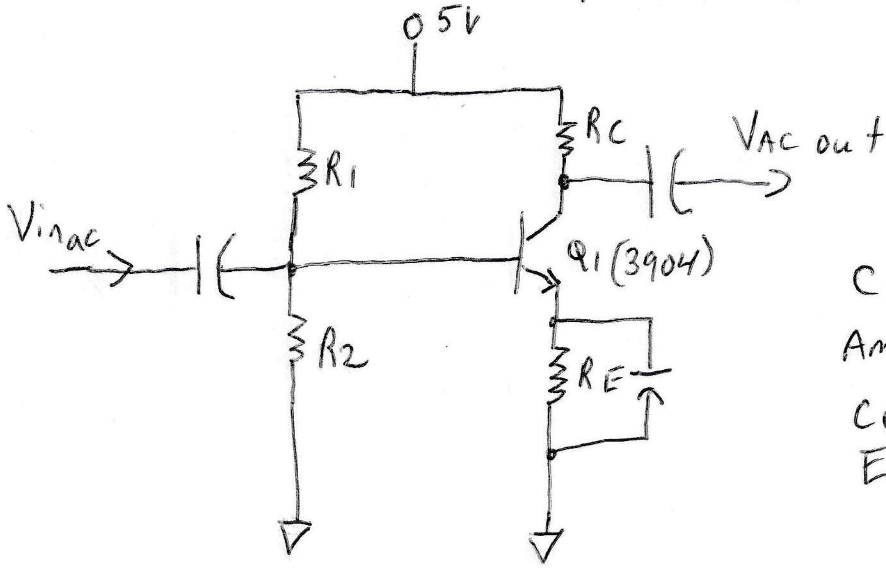
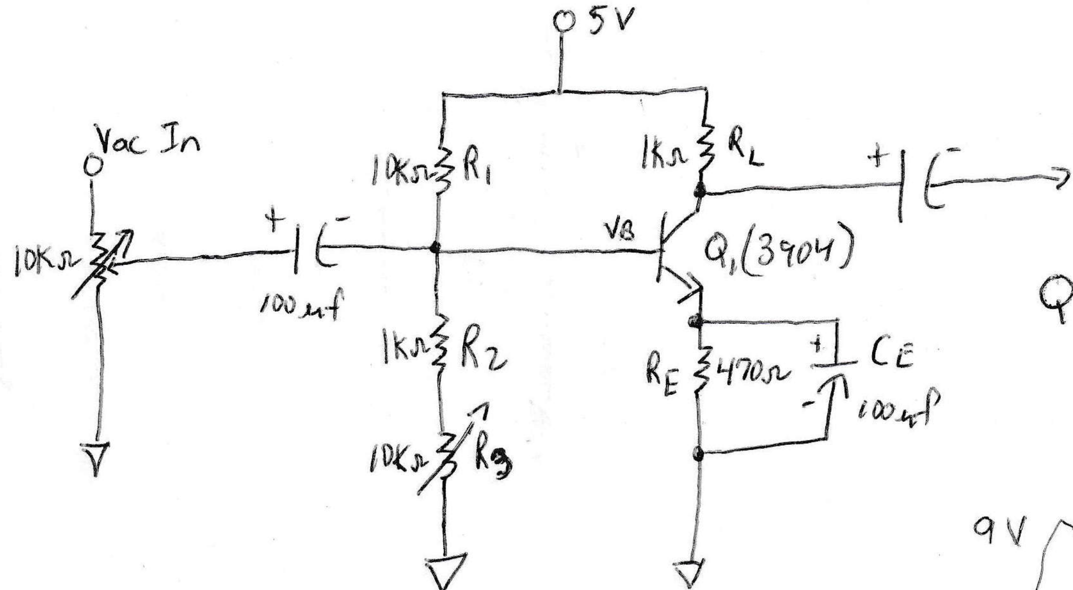
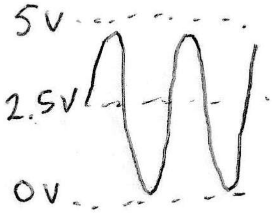
# The amazing Semiconductor – Part 6 | Amplifier Design

