

25. ELEKTRIČNI KAPACITET (4.48. - 4.70.)

4.48. Dvije metalne kugle različitih polumjera imaju jednake množine naboja. Što možemo reći o njihovim potencijalima?

$$\begin{aligned} r_1 &> r_2 \\ Q_1 &= Q_2 \\ \frac{\phi_1}{\phi_2} &= ? \end{aligned}$$

$$\begin{aligned} \phi &= k \cdot \frac{Q}{r} \\ \frac{\phi_1}{\phi_2} &= \frac{k \cdot \frac{Q}{r_1}}{k \cdot \frac{Q}{r_2}} = \frac{1}{r_1} \cdot \frac{r_2}{1} = \frac{r_2}{r_1} \\ \phi_1 \cdot r_1 &= \phi_2 \cdot r_2 \quad \rightarrow \quad \phi_2 > \phi_1 \end{aligned}$$

4.49. Dvije jednake metalne kugle imaju različite množine naboja. Što možemo reći o potencijalima tih kugala?

$$\begin{aligned} Q_1 &> Q_2 \\ r_1 &= r_2 \\ \frac{\phi_1}{\phi_2} &= ? \end{aligned}$$

$$\begin{aligned} \phi &= k \cdot \frac{Q}{r} \\ \frac{\phi_1}{\phi_2} &= \frac{k \cdot \frac{Q_1}{r}}{k \cdot \frac{Q_2}{r}} = \frac{Q_1}{Q_2} \\ \phi_1 \cdot Q_2 &= \phi_2 \cdot Q_1 \quad \rightarrow \quad \phi_1 > \phi_2 \end{aligned}$$

4.50. Metalna izolirana kugla polumjera 5 cm ima potencijal 800 V. Koliki je naboj na kugli?

$$\begin{aligned} r &= 5 \text{ [cm]} \\ \phi &= 800 \text{ [V]} \\ Q &= ? \end{aligned}$$

$$\begin{aligned} \phi &= k \cdot \frac{Q}{r} \Rightarrow Q = \frac{\phi \cdot r}{k} \\ Q &= \frac{800 \cdot 0,05}{9 \cdot 10^9} = 4,44 \cdot 10^{-9} \text{ [C]} \end{aligned}$$

4.51. Dvije nabijene kugle nakon dodira imaju naboje $Q_1 = 400 \text{ nC}$ i $Q_2 = 200 \text{ nC}$. Kako se odnose njihovi obujmovi?

$$\begin{aligned}\phi_1 &= \phi_2 = \phi \\ Q_1 &= 400 \text{ [nC]} \\ Q_2 &= 200 \text{ [nC]} \\ \frac{V_1}{V_2} &= ?\end{aligned}$$

$$\begin{aligned}\phi_1 &= k \cdot \frac{Q_1}{r_1} \Rightarrow r_1 = \frac{k \cdot Q_1}{\phi} \\ V_1 &= \frac{4}{3} \cdot r_1^3 \cdot \pi \\ V_1 &= \frac{4}{3} \cdot \frac{k^3 \cdot Q_1^3}{\phi^3} \cdot \pi\end{aligned}$$

$$\begin{aligned}\phi_2 &= k \cdot \frac{Q_2}{r_2} \Rightarrow r_2 = \frac{k \cdot Q_2}{\phi} \\ V_2 &= \frac{4}{3} \cdot r_2^3 \cdot \pi \\ V_2 &= \frac{4}{3} \cdot \frac{k^3 \cdot Q_2^3}{\phi^3} \cdot \pi\end{aligned}$$

$$\frac{V_1}{V_2} = \frac{\frac{4}{3} \cdot \frac{k^3 \cdot Q_1^3}{\phi^3} \cdot \pi}{\frac{4}{3} \cdot \frac{k^3 \cdot Q_2^3}{\phi^3} \cdot \pi} = \frac{Q_1^3}{Q_2^3}$$

$$\begin{aligned}\frac{V_1}{V_2} &= \frac{(400 \cdot 10^{-9})^3}{(200 \cdot 10^{-9})^3} = \frac{6,4 \cdot 10^{-20}}{8 \cdot 10^{-21}} = 8 \\ V_1 &= 8 \cdot V_2\end{aligned}$$

