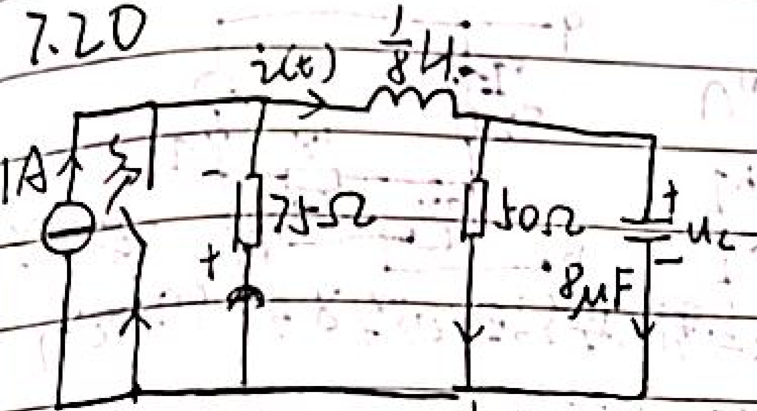
7.20



$i_L(0_-)=\frac{75}{75+50}\times 1A=0.6A$

$u_C(0_-)=0.6\times 50=30V$

$\frac{du_C}{dt}(0_+)=\frac{i_C(0_+)}{C}=0$

闭合后: $i(t)=C\frac{du_C}{dt}+\frac{u_C}{50}$

$L\frac{di(t)}{dt}+u_C=0$

$\frac{1}{8}\times 8\times 10^{-6}\frac{d^2u_C}{dt^2}+\frac{1}{400}\frac{du_C}{dt}+u_C=0$

$$\frac{d^2u_C}{dt^2}+2500\frac{du_C}{dt}+10^6u_C=0$$

特征方程 $s^2+2500s+10^6=0$ $s_1=-2000$
$s_2=-500$

齐次解 $u_{ch}=A_1e^{-2000t}+A_2e^{-500t}$

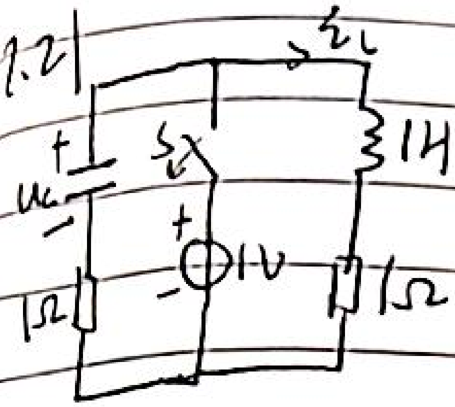
特解 $u_{cp}=0$

$u_C(0_+)=u_C(0_-)=A_1+A_2=30$

$C\frac{du_C}{dt}(0_+)=-2000A_1-500A_2=0$ $\Rightarrow\begin{cases}A_1=-10\\A_2=40\end{cases}$

