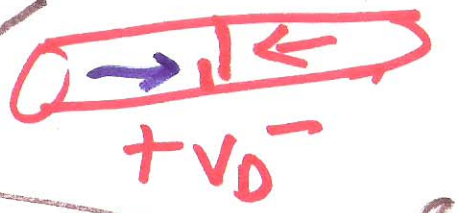
EE 320 Electronics

2/19/2014 Lecture 8

for forward bias

$V_D = nV_T \ln \frac{I_D}{I_S}$

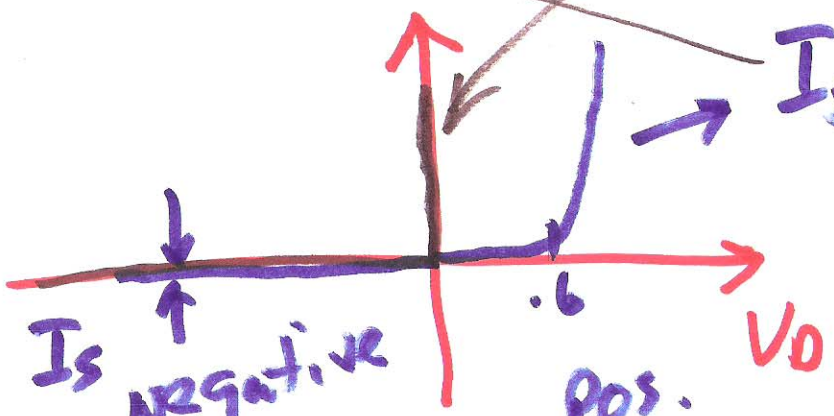


ideal diode turns on when $V_D = 0$

$$I_D = I_S\left(e^{V_D/nV_T} - 1\right)$$

n → emiss. coeff.

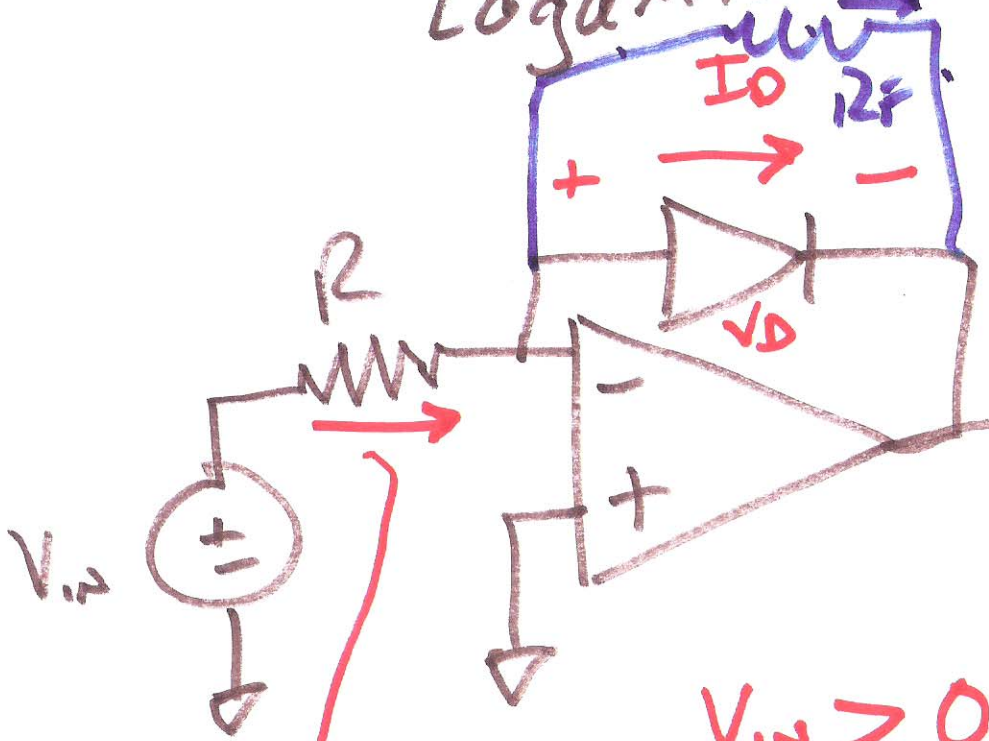
$$V_T = \frac{kT}{q} = 25mV \text{ @ Room Temp}$$



UNLV
UNIVERSITY OF NEVADA LAS VEGAS

CMOSedu.com

Logarithmic op-Amp



$V_{IN} > 0$

$$\frac{0 - V_{OUT}}{R_F} + I_D = \frac{V_{IN}}{R} = I_D \simeq I_S e^{V_D/nV_T} = I_S e^{-\frac{V_{OUT}}{nV_T}}$$

