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2-1 解：1. a，b，a，a　　2. b　　3. a，b　　4. a，a，b　　5. b

2-4 解：(1) A管：$U_x > U_y > U_z$　$U_{yx} = -0.3V$

∴ y为基极b，x为发射极e，z为集电极C，$U_e > U_b > U_c$，晶体管为PNP型

(2) B管：$U_y > U_x > U_z$　$U_{xz} = 0.3V$

∴ x为基极b，z为发射极e，y为集电极C，$U_C > U_b > U_e$，晶体管为NPN型

2-7 解：(a) 不能正常放大，不符合晶体管工作在放大区的条件；将电源 $+V_{CC}$ 改接成 $-V_{CC}$

(b) 不能正常放大，晶体管发射结为零偏置，不能工作在放大状态；将电阻 R_B 接至 V_{CC} 处

(c) 不能正常放大，晶体管b极电位为 V_{CC}，处于饱和状态；在基极与 V_{CC} 间加电阻

(d) 不能正常放大，晶体管无基极偏置电流，无法工作在放大状态；将 R_B 断开

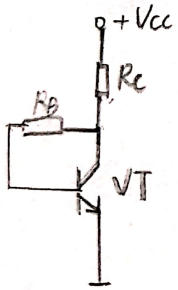
(e) 能正常放大

(f) 能正常放大

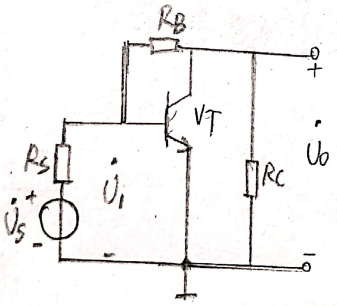
(g) 不能正常放大；输出电压对地短路；应在集电极加电阻

(h) 不能正常放大；电容 C_B 将晶体管基极对地短路；应去掉电容 C_B

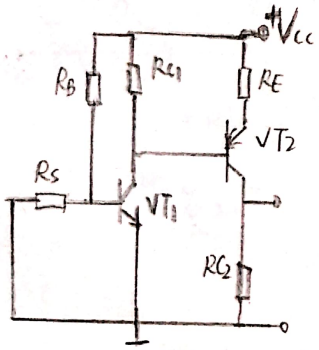
2-8 解：



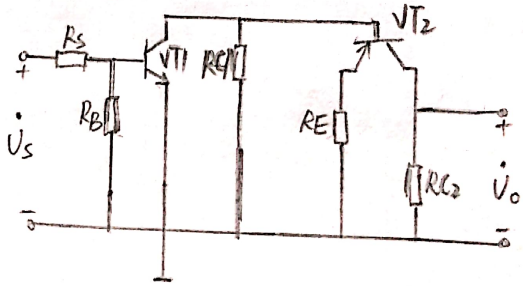
a)的直流通路



a)的交流通路



b)的直流通路



b)的交流通路

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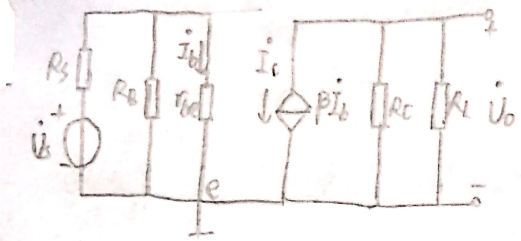
2-14 解：(1) $I_{BQ}=\frac{I_{CQ}}{\beta}=10\mu A$　　$R_B=\frac{V_{CC}-U_{BEQ}}{I_{BQ}}=1.13\ M\Omega$

(2) 微变等效电路如左下图所示



$r_{be}=r_{bb'}+(1+\beta)\frac{26mV}{I_{EQ}}=2700\Omega$

$A_U=\frac{\dot{U}_o}{\dot{U}_i}=\frac{-\beta R_L'}{r_{be}}$

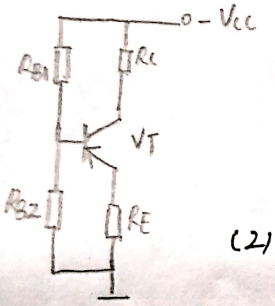
$R_L'=R_C//R_L$　　$A_U=\frac{\dot{U}_o}{\dot{U}_i}=\frac{-\beta R_L'}{r_{be}}=-112$

