R_S}{1+g_m R_S}$

1d



$z_{in} = \infty$

$z_{out} = \infty$

$A_{ISC} = 1$ $\quad A_{VOC} = \infty$

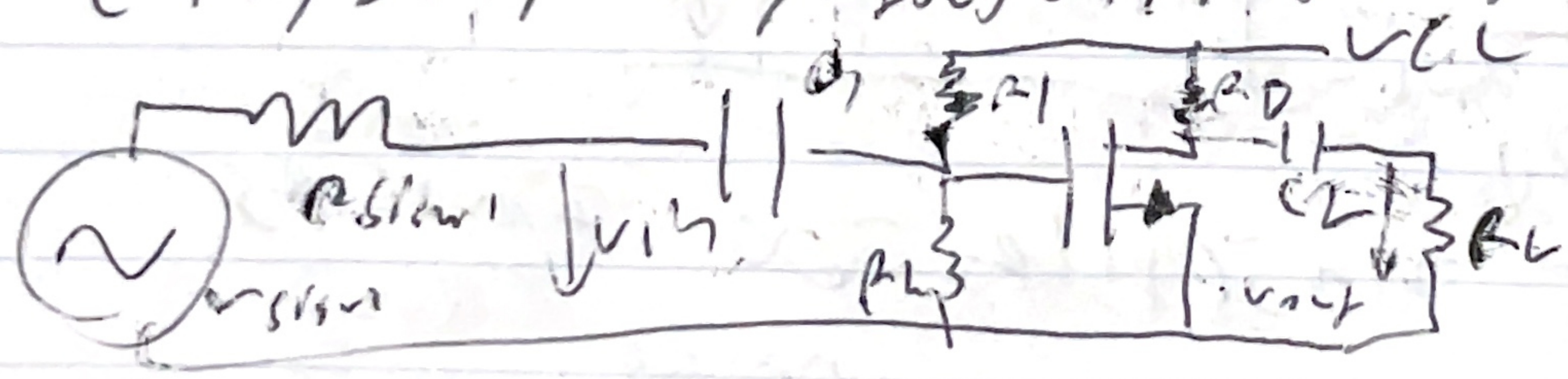
1e	S	D	G
Zin	mid	High	Low
Zout	mid	[illegible]	High
Avoc	mid	Low	High
Aisc	mid	High	Low

1f Lowest Zout is Common Drain, since its a source follower with no Avoc, having low Zout is desirable.

1g Lowest Zin is Common Gate, since it is a current follower, having low Zin is desirable.

1h Lowest Avoc is Common D which is roughly 1. This is good since Common Drain is a source follower

1i Common Source is the most useful since all of its values (Zin, Zout, Avoc, Aisc) are mid range, letting it be very versatile.

2 

$k = 20\,mA/V^2$ $\quad V_{th} = 1$

$R1 = 80k$ $\quad R_2 = 20k$

$R_{sig} = 25k$ $\quad R_L = 1k$ varied

2a This is common Source.