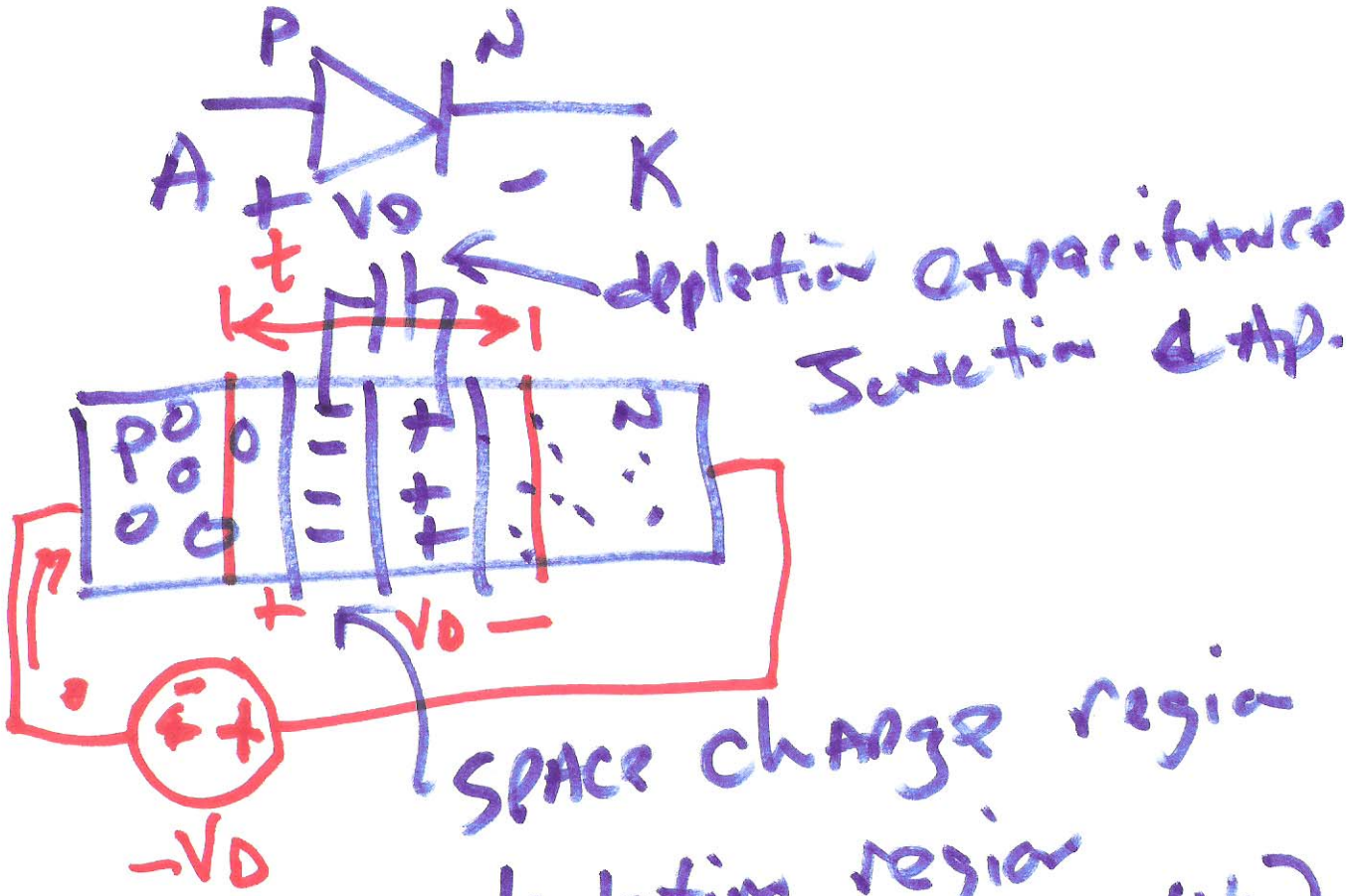
$$e^{-V_{OUT}/nV_T} = \frac{V_{IN}}{R \cdot I_S}$$

$$-\frac{V_{OUT}}{nV_T} = \ln \frac{V_{IN}}{R \cdot I_S}$$

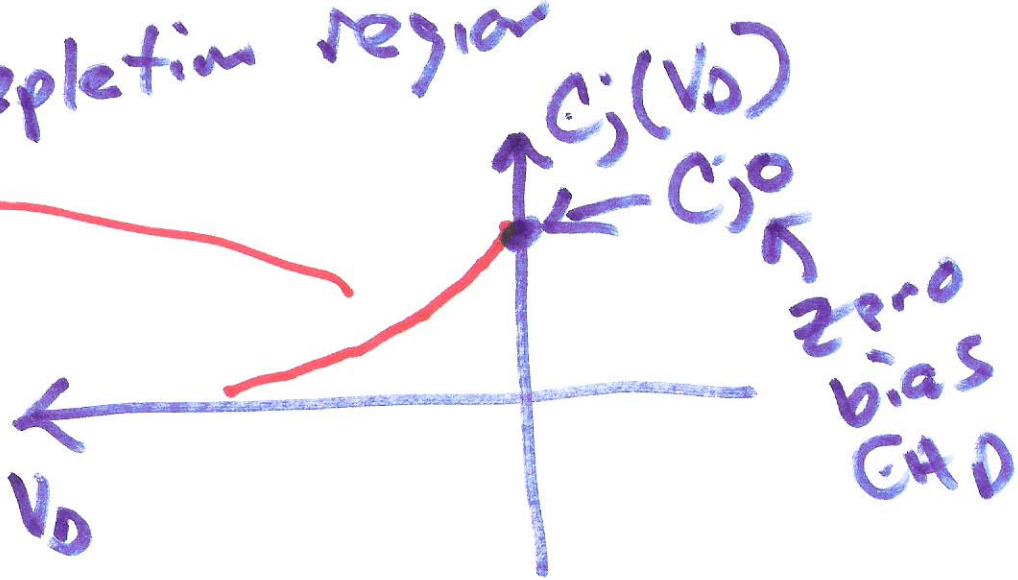
$$V_{OUT} = -nV_T \ln \frac{V_{IN}}{R \cdot I_S}$$

