Exercise 1. Spring vs Capacitor

Consider the equations: $U = \frac{1}{2}kx^2$, and $U = \frac{1}{2}CV^2$. What are the units of k and C? What are the units of x and V? How do you increase x, how do you increase V? Can you change k, can you change C?

Exercise 2. Prius I

In a 2010 Prius, some energy is stored in a 315 [μF] capacitor with a potential difference of 470 [V]. What is the magnitude of the charge on each surface?

Exercise 3. Prius II

How much energy is stored?

Exercise 4. Prius III

How does this compare to the 2017 Prius with a 471 [μF] capacitor with a potential difference of 200 [V]? You will find that this is less. What are possible reasons for the decrease?

Exercise 5. Typical Capacitance I

What is the capacitance of a parallel plate capacitor with charge density 1 [μC/cm^2], area 20 [cm^2], and dielectric constant 1 (air), and separation 2 mm?

Exercise 6. Typical Capacitance II

How does this change when you double the charge density σ by applying a voltage?

Exercise 7. Typical Capacitance III

How does this change when you fill the capacitor with a material of dielectric constant 10?

Exercise 8. Typical Capacitance IV

Why are capacitors typically cylindrical rather than planar or spherical?

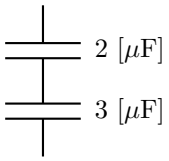
Exercise 9. Changing Permittivity

If you decrease the permittivity of a capacitor by say, removing its dielectric, with constant charge, does the energy stored:

(a) decrease (b) stay the same (c) increase

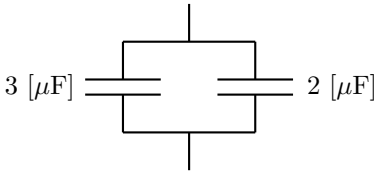
Exercise 10. Circuit I

Calculate the capacitance of the following circuit:



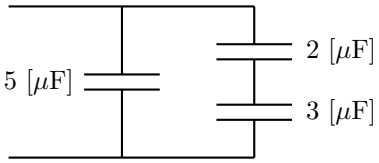
Exercise 11. Circuit I

Calculate the capacitance of the following circuit:



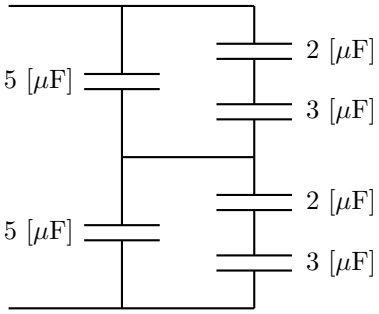
Exercise 12. Circuit II

Calculate the capacitance of the following circuit:



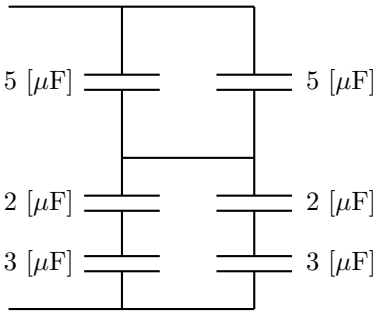
Exercise 13. Circuit III

Calculate the capacitance of the following circuit:



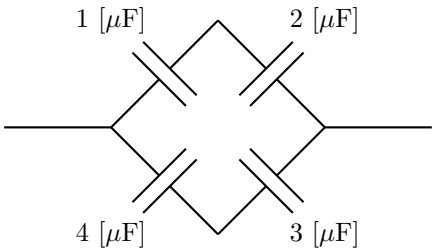
Exercise 14. Circuit IV

Calculate the capacitance of the following circuit:



Exercise 15. Circuit V

Calculate the capacitance of the following circuit:



Exercise 16. Circuit VI

Calculate the capacitance of the following circuit: