intro to electrical quiz 2

ical quiz 2

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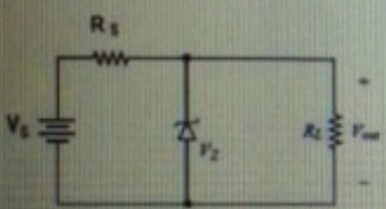
https://www.dropbox.com/lightbox/home/MA2009 Intro to Electrical Circuits %26 Electronic Devices/Quiz 2

Find the minimum value of R_L for which the output voltage keeps exactly at V_Z.



Given V_S = 25 V, V_Z = 15V, and Rs = 25 KΩ.

- ○ 35.0 KΩ
- ○ 20.5 KΩ
- ● 37.5 KΩ
- ○ 25.0 KΩ

Moving to the next question prevents changes to this answer.

Question 2 of 5

2 of 5

intro to electrical quiz 2

ectrical quiz 2

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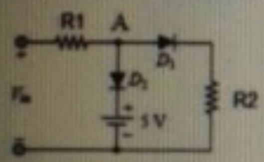
Question 1 20 points ✓ Saved

Two ideal diodes are connected in a circuit shown in the figure. Calculate the voltage range of V_{in} so that D_1 is "ON" but D_2 is "OFF".



Given R1 = 9 kΩ and R2 = 12 kΩ.

- ○ $0 < V_{in} < 7.75$ V
- ● $0 < V_{in} < 8.75$ V
- ○ $0 < V_{in} < 7.25$ V
- ○ $0 < V_{in} < 8.25$ V

⚠ Moving to the next question prevents changes to this answer.

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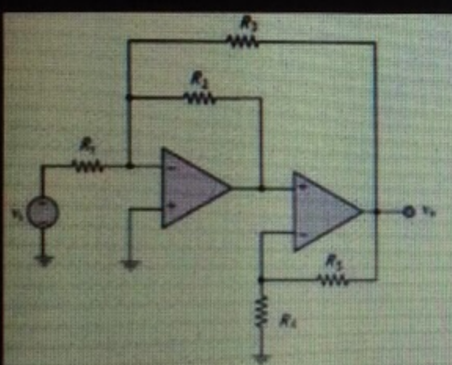

Given R_1=10Ω, R_2=10 Ω, R_3=10 Ω, R_4=10 Ω and R_5= 30 Ω.

- ○ Av= -2.25(V/V)
- ○ Av= 0.80(V/V)
- ● Av= -0.80(V/V)
- ○ Av= 2.25(V/V)

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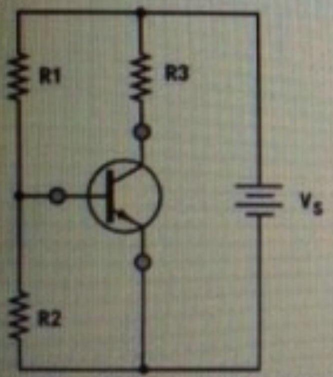
https://www.dropbox.com/lightbox/home/MA2009 Intro to Electrical Circuits %26 Electronic Devices/Quiz 2

Given the circuit of the figure, determine the base current I_{BQ} and collect voltage V_{CEQ}. Assume a 0.6 V offset voltage, $\beta = 50$, and $V_S =$ 5 V.



Given R_1=100 kΩ, R_2=200 kΩ, and R_3=500Ω.

- I_{BQ}=0.032mA, V_{CEQ}= 3.350V.
- I_{BQ}=0.041mA, V_{CEQ}= 3.975V.

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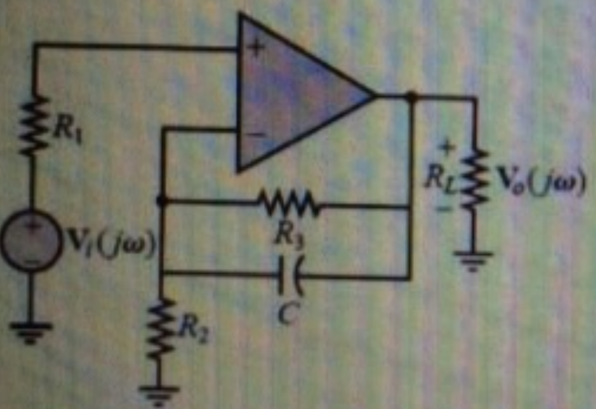
The circuit shown in the figure is an active filter with. Determine the cutoff frequency (ω_0) and pass-band gain (A_V) of the filter.



Given R_1=2kΩ,R_2=5kΩ,R_3=50kΩ,C=100nF.

- ○ ω_0 = 2000 rad/sec; A_V = 8.22 dB.
- ● ω_0 = 200 rad/sec; A_V = 20.83 dB.
- ○ ω_0 = 2000 rad/sec; A_V = 20.83 dB.
- ○ ω_0 = 200 rad/sec; A_V = 8.22 dB.

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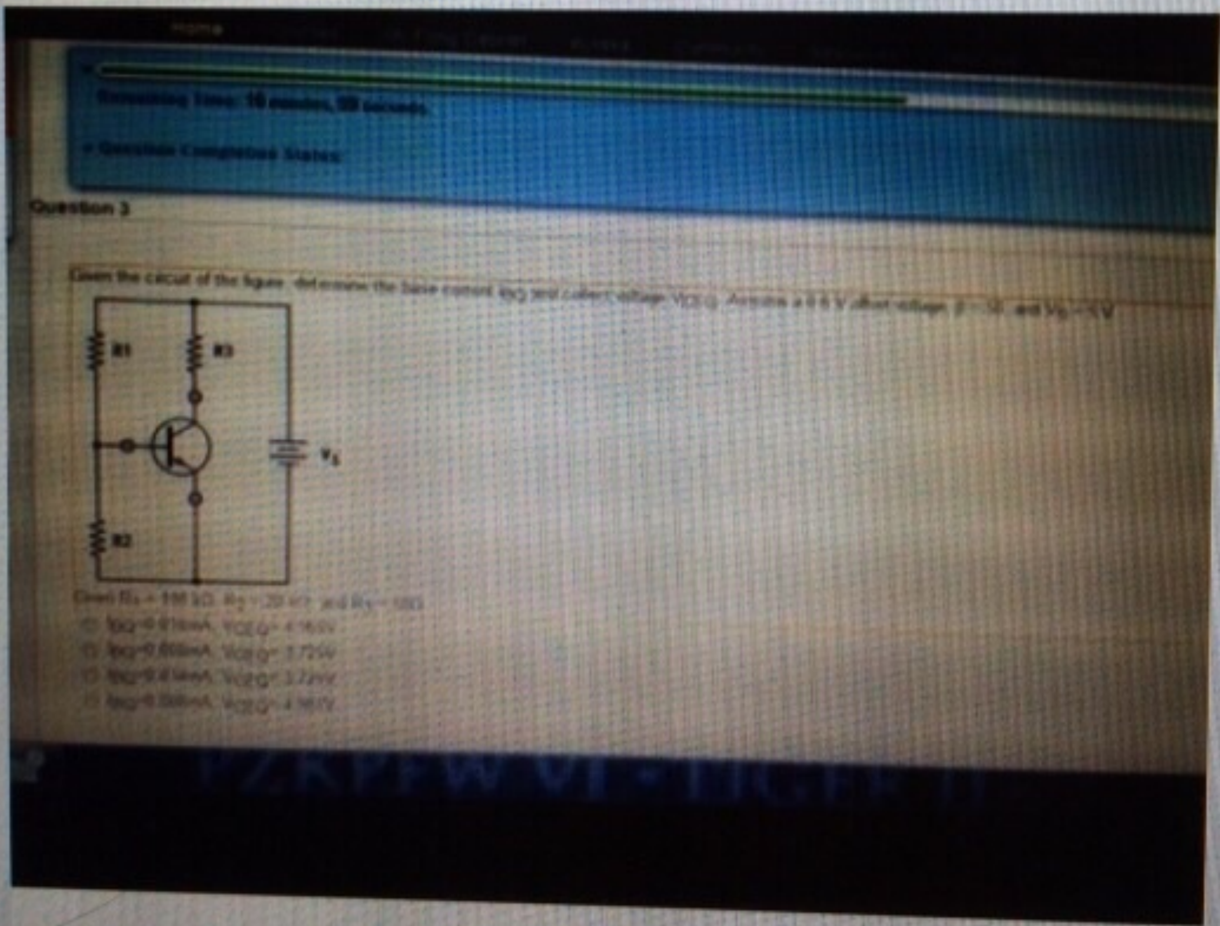

intro to electrical quiz 2

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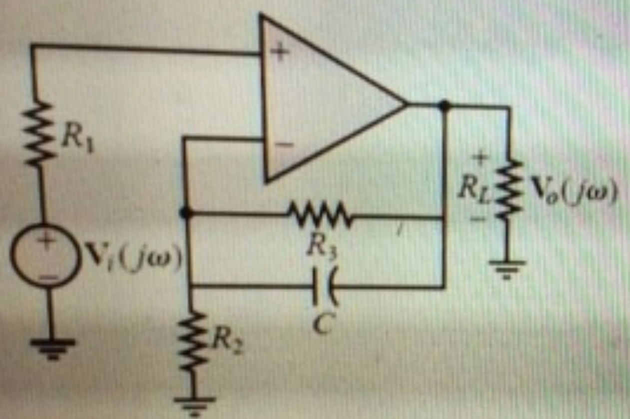
Remaining Time: **14 minutes, 34 seconds.**

Question Completion Status:

The circuit shown in the figure is an active filter with. Determine the cutoff frequency (ω_0) and pass-band gain (A_V) of the filter