$$C = \frac{\epsilon \cdot A}{t}$$

$$CV = Q$$

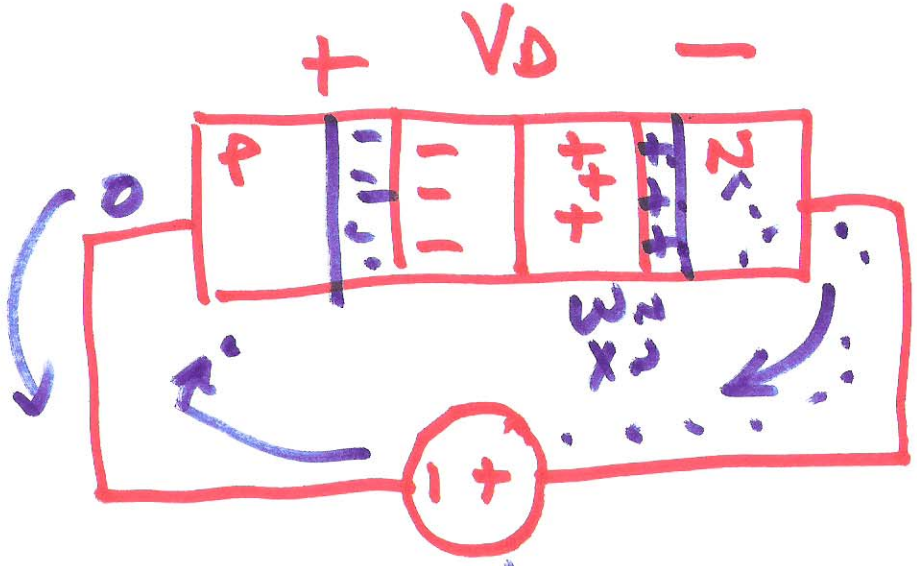


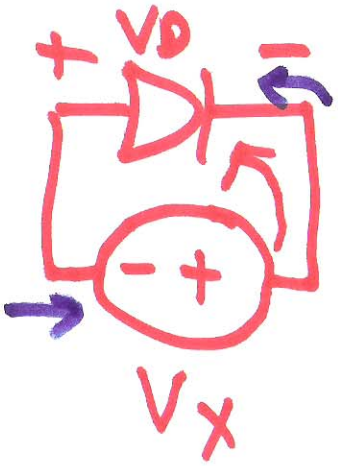
$$C_j(V_D) = \frac{C_{j0}}{\left(1 + \frac{|V_D|}{V_{bi}}\right)^M}$$



