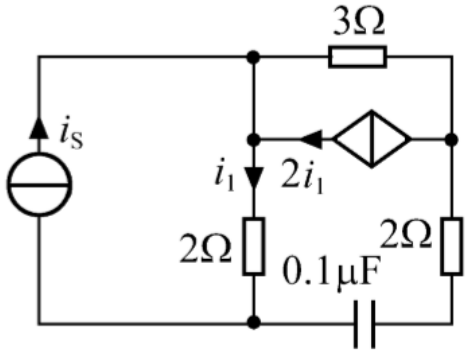
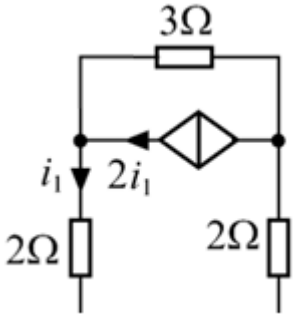
电路暂态过程的时域分析

习题讲解

1. 求题图所示一阶电路的时间常数。

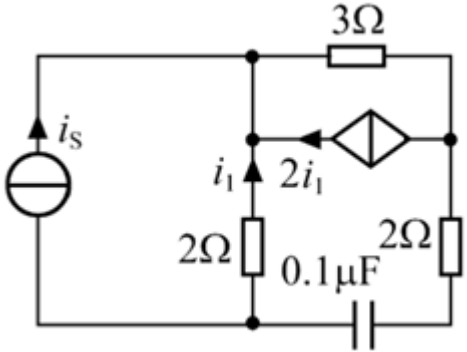


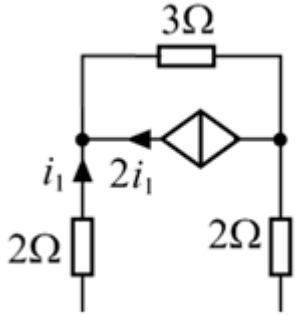


$$u = 2i_1 - 3i_1 + 2i_1 = i_1$$

$$R = 1\Omega$$

$$\tau = RC = 0.1\mu s$$



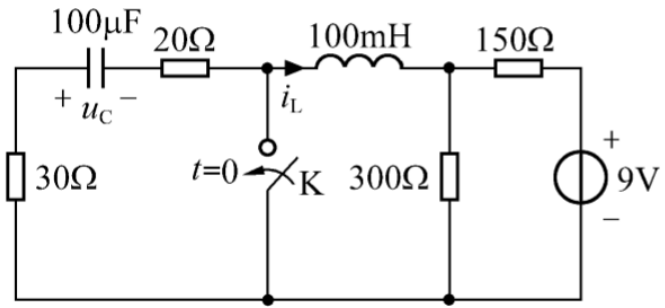


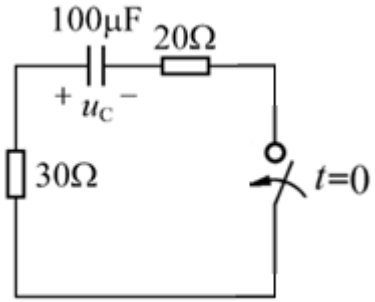
$$u = 2i_1 + 3\times 3i_1 + 2i_1 = 13i_1$$

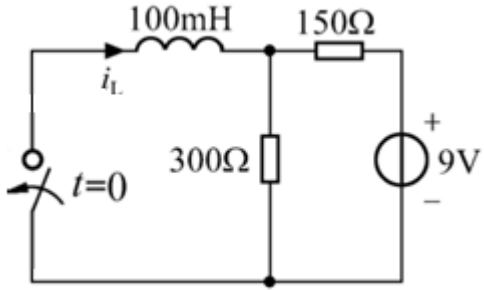
$$R = 13\Omega$$

$$\tau = RC = 1.3\mu s$$

2. 电路如题图所示，t =0时开关K闭合，若开关动作前电路已经稳定，求t >0时的$i_L(t)$和u_C(t)。







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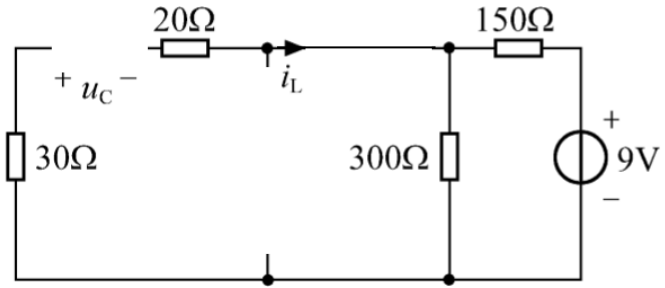
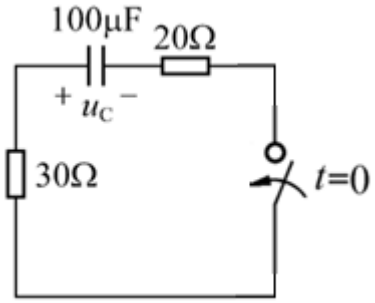
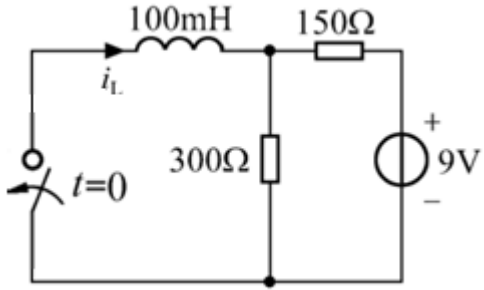