4.52. Dvije kugle polumjera r_1 i r_2 , a istog naboja Q , dovedemo u dodir. Kako se među njima podijele naboji?

$$\begin{aligned}\phi_1 &= \phi_2 = \phi \\ r_1 &\neq r_2 \\ \frac{Q_1}{Q_2} &= ?\end{aligned}$$

$$\begin{aligned}\phi_1 &= k \cdot \frac{Q_1}{r_1} & \phi_2 &= k \cdot \frac{Q_2}{r_2} \\ k \cdot \frac{Q_1}{r_1} &= k \cdot \frac{Q_2}{r_2} \\ \frac{Q_1}{Q_2} &= \frac{r_1}{r_2}\end{aligned}$$

4.53. Metalna kugla polumjera $R = 6 \text{ cm}$ dotiče se jednog pola akumulatora napona $U = 4 \text{ V}$, dok mu je drugi pol uzemljen. Koliki naboj Q prima kugla?

$$\begin{aligned}R &= 6 \text{ [cm]} = 0,06 \text{ [m]} \\ U &= 4 \text{ [V]} \rightarrow \phi = 4 \text{ [V]} \\ Q &= ?\end{aligned}$$

$$\begin{aligned}\phi &= k \cdot \frac{Q}{r} \Rightarrow Q = \frac{\phi \cdot r}{k} \\ Q &= \frac{4 \cdot 0,06}{9 \cdot 10^9} = 2,66 \cdot 10^{-11} \text{ [C]}\end{aligned}$$

4.54. Mjehur od sapunice promjera 0,16 m nabijen je $Q = 33 \text{ nC}$. Za koliko se promijeni potencijal mjehura ako mu se promjer poveća 4 cm?

$$d_1 = 0,16 \text{ [m]} \rightarrow r = 0,08 \text{ [m]}$$

$$Q = 33 \text{ [nC]} = 33 \cdot 10^{-9} \text{ [C]}$$

$$\Delta d = 4 \text{ [cm]} \rightarrow \Delta r = 0,02 \text{ [m]}$$

$$\Delta \phi = ?$$

$$\phi_1 = k \cdot \frac{Q}{r_1} = 9 \cdot 10^9 \cdot \frac{33 \cdot 10^{-9}}{0,08} = 3712,5 \text{ [V]}$$

$$\phi_2 = k \cdot \frac{Q}{r_2} = 9 \cdot 10^9 \cdot \frac{33 \cdot 10^{-9}}{0,08 + 0,02} = 2970 \text{ [V]}$$

$$\Delta \phi = \phi_2 - \phi_1 = 2970 - 3712,5 = -742,5 \text{ [V]}$$

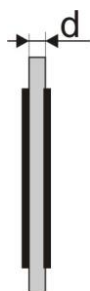
4.55. Ploča od pertinaksa ima debljine 0,2 cm. S obje strane nalijepljeni su aluminijski listići u obliku kvadrata stranice 30 cm. Koliki je kapacitet tog kondenzatora ako je $\epsilon_r = 6$?

$$d = 0,2 \text{ [cm]} = 2 \cdot 10^{-3} \text{ [m]}$$

$$S = a \cdot a = a^2 = (0,3 \text{ m})^2$$

$$\epsilon_r = 6$$

$$C = ?$$



$$C = \epsilon_0 \cdot \epsilon_r \cdot \frac{S}{d}$$

$$C = 8,854 \cdot 10^{-12} \cdot 6 \cdot \frac{0,3^2}{2 \cdot 10^{-3}} = 2,39 \cdot 10^{-9} \text{ [F]}$$

4.56. Na staklenu ploču debljine 1mm nalijepljena su s obje strane dva kvadrata od staniola površine 50 cm^2 . Koju množinu naboja treba prenijeti na taj kondenzator da bi imao napon 1000 V? Relativna je permitivnost stakla 8.