UNLV
UNIVERSITY OF NEVADA LAS VEGAS

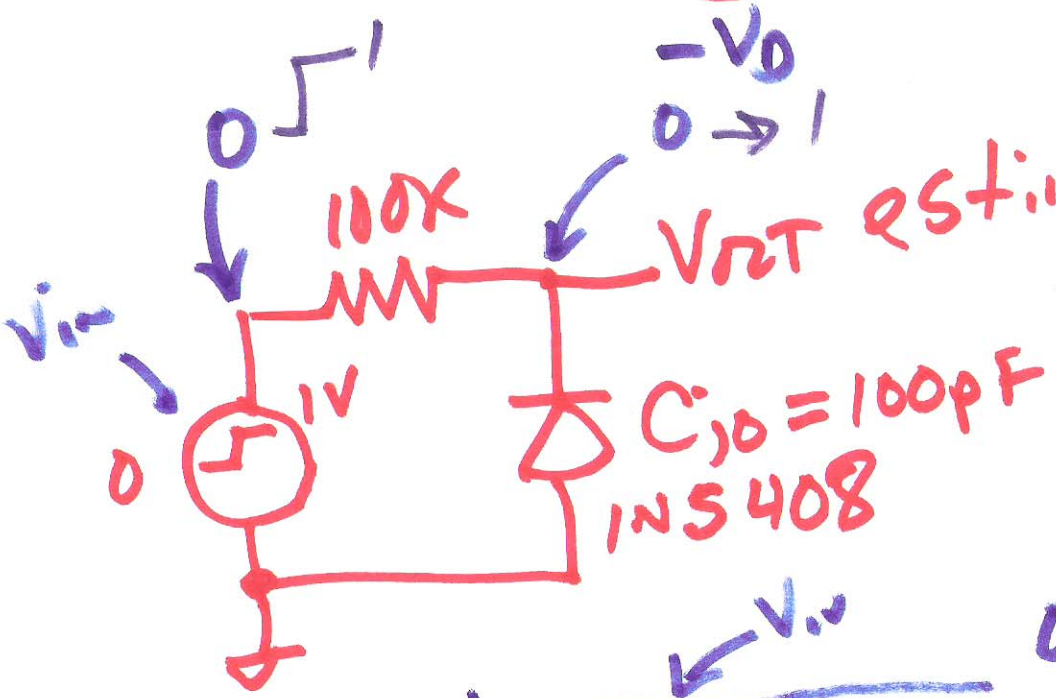
CMOSedu.com

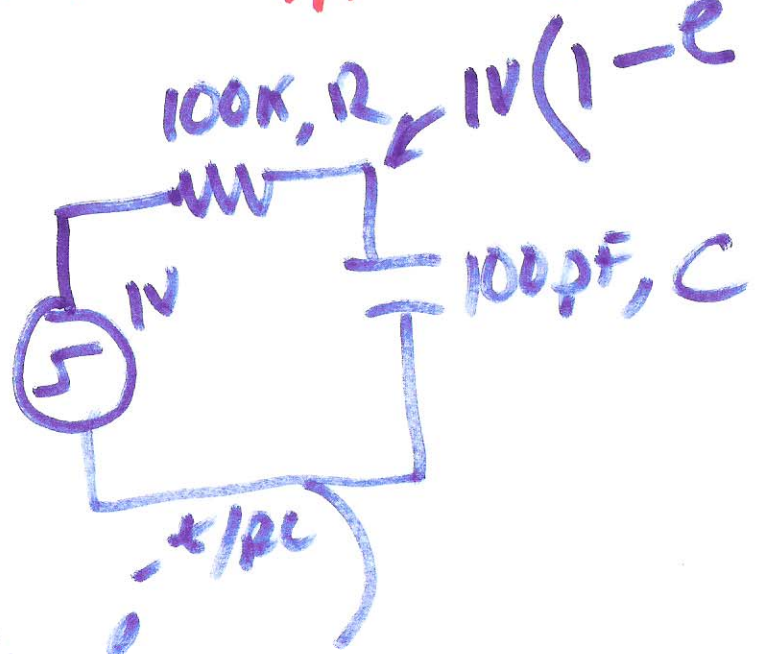


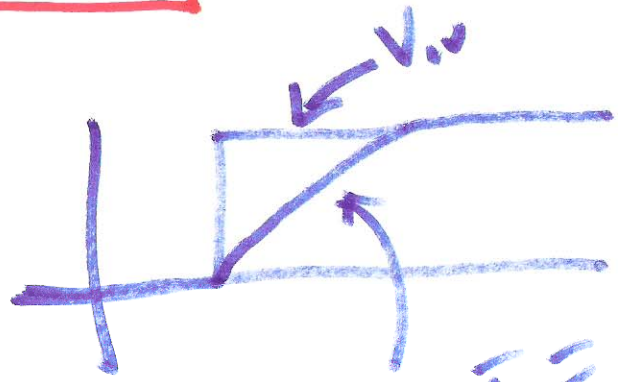


$V_X + V_D = 0$

$V_X = -V_D \left(1 - e^{-t/RC}\right)$





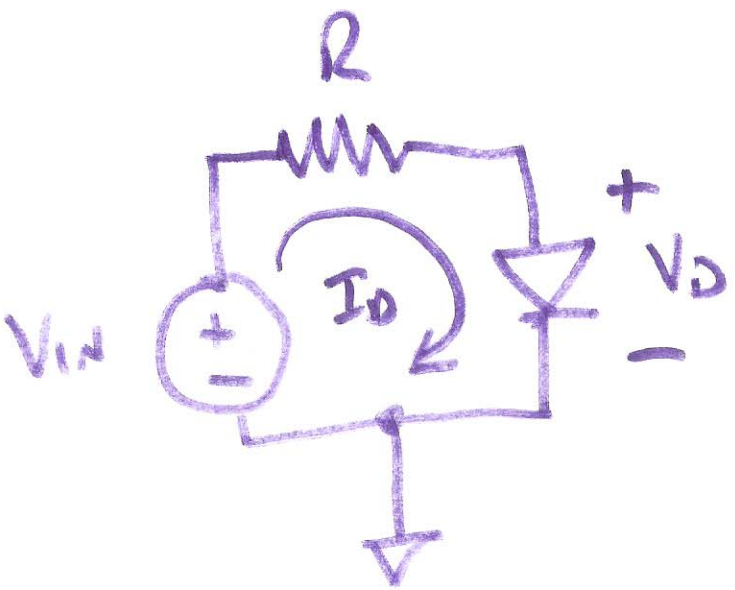


UNLV
UNIVERSITY OF NEVADA | LAS VEGAS

CMOSedu.com

