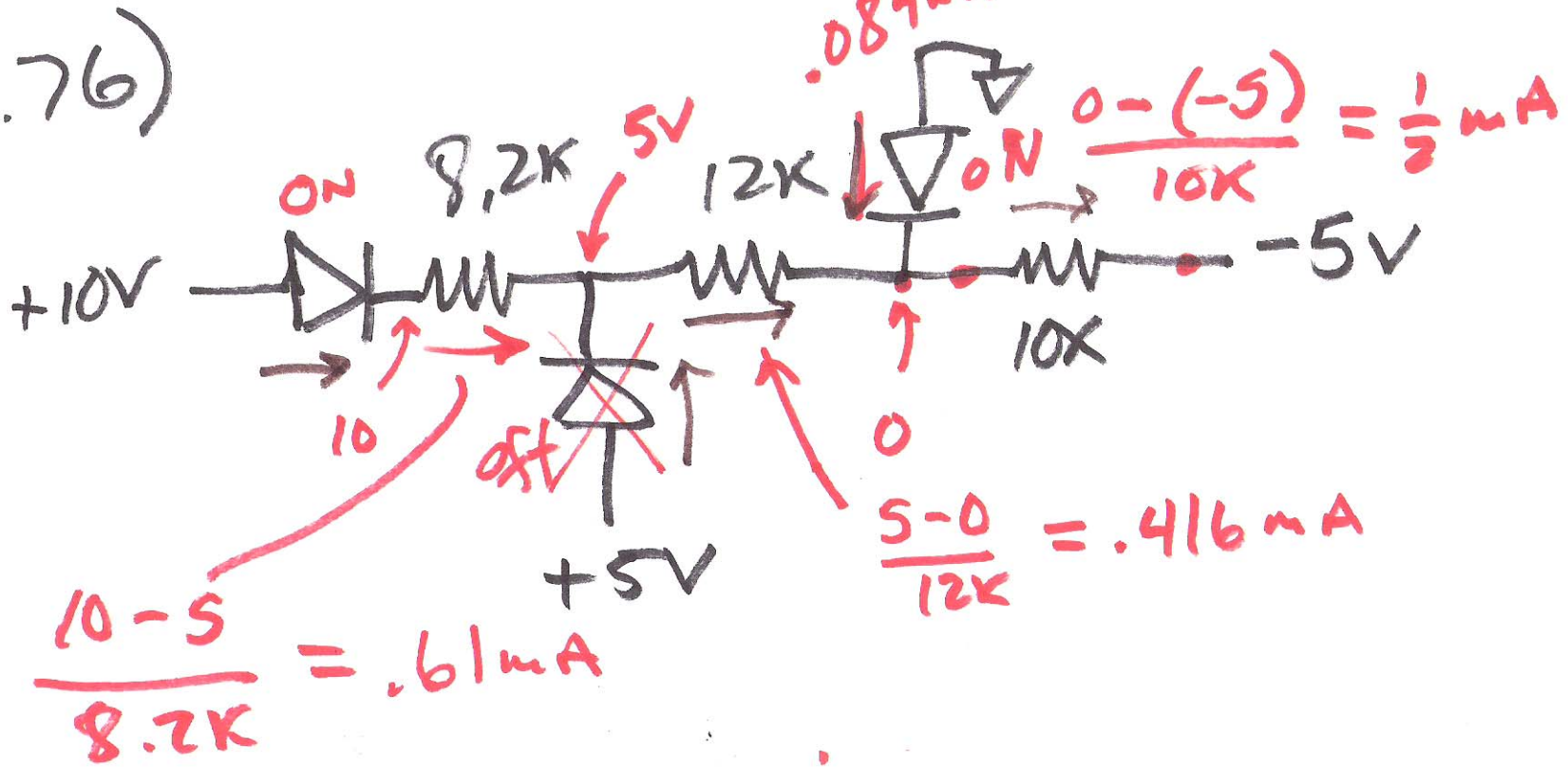
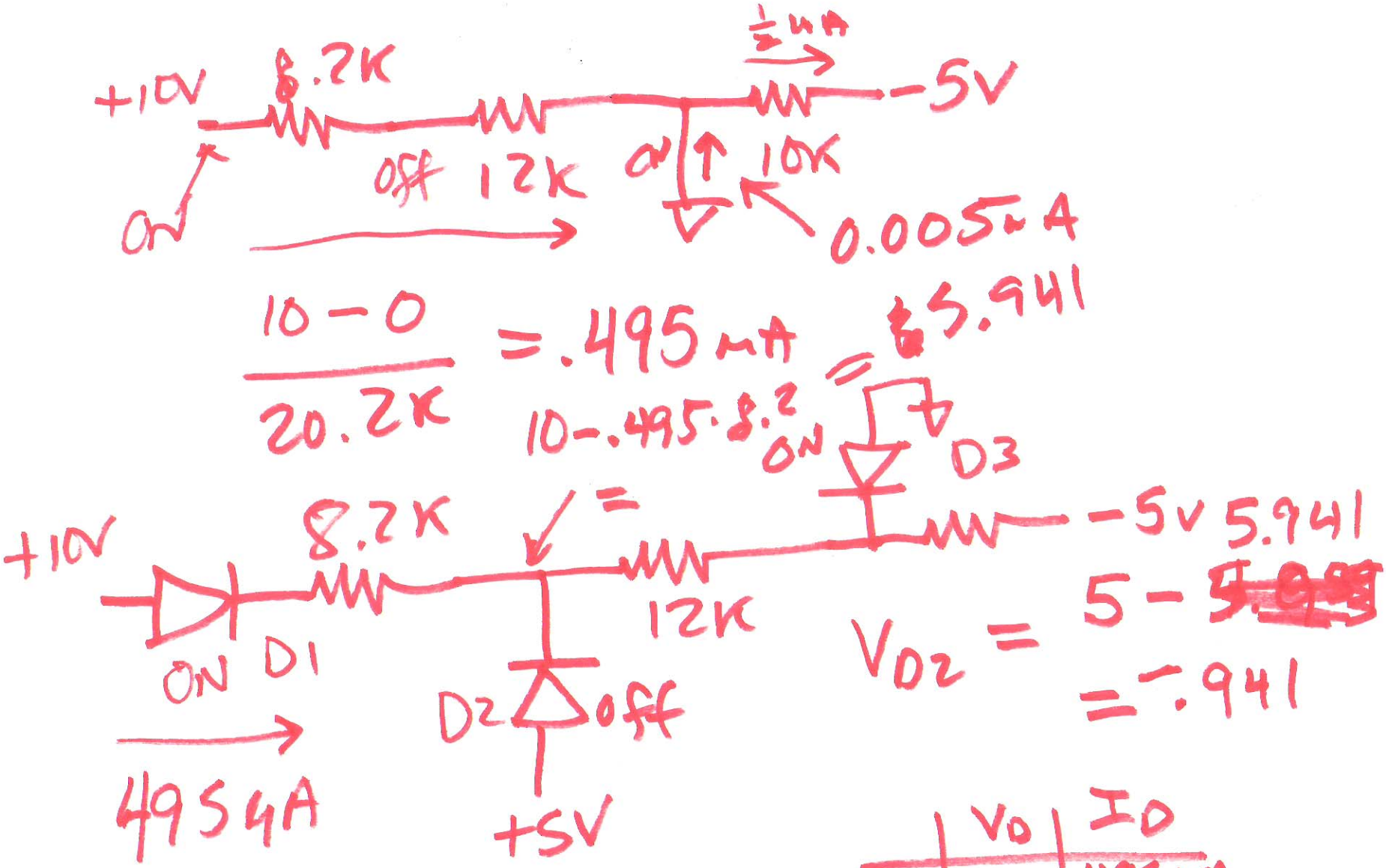
Lecture 12, March 5, 2014

