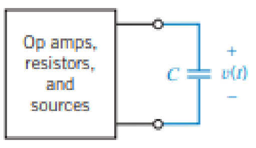
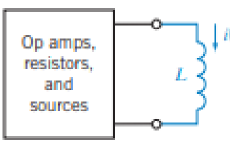
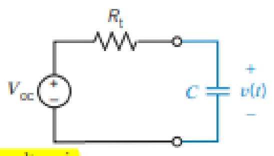
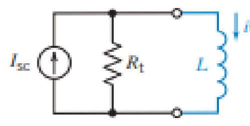
class 16 23.11.2022

Section 8.3 The Response of a First-Order Circuit to a Constant Input

Table 8.12-1 Summary of First-Order Circuits

FIRST-ORDER CIRCUIT CONTAINING A CAPACITOR	FIRST-ORDER CIRCUIT CONTAINING AN INDUCTOR
	
Replace the circuit consisting of op amps, resistors, and sources by its Thévenin equivalent circuit:	Replace the circuit consisting of op amps, resistors, and sources by its Norton equivalent circuit:
	
The capacitor voltage is: $v(t) = V_{oc} + (v(0) - V_{oc})e^{-t/\tau}$ where the time constant τ is $\tau = R_t C$ and the initial condition $v(0)$ is the capacitor voltage at time $t = 0$.	The inductor current is $i(t) = I_{sc} + (i(0) - I_{sc})e^{-t/\tau}$ where the time constant τ is $\tau = \frac{L}{R_t}$ and the initial condition $i(0)$ is the inductor current at time $t = 0$.

P 8.3-20 The circuit shown in Figure P 8.3-20 is at steady state before the switch closes. Determine $i(t)$ for $t \geq 0$.

a)

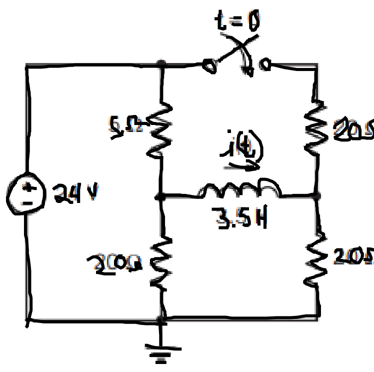


Figure P 8.3-20

1) $i(t) = ?$

$= i_{sc} + [i(0) - i_{sc}]e^{-t/\tau}$

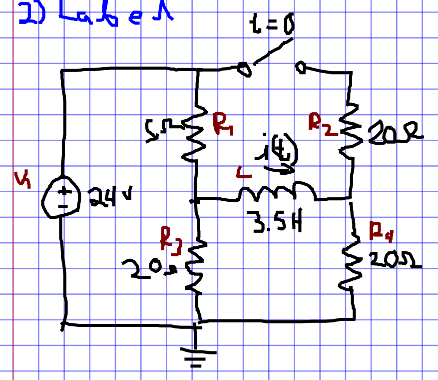
$i_{sc} = ?$

$i(0) = ?$

$\tau = \frac{L}{R_t} = ?$

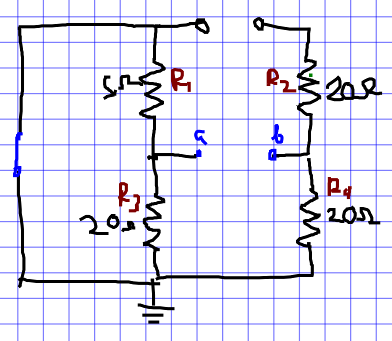
$R_t = ?$

2) Label

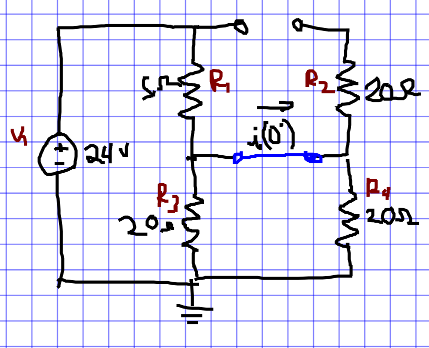


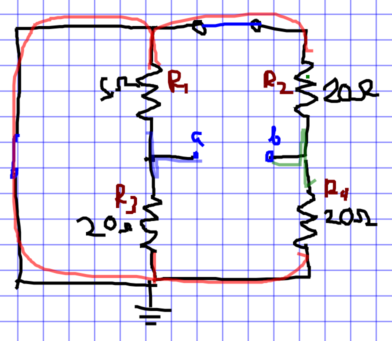
3)

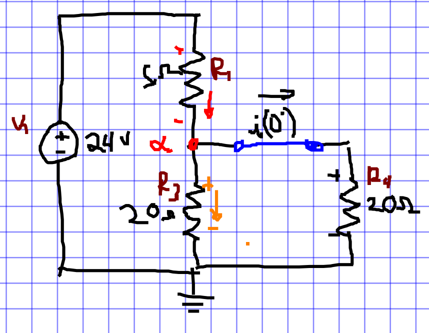
3.1) R_t

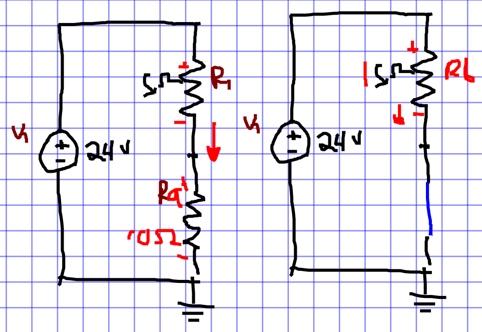


3.2) $i(0)$

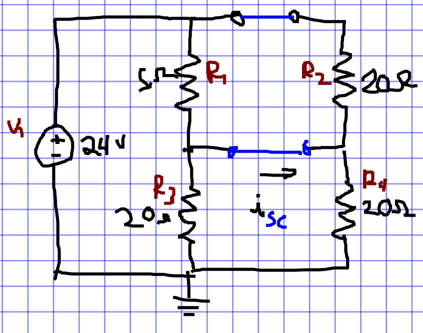








2.3



H.A

4.2

$i_{R_1} = \frac{V_1}{R_t}$

$= \frac{24V}{15\Omega}$

$= 1.6A$

$i(0) = \frac{R_a}{R_4} \cdot i_{R_1}$

$= \frac{10\Omega}{20\Omega} 1.6A$

$= 800mA$