

Ques 2.

Q1.

$$P = 2 \text{ mW} = V_{DD} \times I_D, \quad V_{DD} = 1.8 \text{ V}$$

$$I_D = \frac{2 \times 10^{-3}}{1.8} = 1.11 \text{ mA}$$

200mV from triode = overdrive voltage + 200mV

$$\Rightarrow V_{DS} = V_{GS} - V_{TH} + 0.2 \text{ V}$$

$$\Rightarrow V_D = V_G - V_{TH} + 0.2 \text{ V}$$

$$= 1.8 - 0.4 + 0.2 = 1.6 \text{ V}$$

$$V_O = V_{out} = V_{DD} - R_D I_D$$

$$R_D = \frac{0.2}{1.11 \text{ mA}} = 180 \Omega$$

Gain of the stage is $\frac{g_m R_D}{H g_m R_S} = 6$.

As g_m is positive value

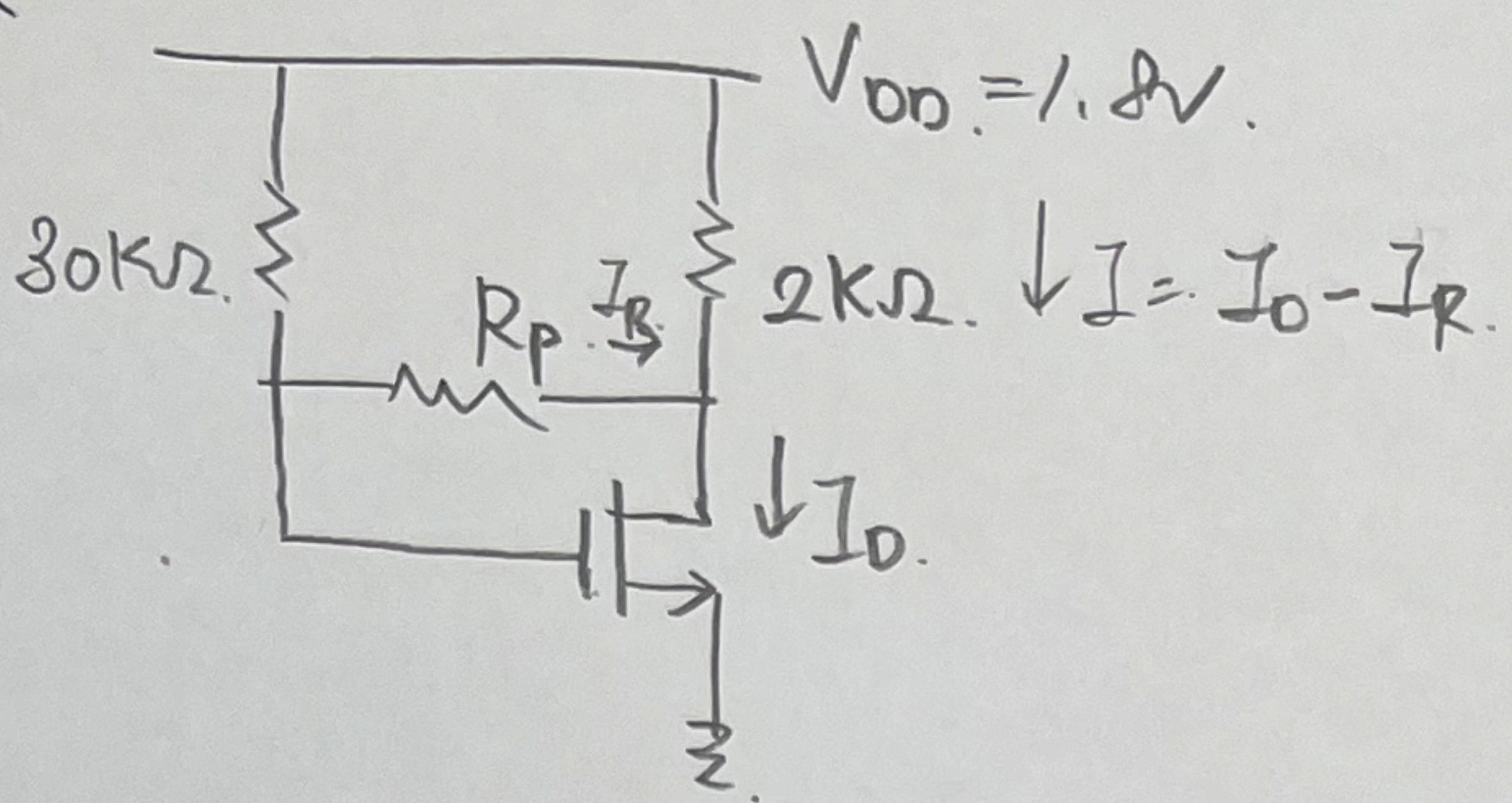
$$R_D - 6R_S > 0$$

$$0 < R_S < 80$$

$$R_D = \frac{6}{g_m} + 6R_S$$

Positive.

Q2.