EE 320 Electronics

Test on Monday March 10!

3.76)



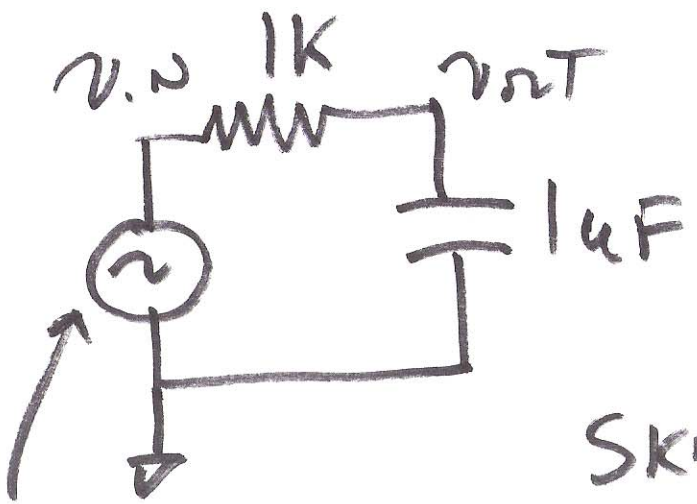


	V_D	I_D
D1	0	495μA
D2	-.941	0
D3	0	5μA

2)