$R_i=\frac{\dot{U}_i}{\dot{I}_i}=R_B//r_{be}\approx 2.7K\Omega$

$A_{US}=\frac{R_i}{R_i+R_S}A_U=-83$

(3) $R_i=2.7K\Omega$　　$R_o=R_C=16K\Omega$

2-15 解：(1) 电路直流通路如下图所示



$U_B=\frac{R_{B2}}{R_{B1}+R_{B2}}(-V_{CC})=-4V$

$I_{CQ}=\frac{U_B-U_{BE}}{R_E}=-1.85\ mA$

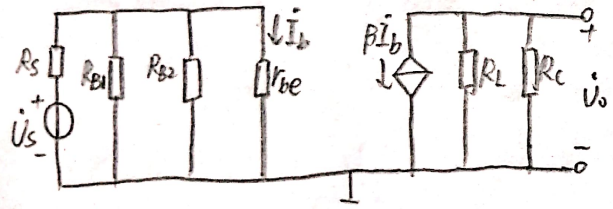
$U_{CEQ}=-V_{CC}+I_{CQ}(R_C+R_E)=-6.75V$

(2) 令 $U_{CEQ}=-4V$　　$I_{CQ}=\frac{-U_{CEQ}-V_{CC}}{R_C+R_E}=-2.4\ mA$

$U_B\approx I_{CQ}R_E=-4.8V$　　$U_B=\frac{R_{B2}}{R_{B1}+R_{B2}}(-V_{CC})=-4.8V$

$R_{B1}=47K\Omega$

(3) 微变等效电路如下图所示



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

$R_i=R_{B1}//R_{B2}//r_{be}\approx 1.2K\Omega$

$A_{US}=\frac{R_i}{R_i+R_S}\cdot\frac{-\beta(R_C//R_L)}{r_{be}}=-55$

$R_o=R_C=3K\Omega$

2-16 解：$A_U=\frac{-\beta(R_C//R_L)}{r_{be}}$　　$R_i=R_{B1}//R_{B2}//r_{be}$

$r_{be}=r_{bb'}+(1+\beta)\frac{26mV}{I_{EQ}}\approx(1+\beta)\frac{26mV}{I_{EQ}}$　　$I_{EQ}\approx\frac{U_B-U_{BE}}{R_E}$

(1) β增大，I_E 几乎不变，电压增益 $A_U=\frac{-\beta(R_C//R_L)}{r_{be}}\approx\frac{-(R_C//R_E)I_{EQ}}{26\ mV}$ 几乎不变，输入电阻 $R_i=R_{B1}//R_{B2}//r_{be}$ 增大

(2) R_E 增大，I_E 减小，电压增益 $A_U\approx\frac{-(R_C//R_L)I_{EQ}}{26\ mV}$ 减小，输入电阻 R_i 增大

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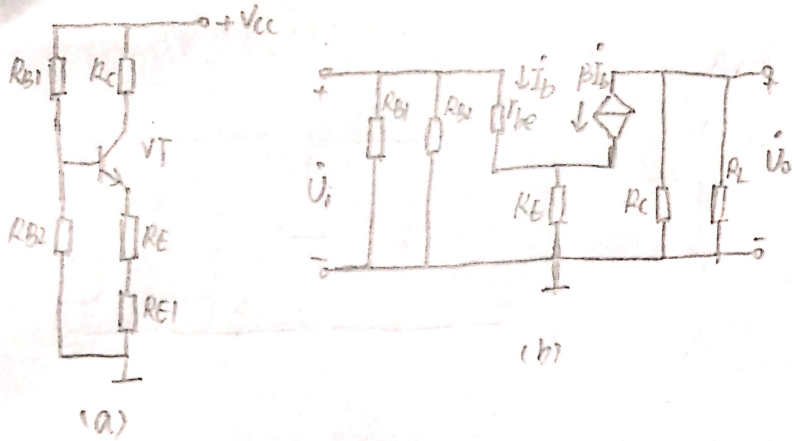
2-17 解：直流通路与微变等效电路分别如下所示

(a)　　(b)



