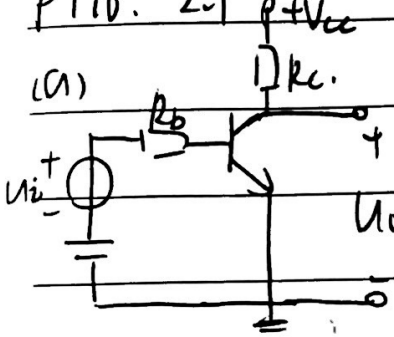
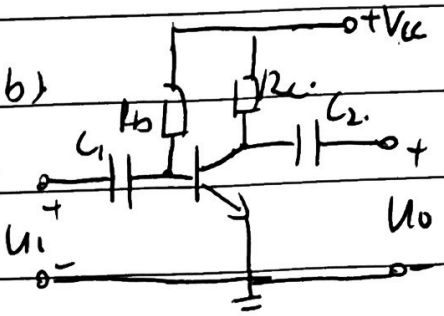
P116. 2-1

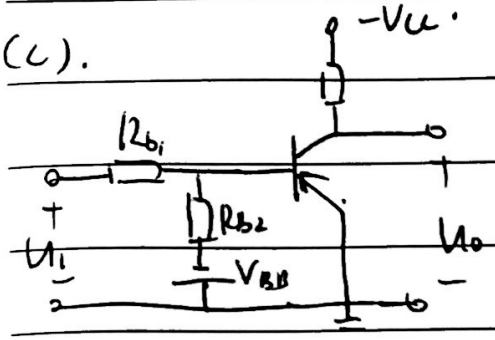
(a)



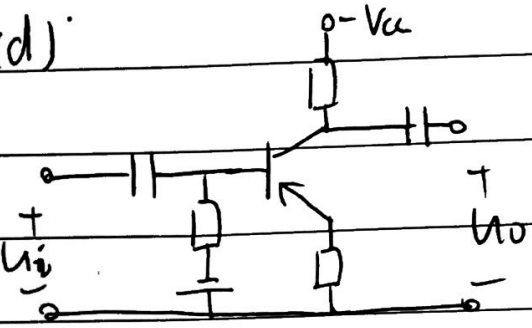
(b)



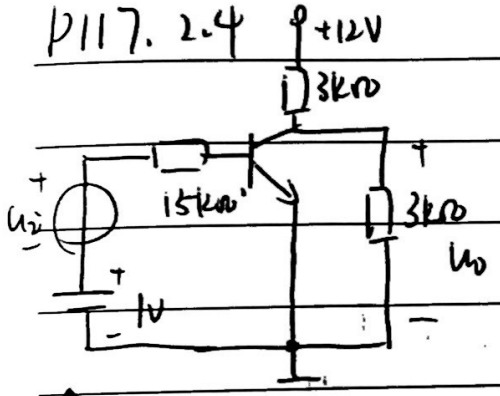
(c).



(d)



P117. 2.4



$R_L = 3k\Omega$ 时.

$U_i = 0$ 时. $\beta = \frac{1mA}{10\mu A} = \frac{1m}{10} = 100$.

$$\begin{cases} 1 - U_{BEQ} = I_{BQ} \cdot 15k \\ I_{CQ} = \beta I_{BQ} \\ \sout{U_{CEQ} = V_{CC} - I_{CQ} \cdot 3k} \end{cases} \Rightarrow \begin{cases} I_{BQ} = 0.02\,mA \\ I_{CQ} = 2\,mA \\ \sout{U_{CEQ} = 6V} \end{cases}$$

$\therefore U_{BE} = 1 - 15k i_B$.