$i(t)=C\frac{du_C}{dt}+\frac{u_C}{50}=0.64e^{-500t}-0.04e^{-2000t}$

1.21



闭合前: $i_L(0-)=1A$

$u_c(0-)=1V$

$$\frac{du_c}{dt}(0+)=\frac{i_c}{C}=\frac{-i_L(0+)}{C}=-1A$$

$$i_L=-C\frac{du_c}{dt}$$

$$i_L\times 2\Omega+L\frac{di_L}{dt}=u_c$$

$$2\frac{du_c}{dt}+\frac{d^2u_c}{dt^2}+u_c=0$$

特解 $u_{cp}=0V$

$$s^2+2s+1=0$$

$$s_1=s_2=-1$$

齐次解 $u_{ch}=(A_1+A_2t)e^{-t}$

$$u_c(0+)=A_1=1V$$

$$\frac{du_c}{dt}(0+)=A_2-A_1=-1A$$

$$A_2=0$$

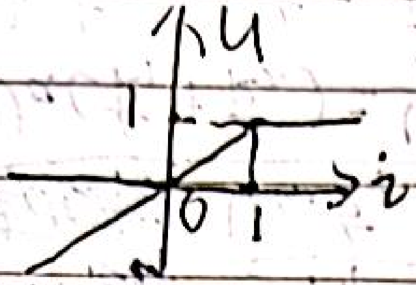
$$u_c=e^{-t}V$$

$$i_L=-C\frac{du_c}{dt}=e^{-t}A$$

9.2, (a) $u_D = 1 \times i - 1$

当$u_D<0$ $i<1$，二极管不导通，$u=1\times i$

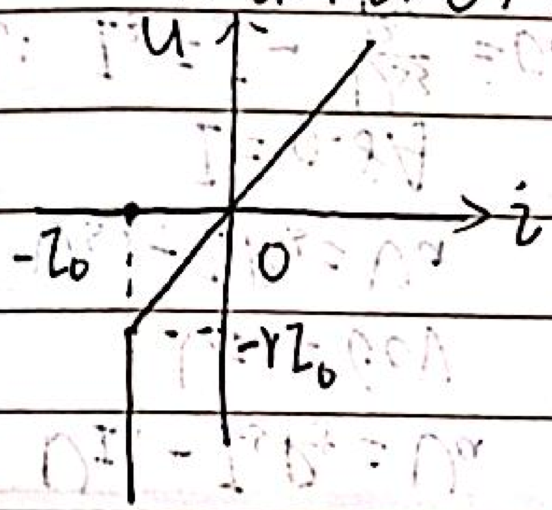
当$u_D\geq 0$ $i\geq 1$，导通，$u=1V$.