$$\epsilon_r = 8$$

$$d = 1 \text{ [mm]} = 10^{-3} \text{ [m]}$$

$$S = 50 \text{ [cm}^2] = 5 \cdot 10^{-3} \text{ [m}^2]$$

$$U = 1000 \text{ [V]}$$

$$Q = ?$$

$$C = \epsilon_0 \cdot \epsilon_r \cdot \frac{S}{d}$$

$$C = 8,854 \cdot 10^{-12} \cdot 8 \cdot \frac{5 \cdot 10^{-3}}{10^{-3}} = 3,54 \cdot 10^{-10} \text{ [F]}$$

$$C = \frac{Q}{U} \Rightarrow Q = C \cdot U$$

$$Q = 3,54 \cdot 10^{-10} \cdot 1000 = 3,54 \cdot 10^{-7} \text{ [C]}$$

4.57. Jedan je oblog kondenzatora uzemljen, a na drugi dovedemo naboj $1 \text{ }\mu\text{C}$. Napon među pločama iznosi 20 V. Koliki je kapacitet kondenzatora?

$$Q = 1 \text{ [}\mu\text{C]} = 10^{-6} \text{ [C]}$$

$$U = 20 \text{ [V]}$$

$$C = ?$$

$$C = \frac{Q}{U}$$

$$C = \frac{10^{-6}}{20} = 5 \cdot 10^{-8} \text{ [F]}$$

4.58. Kondenzatori kapaciteta $C_1 = 10 \mu\text{F}$, $C_2 = 15 \mu\text{F}$ i $C_3 = 12 \mu\text{F}$ spojeni su usporedno. Koliki je kapacitet kondenzatorske baterije?

$$C_1 = 10 [\mu\text{F}]$$

$$C_2 = 15 [\mu\text{F}]$$

$$C_3 = 12 [\mu\text{F}]$$

$$C = ?$$

$$C = C_1 + C_2 + C_3 = (10 + 15 + 12) \cdot 10^{-6} = 37 \cdot 10^{-6} [\text{F}] = 37 [\mu\text{F}]$$

4.59. Kondenzatori kapaciteta $C_1 = 5 \mu\text{F}$, $C_2 = 15 \mu\text{F}$ i $C_3 = 25 \mu\text{F}$ spojeni su u seriju. Koliki je kapacitet kondenzatorske baterije?

$$C_1 = 5 [\mu\text{F}]$$

$$C_2 = 15 [\mu\text{F}]$$

$$C_3 = 25 [\mu\text{F}]$$

$$C = ?$$

$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

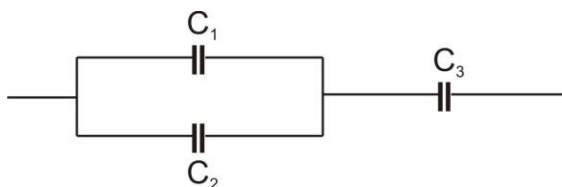
$$\frac{1}{C} = \frac{1}{5 \cdot 10^{-6}} + \frac{1}{15 \cdot 10^{-6}} + \frac{1}{25 \cdot 10^{-6}} = 200000 + 66666 + 40000 = 306666$$

$$C = \frac{1}{306666} = 3,26 \cdot 10^{-6} [\text{F}] = 3,26 [\mu\text{F}]$$

4.60. Dva usporedno spojena kondenzatora C_1 i C_2 serijski su spojeni s kondenzatorom kapaciteta C_3 . Koliki je ukupni kapacitet? Nacrtaj shemu.

$$C_1, C_2, C_3$$

$$C = ?$$



$$\frac{1}{C} = \frac{1}{C_{1,2}} + \frac{1}{C_3} \quad C_{1,2} = C_1 + C_2$$

$$\frac{1}{C} = \frac{1}{C_1 + C_2} + \frac{1}{C_3} = \frac{C_3 + C_1 + C_2}{(C_1 + C_2) \cdot C_3}$$

$$C = \frac{C_3 \cdot (C_1 + C_2)}{C_1 + C_2 + C_3}$$

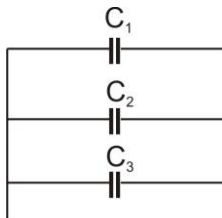
4.61. Koje sve vrijednosti za kapacitet možemo dobiti ako na različite načine spojimo kondenzatore kapaciteta 2 μF , 4 μF i 6 μF . Nacrtaj sheme.