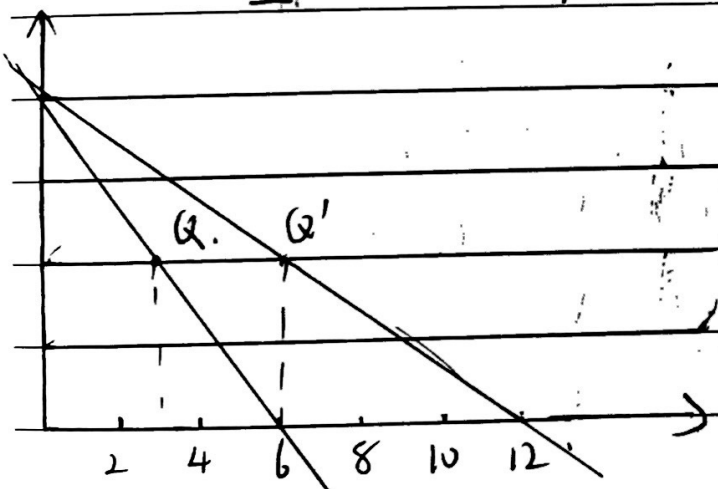
$U_{CE} = -\frac{3}{1}k i_C + 6$

$U_{CEQ} = 3V$; $U_{CES} = 0.7V$

$U_{om} = \frac{2.3}{\sqrt{2}} = 1.63\,V$

$I_{CQ} \frac{3}{1} K/\sqrt{2} >$

$= 2.\cdots$

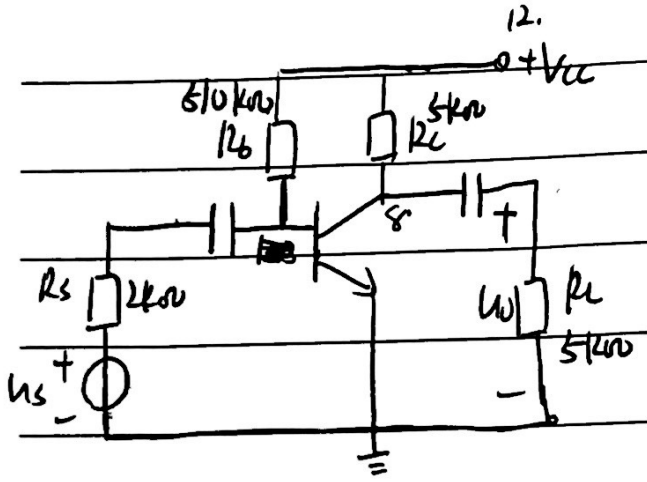


$R_L = \infty$ 时. 同理 $I_{BQ} = 0.02mA$ $\therefore U_{CE} = V_{CC} - I_C \cdot 3k = 12 - 3k I_C$.

$I_{CQ} = 2mA$ $\therefore U_{CEQ} = 6V$. $\sout{U_{om} = \frac{6-U}{\sqrt{2}} = 3.75V}$ $\sout{I_{CQ} \frac{3}{1} K/\sqrt{2}}$

$U_{om} = \frac{3}{\sqrt{2}} = 2.12V$

P117. 2.5



$\beta = 80$. $r_{be} = 1\,k\Omega$.

$U_i = 20mV$

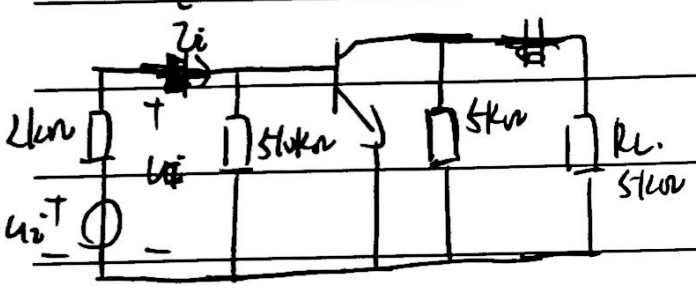
$U_{BEQ} = 0.7V$. $U_{CEQ} = 4V$

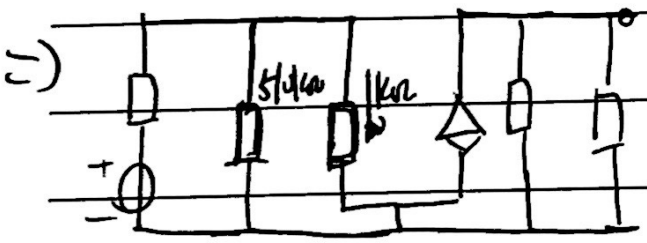
$I_{BQ} = 20\mu A$.

$I_{BQ} = \frac{V_{cc} - U_{BEQ}}{R_b} = 20\mu A \Rightarrow V_{cc} = 10.9V$

$I_{CQ} = \beta I_{BQ} = 1.6mA$, $V_{cc} = U_{CEQ} + I_{CQ} \cdot R_c = 12V$

$h_{ie} = r_{be} = 1k\Omega$.