Given R_1=2kΩ,R_2=5kΩ,R_3=10kΩ,C=100nF

- ω_0 = 2000 rad/sec, A_V = 9.54 dB
- ω_0 = 2000 rad/sec, A_V = 7.63 dB
- ω_0 = 1000 rad/sec, A_V = 9.54 dB
- ω_0 = 1000 rad/sec, A_V = 7.63 dB

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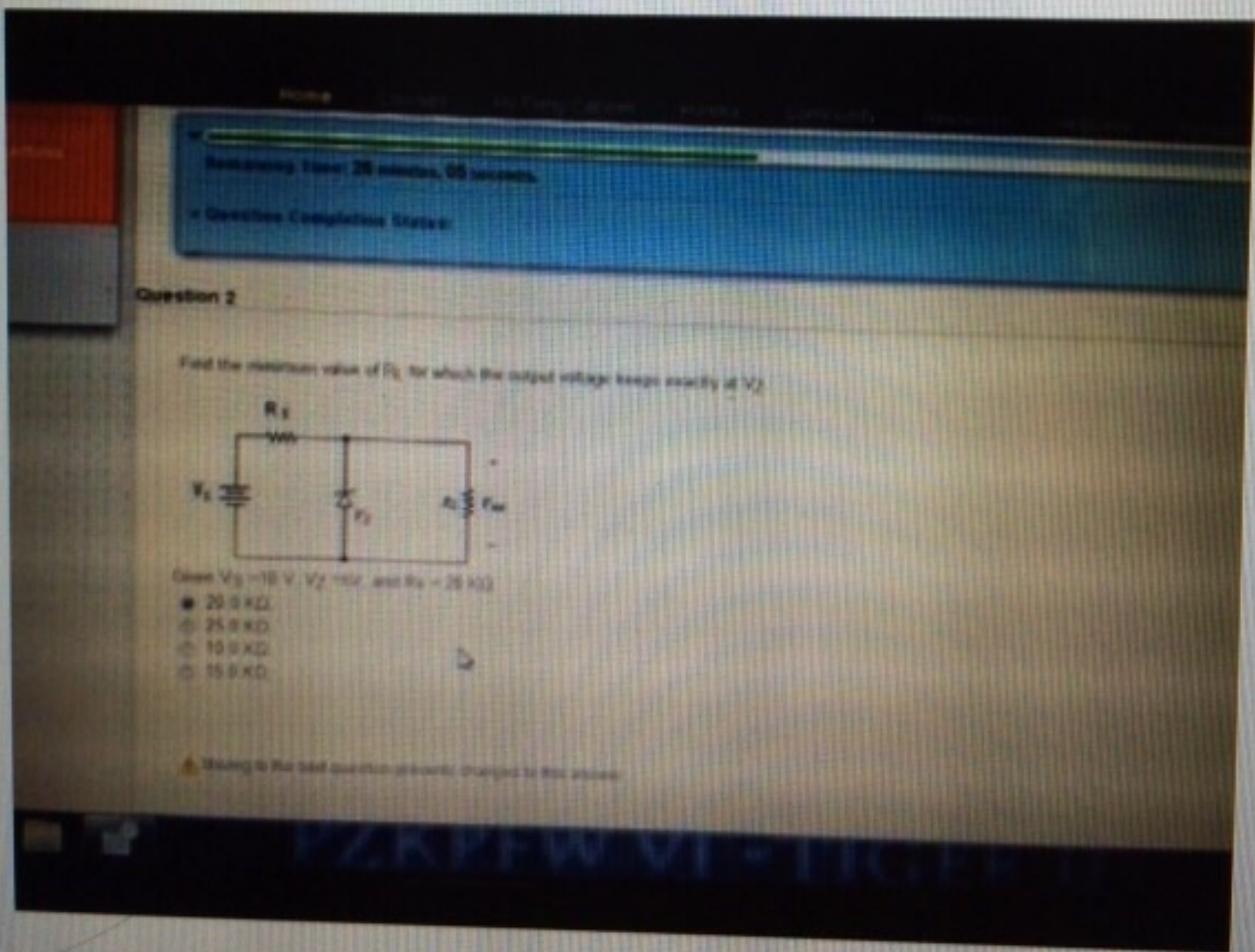

