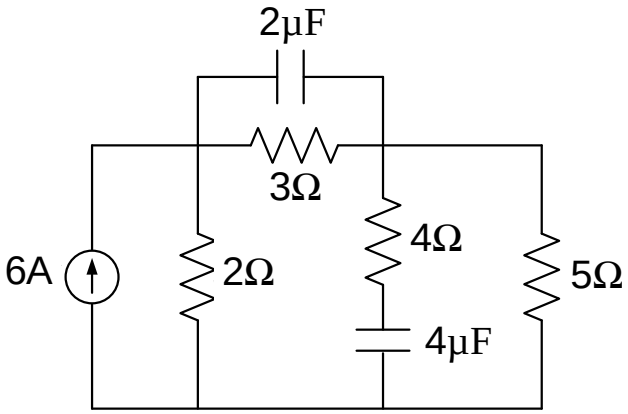
Basic Electrical Engineering Tutorial sheet 3 (Transients)

Q1: Find the energy (E_1 and E_2) stored in the 2 capacitors (2 and 4μF) at steady state.

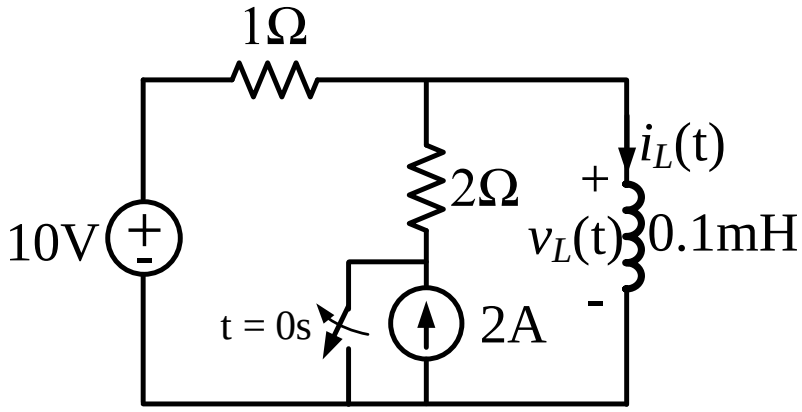
[$E_1 = 12.96\mu J \; and \; E_2 = 72\mu J$]



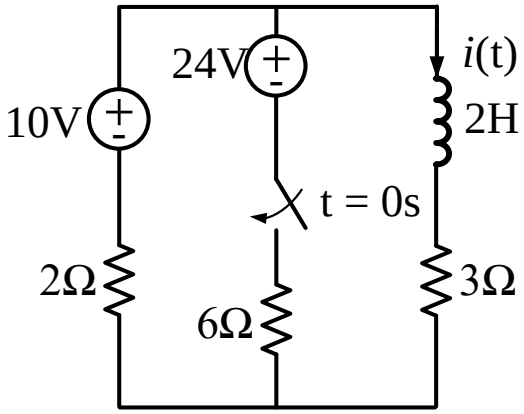
Q2 A 50 μF capacitor and a 20000 Ω resistor are connected in series across a battery of 100 V at instant t = 0. At instant 1 = 0.5 sec, the voltage is suddenly increased to 150 V. Find the charge on the capacitor at t = 0.75 sec. [3.19×10^{-3} C]

Q3 Find the value of $i_L(t)$ and $v_L(t)$ at t = 0.2ms.

[$i_L(0.2 \times 10^{-3}) = 11.73\ A \; and \; v_L(0.2 \times 10^{-3}) = 0.27\ V$.]

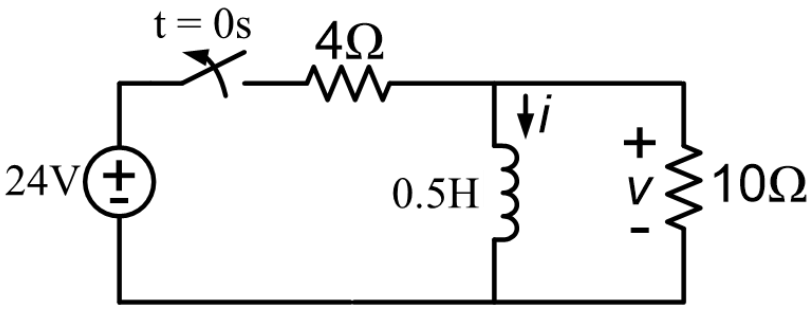


Q4. Find the expression of current i(t) for t > 0s if the switch is closed at t = 0s. $[i(t) = 3 - e^{-\frac{9}{4}t}\ A]$