(a)　　(b)

$$U_B = \frac{R_{B2}V_{CC}}{R_{B1}+R_{B2}} = 2.12V$$

$$I_E = \frac{U_B - U_{BE}}{R_E + R_{E1}}$$

$$r_{be} = r_{bb'} + (1+\beta)\frac{26mV}{I_E}$$

$$R_i = R_{B1} // R_{B2} // [r_{be} + (1+\beta)R_E]$$

$$A_u = -\frac{\beta(R_C // R_L)}{r_{be} + (1+\beta)R_E} \qquad R_o = R_C = 8.2k\Omega$$

(1) 当 $R_E = 0$ 时　$I_E = 1.42mA$　$r_{be} = 1.217k\Omega$　$R_i = 1.63k\Omega$　$A_u = -174$　$R_o = 8.2k\Omega$

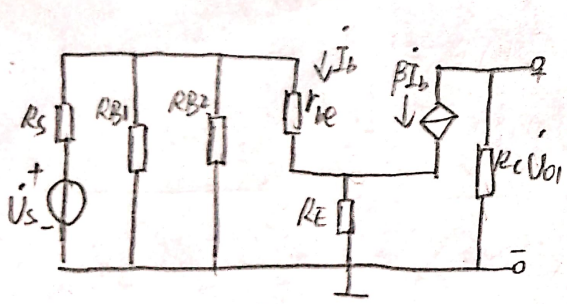
(2) 当 $R_E = 200\Omega$ 时　$I_E = 1.18mA$　$r_{be} = 1.4k\Omega$　$R_i = 6.3k\Omega$　$A_u = -15.5$　$R_o = 8.2k\Omega$

当 R_E 增大时，电路的电压增益 $|A_u|$ 减小，输入电阻 R_i 增大

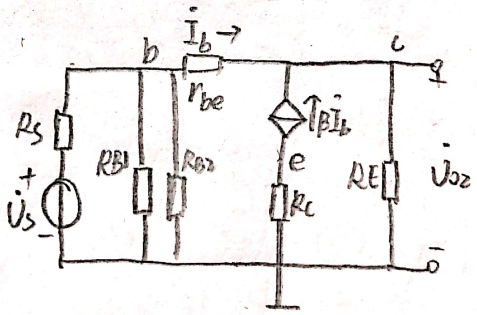
2-18 解：(1) $U_B = \frac{R_{B2}V_{CC}}{R_{B1}+R_{B2}} = 4.3V$　$I_{EQ} = \frac{U_B - 0.7V}{R_E} = 1.8mA \approx I_{CQ}$

$U_{CEQ} = V_{CC} - I_{CQ}(R_C + R_E) = 2.8V$

(2) 集电极和射极输出时的微变等效电路分别如图 a、b 所示



(a)



(b)

$$r_{be} = r_{bb'} + (1+\beta)\frac{26mV}{I_E} = 1.2k\Omega \qquad R_i = R_{B1} // R_{B2} // [r_{be} + (1+\beta)R_E] = 8.2k\Omega$$

$$A_{us1} = \frac{-\beta R_C}{r_{be} + (1+\beta)R_E} \cdot \frac{R_i}{R_i + R_S} = -0.79 \qquad A_{us2} = \frac{(1+\beta)R_E}{r_{be} + (1+\beta)R_E} \cdot \frac{R_i}{R_i + R_S} = 0.797$$

(3) $R_i = 8.2k\Omega$　$R_{o1} = R_C = 2k\Omega$　$R_{o2} = R_E // \frac{r_{be} + R_S // R_{B1} // R_{B2}}{1+\beta} = 33\Omega$

2-19 解：(1) $U_{BQ} = \frac{R_{B2}V_{CC}}{R_{B1}+R_{B2}} \approx 5V$　$I_{EQ} = \frac{U_{BQ} - 0.7V}{R_E} = 2.15mA$

$I_{CQ} = \frac{\beta}{1+\beta} I_{EQ} \approx 2.1mA$　$U_{CEQ} = V_{CC} - I_{EQ}R_E = 7.7V$

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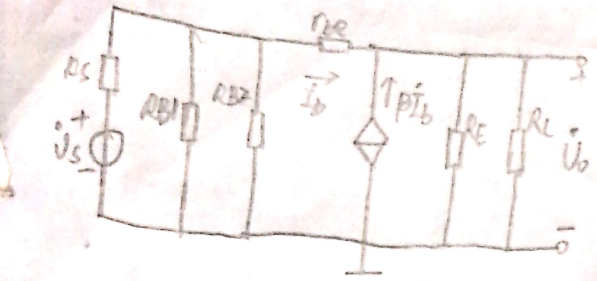
(2) 电路的微变等效电路如下图所示