Load lines and Q-point

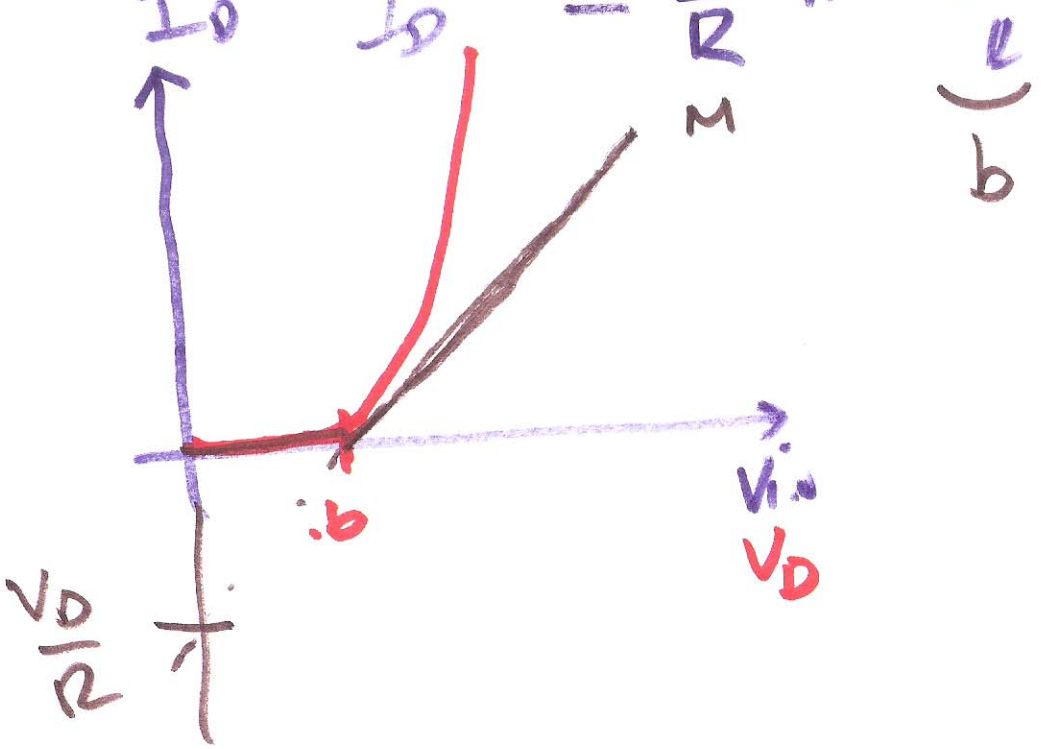
→ Quiescent



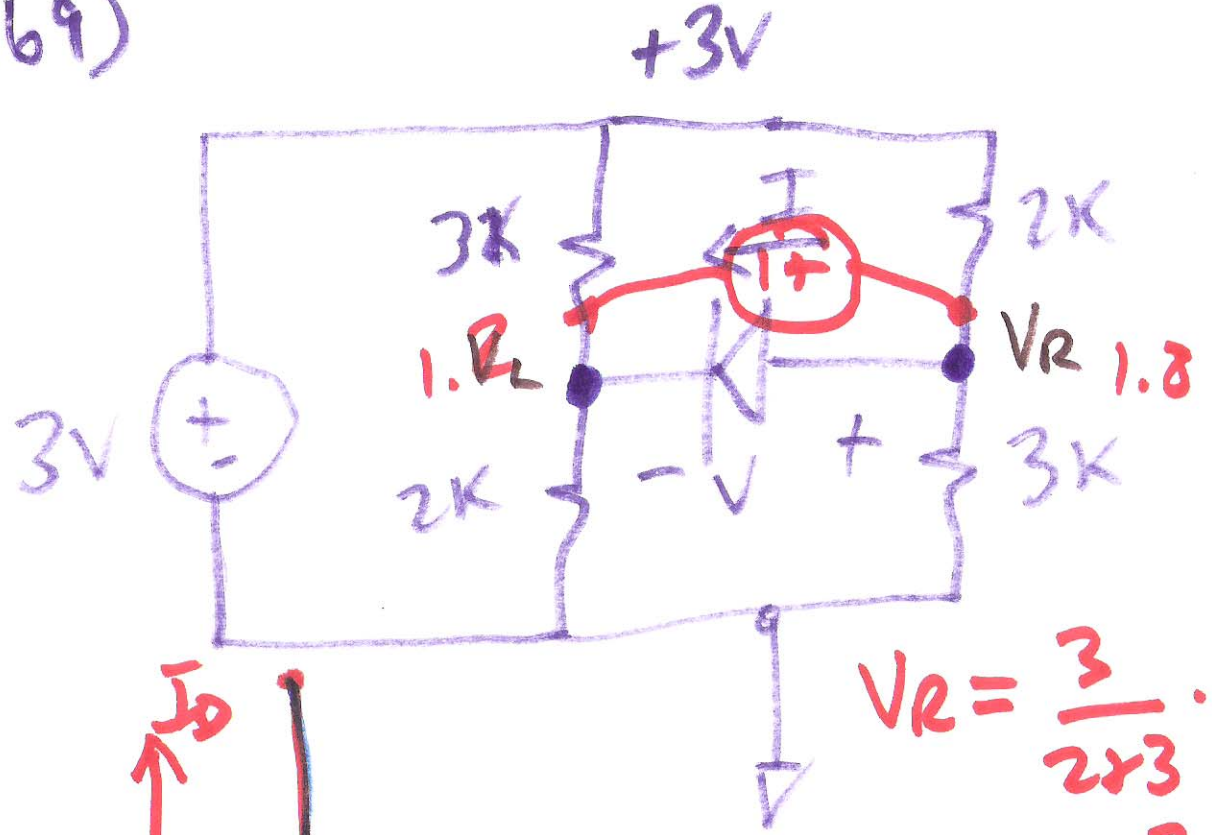
$$I_D = \frac{V_{IN} - V_D}{R}$$

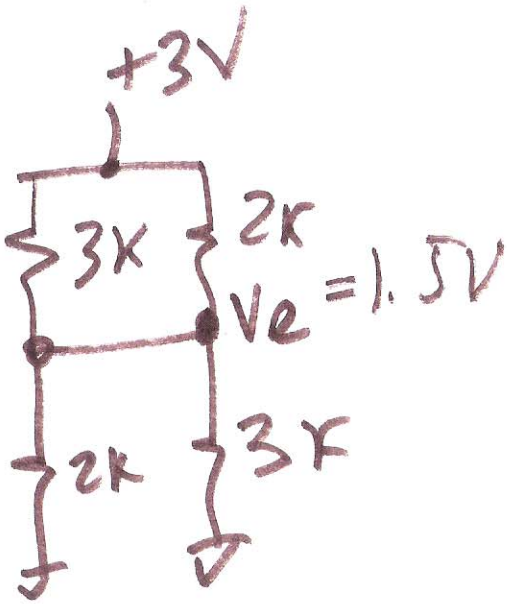
$$y = \frac{1}{R}\, x - \frac{V_D}{R}$$

$$m = \frac{1}{R}, \quad b = -\frac{V_D}{R}$$



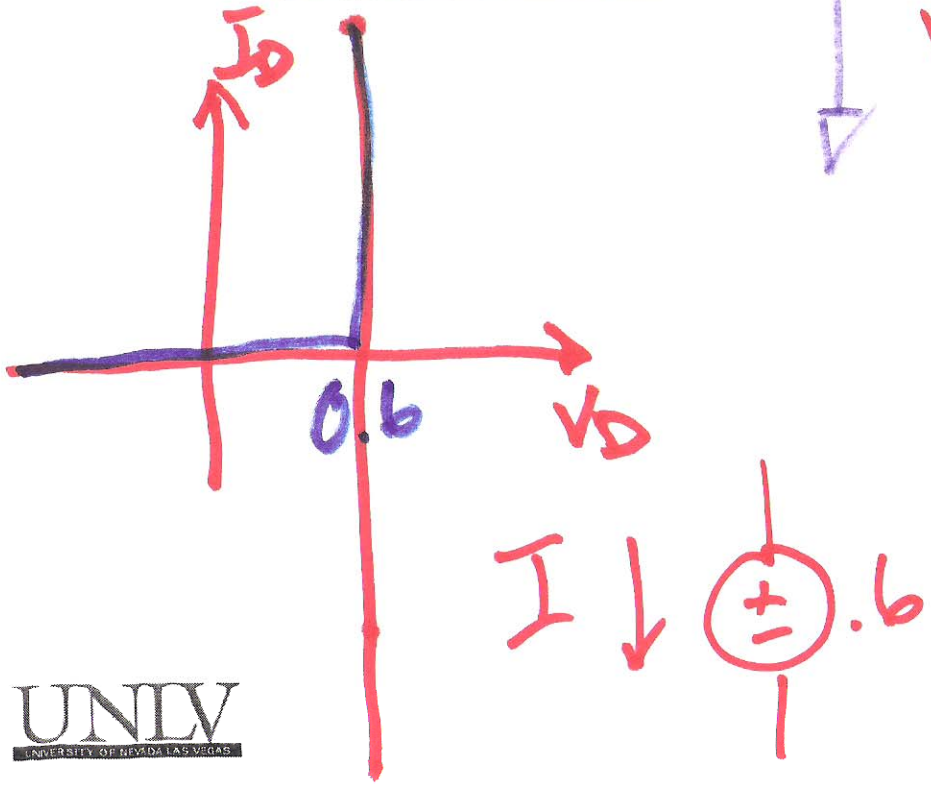
3.69)