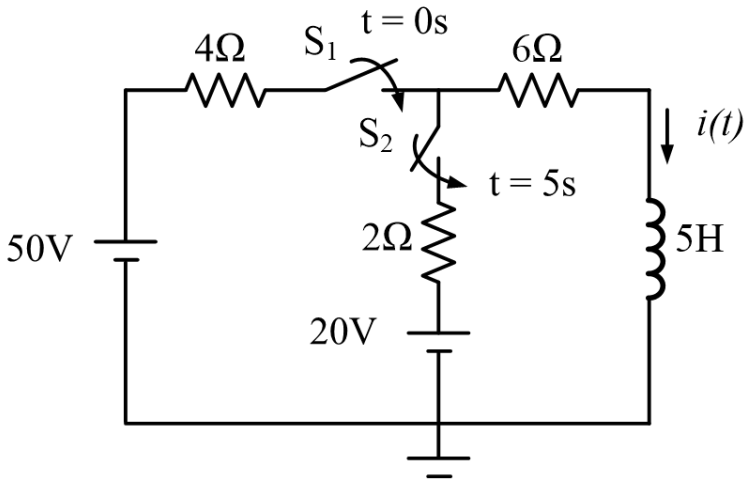


Q5 Find the value of voltage (v) across 10Ω resistor at t = 5ms if the switch is open at t = 0s.

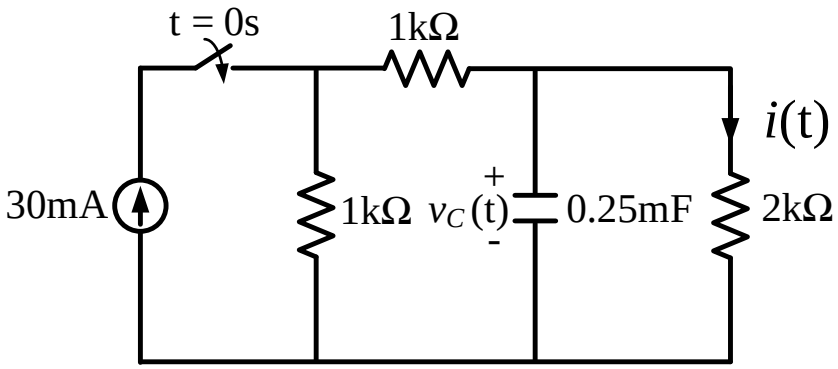
$[v(5 \times 10^{-3}s) = -54.29\ \text{V}.]$



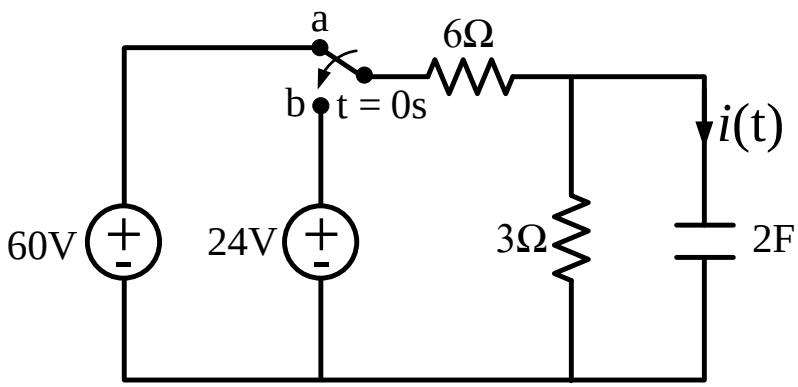
Q6 In the circuit, switch 1 is closed at t = 0s, and switch 2 is closed at 5s later. Find the value of inductor current i(t) at t = 10s. $[i(10) = 4.09\ A]$



