

Task 1 (60 points)

Write an **essay** to develop the concepts of a self-energy of an electrostatic field of a charge distribution, and the interaction energy of an electrostatic field of two charge distributions.

Show, by an explicit calculation, the formula

$$W = 2W_0 + W_{\text{int}} = 2 \times \frac{q^2}{8\pi\epsilon_0 a} - \frac{q^2}{4\pi\epsilon_0 R} > 0 = \frac{q^2}{4\pi\epsilon_0} \left(\frac{1}{a} - \frac{1}{R} \right), \quad (1)$$

for the total energy stored in the electrostatic field of a configuration consisting of two uniformly charged spheres, each of radius a , of charges $+q$ and $-q$, a distance R apart. You may use lecture notes. **SHOW WORK!!!!**

Also, calculate the total field energy (sum of self energies and interaction energies) of the electrostatic field of three (!) uniformly charged spheres, each of charge $-q$, at positions \vec{x}_1 , \vec{x}_2 and \vec{x}_3 .

The tasks are due Tuesday, 04-APR-2023. Have fun doing the problems!