Hint 2

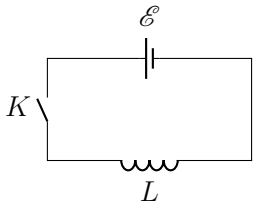
Tasks that are rated at zero points are not checked, so if you decide to make a CHOICE (see the rules of the Cup), you do not need to send a solution to these problems. They are *leading*. Many of them can be found in open sources, which we recommend using.

Problem 1

0 points. You don't need to send a solution to this problem.
The C_0 capacitor is charged to U_0 and disconnected from the battery. The distance between the plates is slowly doubled. What is the work of an external force equal to? How will the solution change if the distance between the plates slowly increases when the EMF source is connected?
Answer: $\frac{C_0U_0^2}{2}$; $\frac{C_0U_0^2}{4}$.

Problem 2

0 points. You don't need to send a solution to this problem.
Find the dependence of the current strength on time in the circuit shown in the figure. What is the energy of the magnetic field at time t? Find the work of the EMF source completed at this time? Make conclusions.



Answer: $I = \frac{\mathscr{E}t}{L}$; $A = W = \frac{\mathscr{E}^2t^2}{2L}$.

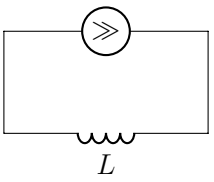
Problem 3

0 points. You don't need to send a solution to this problem.
Find the tension force in a superconducting ring with radius R from a cylindrical wire with radius r ($r \ll R$), through which the current I flows. Inductance of the ring $L = \mu_0.R\,[\ln(8R/r) - 2]$.
Comment. The flow through the ring in the superconducting state is always constant.
Answer: $T = \frac{\mu_0 I^2}{4\pi}(\ln(8R/r) - 1)$.

Problem 4

0 points. You don't need to send a solution to this problem.
A long single-layer solenoid with n turns per unit length is connected to a constant current

source. Determine the pressure acting on the side surface of the solenoid if the current in the circuit is equal to I.



Answer: $p = \mu_0 n^2 I^2/2$

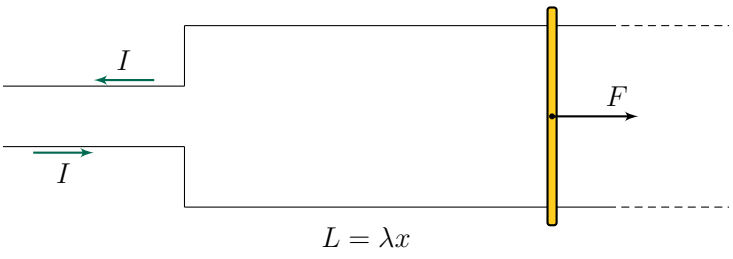
IMPORTANT! The next task is both a hint and an alternative to the main task. Three important points:

1. You can continue to send the solution to the main problem.
2. At any time before the final deadline, you can switch to *alternative task*. If you do this, write at the very beginning of the solutionI'm moving on to an alternative task!. In this case, you get an additional coefficient of 0.7, which is multiplied by the old coefficient, and the solutions to the main problem are not checked from this point on. Be careful!
3. The task consists of several items. The penalty coefficient earned **before** is applied to all points. In the future, each item is evaluated as a separate task. If you send a solution without any of three parts, such a solution is considered Incorrect. For more information about scoring points for composite tasks, see the rules of the Cup.

Alternative problem

A system consists of two long wires forming an inductance with a linear density λ (inductance of a unit of length) is connected to a constant current source I. At the initial moment, the jumper (yelLow stick on the picture) is stationary.

1. *(4 points)* Find the work of the current source when moving the jumper slowly over a distance of x.
2. *(6 points)* In the conditions of the first point, find the work of external forces that prevent the movement of the jumper under the influence of the magnetic field of the wires.



Send your solutions until — 01.05.2020 22:00 (Moscow time)