RC circuits

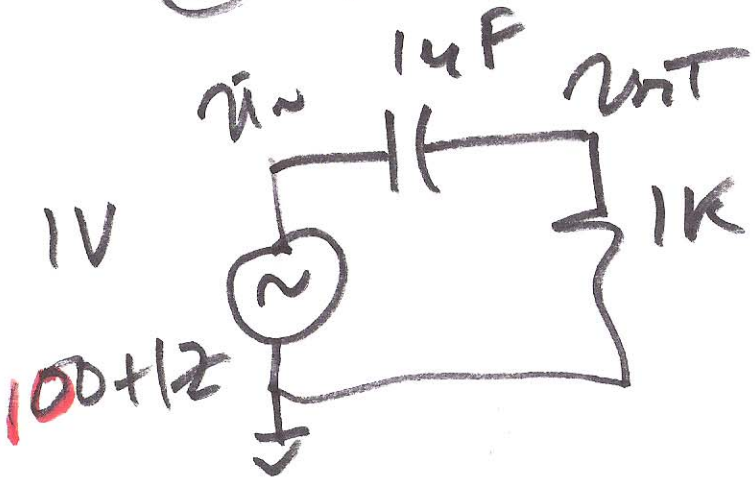
$$\theta = \frac{t_d}{T} \cdot 360$$

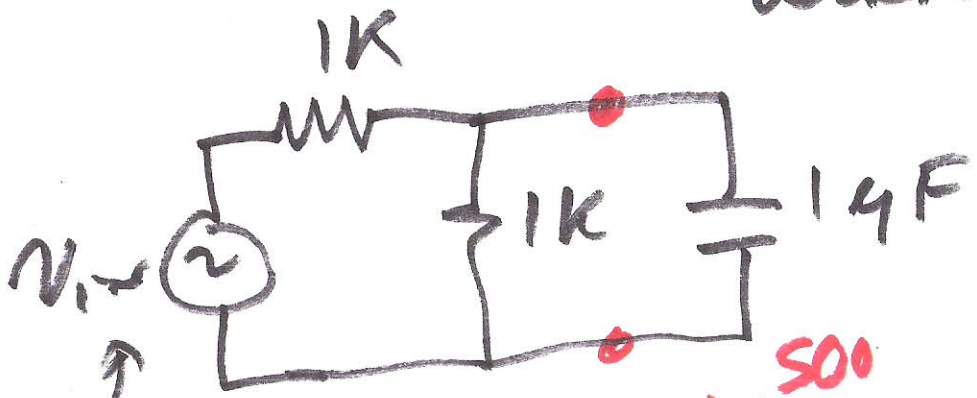


1V-peak @ 175Hz

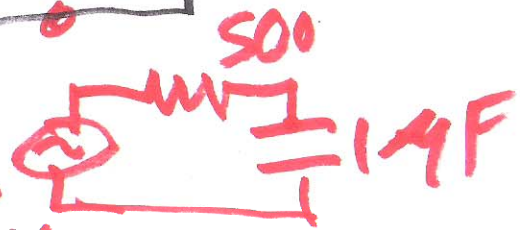
Sketch v_{RT} & v_{in} on the same plot

Show your work!