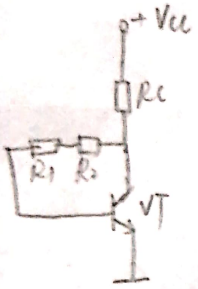
$r_{be}=r_{bb'}+(1+\beta)\frac{26mV}{I_{EQ}}=1.35\,K\Omega$

$A_U=\frac{(1+\beta)R_L'}{r_{be}+(1+\beta)R_L'}=0.987$

$R_i=R_{B1}//R_{B2}//[r_{be}+(1+\beta)R_L']=21.8\,K\Omega$

$R_o=R_E//\frac{r_{be}+R_S//R_{B1}//R_{B2}}{1+\beta}=23\,\Omega$

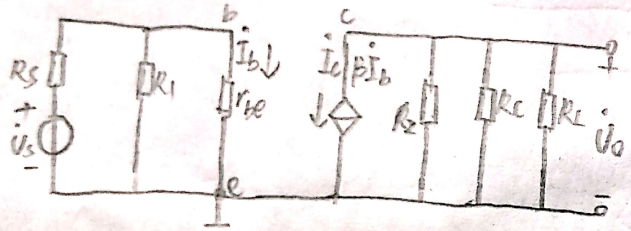
2-24 解：(1) 直流通路如下图所示



$I_{CQ}=\beta I_{BQ}$　$I_{EQ}=I_{BQ}+I_{CQ}$　$\frac{V_{CC}-U_{CEQ}}{R_C}=I_{BQ}+I_{CQ}=(1+\beta)I_{BQ}$

$I_{BQ}=\frac{U_{CEQ}-U_{BEQ}}{2R_1}$　$R_1=R_2=62\,K\Omega$

(2) 微变等效电路如下图所示



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

$A_U=\frac{-\beta(R_C//R_L//R_2)}{r_{be}}=-149$

~~$A_{US}=$~~　$R_i=r_{be}//R_1=1.3K\Omega$

$A_{US}=\frac{R_i}{R_i+R_S}A_U=-83$

(3) $R_i=1.3\,K\Omega$　$R_o=R_C//R_2=7.3\,K\Omega$

2-25 解：(1) $I_{BQ}=\frac{I_{CQ}}{\beta}=10\mu A$　$I_{EQ}\approx I_{CQ}=1\,mA$　$U_{BQ}=\frac{R_{B1}V_{CC}}{R_{B1}+R_{B2}}=5\,U_{BEQ}=3.5V$

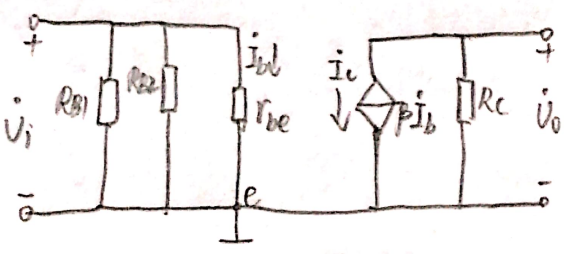
$I_{EQ}=\frac{U_{BQ}-U_{BEQ}}{R_E}=\frac{2.8V}{R_E}=1mA$　$R_E=2.8\,K\Omega$

$R_C=\frac{V_{CC}-(U_{BQ}-U_{BEQ})-U_{CEQ}}{I_{CQ}}=5.2K\Omega$

$\because I_C(R_{B1}+R_{B2})=V_{CC}$，$I_1R_{B1}=U_{BQ}$，　$I_1\approx 10I_{BQ}=0.1mA$　~~$\therefore R_{B1}=35$~~

$\therefore R_{B1}=35\,K\Omega$，$R_{B2}=85\,K\Omega$

(2) 电路微变等效电路如下图所示



$A_U=\frac{-\beta R_C}{r_{be}}=-193$

$R_i=R_{B1}//R_{B2}//r_{be}=2.4\,K\Omega$

$R_o=R_C=5.2\,K\Omega$