武汉大学2019－2020学年度 第二学期《模拟电路基础(上)》答卷

本人郑重声明，试卷属于本人独立完成，不存在抄袭、代考行为。

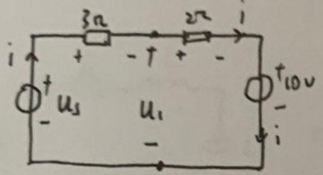
[redacted]

[redacted]

总分	一	二	三	四	五

一、

1. 解：



$U_1 = 2\Omega \cdot i + 10V$

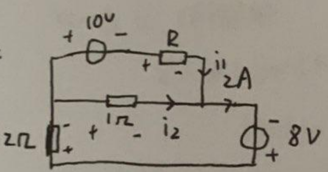
$P_s = P_{U_s} = -U_s \cdot i$

又 $U_1 = -3\Omega \cdot i + U_s$

$\therefore i = 2A$，$U_s = 20V$

$\therefore P_s = -U_s \cdot i = -40W$

2. 解：电路图可画为：



$$\begin{cases} i_1 + i_2 = 2A \\ 10V + i_1 \cdot R = 1\Omega \cdot i_2 \\ 1\Omega \cdot i_2 - 8V = 0 \\ \therefore R = \frac{1}{3}\Omega = 0.33\Omega \end{cases}$$

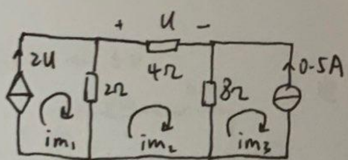
$i_1 + i_2 = 2A$

$10V + i_1 \cdot R = 1\Omega \cdot i_2$

$2\Omega \cdot 2A + 1\Omega \cdot i_2 = 8V$

$\therefore R = 3\Omega$.

3. 解：



运用网孔电流法：

$i_{m1} = 2u$.

$(2\Omega + 4\Omega + 8\Omega) i_{m2} - 2\Omega \cdot i_{m1} - 8\Omega \cdot i_{m3} = 0$

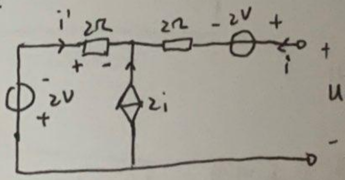
$u = 4\Omega \cdot i_{m2}$

$i_{m3} = -0.5A$

$\therefore i_{m2} = 2A$.

$\therefore u = 4\Omega \cdot 2A = 8V$

4. 解：求 U_{oc}：



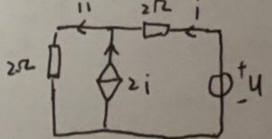
此时 $i = 0$.

$$\begin{cases} i' = \frac{-2V}{2\Omega} = -1A \\ U_{oc} = 2V - i' \cdot 2\Omega - 2V = 2V \end{cases}$$

$U_{oc} = 2V - 2V = 0$

求R：利用外施电源法：

令独立源 = 0，

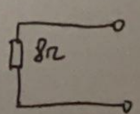


$i_1 = i + 2i$

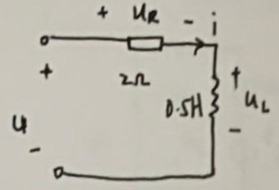
$u = 2\Omega \cdot i + 2\Omega \cdot i_1 = 8i$

$\therefore R = 8\Omega$

$\therefore$ 等效电路为：



5. 解：

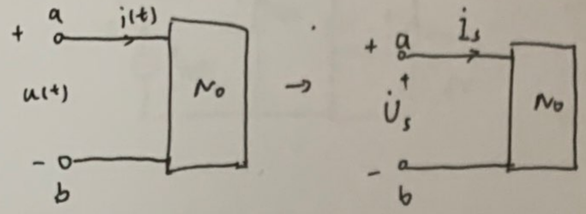


$\left(u_R(t) = 2e^{-t} \quad u_R(\infty)=0.\ u_R(0)=2.\ \tau = 1s. \right)_\times$

$i = \frac{u_R(t)}{R} = \frac{2e^{-t}V}{2\Omega} = e^{-t}A$

$\therefore u_L(t) = L\frac{di}{dt} = 0.5H \cdot \frac{d(e^{-t})}{dt} = -0.5e^{-t}V$

6. 解：

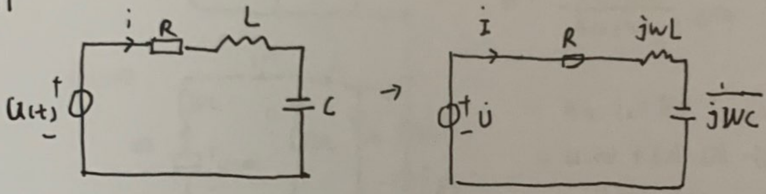


$\dot{I}_s = 2\angle -30^\circ A \quad \dot{U}_s = 10\angle 30^\circ V.$

$\therefore Z_{ab} = \frac{\dot{U}_s}{\dot{I}_s} = \frac{10\angle 30^\circ V}{2\angle -30^\circ A} = 5\angle 60^\circ \Omega$