1V @ 300Hz



$\frac{1}{2}$V peak @ 300Hz

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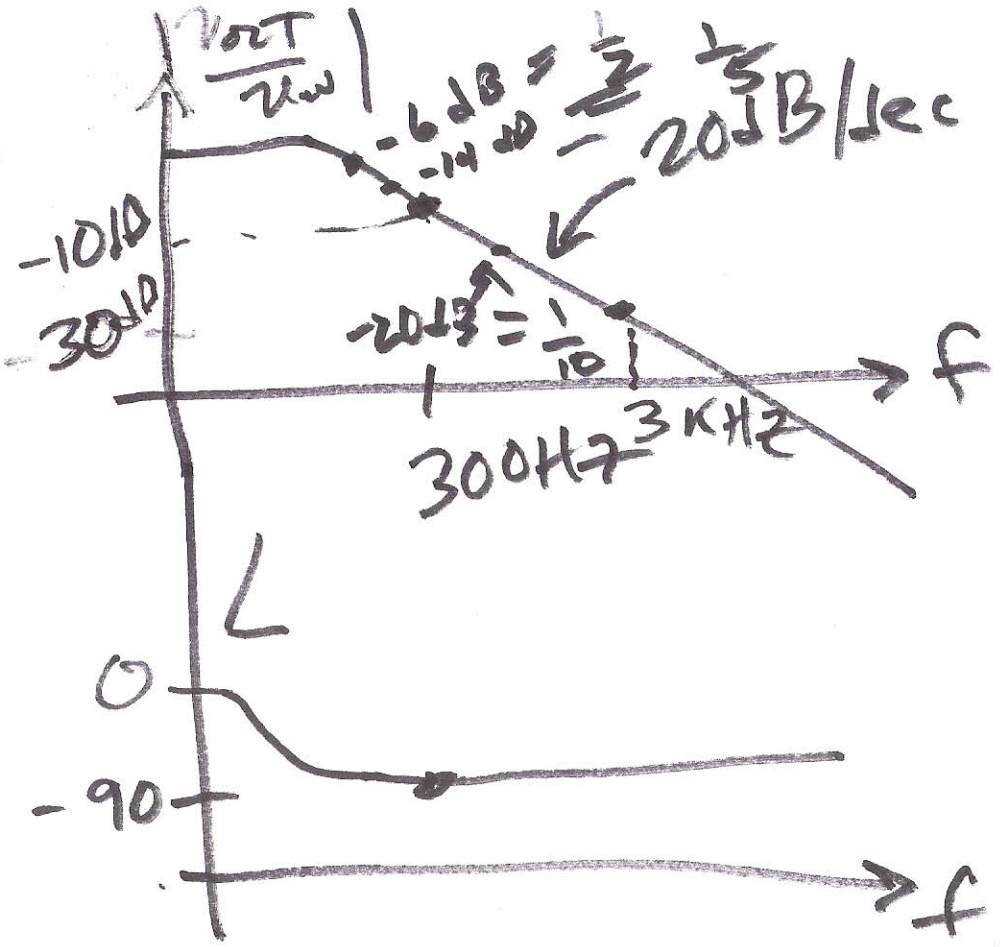


