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Exercises and Complements for the Introduction to Physics II

for Students

of Biology, Pharmacy and Geoscience

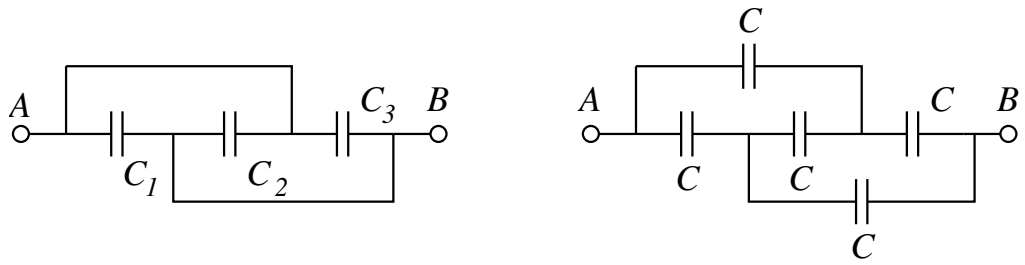
Sheet 3 / 16.03.2022 Discussion: **22.03.2022 / 23.03.2022**

Exercise 9.
(a) Assume an air-filled parallel-plate capacitor with square plates with side length 25 cm and distance $d_1 = 0.5$ mm. Calculate its capacity.

(b) This capacitor is charged till a potential difference of $U_1 = 10$ V is reached. Then the capacitor is disconnected form the source. What is the potential difference U_2 if the distance between the plates is increased to $d_2 = 5$ mm?

(c) Now, the space between the two plates is filled with a dielectric material ($\varepsilon = 2.1$) and an additional capacitor with capacity C_x is connected in series. How large must C_x be for the total charge of the system to remain the same and equal C_1?

Exercise 10.
Calculate the total capacity between points A and B.



Exercise 11.
A 20-pF-capacitor is charged to 3 kV. Subsequently it is disconnected from the battery and connected to a 50-pF-capacitor.
(a) What is the charge on each capacitor after?

(b) What is the energy stored in the 20-pF-capacitor before it is disconnected from the battery?

(c) What is the energy stored in both capacitors after they are connected to each other?

Exercise 12.
In a capacitor with plate area $A = 0.15$ m^2 and plate distance $d = 3$ cm a dielectric material ($\varepsilon = 2.1$) is inserted to occupy half the space in between. For the two cases shown in the image, calculate the capacity of the capacitor.