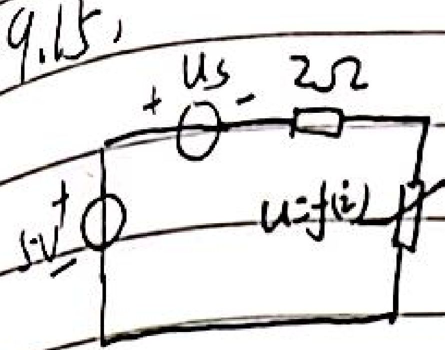
(b) $u_D = u - ri$

当 $u-ri<0$，截止，此时 $i=-I_0$ $u=-rI_0$

当 $u-ri>0$，导通，此时 $u=ri$



9.15,



令 $u_s=0$, $I_0=1A$

$R_d=\frac{du}{di}\Big|_{i=I_0}=5\Omega$

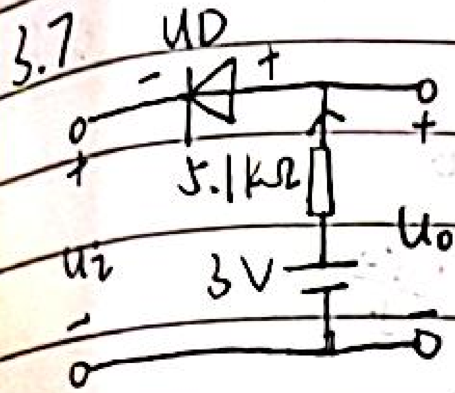
只有u_s作用时

$i(t)=\frac{\sin\omega t}{2+5}=\frac{\sin\omega t}{7}$ V

$i(t)$与I_0方向相反

$I=I_0-i(t)=1-\frac{1}{7}\sin\omega t$ A

3.7



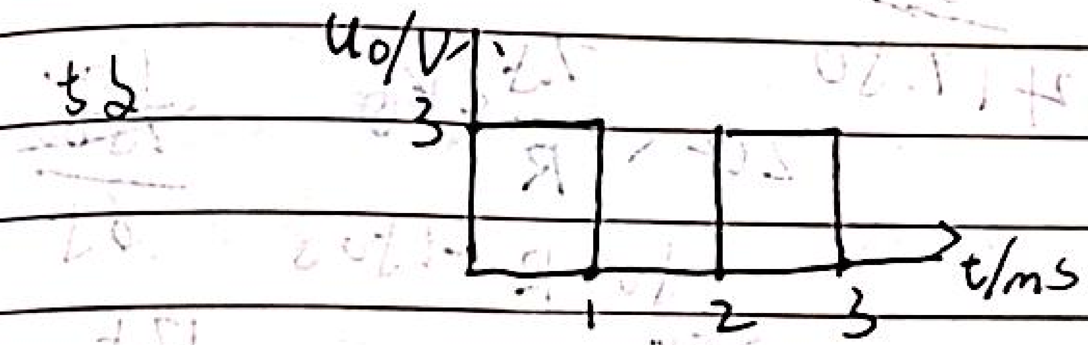
断开D

$u_D+u_i=3V$

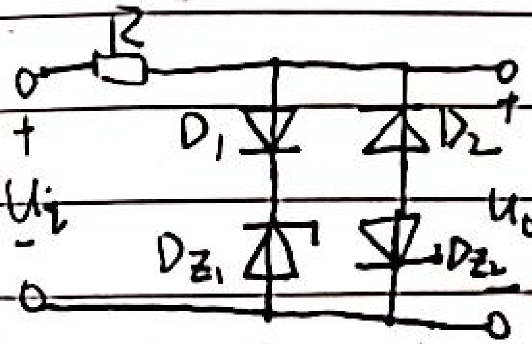
当 $u_i=5V$ 时 $u_D<0$ 截断

$u_o=3V$

$u_i=0V$ 时，短接，$u_o=0V$



3.9.



当 $u_i>0$ 时

D_2 截断

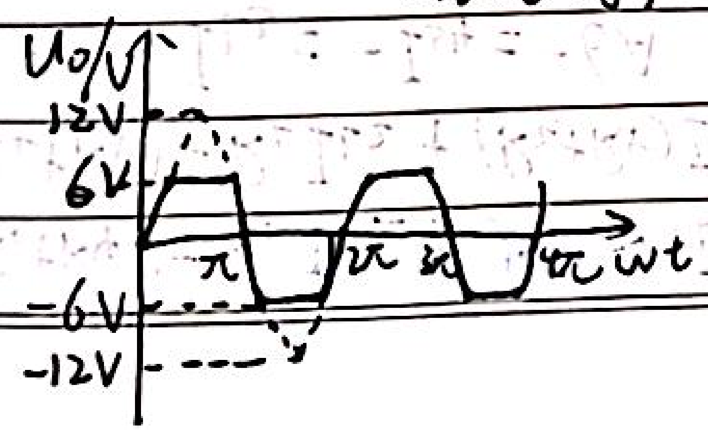
$0<u_i<6V$ 时 D_{z1} 截止，

$u_o=u_i$

$u_i>6V$，D_{z1} 稳压 $u_o=U_z=6V$

当 $u_i<0$ 时，同理，$-6<u_i<0$ 时，D_{z2} 截止 $u_o=u_i$

$u_i<-6$ 时，$u_o=-U_z=-6V$



3.10. $I_Z = I - I_L = I - \frac{U_Z}{R_L}$

$IR + U_Z = U_I$

$I_Z = \frac{U_I - 7.5}{R} - I_L \in [5mA, 50mA]$

$U_I \in [15, 25]$ $\quad I_L \in [0, 15mA]$

~~当 $U_I = 15V$, $I_L = 0$. $150\Omega \le R \le 1500\Omega$~~

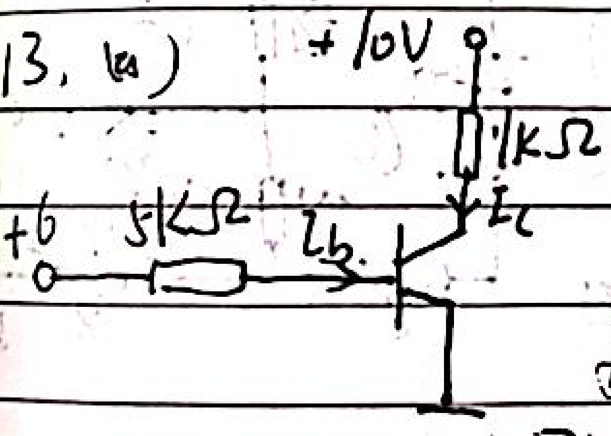
~~$U_I = 15V$, $I_L = 15mA$. $\frac{1500}{13}\Omega \le R \le 375\Omega$~~

$U_I = 25V$, $I_L = 0$ $\quad 350\Omega \le R \le 3500\Omega$

$U_I = 25V$, $I_L = 15mA$ $\quad \frac{3500}{13}\Omega \le R \le 875\Omega$

故 $350\Omega \le R \le 375\Omega$

3.13. (a)