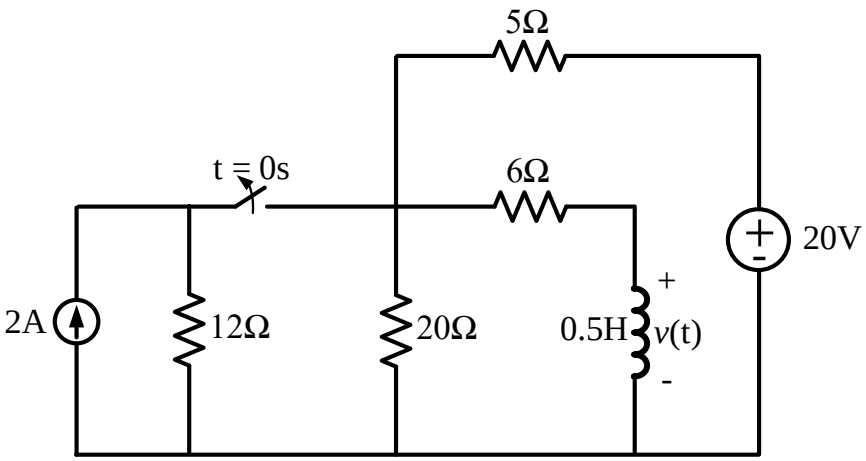
Q7 Find the expression of voltage across capacitor ($v_C(t)$) and current (i(t)) through 2kΩ resistor for t > 0s if the switch is closed at t = 0s. $[v_C(t) = 15 - 15e^{-4t}\ V\ and\ i(t) = 7.5 - 7.5e^{-4t}\ mA.]$



Q 8 The switch in the circuit has been in position *a* for a long time. At t = 0s, it moves to position *b*. Find the expression of i(t) for t > 0s. $[i(t) = -6e^{-0.25t}A]$



Q9 Find the expression of voltage v(t) for t > 0s if the switch is open at t = 0s. $[v(t) = -4e^{-20t}\ \text{V}\ ]$

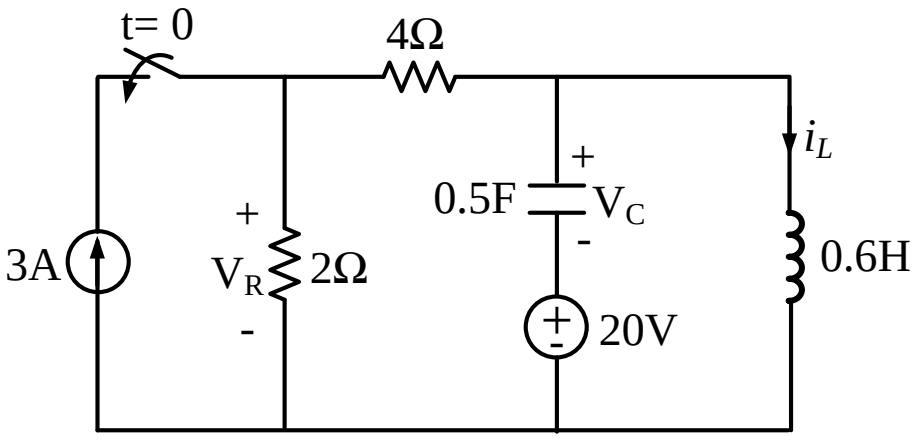


Q10. Find the values of (a) $i_L(0^+), V_C(0^+),\ V_R(0^+),\ V_L(0^+)$

(b) $i_L(\infty),\ V_C(\infty),\ and\ V_R(\infty)$ for the circuit shown.

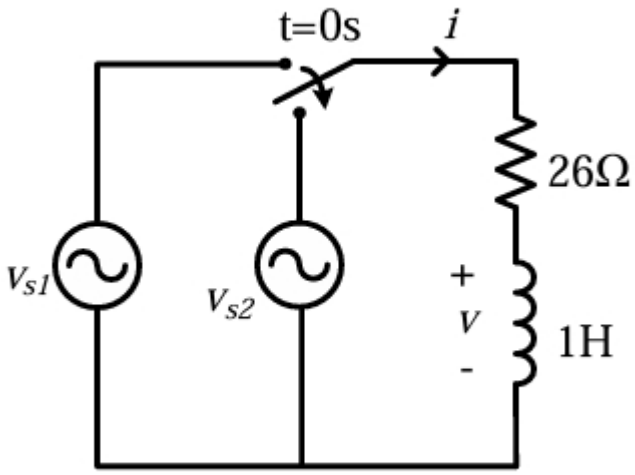
$[V_R(0^+) = 4V,\ V_C(0^+) = -20V,\ \ i_L(0^+) = 0A,\ V_L(0^+) = 0\ \text{V}$

$V_R(\infty) = 4V,\quad V_C(\infty) = -20V\ \ and\ i_L(\infty) = 1A]$



Q11.

Find $i(t)$ and $v(t)$ in the circuit.



Where v_{s1}=6cos15t and v_{s2}=12cos15t,

Ans: $i(t)=0.4\cos(15t-30^0)-0.173e^{-26t}$ A, $v(t)=6\cos(15t+60^0)+4.5e^{-26t}$ V