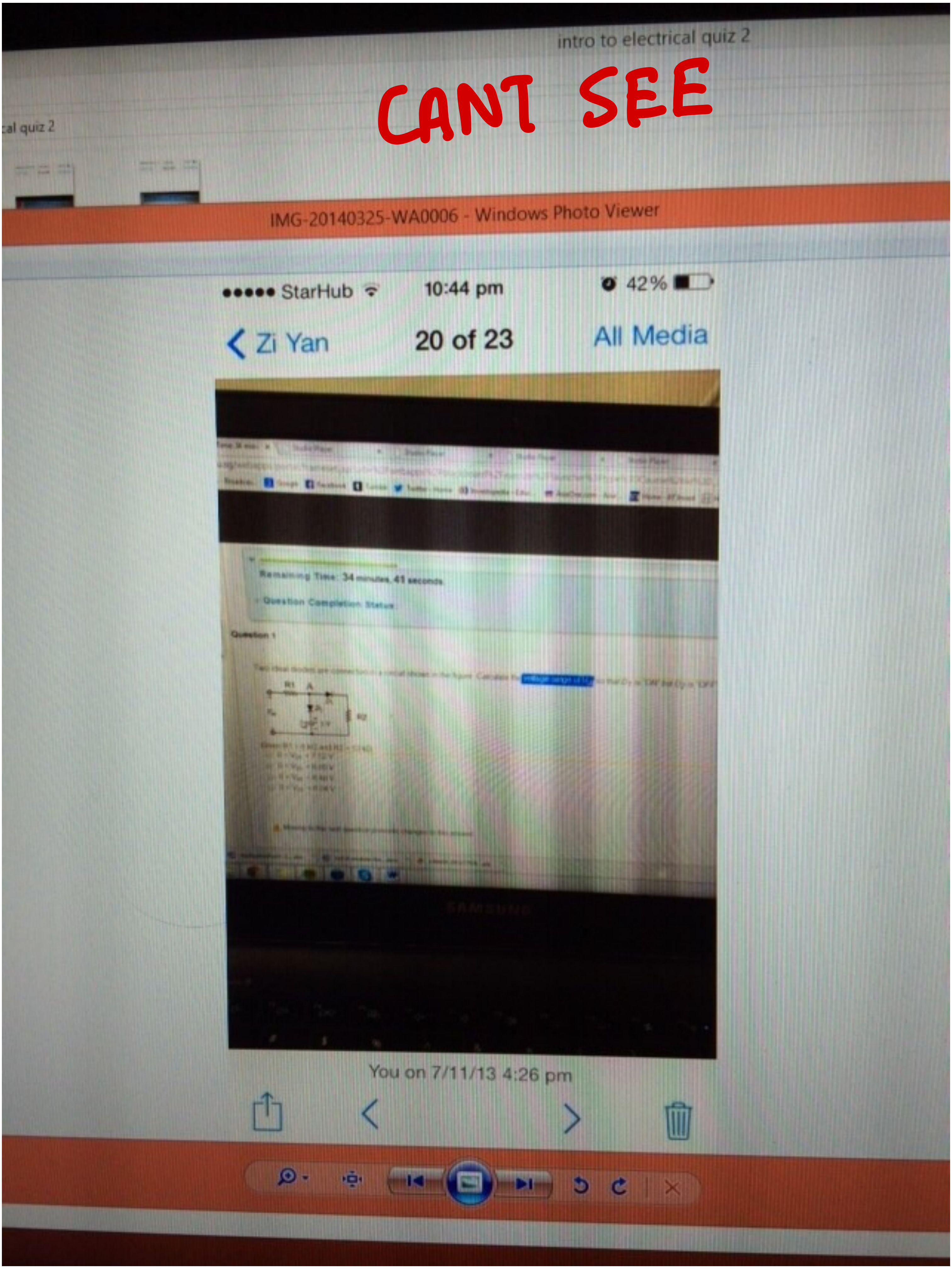
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20 of 23
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Remaining Time: 34 minutes, 41 seconds
Question Completion Status
Question 1
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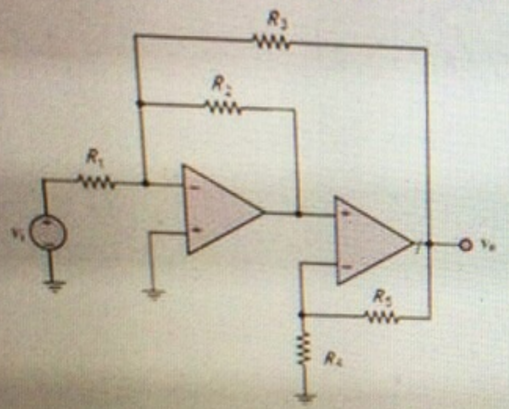
Remaining Time: 16 minutes, 34 seconds.

Ques

Question Completion Status:

If the op-amps in the following circuit are ideal, calculate the overall voltage gain of the circuit $A_V = V_o/V_i$.



Given R_1=10Ω, R_2=10 Ω, R_3=10 Ω, R_4=20 Ω and R_5= 10 Ω.

