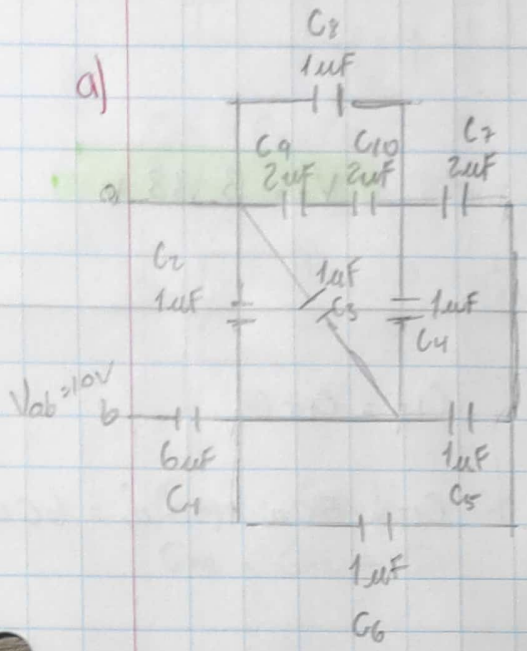
HT5

P.1

a)



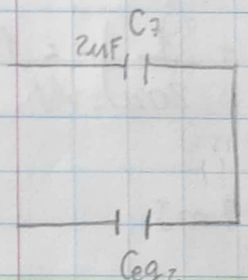
C_{eq1} = C_9 y C_{10} → En Serie

C_{eq2} = C_5 y C_6 → Paralelo.

$$C_{eq1} = \frac{1}{C_9} + \frac{1}{C_{10}} = \frac{1}{2\mu} + \frac{1}{2\mu}$$

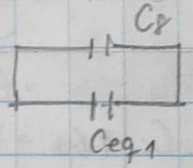
$$C_{eq1} = 1 \times 10^{6}\ F$$

$$C_{eq2} = C_5 + C_6 = 1\mu + 1\mu = 2\mu F$$



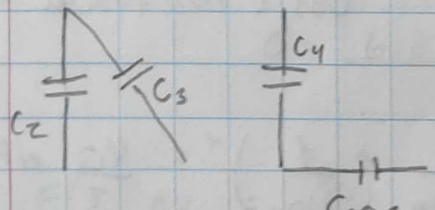
$$C_{eq3} = C_{eq2} + C_7$$

$$C_{eq3} = \left(\frac{1}{2\mu} + \frac{1}{2\mu}\right)^{-1} = 1\mu F$$



$$C_{eq4} = C_{eq1} + C_8$$

$$C_{eq4} = 1\mu + 1\mu = 2\mu F$$

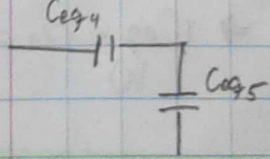


$$C_{eq5} = C_{eq3} + C_4$$

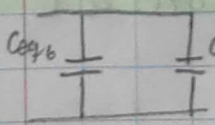
$$C_{eq5} = 1\mu + 1\mu = 2\mu F$$

$$C_{eq6} = C_2 + C_3$$

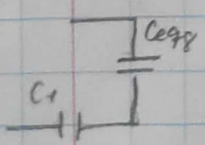
$$C_{eq6} = 1\mu + 1\mu = 2\mu F$$



$$C_{eq7} = \left(\frac{1}{C_{eq4}} + \frac{1}{C_{eq5}}\right)^{-1} = \frac{1}{2\mu} + \frac{1}{2\mu} = 1\mu F$$



$$C_{eq8} = C_{eq6} + C_{eq7} = 2\mu + 1\mu = 3\mu F$$



$$C_{eqT} = \left(\frac{1}{C_{eq8}} + \frac{1}{C_1}\right)^{-1} = \left(\frac{1}{3\mu} + \frac{1}{6\mu}\right)^{-1} = 2\mu F$$