$\therefore$

$\dot{A}_u = -\beta \frac{R_c // R_L}{r_{be}}$

$= -80 \cdot 2.5$

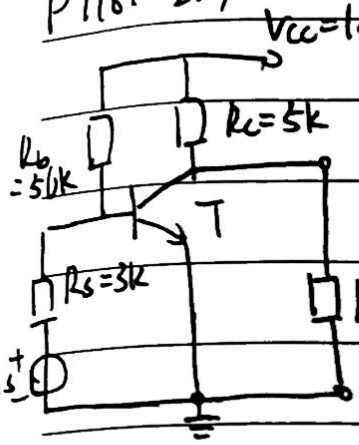
$r_i = R_b // \beta r_{be} \approx 1k\Omega$.

$R_b = R_L = 5k\Omega$. $U_s = U_i + 2k \cdot \frac{U_i}{r_i} \approx 60mV$

$\therefore$ (4) (8) (9) (12) ✓

其它 ×

P116. 2.7



$\beta = 80$. $r_{bb'} = 100\Omega$

$U_{BEQ} = 0.7V$. $U_T = 26mV$.

直流通路，去掉 U_s.

$\therefore V_{CC} = I_{CQ}R_c + U_{CEQ} + \frac{U_{CEQ}}{R_L} \cdot R_c$

$\frac{V_{CC} - U_{BEQ}}{R_b} - \frac{U_{BEQ}}{R_s} = \approx I_{BQ}$. $I_{CQ} = \beta I_{BQ}$

$\therefore$ $I_{BQ} = 22\mu A$

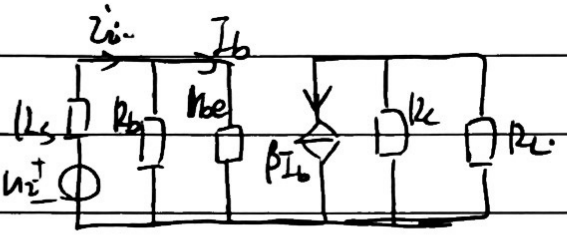
$I_{CQ} = 1.76mA$

$r_{be} = r_{bb'} + (1+\beta)\frac{26mV}{I_{EQ}} = 1.3k\Omega$.

$U_{CEQ} = (1 + \frac{R_c}{R_L})^{-1}(V_{CC} - I_{CQ}R_c)$

$\therefore R_L = \infty$ 时. $U_{CEQ} = 6.2V$.

$R_L = 3k\Omega$ 时. $U_{CEQ} = 2.3V$



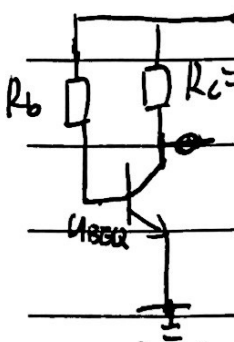
$\dot{A}_u = \frac{\dot{U}_o}{\dot{U}_i} = -\frac{\beta \dot{I}_b R_c // R_L}{\dot{I}_b r_{be}} = -\beta \frac{R_c // R_L}{r_{be}}$ .2

$\therefore R_L = \infty$ 时. $\dot{A}_u = -307.7$. $R_L = 3k\Omega$ 时. $\dot{A}_u = -115.4$

$R_i \equiv R_b // r_{be} = 1.27k\Omega$. $R_o \equiv R_c = 5k\Omega$.

P118. 2.9.

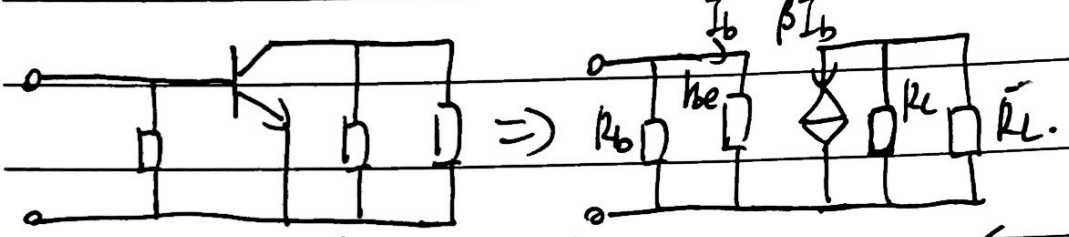
(1) 直流通路. $\beta=100$. $r_{be}=1k\Omega$.