- Av= -5.25 (V/V)
- Av= 0.6 (V/V)
- Av= -0.6 (V/V)
- Av= 5.25 (V/V)

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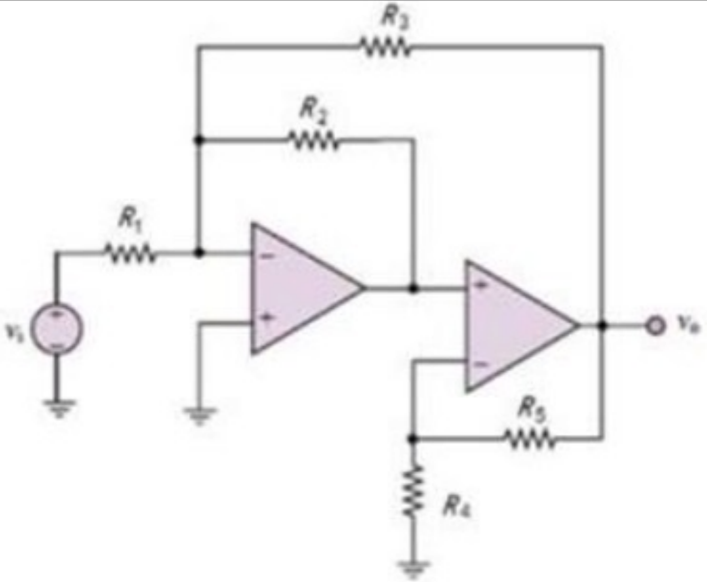


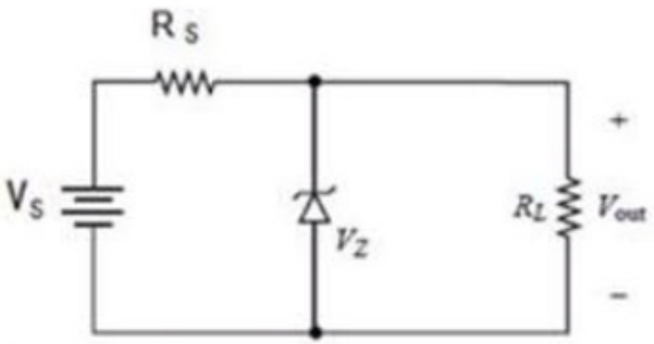
Given R_1=10Ω, R_2=10 Ω, R_3=10 Ω, R_4=10 Ω and R_5= 30 Ω.

- ○ Av= -2.25(V/V)
- ○ Av= 0.80(V/V)
- ◉ Av= -0.80(V/V)
- ○ Av= 2.25(V/V)

[redacted]

[redacted]

Find the minimum value of R_L for which the output voltage keeps exactly at V_Z.



Given V_S =25 V, V_Z =15V, and Rs = 25 KΩ.

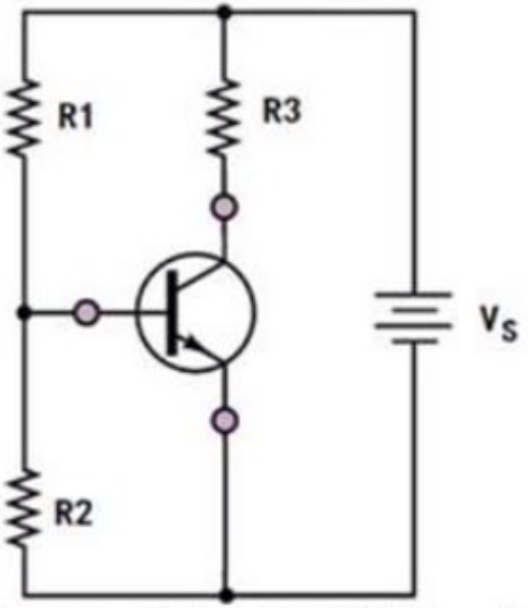
- ( ) 35.0 KΩ.
- ( ) 20.5 KΩ.
- (•) 37.5 KΩ.
- ( ) 25.0 KΩ.

⚠ Moving to the next question prevents changes to this answer.

[redacted]

[redacted]

Given the circuit of the figure, determine the base current I_{BQ} and collect voltage V_{CEQ}. Assume a 0.6 V offset voltage, β = 50, and V_S = 5 V.



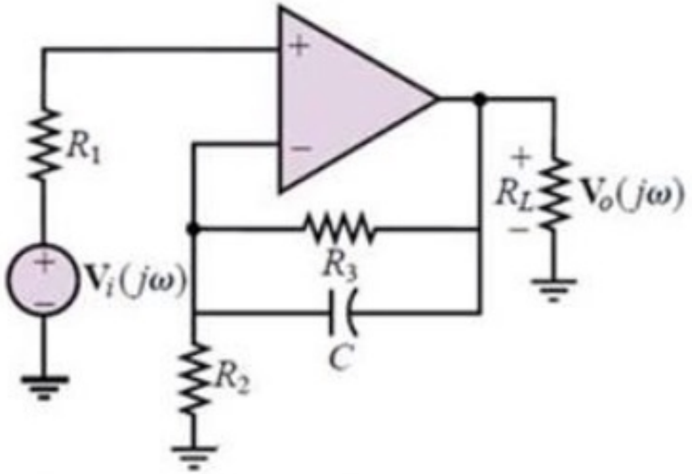
Given R_1=100 kΩ, R_2=200 kΩ, and R_3=500Ω.