$$V_R = \frac{3}{2+3} \cdot 3 = \frac{9}{5} = 1.8$$

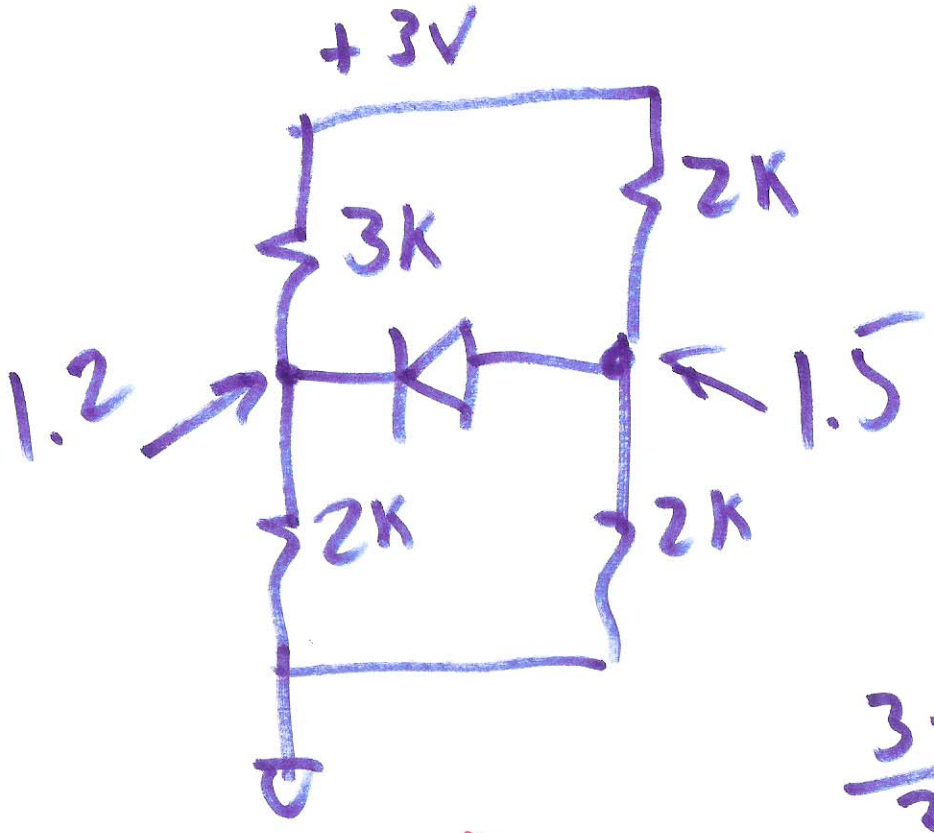
$$V_L = \frac{2}{2+3} \cdot 3 = \frac{6}{5} = 1.2$$

