Problem 4. RLC-circuit *(5 points)*

i. (1 pt) In the stationary regime, the capacitors can be effectively disconnected (they conduct no direct current) and the inductors can be substituted by wires. If the voltmeter is ideal, there is therefore no current through R_1 and the voltmeter shows the voltage on R_2 equalling $\mathcal{E}$.

ii. (2 pts) Capacitors cannot immediately change their voltage and inductors cannot instantaneously change their current. L_1 and L_2 had both been carrying all the current that had been flowing through the circuit, hence, after opening the switch, they still carry a current of $\mathcal{E}/R_2$ and act as such current sources. As the current from L_2 flows also through R_2, the voltage on R_2 is $\mathcal{E}$ (with the "+"-side at the centre of the circuit). The current through L_1 flows also through R_1 (it is the current charging C_1); therefore the voltage on R_1 is $\mathcal{E}R_1/R_2$ (with the "+"-side at the centre). The reading of the voltmeter has changed its sign and is $\mathcal{E}(1 - R_1/R_2)$ or, plugging in the data, $-2\mathcal{E}$.

iii. (2 pts) Immediately after opening the switch, capacitor C_1 was uncharged (it had been parallel to R_1 that was carrying no current) and C_2 had a voltage of $\mathcal{E}$ (it had been directly parallel to the battery). L_1 and L_2 were both carrying a current of $\mathcal{E}/R_2$. The voltmeter can be effectively disconnected (its resistance is huge), giving us two separate circuits, $R_1L_1C_1$ and $R_2L_2C_2$. Therefore (by the potential energy formulae $CU^2/2$ and $LI^2/2$) the energy stored in the left-hand circuit was $L_1\mathcal{E}^2/(2R_2^2)$ or, with the given data, $L\mathcal{E}^2/(2R^2)$. This is the energy dissipated from R_1. The corresponding expressions for the right-hand circuit (giving the energy dissipated from R_2) are $C_2\mathcal{E}^2/2 + L_2\mathcal{E}^2/(2R_2^2)$ and $C\mathcal{E}^2/2 + L\mathcal{E}^2/(2R^2)$.