$$C_1 = 2 [\mu\text{F}]$$

$$C_2 = 4 [\mu\text{F}]$$

$$C_3 = 6 [\mu\text{F}]$$

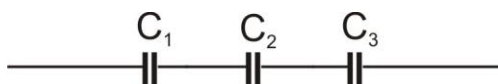
$$C = ?$$



$$C = C_1 + C_2 + C_3$$

$$C = (2 + 4 + 6) \cdot 10^{-6}$$

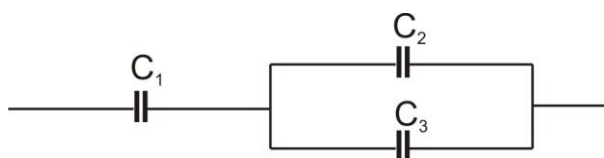
$$C = 12 \cdot 10^{-6} [\text{F}] = 12 [\mu\text{F}]$$



$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3}$$

$$\frac{1}{C} = \frac{1}{2} + \frac{1}{4} + \frac{1}{6} = \frac{11}{12}$$

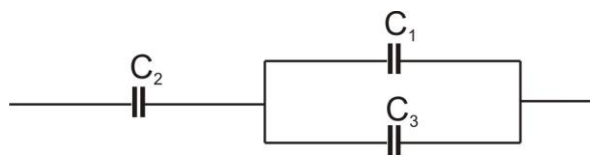
$$C = \frac{12}{11} = 1,09 [\mu\text{F}]$$



$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2 + C_3}$$

$$\frac{1}{C} = \frac{1}{2} + \frac{1}{4+6} = \frac{6}{10}$$

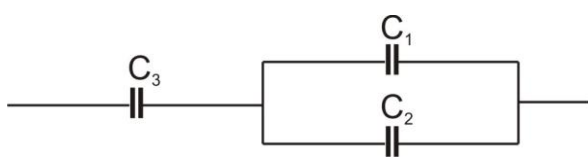
$$C = \frac{5}{3} = 1,66 [\mu\text{F}]$$



$$\frac{1}{C} = \frac{1}{C_2} + \frac{1}{C_1 + C_3}$$

$$\frac{1}{C} = \frac{1}{4} + \frac{1}{2+6} = \frac{3}{8}$$

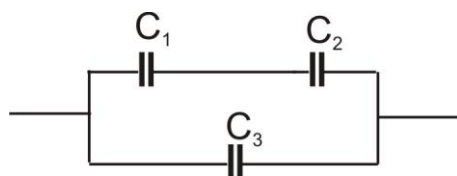
$$C = \frac{8}{3} = 2,66 [\mu\text{F}]$$



$$\frac{1}{C} = \frac{1}{C_3} + \frac{1}{C_1 + C_2}$$

$$\frac{1}{C} = \frac{1}{6} + \frac{1}{2+4} = \frac{2}{6}$$

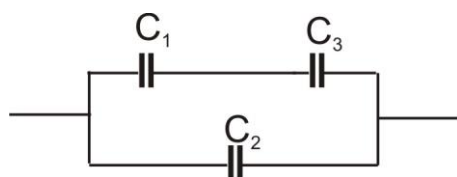
$$C = \frac{6}{2} = 3 [\mu\text{F}]$$



$$C = C_{1,2} + C_3$$

$$C = \frac{C_1 \cdot C_2}{C_1 + C_2} + C_3$$

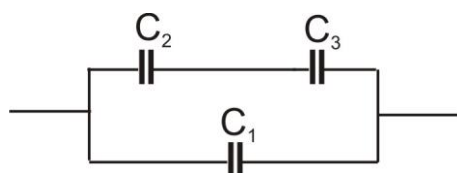
$$C = \frac{2 \cdot 4}{2+4} + 6 = 7,33 [\mu\text{F}]$$



$$C = C_{1,3} + C_2$$

$$C = \frac{C_1 \cdot C_3}{C_1 + C_3} + C_2$$

$$C = \frac{2 \cdot 6}{2+6} + 4 = 5,5 [\mu\text{F}]$$

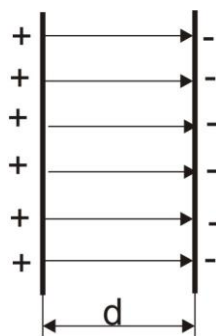


$$C = C_{2,3} + C_1$$

$$C = \frac{C_2 \cdot C_3}{C_2 + C_3} + C_1$$

$$C = \frac{4 \cdot 6}{4+6} + 2 = 4,4 [\mu\text{F}]$$

4.62. Možemo li povećati energiju školskoga pločastog kondenzatora a da ne mijenjamo količinu naboja na njemu?



$$C = \varepsilon \cdot \frac{S}{d}$$

$$W = \frac{1}{2} \cdot C \cdot U^2$$

Možemo, mijenjajući udaljenost između ploča d .
Što je udaljenost veća, kapacitet i energija su manji i obrnuto.