- ○ I_{BQ}=0.032mA, V_{CEQ}= 3.350V.
- ◉ I_{BQ}=0.041mA, V_{CEQ}= 3.975V.

[redacted]

[redacted]

The circuit shown in the figure is an active filter with. Determine the cutoff frequency (ω_0) and pass-band gain (A_V) of the filter.



Given R_1=2kΩ,R_2=5kΩ,R_3=50kΩ,C=100nF.

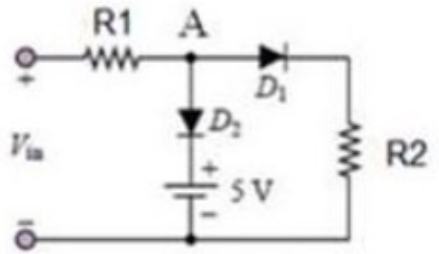
- ○ ω_0 = 2000 rad/sec; A_V = 8.22 dB.
- ◉ ω_0 = 200 rad/sec; Av = 20.83 dB.
- ○ ω_0 = 2000 rad/sec; A_V = 20.83 dB.
- ○ ω_0 = 200 rad/sec; A_V = 8.22 dB.

[redacted]

Question 1

20 points ✔ Saved

Two ideal diodes are connected in a circuit shown in the figure. Calculate the voltage range of V_{in} so that D_1 is "ON" but D_2 is "OFF".



Given R1 = 9 kΩ and R2 = 12 kΩ.

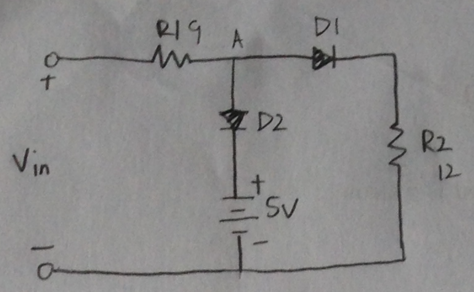
- ○ $0 < V_{in} < 7.75$ V
- ◉ $0 < V_{in} < 8.75$ V
- ○ $0 < V_{in} < 7.25$ V
- ○ $0 < V_{in} < 8.25$ V

⚠ Moving to the next question prevents changes to this answer.

Question **1** of **5**

MA2009 QUIZ 2

- Calculate Vin so that $D_1 = ON$ $D_2 = OFF$



Given $R1 = 9k\Omega$ $R2 = 12k\Omega$

→ $0 < Vin < 8.75V$

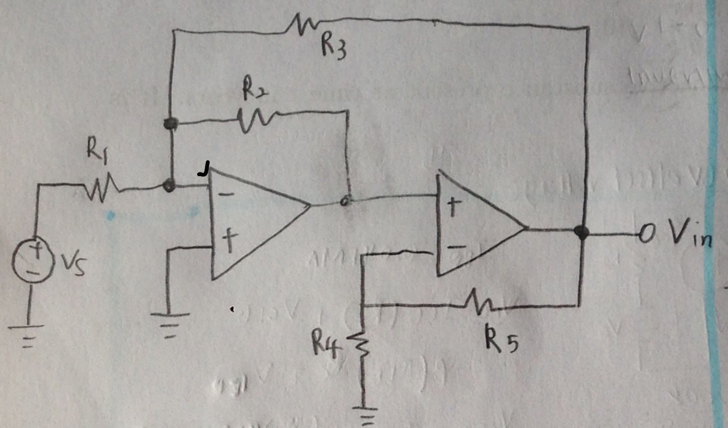
$Vin > 0$; D_1 will be ON regardless of D_2

$V_A < 5A$; D2 is OFF

$$I_{D1} = \frac{Vin}{R_T}$$

$$V_{D1} = \frac{12}{12+9}(Vin)$$

$$Vin = \frac{12}{12+9} \div 5 = 8.75V$$

- 

$R_1 = 10\Omega$, $R_2 = 10\Omega$, $R_3 = 10\Omega$, $R_4 = 10\Omega$, $R_5 = 30\Omega$