$C_{eqT} = 2\mu F$

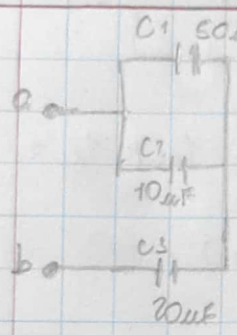
b) $Q_{eqT} = V_{ab}(C_{eqT}) \cdot 20\mu C$

$Q_{eq1} = Q_{eq8} = Q_1 = 20\mu C$

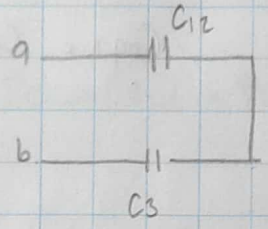
$V_1 = \frac{Q_1}{C_1} = \frac{20\mu}{6\mu} = 3.33\ V$

$V_1 = 3.33\ V$

P. 2

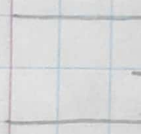


$V_{ab} = 50V$



$C_{12} = C_1 + C_2$

$C_{12} = 50\mu + 10\mu = 60\mu$

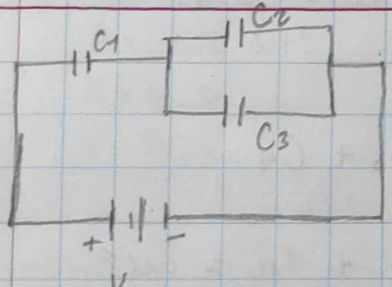


$C_{eq} = \left(\frac{1}{C_{12}} + \frac{1}{C_3}\right)^{-1} = \left(\frac{1}{60\mu} + \frac{1}{20\mu}\right)^{-1} = 15\mu F$

$U_{sist} = \frac{1}{2} C_{eq} \Delta V^2 = \frac{1}{2}(15\mu)(50)^2 = 19\ mJ$

$U_{sist} = 19\ mJ$

P. 3



$C_1 = 20\mu F$
$C_2 = 10\mu F$
$C_3 = 30\mu F$
$V_o = 18V$

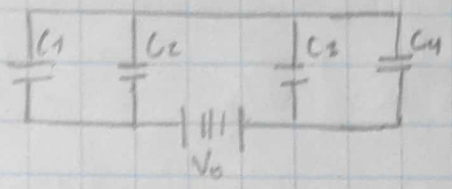
$C_{23} = C_2 + C_3$
$C_{23} = 10\mu + 30\mu = 40\mu$

$C_{eq} = \left(\frac{1}{C_1} + \frac{1}{C_{23}}\right)^{-1} = \left(\frac{1}{20\mu} + \frac{1}{40\mu}\right)^{-1} = \frac{40}{3}\ \mu F$

$Q_{eq} = C_{eq} V_o = \frac{40\mu}{3}(18) = 240\ \mu C \Rightarrow Q_{eq} = Q_1 = Q_{23}$

$Q_{eq} = 240\ \mu C$

P.4



$C_1 = 50\,\mu F$ $\quad C_4 = 12\mu F$

$C_2 = 30\mu F$ $\quad V_o = 30V.$

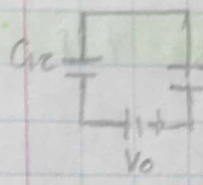
$C_3 = 36\mu F$

$C_{12} = C_1 + C_2$

$C_{12} = 50\mu + 30\mu = 80\mu F.$

$C_{34} = C_3 + C_4$

$C_{34} = 36\mu + 12\mu = 48\mu F$



$$C_{eq} = \left(\frac{1}{C_{12}} + \frac{1}{C_{34}}\right)^{-1} = \left(\frac{1}{80\mu} + \frac{1}{48\mu}\right)^{-1} = 30\,\mu F.$$