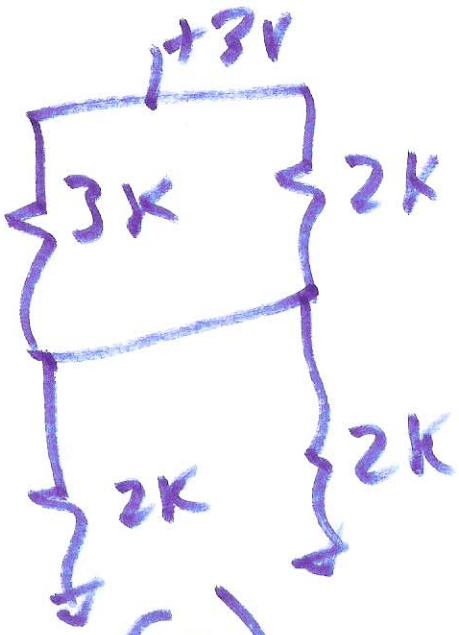


UNLV
UNIVERSITY OF NEVADA LAS VEGAS

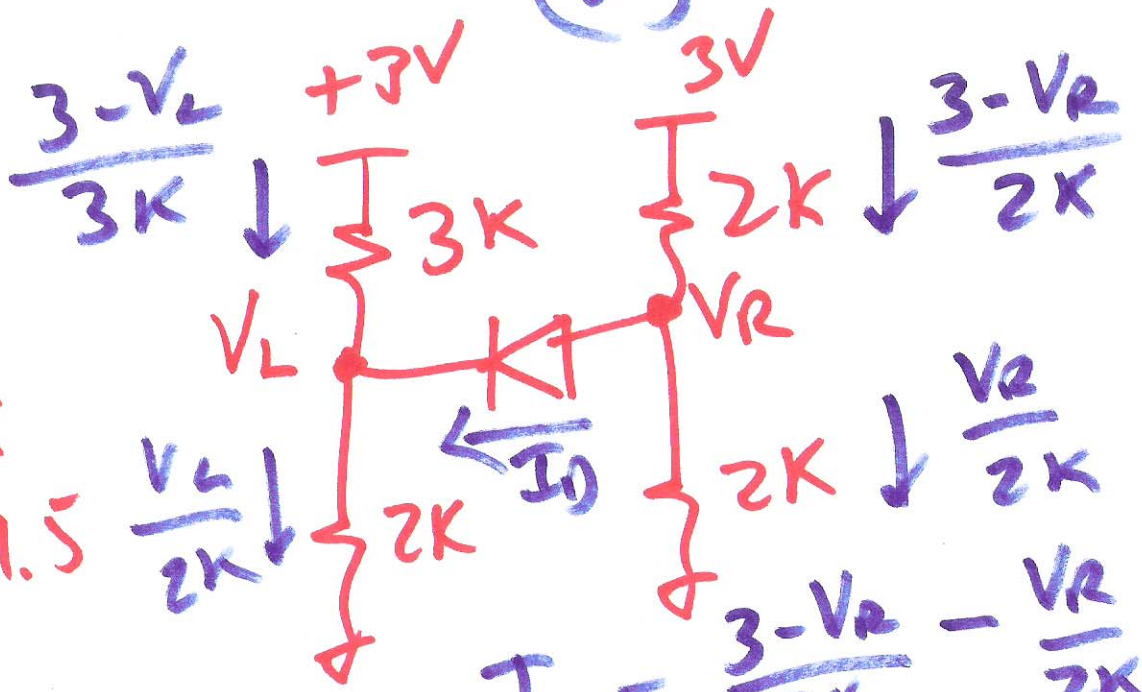
CMOSedu.com

b)

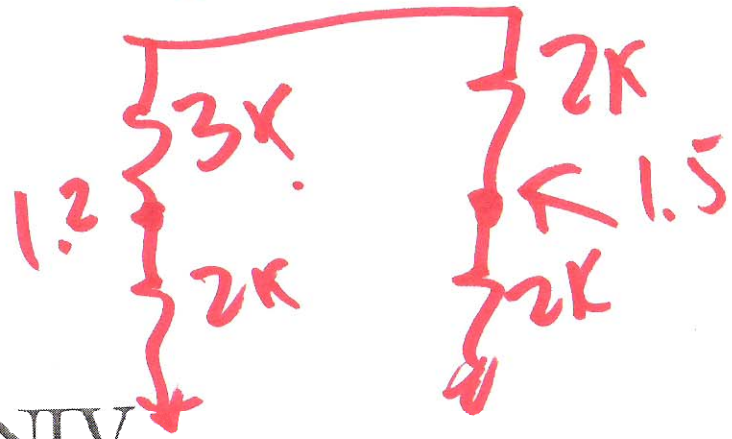


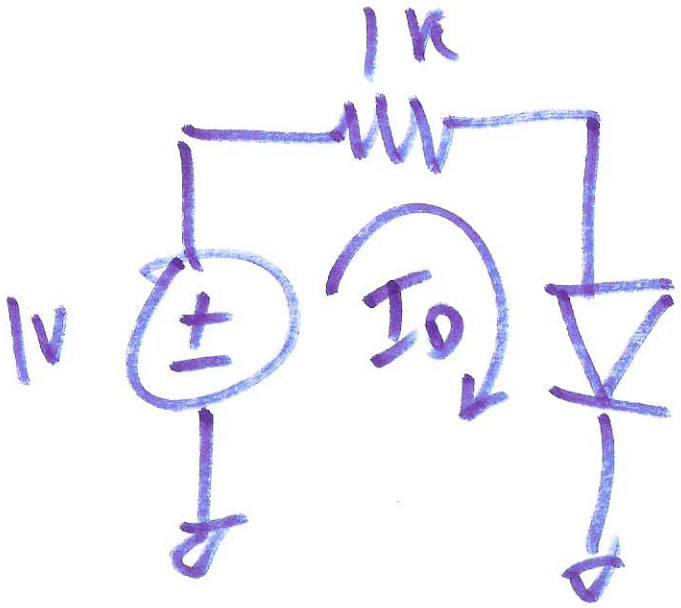


(a)



(b)





$I_s = 10^{-15}$ A, $N = 1$, room temp

find V_D = ?