→ $Av = -0.8 \left(\frac{V}{V}\right)$

Non-inverting

$V^+ = 0$

Inverting

$V^- = V^+ = 0$

$-I_f = I_t$

$$-\left(\frac{V_S - \cancel{V^-}}{R_1}\right) = \frac{V_B^+ - \cancel{V}}{R_2} + \frac{V_{out} - \cancel{V}}{R_3}$$

$$-\frac{V_S}{R_1} = \frac{V_{out}}{R_3} + \frac{V_B^+}{R_2}$$

$$V_B^+ = \left[-\frac{V_S}{R_1} - \frac{V_{out}}{R_3}\right] R_2$$

Inverting

$I_{in} = I_f + I_s$

$-I_s = -I_f$

$$\frac{V_B - 0}{R_4} = -\left(\frac{V_B - V_{out}}{R_5}\right)$$

$$\frac{V_B^-}{R_4} = \frac{V_{out} - V_B^-}{R_5}$$

$$V_B^-\left(\frac{1}{R_4} + \frac{1}{R_5}\right) = \frac{V_{out}}{R_5}$$

$$V_B^- = V_B^+ = \frac{V_{out}}{R_5}\left(\frac{R_4 R_5}{R_4 + R_5}\right)$$

$$V_B^+ = V_{out}\left[\frac{R_4}{R_4 + R_5}\right]$$

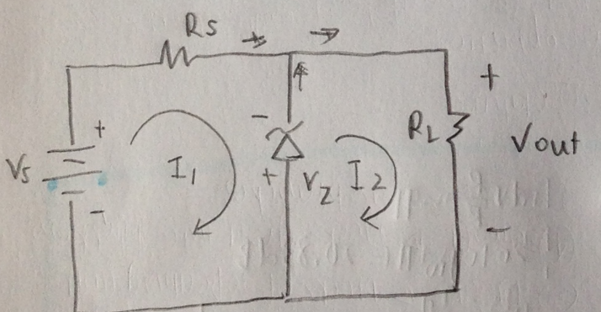
$$\frac{-V_S}{R_1} = \frac{V_{out}}{R_3} + V_{out}\left[\frac{R_4}{R_2(R_4 + R_5)}\right]$$

$$-\frac{1}{10}V_S = \frac{1}{10}V_{out} + \frac{1}{40}V_{out}$$

$$-\frac{1}{10}V_S = -\frac{1}{8}V_{out}$$

$$\frac{V_{out}}{V_S} = -0.8$$

- Find minimum value of R_L for which $V_{out} = V_Z$



$Vs = 25V$, $Vz = 15V$, $Rs = 25K\Omega$

→ $37.5k\Omega$

$$I_1 = \frac{25-15}{25000} = 0.0004$$

$$I_2 = \frac{15}{RL}$$

$$I_Z = I_1 - I_2$$

$$= 0.004 - \frac{15}{R_L} \geq 0$$

$$-\frac{15}{R_L} \geq 0.004$$

$$\frac{15}{R_L} \leq 0.004$$

$$15 \leq 0.004 RL$$

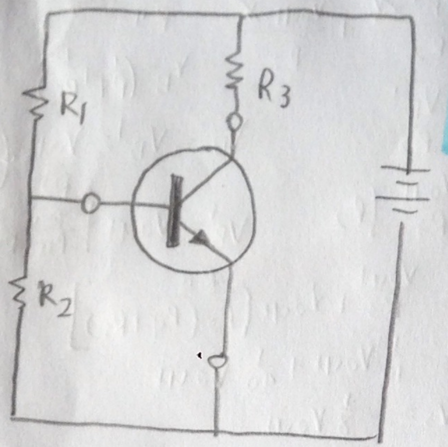
$$RL \geq \frac{15}{0.004} = 37500\Omega$$

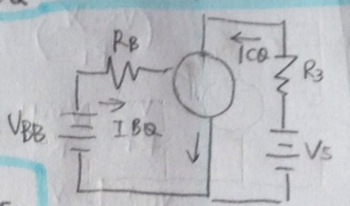
Diode must be ON

$V = 0$

$I > 0$

• Determine base current I_{BQ} & V_{CEQ}. Assume 0.6V offset voltage





$I_{BQ} = 0.041\ mA$

$V_S = I_{CQ}(R_3) + V_{CEQ}$

$= \beta(I_{BQ})R_C + V_{CEQ}$

$V_{CEQ} = 5 - 50(0.041m)(500)$

$= 3.975V$

$V_{BB} = \frac{5 \cdot 200k}{(200+100)k} = 3.33$

$R_B = \left(\frac{1}{200} + \frac{1}{100}\right)^{-1} = 66.67\ k\Omega$

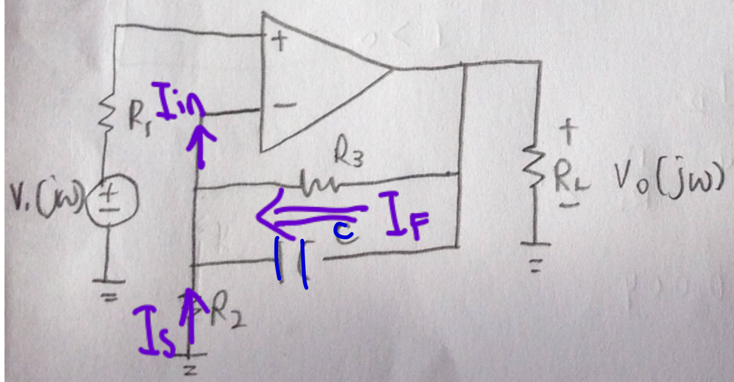
$V_{BB} = I_{BQ}(R_B) + V_{BEQ} \rightarrow 0.6$