$I_D = \frac{1}{2}k(V_{GS} - V_{th})^2 \qquad V_{GS} = \frac{R2}{R1+R2}V_{CC}$

$V_{GS} = 2V \qquad I_D = 20 \cdot \frac{1}{2}(2-1)^2 = 10mA$

2b $V_{DS} = 5$, $I_D = 10mA$

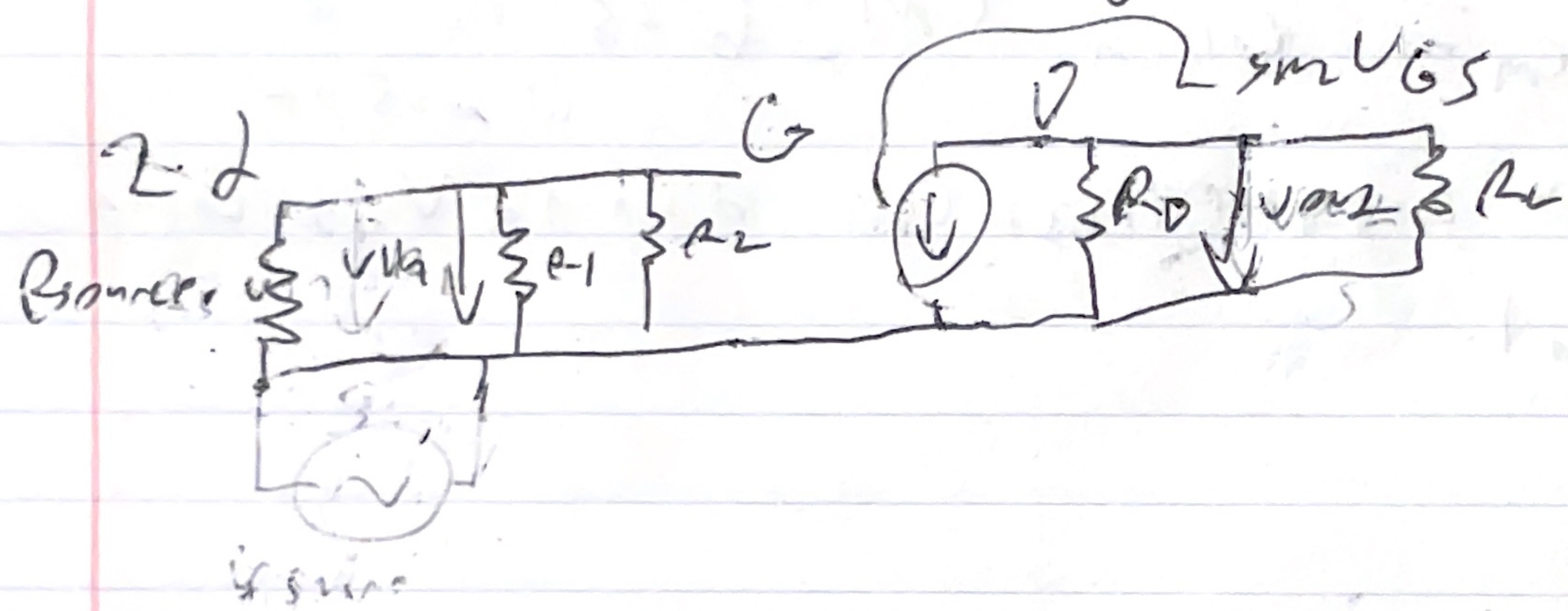
$V_{RD} = I_D R_D$

$V_{RD} = V_{CC} - V_{DS}$

$I_D R_D = V_{CC} - V_{DS}$ $10mA\ R_D = 5$ $R_D = 500\Omega$

2c $g_m = k(V_{GS} - V_{th}) = 20\frac{mA}{V^2}$

2d



2e $Z_{in} = R_1 \| R_2 \| R_{source} = 381.9\Omega$

$Z_{out} = R_D \| R_L = 333\Omega$

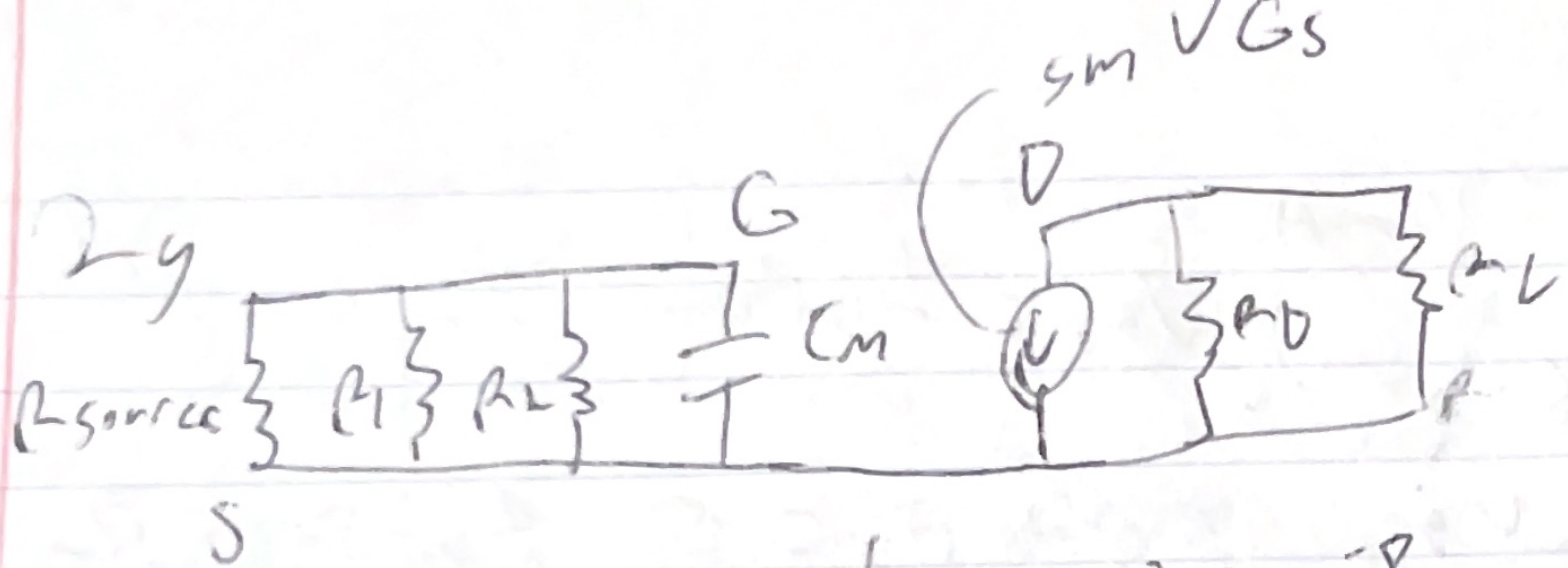
$A_{VL} = \frac{V_{out}}{V_{in}} = \frac{V_{GS}\, g_m (R_D \| R_L)}{V_{GS}} = 20 \cdot 333 = 6.66$

$A_V = \frac{V_{out}}{V_{in}} = \frac{V_{GS}\, g_m (R_D \| R_L)}{V_{GS}} = 20 \cdot 333 = 6.66$

2f Drain gate capacitance C_{DG} is a parasitic capacitance inside the FET between the drain and gate. It arises due to the fact that capacitance will "exist" between any two sources of voltage that have resistance between them.

Miller capacitance (C_M) is C_{DG} but with different coefficients to fit into the equivalent circuit better.

2g



$20\,MHz = \omega_{in,p}$

$20\,MHz = \frac{1}{R_1 C_m}$

$20\,MHz = \frac{1}{\tau}$ $\tau = 5 \cdot 10^{-8}$ seconds 50 ns

2h $20\,MHz = \frac{1}{R_1 C_m} = \frac{1}{80k\,C_m}$ $C_m = 6.25 \cdot 10^{-13}\,F$

$0.625\,pF$

2i Common Drain has the least Cm due to V_{GD} being very close to 1.