基极电压远大于发射结导通电压,

故 $5k\Omega \cdot I_b + V_{BE} = +6V$

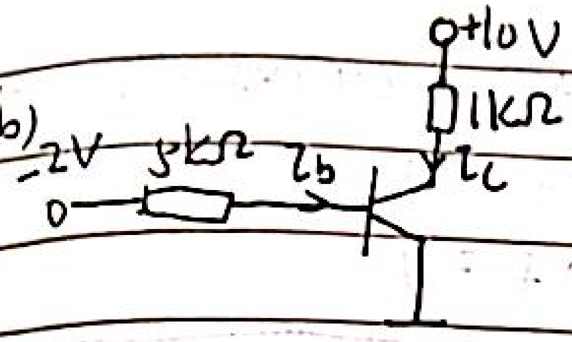
$V_{BE} = 0.7V$ $\quad I_b = 1.06mA$

如果饱和: 临界时: $I_{C饱} = \frac{+10V}{1k\Omega} = 10mA$

如果为放大状态, $I_C = \beta I_b = 31.8mA > 10mA$

故已经饱和

(b)

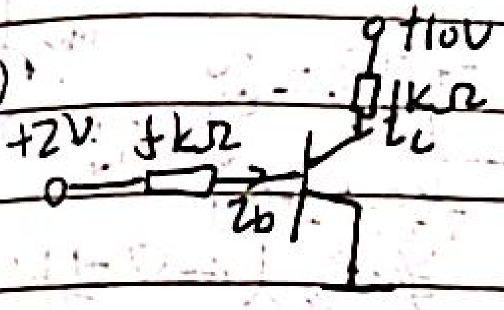


基极电压为-2V，发射结反偏，$I_b=0$

集电结也反偏，$U_{CB}>0$

故截止状态

(c)



基极电压+2V，发射结正偏

$5k\Omega\, I_b + U_{BE} = +2V$

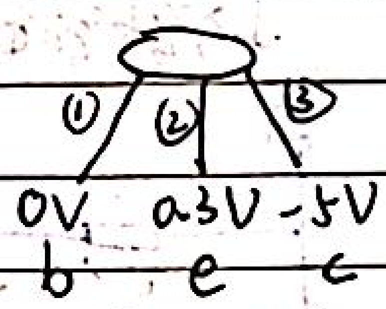
$I_b = 0.26mA$

临界饱和时：$U_{CB}=0$，$I_{C饱}=\frac{10V}{1k\Omega}=10mA$

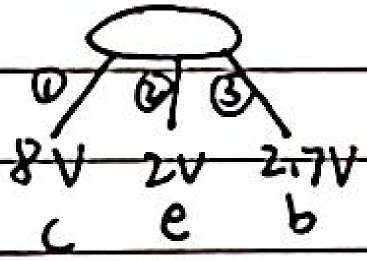
如果放大 $I_c=\beta I_b=7.8mA<10mA$

故处于放大状态

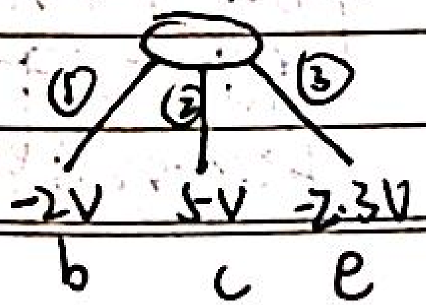
3.14 (a) PNP锗管



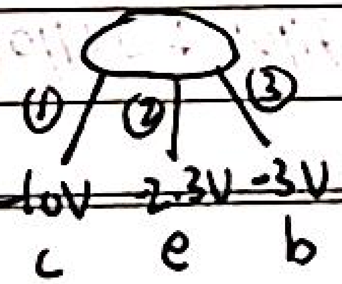
(b) NPN硅管



(c) NPN锗管



(d) PNP硅管



3.15. (a) NPN型. $V_{BE}<0$, $V_{CB}>0$ 都反偏，截止

(b) PNP型 $V_{BE}<0$, $V_{BC}>0$，放大

(c) PNP型 $V_{BE}>0$, $V_{BC}<0$，发射结正偏，集电结反偏 倒置

(d) NPN型 $V_{BE}>0$, $V_{BC}>0$. 饱和

(e) NPN型 $V_{BE}>0$, $V_{BC}<0$. 放大

(f) PNP型 $V_{BE}<0$, $V_{BC}<0$, 饱和

(g) NPN型 $V_{BE}>0$, $V_{BC}<0$, 放大

(h) NPN型 $V_{BE}=2.7V>0$，远超 0.7V，可能已损坏