20dB ×10

-20dB ÷10

1 dec. ×10

Lower dec ÷10

1.2KHz

↓ 1 decade above

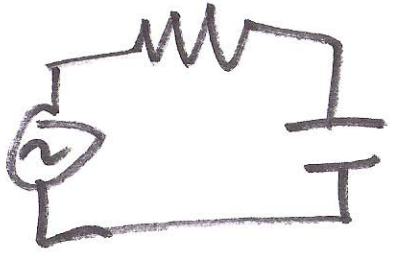
12KHz

6dB ×2

1 octave ×2

14dB ×5

write a spice netlist



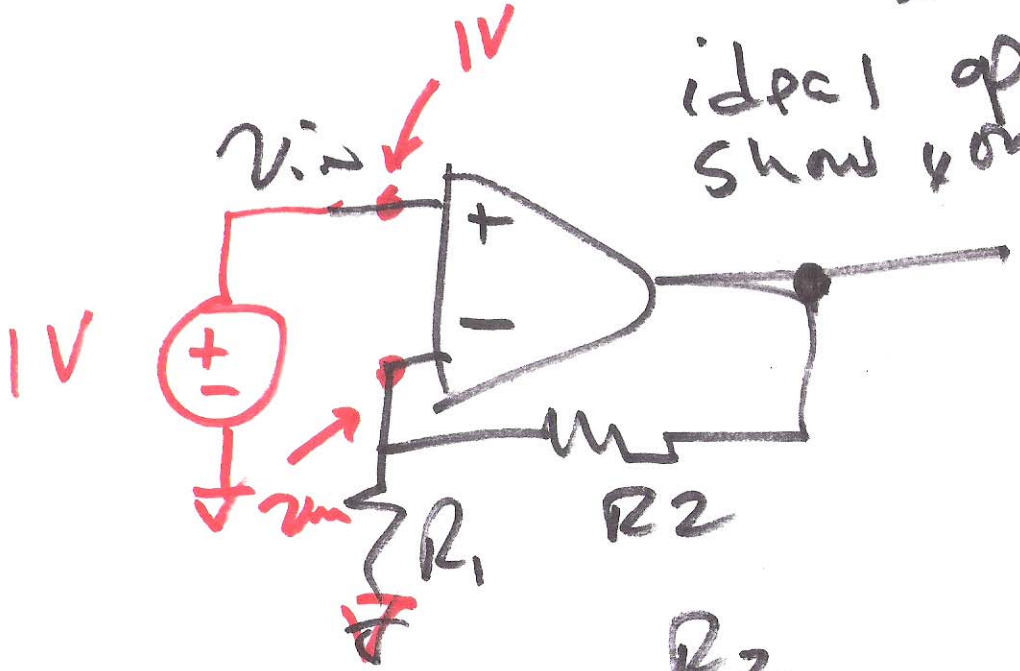
OP-Amp CIRCuits

Calculate $\frac{v_{out}}{v_{in}}$ for: $A_{OL} = 250$

$V_{OS} = \pm 10\,mV$

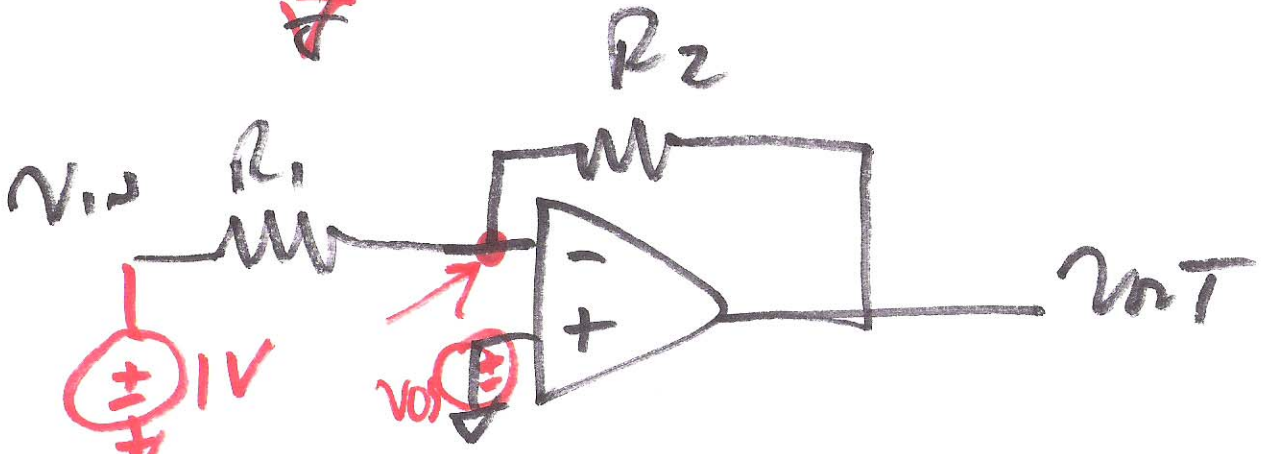
ideal op-amp
show your work

Calculate V_{out}

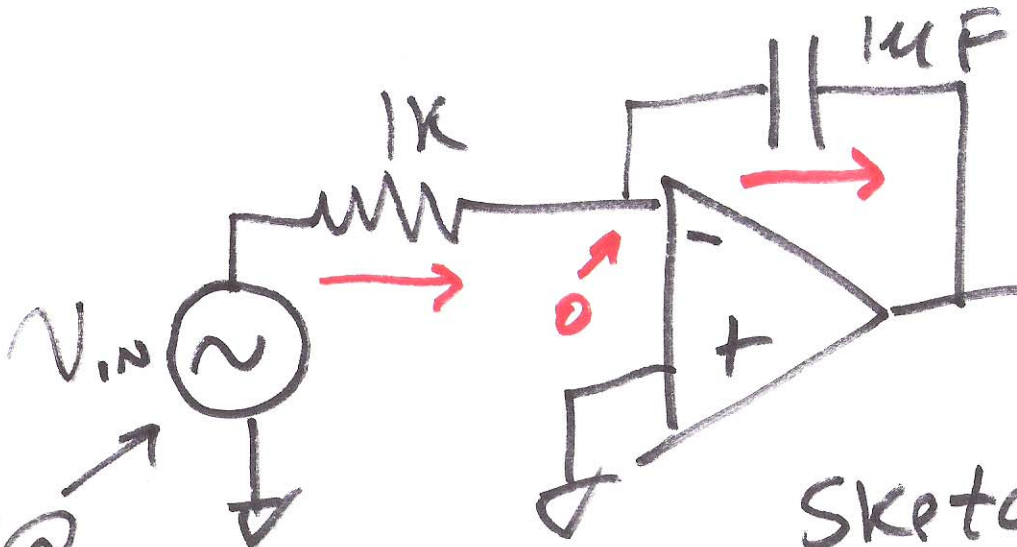


$v_{out} = A_{OL}(1 - v_{in})$

$$\frac{v_{out}}{v_{in}} = 1 + \frac{R_2}{R_1} = \frac{R_1 + R_2}{R_1}$$



$$\frac{v_{out}}{v_{in}} = -\frac{R_2}{R_1}$$



$$\frac{V_{out}}{V_{in}} = -\frac{1}{j\omega RC}$$

V_{out} =

Bode Response

Sketch V_{out} & V_{in} in the time domain on the same plot.