$$\begin{cases} I_{BQ}\cdot R_b = V_{CC} - U_{BEQ} \\ V_{CC} - U_{CEQ} = I_{CQ} R_c \end{cases}$$

$$\Rightarrow R_b = 565\,k\Omega.$$

(2). 交流通路

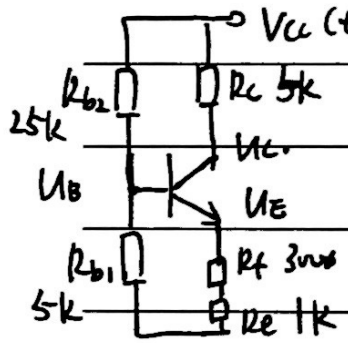


$$\therefore \dot{A}_u = \frac{\dot{U}_o}{\dot{U}_i} = \frac{-\beta I_b R_c' /\!/ R_L}{I_b r_{be}} = -\beta \frac{R_c /\!/ R_L}{r_{be}} \geq -220$$

$$\therefore R_{c\min} = 392.9\,\Omega.$$

P119. 2.11.

(1) 直流通路.



$$\begin{cases} I_{CQ} = \dfrac{V_{cc}-U_C}{R_c} = \beta I_{BQ}. \\ I_{BQ} = \dfrac{V_{cc}-U_B}{R_{b2}} - \dfrac{U_B}{R_{b1}} \\ U_E = (1+\beta) I_{BQ}(R_f + R_e). \end{cases}$$

$$\Rightarrow \begin{cases} U_{CEQ} = \\ U_{BEQ} = \\ I_{BQ} = \\ I_{CQ} = \end{cases}$$

$$U_{BQ} \approx \frac{R_{b1}}{R_{b1}+R_{b2}} V_{cc} = 2V.$$

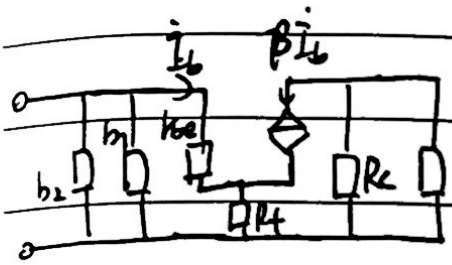
$$I_{EQ} = \frac{U_{BQ}-U_{BEQ}}{R_f + R_e} = 1\,mA$$

$$I_{BQ} = \frac{1}{\beta+1} I_{EQ} \approx \frac{1}{\beta} I_{EQ} = 10\,\mu A.$$

$$I_{CQ} \approx I_{EQ} = 1\,mA.$$

$$U_{CEQ} \approx 12 - 5 - 1.3 = 5.7V$$

交流通路.



$$r_{be} = r_{bb'} + (1+\beta)\frac{26mV}{I_{EQ}} = 2.73k\Omega$$

$$\dot{A}_u = \frac{-\beta I_b R_c // R_L}{I_b r_{be} + (1+\beta) I_b R_4} = -\beta \frac{R_c // R_L}{r_{be} + (1+\beta) R_4} = -7.57$$

$$R_i = (r_{be} + (1+\beta)R_4) // R_{b1} // R_{b2} = 3.7k\Omega$$

$$R_o = R_c = 5k\Omega.$$

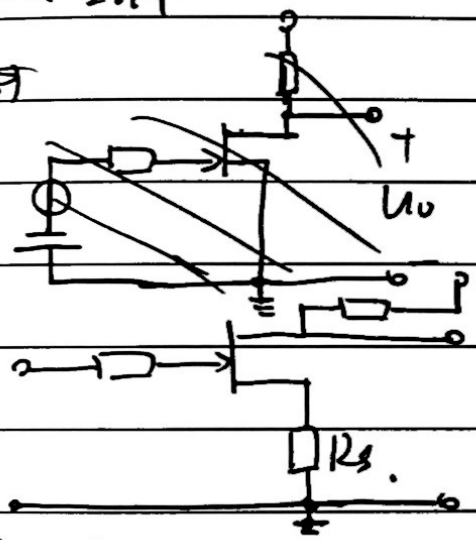
(2). I_{EQ} 不变, I_{BQ} 减小, I_{CQ} 不变. U_{CEQ} 不变.

(3). $R_4 \rightarrow R_4$ 串 R_e.

∴ $|\dot{A}_u|$ 变小, R_i 变大. R_o 不变.

P120. 2.14.