$$\frac{1 - V_D}{1K} = I_D \simeq I_s e^{V_D / 0.025}$$

10^{-12}

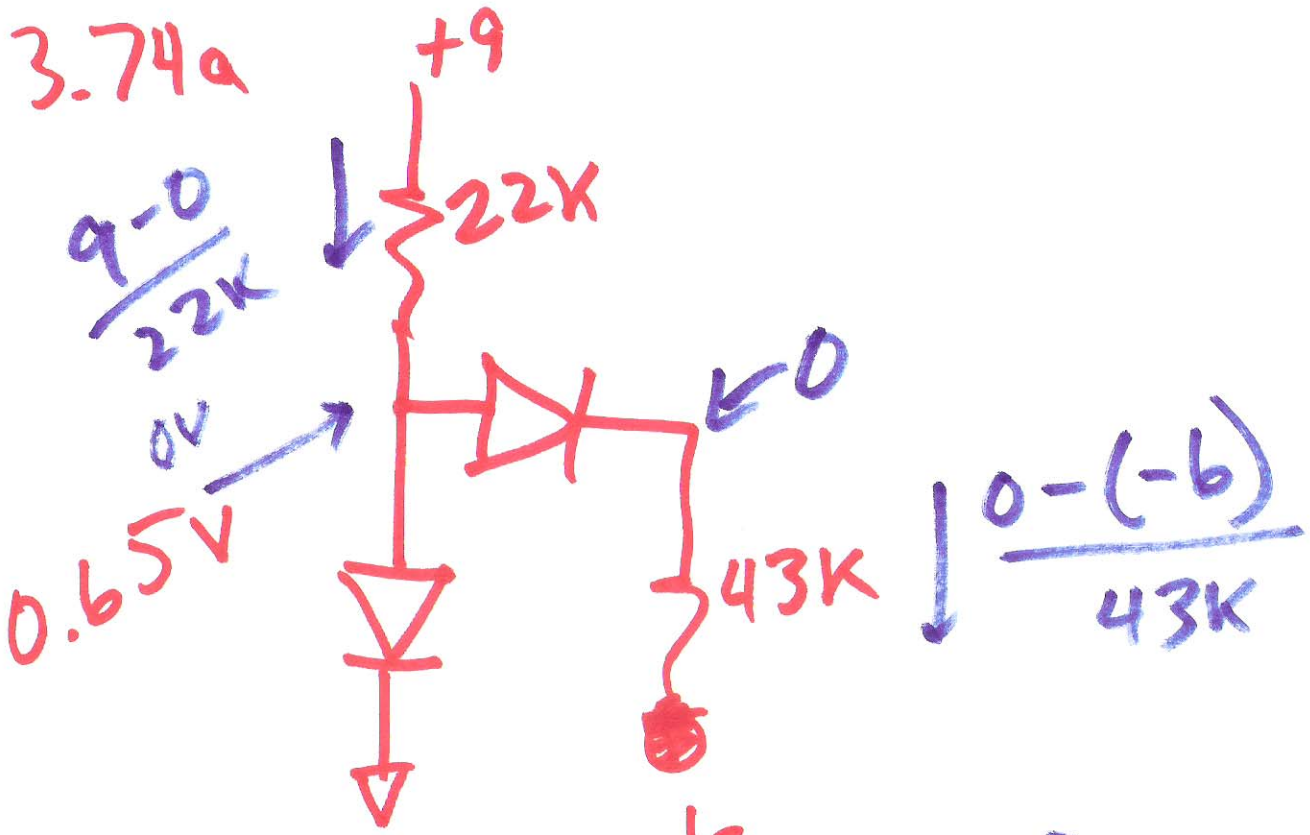
L	R	V_D
0.4	0.826	0.6
0.3	1.424	0.7
0.35	.795	0.65

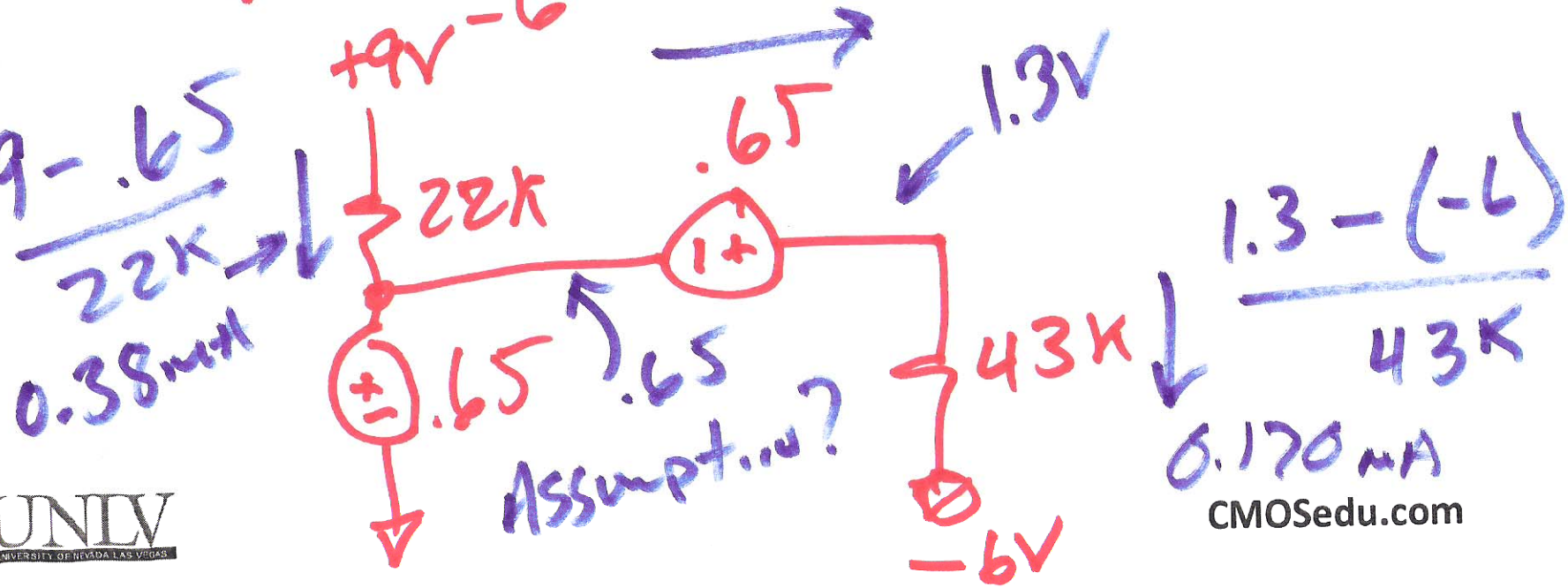
UNLV
UNIVERSITY OF NEVADA, LAS VEGAS

CMOSedu.com

8)

3.74a





CMOSedu.com

UNLV UNIVERSITY OF NEVADA LAS VEGAS