$Q_{eq} = C_{eq} V_o = 30\mu(30) = 900\,\mu C.$

$Q_{eq} = Q_{12} = Q_{34}$

$$V_{34} = \frac{Q_{34}}{C_{34}} = \frac{900\mu}{48\mu} = 18.75\,V.$$

$V_{34} = V_3 = V_4$

$$U_3 = \frac{1}{2} C_3 V_3^2 = \frac{1}{2} (36\mu)(18.75)^2 = 6.33\,mJ.$$

$U_3 = 6.33\,mJ.$

P.5

a) $C = 120\,\mu F$

$A = 120\,cm^2$

$K = 6.2$

$V = 90\,V.$

$$C = \frac{K\varepsilon_0 A}{d} \Rightarrow d = \frac{K\varepsilon_0 A}{C}$$

$$d = \frac{6.2(8.85\times10^{-12})(120\times10^{-4})}{120\times10^{-6}} = 5.487\,nm.$$

$$E = \frac{\Delta V}{d} = \frac{90}{5.87\times10^{-9}} = 1.64\times10^{10}\,V/m.$$

$E = 1.64\times10^{10}\,V/m.$

b) $Q = CV$

$Q = 120\mu(90) = 0.0108\,C$

$$Q_{ind} = Q\left(1 - \frac{1}{K}\right) = 0.0108\left(1 - \frac{1}{6.2}\right) = 9.058\times10^{-3}\,C$$

$Q_{ind} = 9.058\times10^{-3}\,C$

a) $Q = 8.9 * 10^{-7}\ C$

$A = 0.01\ m^2$

$E = 1.4 * 10^6\ V/m$

$E = \frac{E_0}{K} = \frac{\sigma}{K\varepsilon_0}$

$K = \frac{\sigma}{\varepsilon_0 E} = \frac{Q}{EA\varepsilon_0} = \frac{8.9 * 10^{-7}}{(1.4 * 10^6)(0.01)(8.85 * 10^{-12})} = 7.18$

$K = 7.18$

b) $Q_{ind} = Q\left(1 - \frac{1}{K}\right)$

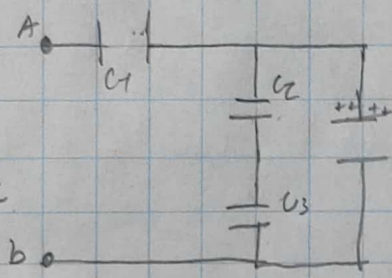
$Q_{ind} = 8.9 * 10^{-7}\left(1 - \frac{1}{7.18}\right) = 7.66 * 10^{-7}\ C.$

$Q_{ind} = 7.66 * 10^{-7}\ C.$

$Q_4 = 50\ \mu C.$

a) $C_1 = 5\ \mu F$

$C_2 = C_3 = C_4 = 10\ \mu F$



$V_4 = \frac{50\mu}{10\mu} = 5V$

$C_{23} = \left(\frac{1}{10\mu} + \frac{1}{10\mu}\right)^{-1} = 5\mu F$

$Q_{234} = V_{234} C_{234}$

$Q_{234} = (5\mu)(15\mu) = 75\mu$

$C_{234} = C_{23} + C_4 = 5\mu + 10\mu = 15\mu$

$Q_1 = Q_{234} = 75\mu C.$

$Q_1 = 75\mu C$

b) $C_{eq} = \left(\frac{1}{C_1} + \frac{1}{C_{234}}\right)^{-1} = \left(\frac{1}{5\mu} + \frac{1}{15\mu}\right)^{-1} = \frac{15}{4}\ \mu F$

$Q_{eq} = 75\mu C \Rightarrow V_{eq} = \frac{Q_{eq}}{C_{eq}} = \frac{75\mu}{15/4\mu} = 20V.$

$Q_{eq} = 20V$

c) $Q_{23} = C_{23} V_{23}$

$Q_{23} = (5 * 10^{-6})(5) = 25 * 10^{-6}\ C.$

$U_3 = \frac{Q_3^2}{2C_3} = \frac{(25\mu)^2}{2(10\mu)} = 3.125 * 10^{-5}\ J$

$U_3 = 31\ \mu J$

d) $Q_{ind} = Q\left(1 - \frac{1}{K}\right)$

$Q_{ind} = 50\mu\left(1 - \frac{1}{5}\right) = 4 * 10^{-5}\ C$

$Q_{ind} = 40\ \mu C.$