$3.33 = I_{BQ}(66.67k) + 0.6$

$\beta = 50$, $V_S = 5V$, $R_1 = 100k\Omega$, $R_2 = 200k\Omega$, $R_3 = 500\Omega$

→ $I_{BQ} = 0.041\ mA$, $V_{CEQ} = 3.975V$

• Determine cutoff freq (W_0) & Pass band gain (A_V)



$R_1 = 2k\Omega$, $R_2 = 5k\Omega$, $R_3 = 50k\Omega$, $C = 100nF$

→ $W_0 = 200\ rad/sec$, $A_V = 20.83dB$

Non-inverting

$V^+ = V_i(j\omega)$

Inverting

$V^+ = V^-$

$\cancel{I_{in}}^{0} = I_S + I_F$

$-I_S = I_F$

$-\left[\frac{0 - V_{in}}{R_2}\right] = \left[\frac{V_0 - V_{in}}{R_3 \| C}\right]$

$\frac{V_{in}}{R_2} = V_0 - V_{in}\left[\frac{1 + j\omega C}{R_3}\right]$

$\frac{V_0 - V_{in}}{V_{in}} = \frac{R_3}{R_2}\left[\frac{1}{1 + j\omega C R_3}\right]$

$\frac{V_0}{V_{in}} = \underbrace{1 + \frac{R_3}{R_2}}_{gain}\left[\frac{1}{1 + j\omega C R_3}\right]$ ← bandwidth

$\left|1 + \frac{R_3}{R_2}\right| = 11 = A$

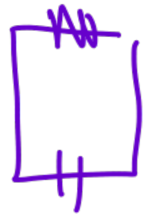
$20\log_{10} 11 = 20.83dB$

• $W_0 = \frac{1}{C_F R_F} = 200\ rad/s$

$R_3 \| C = \left\{\frac{1}{R_3} + \left[\frac{1}{j\omega C}\right]^{-1}\right\}^{-1}$

$= \left[\frac{1}{R_3} + j\omega C\right]^{-1}$

$= \frac{R_3}{1 + j\omega C}$



$$\frac{V_{in}}{R_2} = \frac{V_0 - V_{in}}{R_3 \parallel C}$$

$$\frac{V_0 - V_{in}}{V_{in}} = \frac{1}{R_2}(R_3 \parallel C)$$

$$= \frac{1}{R_2}\left(\frac{R_3}{1+j\omega CR_3}\right)$$

$$\frac{V_0}{V_{in}} = 1 + \frac{R_3}{R_2}\left(\frac{1}{1+j\omega CR_3}\right)$$

$$= 1 + \frac{50}{5}\left(\frac{1}{1+j\omega(100\times10^{-9})(50\times10^{3})}\right)$$

$$= 1 + 10\left(\frac{1}{1+j\omega\frac{1}{200}}\right)$$

$$= 1 + \frac{10}{1+j\omega\frac{1}{200}}$$

$$= 1 + \frac{2000}{200+j\omega}$$

$$= \frac{2200+j\omega}{200+j\omega}$$

$R_3 \parallel C$

$$= \left(\frac{1}{R_3} + j\omega C\right)^{-1}$$

$$= \left(\frac{1 + R_3 j\omega C}{R_3}\right)^{-1}$$

$$= \frac{R_3}{1 + R_3 j\omega C}$$

$R_3 \parallel C$

$$= \left(\frac{1}{R_3} + \frac{j\omega C}{1}\right)^{-1}$$

$$= \left(\frac{1 + j\omega CR_3}{R_3}\right)^{-1}$$

$$= \frac{R_3}{1+j\omega CR_3}$$

$$\frac{1}{\frac{1}{j\omega_?}}$$

gain

$$1 + \frac{50}{10}$$

$$= 11$$

$$\frac{1}{RC} = 200$$

$$20\log_{10}\sqrt{\frac{2200^2+\omega^2}{200^2+\omega^2}}$$

$$= 20\log\sqrt{\frac{2200^2+200^2}{200^2+200^2}}$$

$=$

$$\frac{V_{out}}{V_s}(j\omega) = 1 + \frac{Z_F}{Z_S}$$

$$= 1 + \frac{R_3 \parallel C}{R_2}$$

$$= 1 + \frac{1}{R_2}\left(\frac{R_3}{1+R_3 j\omega C}\right)$$

$$= 1 + \frac{50}{5}\left(\frac{1}{1+j\omega(50\times10^3)(100\times10^{-9})}\right)$$

$$= 1 + 10\left(\frac{1}{1+j\omega\left(\frac{1}{200}\right)}\right)$$