$$\frac{V_{in}-0}{1K} = \frac{0-V_{out}}{1/j\omega 10^{-6}}$$

$\frac{1}{2\pi fRC} = \frac{1}{\omega RC}$

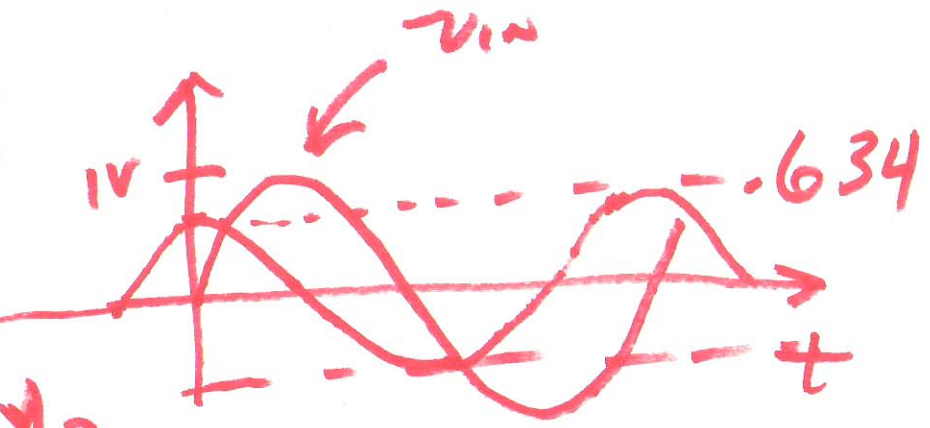
$$\left|\frac{V_{out}}{V_{in}}\right| = \left|-\frac{1}{0+j\cdot 2\pi\cdot 200\cdot 10^{-3}}+j0\right| = \frac{\sqrt{1^2+0^2}}{\sqrt{0^2+(1.256)^2}}$$

$$\left|\frac{V_{out}}{V_{in}}\right| = .634$$

① $\frac{v_{out}}{v_{in}} = -\frac{1}{j\omega RC}\cdot\frac{j}{j} = 0 + j\cdot\frac{1}{\omega RC}$

$\angle a+jb \Rightarrow \tan^{-1}\frac{b}{a}$ $\quad \angle\frac{v_{out}}{v_{in}} = \tan^{-1}\frac{\frac{1}{\omega RC}}{0} = 90°$

$\angle\frac{1}{a+jb} \Rightarrow -\tan^{-1}\frac{b}{a}$



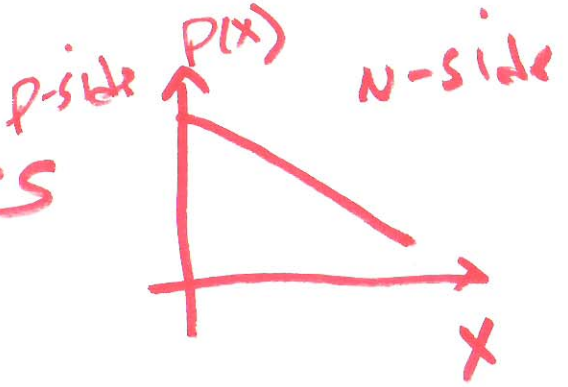
② $\frac{j}{\omega RC}$ $\quad$ I_m $\quad +90°$ $\quad X_C$

