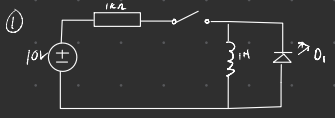
① 

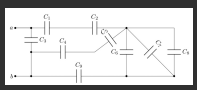
Når bryteren har vært lukket lenge all strømmen passere gjennom spolen $i(0) = \frac{V}{R} = \frac{10}{1k\Omega} = 10mA$

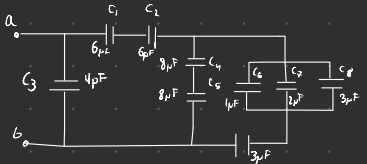
$i(\infty) = 0A$

$i(t) = 0{,}01 \cdot e^{-t \cdot 200\Omega}$

$0{,}01e^{-t \cdot 200\Omega} = 0{,}0025$

$t = -\frac{\ln\left(\frac{0{,}0025}{0{,}01}\right)}{200} = 0{,}0075$

② a) 



b) $C_{678} = 1\mu F + 2\mu F + 3\mu F = 6\mu F$

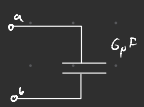
$C_{6789} = \left(\frac{1}{6\mu F} + \frac{1}{3\mu F}\right)^{-1} = 2\mu F$

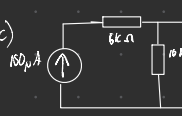
$C_{45} = \left(\frac{1}{8\mu F} + \frac{1}{8\mu F}\right)^{-1} = 4\mu F$

$C_{456789} = 2\mu F + 4\mu F = 6\mu F$

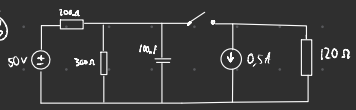
$C_{123456789} = \left(\frac{1}{6\mu F} + \frac{1}{6\mu F}\right)^{-1} = 2\mu F$

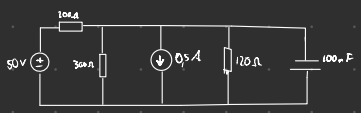
$C_{tot} = 4\mu F + 2\mu F = 6\mu F$



c) 

$V = 150{,}1A \cdot 10k\Omega = 1{,}5V$

③ 



$I = \frac{50V}{200\Omega} = 0{,}25$

$R_{1,2} = \frac{120 \cdot 120}{120 \cdot 120} = 75\Omega$

$R_{tot} = \frac{75 \cdot 300}{377} = 60\Omega$

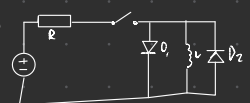
$V(\infty) = V_{R_{tot}} = -0{,}75 \cdot 60\Omega = 15V$

$T = 60\Omega \cdot 100 \cdot 10^{-6}$

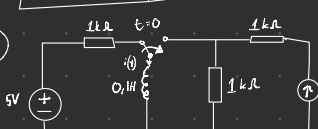
$v(0) = \frac{50V}{500\Omega} \cdot 300\Omega = 30V$

$v(\infty) = -15V$

$v(t) = -15V + (30V - (-15V))e^{-\frac{t}{6\mu s}} = -15 + 45e^{-\frac{t}{6\mu s}} V$

④ 

Når bryteren har vært lukket lenge vil ingen lyse
Når bryteren åpnes vil D_2 lyse i en kort periode
Når bryeren lukkes etter å ha vært åpen lenge vil D_1 lyse

⑤ 

$i(0) = \frac{5V}{1000\Omega} = 5mA$

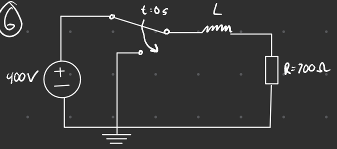
$i(\infty) = 1mA$

$i(t) = i(\infty) + (i(0) - i(\infty))e^{-\frac{t}{RC}}$

$i(t) = 1 + (5 - 1)e^{-\frac{t}{200 \cdot 0{,}001}}$

$i(t) = 1 + 4e^{-\frac{t}{0{,}001}}$

⑥



$P = U \cdot I = I^2 \cdot R$

$I = \sqrt{\frac{P}{R}} = \sqrt{\frac{100W}{700\Omega}} = 0{,}378A$

$I(0) = \frac{V}{R} = \frac{400V}{700\Omega} = 0{,}571A$

$I(\infty) = 0$

$I(t) = 0{,}571 e^{-\frac{t \cdot 700\Omega}{L}}$

$I(28800) = 0{,}571 e^{-\frac{28800 \cdot 700\Omega}{L}} = 0{,}378$

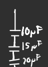
$L = -\frac{28800 \cdot 700\Omega}{\ln\left(\frac{0{,}378}{0{,}571}\right)} = 48\,773\,491\,H$

b) $E = \frac{1}{2} L I^2 = \frac{1}{2} \cdot 48\,773\,491 \cdot (0{,}571)^2 = 7{,}95\,MJ$

c) Fordi spolen har usedvanlig høy verdi som gjør det vanskelig å realisere. Mulig å heller lade opp et batteri.