4.63. Pločasti kondenzator nabijemo tako da ga priključimo na polove akumulatora. Zatim ga isključimo s akumulatora i smanjimo udaljenost među pločama kondenzatora dva puta. Kako će se promijeniti: a) naboj na pločama, b) napon na pločama, c) jakost električnog polja među njima i d) energija kondenzatora?

$$d_2 = \frac{1}{2} \cdot d_1$$

a) $Q_2 = ?$

b) $U_2 = ?$

c) $E_2 = ?$

d) $W = ?$

a) $Q_2 = Q_1 = Q$

$$C = \frac{Q}{U} = \varepsilon \frac{S}{d} \Rightarrow U = \frac{Q \cdot d}{\varepsilon \cdot S}$$

$$b) U_2 = \frac{Q \cdot d_2}{\varepsilon \cdot S} = \frac{1}{2} \frac{Q \cdot d_1}{\varepsilon \cdot S}$$

$$U_2 = \frac{1}{2} \cdot U_1$$

$$E = \frac{U}{d}$$

$$c) E_2 = \frac{U_2}{d_2} = \frac{\frac{1}{2} \cdot U_1}{\frac{1}{2} \cdot d_1} = \frac{U_1}{d_1}$$

$$E_2 = E_1$$

$$W = \frac{1}{2} \cdot Q \cdot U$$

$$d) W_2 = \frac{1}{2} \cdot Q \cdot U_2 = \frac{1}{2} \cdot Q \cdot \frac{1}{2} \cdot U_1 = \frac{1}{4} \cdot Q \cdot U_1$$

$$W_2 = \frac{1}{2} \cdot W_1$$

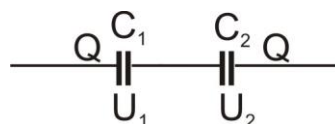
4.64. Dvije ladjenske boce spojene su serijski na napon 15000 V. Odredi kapacitet prve boce ako je kapacitet druge $6,5 \cdot 10^{-10}$ F, a naboj na svakoj boci $4,5 \cdot 10^{-6}$ C.

$$U = 15000 \text{ [V]}$$

$$C_2 = 6,5 \cdot 10^{-10} \text{ [F]}$$

$$Q_1 = Q_2 = 4,5 \cdot 10^{-6} \text{ [C]}$$

$$C_1 = ?$$



$$C_2 = \frac{Q_2}{U_2} \Rightarrow U_2 = \frac{Q_2}{C_2} = \frac{4,5 \cdot 10^{-6}}{6,5 \cdot 10^{-10}} = 6923 \text{ [V]}$$

$$U = U_1 + U_2 \Rightarrow U_1 = U - U_2 = 15000 - 6923 = 8076,92 \text{ [V]}$$

$$C_1 = \frac{Q_1}{U_1} = \frac{4,5 \cdot 10^{-6}}{8076,92} = 5,57 \cdot 10^{-10} \text{ [F]}$$

4.65. Kondenzator je sastavljen od 100 listića staniola površine $10 \text{ cm} \cdot 12 \text{ cm}$, odijeljenih parafiniranim papirom ($\epsilon_r = 4$) debljine $0,2 \text{ mm}$. Svi neparni listići spojeni su zajedno, a isto tako i parni. Koliki je kapacitet tog kondenzatora?