$P = \frac{U_s}{\sqrt{2}} \cdot \frac{I_s}{\sqrt{2}} \cdot \cos\varphi W = \frac{10}{\sqrt{2}} \cdot \frac{2}{\sqrt{2}} \cdot \cos 60^\circ = 5W.$

7. 解：



(1) $\dot{U} = \dot{I}R + \dot{I}jwL + \dot{I}\frac{1}{jwC}$

$U = U_R + U_L + U_C$

$\therefore U = 15V$

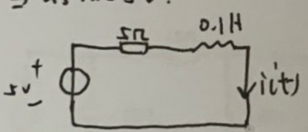
(2) 当 $\dot{U}$. $\dot{I}$ 同相时：

$Z = R + jwL + \frac{1}{jwC} = R$

$\therefore jwL = -\frac{1}{jwC}$

$\therefore w = \frac{1}{\sqrt{LC}}$

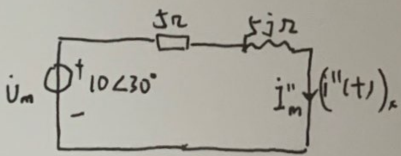
8. 解： 当 $u_s(t) = 5V$:



电感被短路.

$\therefore i'(t) = \frac{5V}{5\Omega} = 1A$

当 $u_s(t) = 10\cos(50t + 30^\circ)V$:

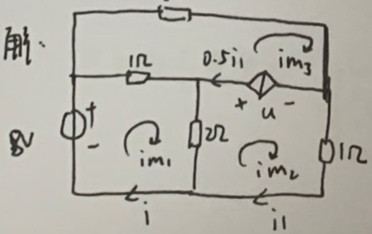


$\dot{I}''_m = \frac{\dot{U}_m}{Z} = \frac{10\angle 30^\circ V}{(5+5j)\Omega} = \sqrt{2}\angle \arctan(\sqrt{3}-2)A.$

$\therefore i''(t) = \sqrt{2}\cos(50t + \arctan(\sqrt{3}-2))A.$

$\therefore i(t) = i'(t) + i''(t) = 1 + \sqrt{2}\cos(50t + \arctan(\sqrt{3}-2))A.$

二. 解：



用网孔电流法得：

$i_{m1} = i$

$(1\Omega+2\Omega)i_{m1} - 1\Omega \cdot i_{m3} - 2\Omega \cdot i_{m2} = 8V$

$i_{m2} = i_1$

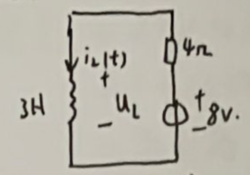
$(2\Omega+1\Omega)i_{m2} - 2\Omega \cdot i_{m1} = -u$

$(1\Omega+2\Omega)i_{m3} - 1\Omega \cdot i_{m1} = u.$

$(i_{m3} - 0)_\times \quad i_{m3} - i_{m2} = 0.5i_1$

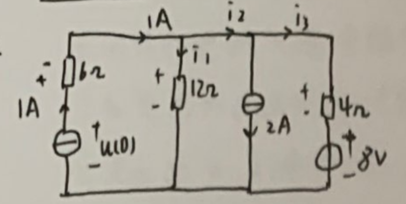
$\therefore i_1 = 2A. \quad i = 5A. \quad u = 4V.$

三.解: $t<0$:



$i_L(0_-)=\frac{8V}{4\Omega}=2A$

$t=0$:



$i_L(0)=i_L(0_-)=2A$ 等效为一个用一个电流源替代.

$\therefore 1A=i_1+i_2$

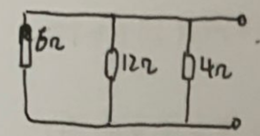
$i_2=2A+i_3$

$u(0)=6\Omega\cdot 1A+12\Omega\cdot i_1$

$u(0)=6\Omega\cdot 1A+4\Omega\cdot i_3+8V$

$\therefore u(0)=9V.$

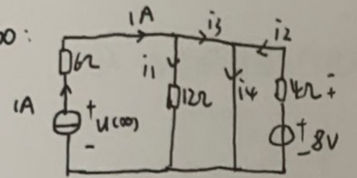
$t\geq 0$:



$R_1=\frac{6\Omega\times 12\Omega}{6\Omega+12\Omega}=4\Omega$

$R=\frac{4\Omega\times 4\Omega}{4\Omega+4\Omega}=2\Omega$. $\tau=\frac{L}{R}=\frac{3}{2}s.$

$t\to\infty$:



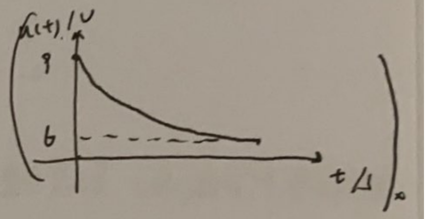
$\therefore 4\Omega\cdot i_2=8V$, $U_{4\Omega}=8V.$