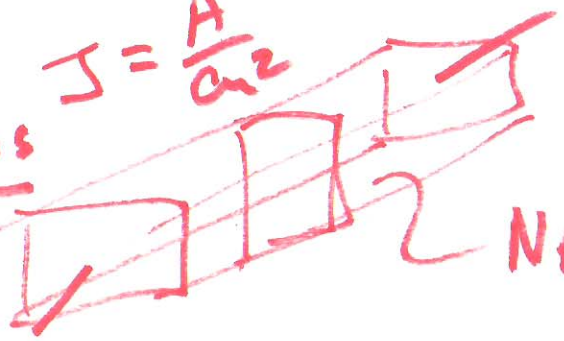
③ $\frac{-1}{j\omega RC} = \frac{-1+j0}{0+j\omega RC}$ $\quad 180-90 = 90°$ $\quad 90$

$= \tan^{-1}\frac{-1}{0}$ $\quad -\tan^{-1}\frac{\omega RC}{0}$

Semiconductors

→ H.W. & Quizzes





$Q = \frac{\text{Columbs}}{cm^2}$ $\quad N_A = 10^{16}\ \frac{\text{Atoms}}{cm^3}$

$$\rho = \frac{1}{q \cdot P \cdot \mu_p + q \cdot N \cdot \mu_N}$$

$P = 10^{16}$ holes/cm³

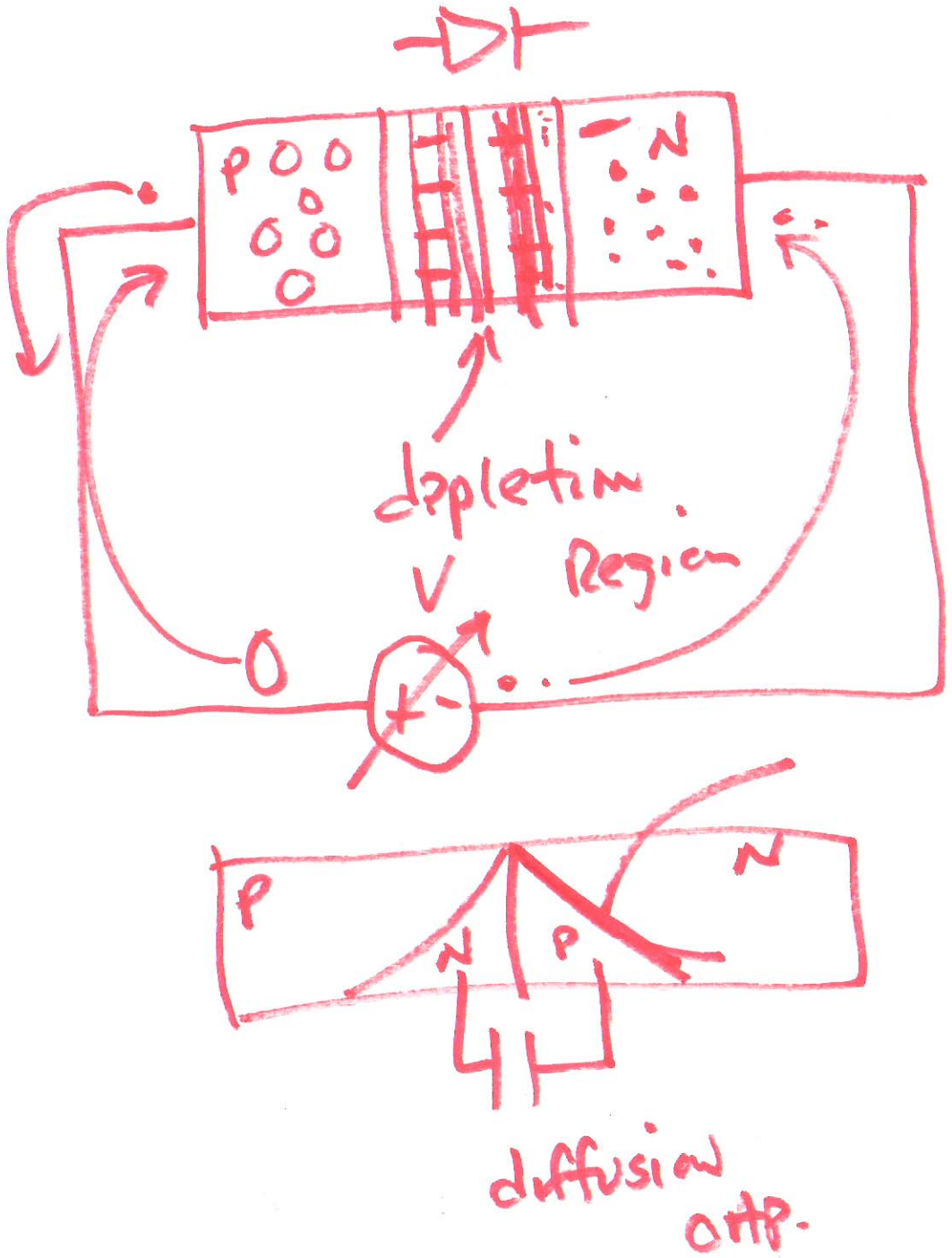
Assuming complete ionization

$$\mu_p = \frac{\text{Velocity}, \frac{cm}{s}}{\mathcal{E}, \frac{V}{cm}}$$

$$N = \frac{N_i^2}{P}$$

I for Applied ✓

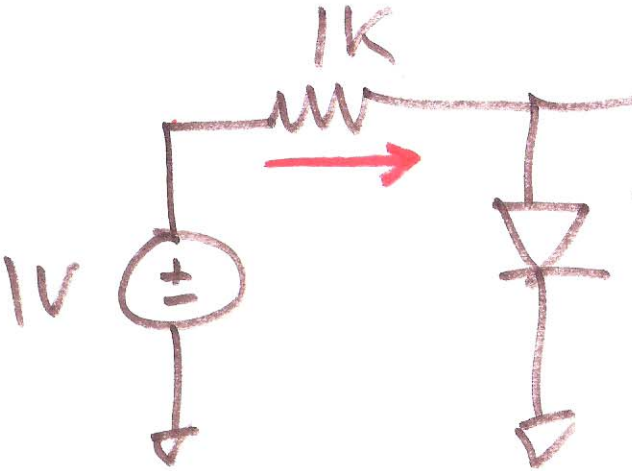
R $\quad J = \frac{cm^2}{V \cdot s}$