$n = 100$ listića $\rightarrow (n - 1)$ kondenzatora

$$S = 10 \cdot 12 = 120 [\text{cm}^2] = 120 \cdot 10^{-4} [\text{m}^2]$$

$$\epsilon_r = 4$$

$$d = 0,2 [\text{mm}] = 2 \cdot 10^{-4} [\text{m}]$$

$$C = ?$$

kapacitet jednog kondenzatora:

$$C_1 = \epsilon_0 \cdot \epsilon_r \cdot \frac{S}{d} = 8,854 \cdot 10^{-12} \cdot 4 \cdot \frac{120 \cdot 10^{-4}}{2 \cdot 10^{-4}} = 2,12 \cdot 10^{-9} [F]$$

ukupni kapacitet:

$$C = (n - 1) \cdot C_1 = (100 - 1) \cdot 2,12 \cdot 10^{-9} = 2,1 \cdot 10^{-7} [F]$$

4.66. Kondenzator je sastavljen od dviju paralelnih ploča površine 60 cm^2 koje su jedna od druge udaljene 3 mm . Među njima je bakelit, kojega je relativna permitivnost 4. Kondenzator ima napon 500 V . Kolika se energija oslobodi izbijanjem tog kondenzatora?

$$S = 60 [\text{cm}^2] = 60 \cdot 10^{-4} [\text{m}^2]$$

$$d = 3 [\text{mm}] = 3 \cdot 10^{-3} [\text{m}]$$

$$\epsilon_r = 4$$

$$U = 500 [\text{V}]$$

$$W = ?$$

$$C = \epsilon_0 \cdot \epsilon_r \cdot \frac{S}{d} = 8,854 \cdot 10^{-12} \cdot 4 \cdot \frac{60 \cdot 10^{-4}}{3 \cdot 10^{-3}} = 7,083 \cdot 10^{-11} [F]$$

$$W = \frac{1}{2} \cdot C \cdot U^2$$

$$W_2 = \frac{1}{2} \cdot 7,083 \cdot 10^{-11} \cdot 500^2$$

$$W_2 = 8,854 \cdot 10^{-6} [J]$$

4.67. Kondenzatore kapaciteta $1 \mu\text{F}$ i $4 \mu\text{F}$ spojimo u seriju i tako spojene priključimo na izvor napona 450 V . a) Koliki je kapacitet tako spojenih kondenzatora? b) Koliki je napon na priključnicama svakog kondenzatora?

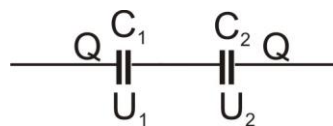
$$C_1 = 1 [\mu\text{F}] = 10^{-6} [\text{F}]$$

$$C_2 = 4 [\mu\text{F}] = 4 \cdot 10^{-6} [\text{F}]$$

$$U = 450 [\text{V}]$$

$$\text{a) } C = ?$$

$$\text{b) } U_1 = ?, U_2 = ?$$



$$\frac{1}{C} = \frac{1}{C_1} + \frac{1}{C_2} \Rightarrow C = \frac{C_1 \cdot C_2}{C_1 + C_2} = \frac{10^{-6} \cdot 4 \cdot 10^{-6}}{10^{-6} + 4 \cdot 10^{-6}} = 0,8 \cdot 10^{-6} [\text{F}]$$

$$Q = Q_1 = Q_2 \quad U = U_1 + U_2$$

$$Q_1 = C_1 \cdot U_1 \quad Q_2 = C_2 \cdot U_2$$

$$C_1 \cdot U_1 = C_2 \cdot U_2$$

$$C_1 \cdot U_1 = C_2 \cdot (U - U_1)$$

$$U_1 \cdot (C_1 + C_2) = C_2 \cdot U$$

$$U_1 = \frac{C_2 \cdot U}{C_1 + C_2} = \frac{4 \cdot 10^{-6} \cdot 450}{(1 + 4) \cdot 10^{-6}} = 360 [\text{V}]$$

$$U_2 = U - U_1 = 450 - 360 = 90 [\text{V}]$$

4.68. Kondenzator kapaciteta 20 pF nabijen je na napon 500 V . Koliko se topline razvije pri izbijanju tog kondenzatora ako pretpostavimo da se 80% energije kondenzatora pretvori u toplinu iskre?