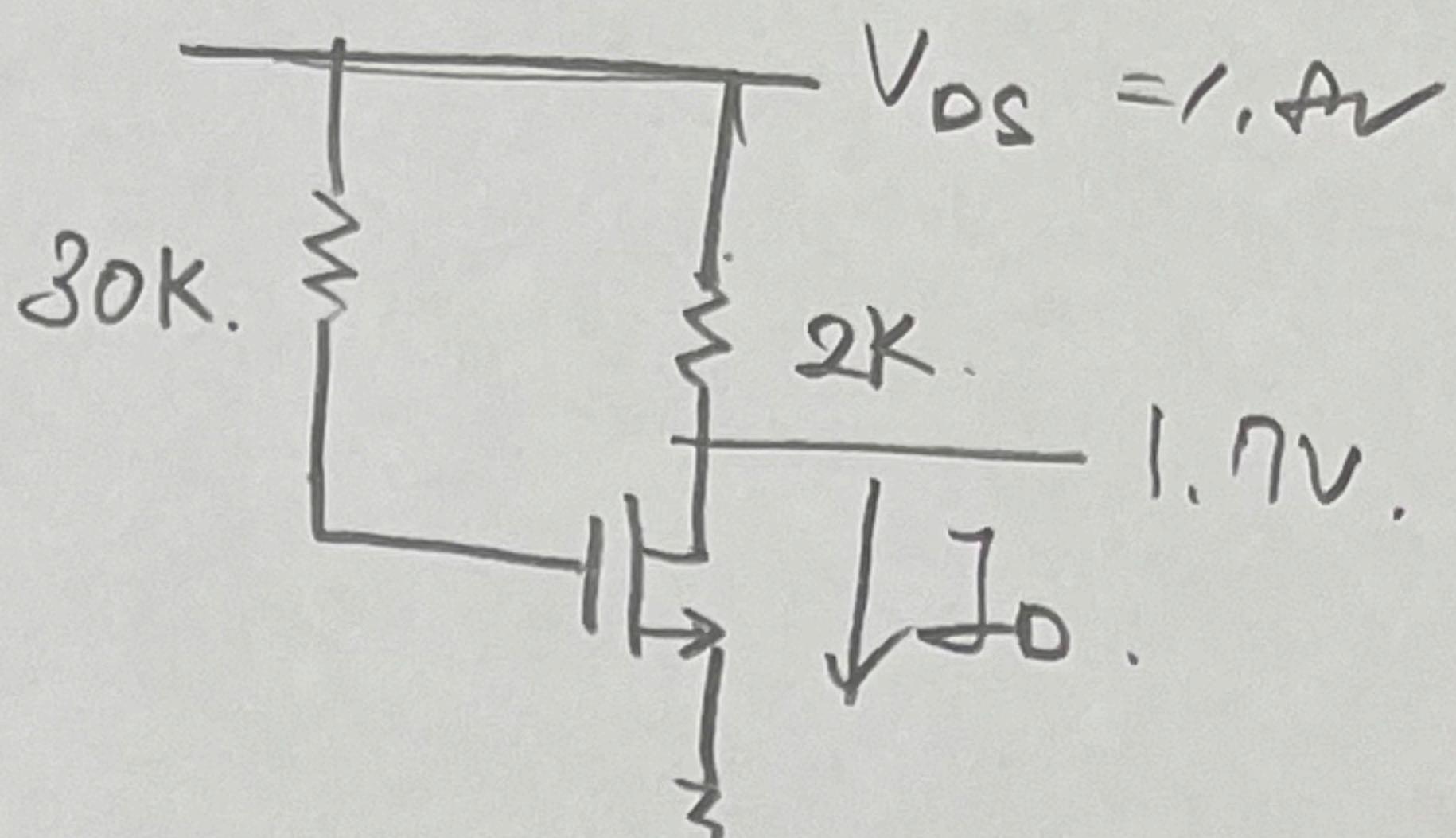
without defect

$$V_{GS} = V_{DS} + 100mV$$

$$V_{GS} = 1.8V \rightarrow V_{DS} = 1.7V$$

$$I_0 = \frac{1.8 - 1.7}{2k} = 0.05mA.$$

$$= \frac{1}{2} \mu_n C_{ox} \frac{W}{L} (V_{GS} - V_T)^2 \Rightarrow \frac{W}{L} = 0.255.$$



with defect.

$$\left\{ \begin{array}{l} V_{GS} = V_{DS} + 50mV \rightarrow \text{Voltage drop at } R_p = 50mV \\ V_{GS} = 1.8 - 30k \times 50 \times 10^{-3} / R_p. \end{array} \right.$$

$$V_{DS} = 1.8 - 2k \left(I_0 - \frac{50 \times 10^3}{R_p} \right) = V_{GS} - 0.05.$$

$$I_0 = \frac{1}{2} \times 200 \times 10^{-6} \times 0.255 \times (V_{GS} - 0.4)^2$$

$$\textcircled{1} \quad V_{GS} = 1.8 - 30k \left(\frac{50 \times 10^{-3}}{R_p} \right)$$

$$\textcircled{2} \quad 1.8 - 2k \left[\left(25.5 \times 10^{-6} \times (V_{GS} - 0.4)^2 \right) - \frac{50 \times 10^{-3}}{R_p} \right] = V_{GS} - 0.05$$

Solve.