$$J_{p,diff} = q \cdot D_p \cdot \frac{dp}{dx}$$

Diodes

Study H.W. & Quizzes



$I_S = 10^{-17}A$

$N = 1$

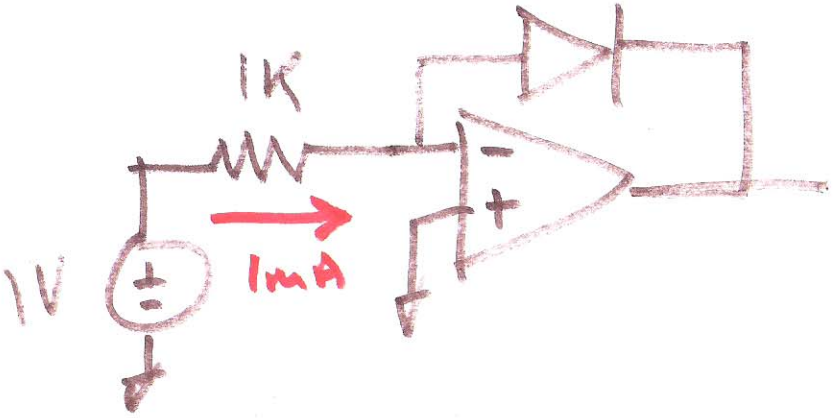
$V_T = 25mV$

find V_D

on the test:

$$I = \frac{1 - V_D}{1K}$$

$$V_D = \frac{KT}{q} N \ln \frac{I_D}{I_S}$$



$$V_{OUT} = -\frac{KT}{q} \cdot N \cdot \ln \frac{I_D}{I_S}$$

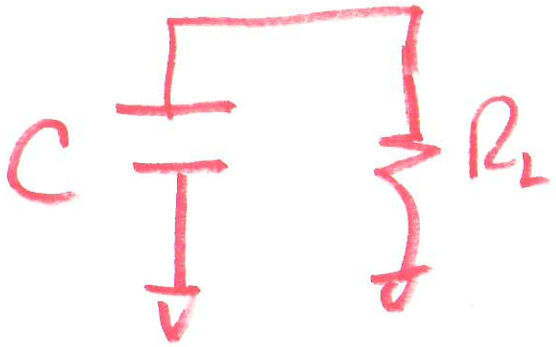
$$= -25mV \cdot \ln \frac{10^{-3}}{10^{-17}}$$

$$=$$

Rectifiers

Basic operation

Selecting the filter CAP for a specific Ripple



$$I = C\frac{dV}{dt} = \frac{V_0}{R_L} = C \cdot \frac{\Delta V}{\Delta T}$$

Reverse Recovery time $\Delta T = \frac{1}{f} = \frac{1}{60}$