$$C = 20 [\text{pF}] = 20 \cdot 10^{-12} [\text{F}]$$

$$U = 500 [\text{V}]$$

$$\eta = 80\%$$

$$W = ?$$

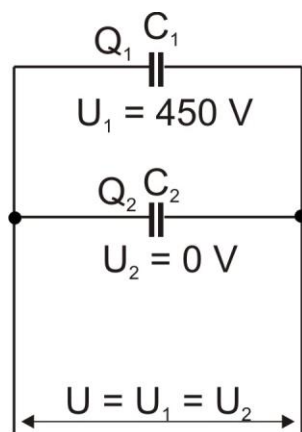
$$W = \eta \cdot \frac{1}{2} \cdot C \cdot U^2$$

$$W = 0,8 \cdot \frac{1}{2} \cdot 20 \cdot 10^{-12} \cdot 500^2$$

$$W = 2 \cdot 10^{-6} [\text{J}]$$

4.69. Kondenzator kapaciteta $4 \mu\text{F}$ nabijemo do napona 450 V i spojimo ga u paralelu s praznim kondenzatorom kapaciteta $5 \mu\text{F}$. Koliki će biti kapacitet baterije i koliki joj je napon?

$$\begin{aligned} C_1 &= 4 [\mu\text{F}] = 4 \cdot 10^{-6} [\text{F}] \\ U_1 &= 450 [\text{V}] \\ C_2 &= 5 [\mu\text{F}] = 5 \cdot 10^{-6} [\text{F}] \\ C &= ?, U_2 = ? \end{aligned}$$



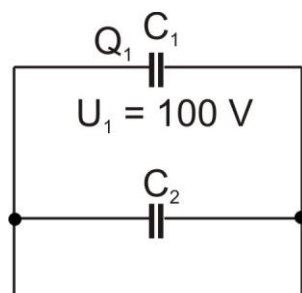
$$\begin{aligned} C &= C_1 + C_2 \\ C &= (4 + 5) \cdot 10^{-6} \\ C &= 9 \cdot 10^{-6} [\text{F}] = 9 [\mu\text{F}] \end{aligned}$$

$$\begin{aligned} C_1 &= \frac{Q_1}{U_1} \Rightarrow Q_1 = C_1 \cdot U_1 \\ Q_1 &= 4 \cdot 10^{-6} \cdot 450 = 1,8 \cdot 10^{-3} [\text{C}] \end{aligned}$$

$$U = \frac{Q}{C} = \frac{1,8 \cdot 10^{-3}}{9 \cdot 10^{-6}} = 200 [\text{V}]$$

4.70. Kondenzator kapaciteta $0,5 \mu\text{F}$ nabijemo do napona 100 V i zatim ga isključimo s izvora napona. Usporedno kondenzatoru priključimo drugi kondenzator kapaciteta $0,4 \mu\text{F}$. Odredi energiju iskre koja preskoči pri spajanju kondenzatora.

$$\begin{aligned} C_1 &= 0,5 [\mu\text{F}] = 0,5 \cdot 10^{-6} [\text{F}] \\ U_1 &= 100 [\text{V}] \\ C_2 &= 0,4 [\mu\text{F}] = 0,4 \cdot 10^{-6} [\text{F}] \\ W &= ? \end{aligned}$$



$$\begin{aligned} W_1 &= \frac{1}{2} \cdot C_1 \cdot U_1^2 \\ W_1 &= \frac{1}{2} \cdot 0,5 \cdot 10^{-6} \cdot 100^2 \\ W_1 &= 2,5 \cdot 10^{-3} [\text{J}] \end{aligned}$$

$$\begin{aligned} C &= C_1 + C_2 \\ C &= (0,4 + 0,5) \cdot 10^{-6} \\ C &= 0,9 \cdot 10^{-6} [\text{F}] = 0,9 [\mu\text{F}] \\ C_1 &= \frac{Q_1}{U_1} \Rightarrow Q_1 = C_1 \cdot U_1 \\ Q_1 &= 0,5 \cdot 10^{-6} \cdot 100 = 5 \cdot 10^{-5} [\text{C}] \\ Q &= Q_1 = Q_2 \\ U &= \frac{Q}{C} = \frac{5,5 \cdot 10^{-5}}{0,9 \cdot 10^{-6}} = 55,55 [\text{V}] \end{aligned}$$

$$\begin{aligned} W &= W_1 - W_2 \\ W &= 2,5 \cdot 10^{-3} - 1,388 \cdot 10^{-3} \\ W &= 1,11 \cdot 10^{-3} [\text{J}] \end{aligned}$$