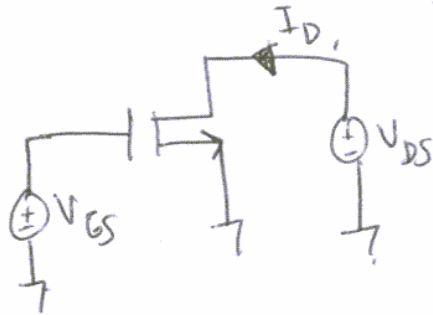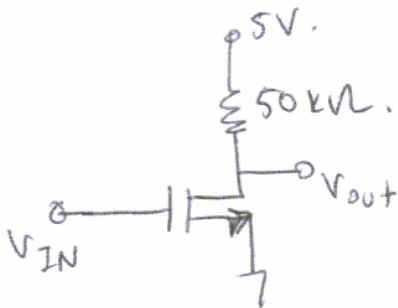①

$V_T = 2V;$

$K = \dfrac{0.5}{} \, mA/V^2$

a) $V_{GS} = 6V;$ $V_{DS} = 2V;$ Find i_D

b) $V_{GS} = 6V;$ $V_{DS} = 6V;$ Find i_D.

c) $I_D = 4mA$ and Transistor is in SAT.
Find V_{GS}

d) $I_D = 6mA$ and Transistor is in SAT
Find V_{GS}.

② NMOS device has $V_{GS} = V_{DS} = 9V$ and $I_D = 4mA$.

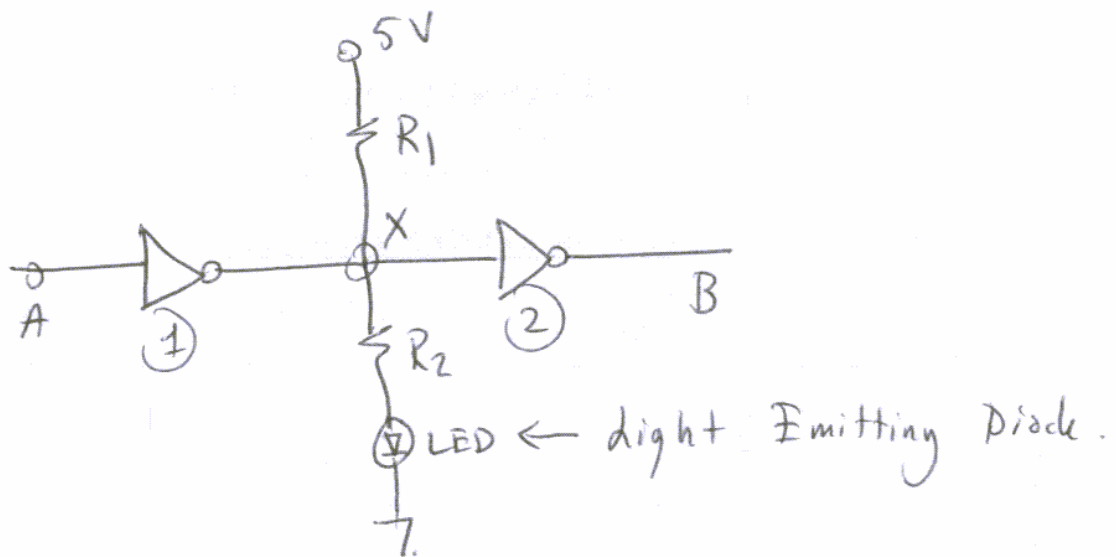the same device has $V_{GS} = V_{DS} = 5V$ and $I_D = 1mA$

Find K and V_{T}.

③

$V_T = 1V;$

$K = 40\mu A/V^2$

a) Find V_{out} for $V_{IN} = 0V;$

b) Find V_{out} for $V_{IN} = 5V;$

c) Find V_{out} for $V_{IN} = 1V;$

d) Sketch VTC.

④

5V

R_1

X

A ① ② B

R_2

Ⓨ LED ← Light Emitting Diode.

LED is a diode which emits light when it is ON.
LED in the circuit requires 0.9V and ‡ 1mA to light.

a) Find minimum value of R_1 so that when the input is High; led is OFF, B output is High.

b) Find maximum value of R_1 so that when the input is Low, led is ON and B output is Low.

Family 1:

$I_{OH}^{max} = 250 \mu A$

$I_{OL}^{max} = 20 mA$

$V_{OL}^{max} = 0.4V$

$V_{OH} = $ Determined by R_1

Family 2:

$I_{IL}^{max} = -2 mA$

$I_{IH}^{max} = 250 \mu A.$

$V_{IH}^{min} = 2.0 V$

$V_{IL}^{max} = 0.8 V$

Note: All $I_{IH}, I_{IL}, I_{OL}, I_{OH}$ are defined to be entering into the gate.