Given that $R_2 = 100\, \text{K} \Omega$, $R_5 = 100\, \text{K} \Omega$, $R_6 = 10\, \text{K} \Omega$, $R_7 = 100\, \text{K} \Omega$, $R_L = 0.5\, \text{K} \Omega$, $C_1 = 10\, \mu\text{F}$, $C_3 = C_4 = 1000\, \mu\text{F}$, $C_2 = 200\, \text{pF}$ and $V_{cc} = 15\, \text{V}$.

a. Find the bias voltage at pin 6 of the op amp.

b. Find the low-frequency cut-off.

c. Find the high-frequency cut-off.

d. What is the gain at 1kHz if $C_2 = 1000\, \mu\text{F}$?

e. If $V_{in} = 1\, \text{V}$, what is the peak voltage at pin 6?
Given that $R_1=R_3=1\,k\text{ }, R_2=2\,k\text{ }, V_1 = 20V\text{, }V_2=2V\text{, and the voltage at pin 6 is 14V.}$

a. Find the voltage at pin 2 of the op amp.

b. What is $V_z$?

c. Find the current in $R_2$.

d. What is the voltage on pin 6 if pin 3 is grounded?

e. If $R_2=4\,K$, what is the voltage at pin 6 of the op amp?
In the given circuit, R2=100K, R1=1K, V2 = 20V, I_B=.1ma and the Zener diode has a breakdown voltage of 5 volts. The transistor has a β of 100.

a. Find V1.
b. Find I_C.
c. Find V_{CE}.
d. What is the current in D5?
e. What is the operating mode of the transistor if V2=5V?
Consider the schematic given at the right in which $V_1=15V$, $V_z=6V$ and $R_1=R_2=R_3=R_4=1k$. Assume that a forward-biased diode has a drop of .7 volt.

a. (10) Find the voltages at pin 6 of the op amp and at the emitter of Q1.

b. Find the base current of Q1

c. Calculate the power dissipation of the diode.

d. Recalling the properties of real op amps, explain why Q1 can’t saturate regardless of the voltage applied to pin 3.