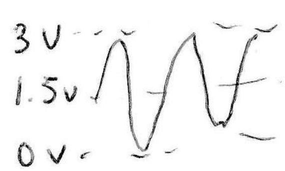


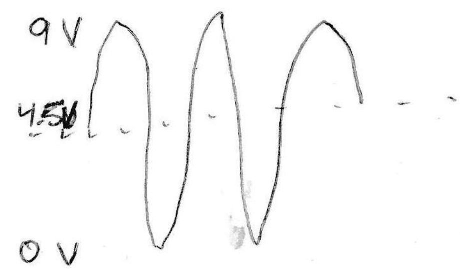

Class A
Amplifier
Common
Emitter




Qpoint = 2.5V




Power = 625 mW Vmax = 40Vdc 50-80%
24V as the highest

Qpoint = 2.5V
PWR Supply = 5V

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Q point 2.5v

" " = 5v

Qpoint = $V_L = V_C$

$I_C \approx I_E = 2.5mA$

- Low power consumption
- Plenty of gain for a pre-amp
- thermal = cool
- Makes calculations of resistors easier 1KΩ, 470Ω

$\boxed{I_C = 2.5mA}$

$V = IR,\ R = \frac{V}{I} = \frac{V_L}{I_C} = \frac{5V - 2.5V}{I_C} = \frac{V_{DC} - V_L}{I_C} = \frac{5 - 2.5}{2.5mA} = \frac{2.5}{.0025} = 1{,}000Ω = 1KΩ$

$\boxed{R_L = 1KΩ}$

$\boxed{V_L = 2.5V}$

$V_E \approx 1.1V$ 10-20% of supply V. $\beta = \text{Gain} = \frac{I_C}{I_B}$

$V_{DC} = 5V$ 10% = 0.5V

20% = 1.0V, could be .9V, 1V, 1.1V

$V = IR,\ R = \frac{V}{I} = \frac{V_E}{I_E} = \frac{1.1V}{2.5mA} = \frac{1.1}{0.0025} = 440Ω$

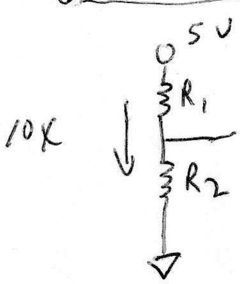
I only had a 470Ω

$V = IR,\ V_E = 2.5mA \cdot 470Ω = 1.175V$

$\boxed{V_E = 1.1V}$

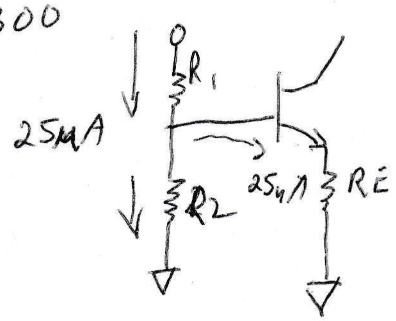
$\boxed{R_E = 470Ω}$

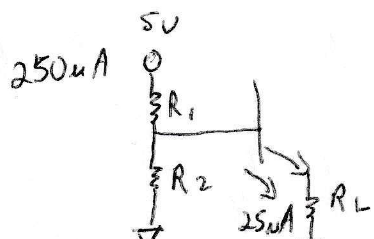
$\boxed{V_B = V_E + V_{EB} = 1.1V + 0.7V = 1.8V}$




$\beta$ = gain 100-300

$\boxed{\beta = 100}$




10%

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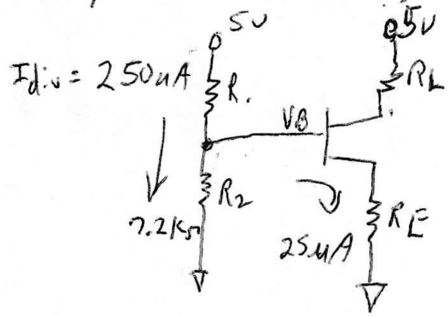