(a)



(a) 在 S 极加 R_s

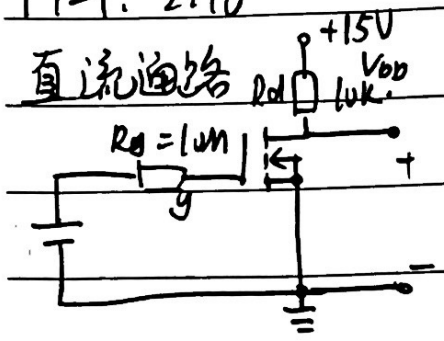
(b). V_{DD} 下加电阻

(c). 在 R_g 支路加 $-V_{GG}$.

将 $+V_{DD}$ 变负.

P121. 2.16

直流通路



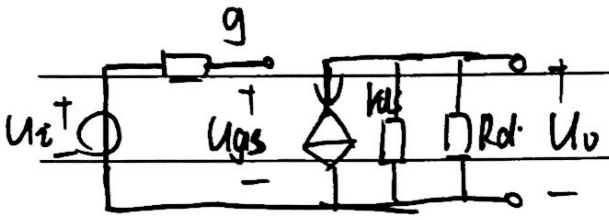
$V_{DD} = R_d \cdot I_{DQ} + U_{GSQ}$

$I_{DQ} = I_{DO}\left(\frac{U_{GSQ}}{U_{GS(th)}} - 1\right)^2$, $U_{GS(th)} = 2V$

$\because U_{GSQ} = U_{GQ} = V_{GG} = 3V$

$\therefore I_{DQ} = 1mA$, $U_{GSQ} = 5V$

交流



r_{ds} 极大. $R_d \ll r_{ds}$ $\therefore r_{ds}$ 忽略.

$\dot{A}_u = \frac{\dot{U}_o}{\dot{U}_i} = \frac{-g_m U_{gs} \cdot R_d}{U_{gs}} = -g_m R_d$

$g_m = \frac{2}{U_{GS(th)}}\sqrt{I_{DO} I_{DQ}} = 2mS$

$\therefore \dot{A}_u = -20$.

P121. 2.17.

~~(1) 降低温度. 减小 I_{BQ}. 减小 R_C. 换 β 小的管子~~

~~(1) 增大本题~~

(1) 底部: 提高 Q. 提高 R_2 电阻, 减小 R_1 电阻; 换 $U_{GS(th)}$ 更小的管.

顶部: 减小 Q. 降低 R_2, 提高 R_1, 减小 V_{DD}. 增大 R_d, R_s.

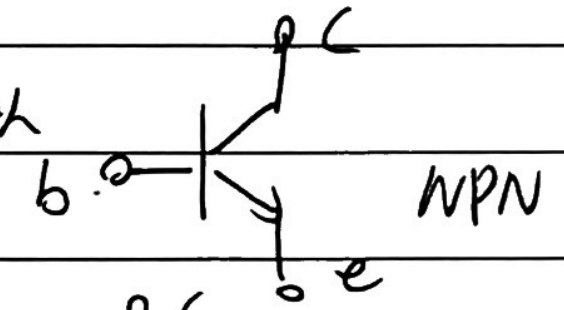
(2) $|\dot{A}_u| = g_m r_{ds} // R_d // R_L$, $g_m = \frac{2}{U_{GS(th)}}\sqrt{I_{DO} I_{DQ}}$.

$\therefore$ 减小 $U_{GS(th)}$, 提高 I_{DO}, I_{DQ}, 提高 r_{ds}, R_d, R_L.

~~P121. 2.18.~~

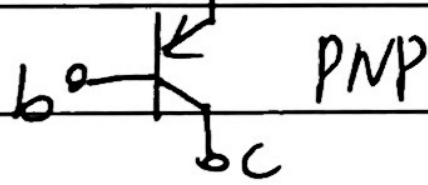
P122. 2.18

(a) 不行　(b) 不行　(c) 可以

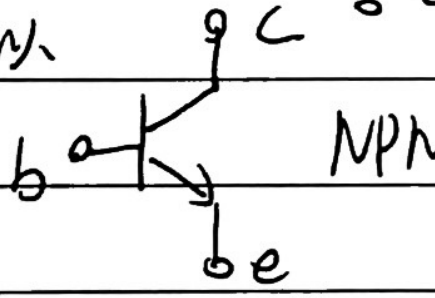


(d) 不行.　(e) 不行

(f) 可以.



(g) 可以.



简答.

信号放大：~~来自神经细胞接受递质，放大为兴奋~~

分泌化学信号，或细胞间接触，细胞内形成对应的反馈.

模拟：b极与其它的e极相接，e极用于调控其它元件，作为自己的反馈