$-u(\infty)+6\Omega\cdot 1A-U_{4\Omega}+8V=0.$

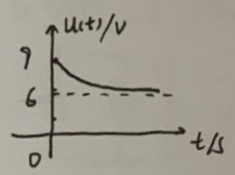
$u(\infty)=6V.$

$\therefore u(t)=u(\infty)+[u(0)-u(\infty)]e^{-\frac{1}{\tau}t}$

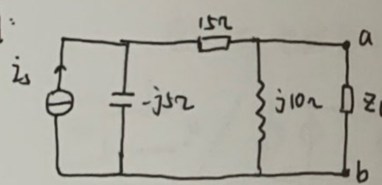
$=6+3e^{-\frac{2}{3}t}$ (V). $(t\geq 0)$



波形:

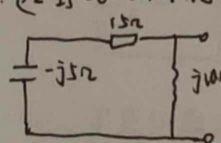


四.解:



先求a、b左侧戴维南等效电路.

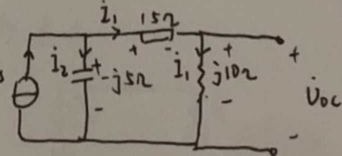
求R: ~~(令 $\dot{I}_s=0$. 用外施电源法)~~ 令 $\dot{I}_s=0$



$\therefore Z_1=(15-j5)\Omega$

$Z_s=\frac{Z_1\cdot j10\Omega}{(Z_1+j10\Omega)}=6+8j.$

求 $\dot{U}_{oc}$:



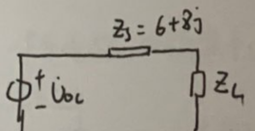
$\therefore \dot{I}_s=\dot{I}_1+\dot{I}_2$

$\dot{I}_2\cdot(-j5\Omega)=\dot{I}_1(15\Omega+j10\Omega)$

$\dot{U}_{oc}=\dot{I}_1\cdot j10\Omega$

$\therefore \dot{U}_{oc}=(18-6j)V=6\sqrt{10}\angle\arctan(-\frac{1}{3})$ V.

$\therefore$ 原电路可等效为



$\therefore$ 当 $Z_L=6-8j$ 时, 可以获得最大功率.

$P_{L\max}=\frac{U_{oc}^2}{4R_s}=\frac{(6\sqrt{10})^2}{4\times 6}=15W$

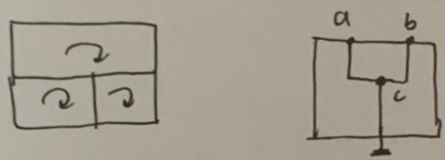
五.解:

观点:我认为这位同学的想法是不对的。第一章是最基础的部分,确定可以解决很多关于电路的分析。但是学习后续章节后,我们了解到更多的方法帮助我们化简电路,从而更快地分析电路,提高效率(利用)例如戴维南定理的运用巧妙地将大堆电阻电源(网)等效为电阻+电源;相量形式帮我们简化了当电源为正弦时的计算,相量图的解题方法也让我们能以画图的方式表示出u、i间的大小、相位关系。它们都是以KCL、KVL、VCR为最基本原理,进一步推出的用于解决电路分析的方法,仍有必要(继)继续学习.

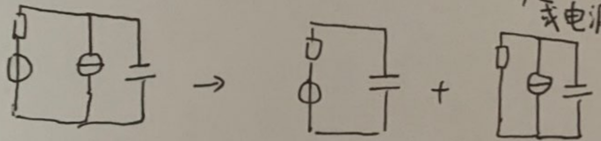
对于不同结构的电路,我们也有不同的分析方法帮我们解决问题.

① 当电源出现正弦形式时,将电路化为相量形式,再回归基本的电路分析.

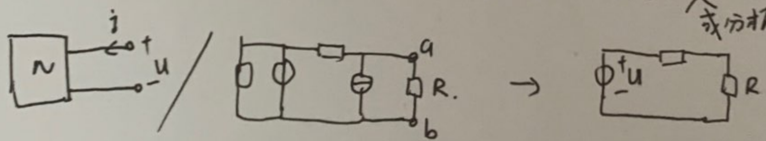
② 当电路有较多网孔时可利用网孔电流法或节点电压法进行计算.



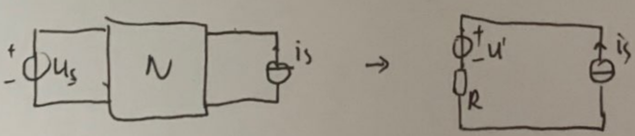
③ 当电路中含多个独立源,或不同电源ω不同(或电源由几部分组成)时,可采用叠加原理,分别分析每个电源的作用.



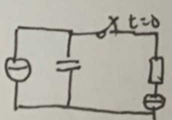
④ 当电路中分析对象集中在一个元件上(或分析单口网络时),可以将电路其它部分用戴维南定理进行等效.(尤其求最大功率时)



⑤ 当电路结构不完整时,可以用戴维南定理将未知结构等效,用线性电路的思想直接构建元件u.i与电源的关系



⑥ 对于一阶电路,分析其中u.i的变化时可用三要素法,选取三种状态进而得出整个的变化过程,其中也包含了替代定理、戴维南等效的思想.



→ $t<0$, $t=0$, $t\to\infty$.