$I_C = 2.5mA$

$V_{DC} = 5V$

$V_B = 1.8V$

Assume $\beta = 100$

$$I_B = \frac{I_C}{\beta} \qquad \beta = \frac{I_C}{I_B}$$

$$I_B = \frac{2.5mA}{100} \qquad I_B \beta = I_C$$

$$\boxed{I_B = 25\mu A} \qquad I_B = \frac{I_C}{\beta}$$

$10 \times 25uA = 250\mu A = I_{divider}$

$I_{divider} = 250\mu A$

$V = IR$

$$R_2 = \frac{V_B}{I_{divider}} = \frac{1.8V}{250\mu A} = \boxed{7.2k\Omega}$$

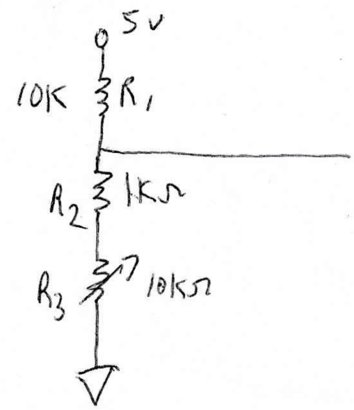
$$R_1 = \frac{V_{DC} - V_B}{I_{divider}} = \frac{5V - 1.8V}{250\mu A} = \frac{3.2V}{250\mu A} = \boxed{12.8k\Omega}$$

I chose:

$R_1 = 10k\Omega$

$R_2 = 1k\Omega$

$R_3 = 10k\Omega$



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LAB

## Quick Recap:

- $V_{CC} = 5V$
- Q-Point = 2.5V
- $I_C = 2.5mA$ (we chose this value) $2.5mA = .0025A$
- $\beta = 100$ (we chose this value)
- $V_E = 1.1V \approx 10-20\%$ of Vcc. (went with $\approx 20\%$)
- $V_{BE} = 0.7V$  Ohm's LAW = $V = I \cdot R$, $R = \frac{V}{I}$

$$R_C = \frac{V_{CC} - V_C}{I_C} = \frac{5v - 2.5v}{0.0025A} = \frac{2.5v}{0.0025A} = 1000\Omega = \boxed{1K\Omega}$$

$$R_E = \frac{V_E}{I_E} = \frac{1.1V}{0.0025A} = \boxed{440\Omega}$$ (Nearest Value $470\Omega$)

$$V_B = V_E + V_{BE} = 1.1V + 0.7V = \boxed{1.8V}$$  $\beta = \frac{I_C}{I_B}$, $I_B = \frac{I_C}{\beta}$

$$I_B = \frac{I_C}{\beta} = \frac{0.0025A}{100} = 0.000025A = \boxed{25\mu A}$$

$$I_{Div} = 10 \times I_B = 10 \times 25\mu A = 10 \times 0.000025A = 0.000250A = \boxed{250\mu A}$$

$$R_2 = \frac{V_B}{I_{Div}} = \frac{1.8}{0.00025A} = 7200\Omega = \boxed{7.2K\Omega}$$

$$R_1 = \frac{V_{CC} - V_B}{I_{Div}} = \frac{5v - 1.8V}{0.000250A} = \frac{3.2V}{0.000250A} = 12800\Omega = \boxed{12.8K\Omega}$$

$R_C = 1K\Omega$
$R_E = 440\Omega$  Calculated
$R_1 = 12.8K\Omega$
$R_2 = 7.2K\Omega$

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LAB Values
$R_C = 1K\Omega$
$R_E = 470\Omega$
$R_1 = 10K\Omega$
$R_2 = 1K\Omega + 10K\Omega$ variable resistor

$\beta = \frac{2V}{0.05V} = \boxed{40}$

$A_V = \frac{V_{out}}{V_{in}}$

LAB Value
$V_{CC} = 5.04V$
$Q = 2.5V$
$I_C = 2.54mA$
$V_E =$ 1.19V
$V_{BE} =$ .67V
$V_B = 1.88V$
$I_{Div} = 300\mu A$
$I_B \approx 30\mu A$

This is on BuildCircuitsWithRich.com
Whoo Buddy!!!