⑦ a) Kapasitans er mengden elektrisk ladning en kondensator kan ta opp

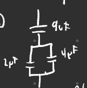
b) i)



$C_{tot} = \left(\frac{1}{10\mu F} + \frac{1}{15\mu F} + \frac{1}{20\mu F}\right)^{-1} = 4{,}6\,\mu F$

$C_{tot} = (10 + 15 + 20)\,\mu F = 45\,\mu F$

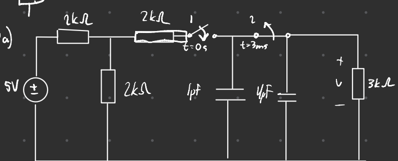
c)



$C_{par} = (2+4)\,\mu F = 6\,\mu F$

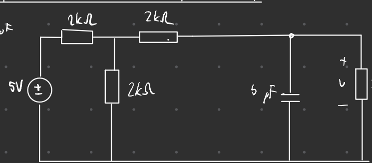
$C_{tot} = \left(\frac{1}{6} + \frac{1}{9}\right)^{-1} \mu F = 3{,}6\,\mu F$

⑧ a)



$T = RC = 1500\Omega \cdot 5\mu F$

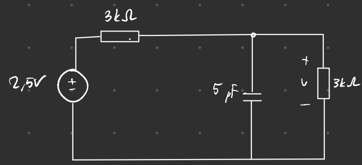
$T = 7{,}5\,ms$



$I = \frac{5V}{2000\Omega} = 2{,}5\,mA$

$R_p = \frac{2k\Omega \cdot 2k\Omega}{2+2\,k\Omega} = 1\,k\Omega$

$R_S = 1\,k\Omega + 2\,k\Omega = 3\,k\Omega$



$I = \frac{2{,}5V}{3000\Omega} = 0{,}833\,mA$

$V_{tot} = 0{,}833\,mA \cdot 1500 = 1{,}25V$

$R_{ny} = 1500\ \Omega$

b) $v(0) = 0V$

$v(\infty) = 1{,}25V$

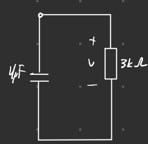
$0 \to 3ms$

$v(t) = 1{,}25 - 1{,}25 e^{-\frac{t}{7ms}}$

$3ms \to \infty$

$v(0) = V_0(3 \cdot 10^{-3}) = 1{,}25 - 1{,}25 e^{-\frac{3 \cdot 10^{-3}}{7 \cdot 10^{-3}}} = 0{,}44V$

$v(\infty) = 0$



$T = 4\mu F \cdot 3000\Omega = 0{,}012$

$v(t) = v(\infty) + (v(0) - v(\infty)) e^{-\frac{t}{0{,}012}}$

$v(t) = 0{,}44 e^{-\frac{t}{0{,}012}} V$

$v(t) \begin{cases} 1{,}25 - 1{,}25 e^{-\frac{t}{0{,}007}} & t < 3ms \\ 0{,}44 e^{-\frac{t}{0{,}012}} & t \geq 3ms \end{cases}$

(9) a)

b)

$L_{parallel} = \left(\frac{1}{12} + \frac{1}{20}\right)^{-1} mH = 8\,mH$

$L_{serie} = 8\,mH + 6mH + 10mH = 24\,mH$

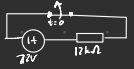
$I = 10A - 6A = 4A$

(10)

$i(0) = 2\,mA$

Super posisjon

$I = \frac{24}{12000\Omega} = 2\,mA$



$I = 0$

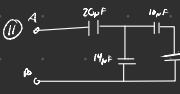
$I = \frac{96V}{24000\Omega} = 4\,mA$

$\tau = \frac{L}{R} = \frac{0.1H}{24000\Omega}$

$i(t) = 4 + (2 - 4)e^{-\frac{t}{24000}}$

$i(t) = 4 - 2e^{-\frac{t}{24000}}$

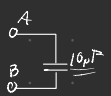
(11)



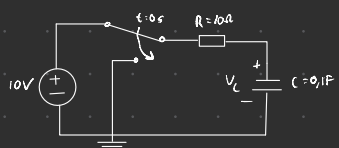
$C_1 = \left(\frac{1}{10} + \frac{1}{15}\right)^{-1}\mu F = 6\,\mu F$

$C_{eq} = 6\mu F + 14\mu F = 20\,\mu F$

$C_{tot} = \left(\frac{1}{20} + \frac{1}{20}\right)^{-1}\mu F = 10\,\mu F$



(12) a)



i) 10 V

ii) 0 A

iii) $I = \frac{10V}{10\Omega} = 1A$

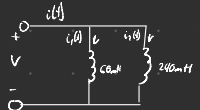
$\tau = R \cdot C = 10\Omega \cdot 0{,}1F = 1$

b) $v(0) = 10V$

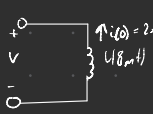
$v(\infty) = 0V$

$v(t) = 10e^{-t}\,V$

(13) a)



$L_{tot} = \left(\frac{1}{60} + \frac{1}{240}\right)^{-1} mH = 48\,mH$



$i_{tot}(0) = i_1(0) + i_2(0) = 3A - 5A = -2A$