$$u_C(0^+)=u_C(0^-)=-\frac{300}{300+150}\times 9=-6\text{V}$$

$$i_L(0^+)=i_L(0^-)=0\text{A}$$

$$u_C(\infty)=0\text{V}$$

$$\tau=RC=5\text{ms}$$

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

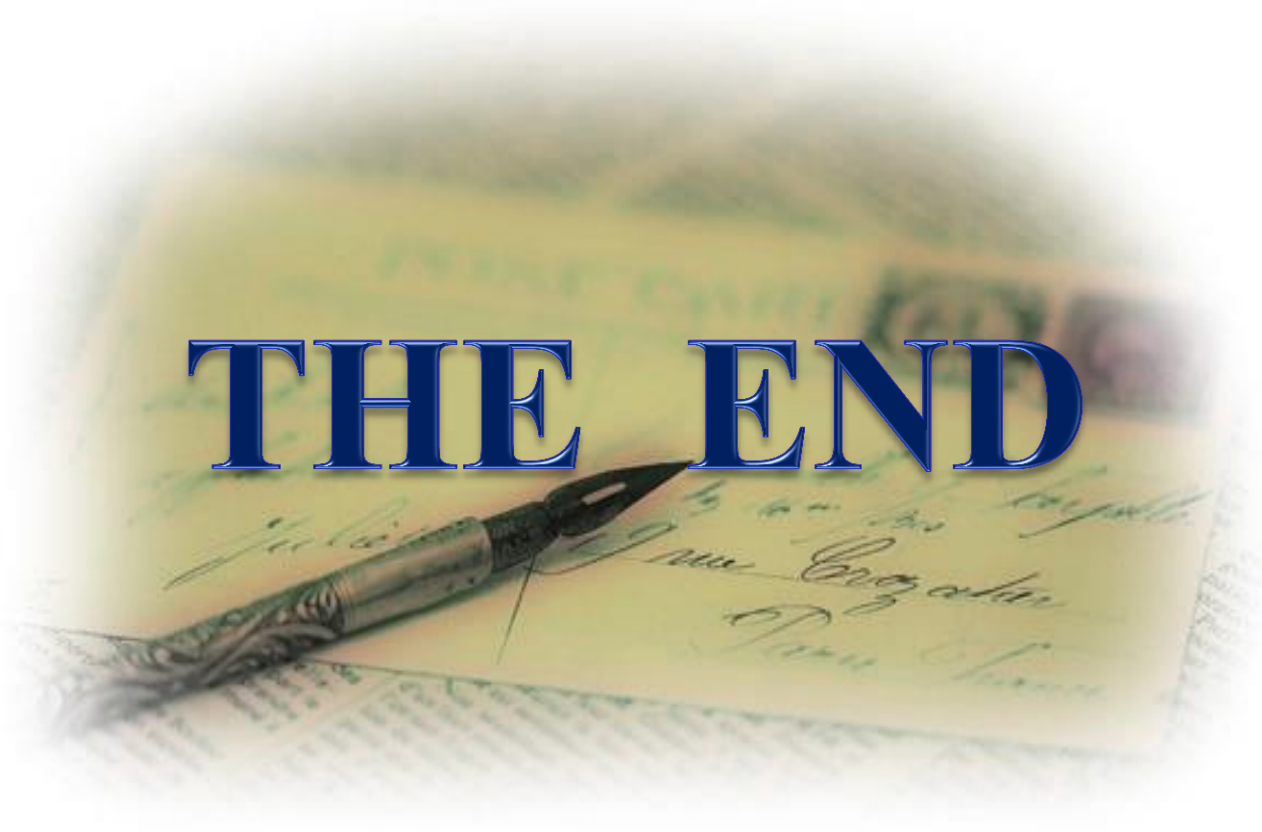
$$=-6e^{-200t}\text{ V}\quad(t\geq 0)$$

$$i_L(\infty)=-\frac{9}{150}=-0.06\text{A}$$

$$\tau=\frac{L}{R}=\frac{100}{300//150}=1\text{ms}$$

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

$$=-0.06(1-e^{-1000t})\text{A}\quad(t\geq 0)$$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