

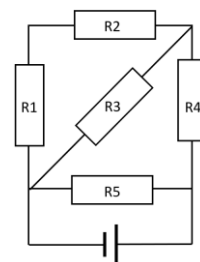
2. kolokvij iz fizike - 12. 1. 2022

19:15-20:45, oddaja do 21:05. Podaljšan čas pisanja do 21:30, oddaja 21:50

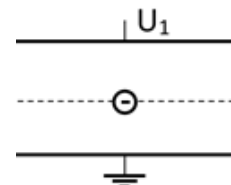
English version below.

1.) Vezje priključimo na Li-ionsko baterijo z napetostjo 3.8 V (glej skico). Izračunaj nadomestno upornost celotnega vezja. Izračunaj tokova, ki tečeta skozi upor R_5 in upor R_4 . Izračunaj moč, ki se troši na uporu R_4 .

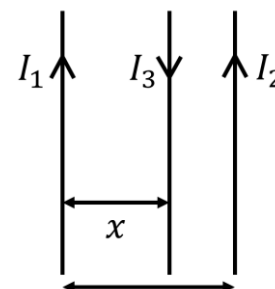
($R_1 = R_2 = R_3 = R_4 = R_5 = 1\ \Omega$)



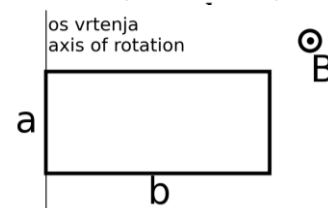
2.) Nabito kroglico z maso $3.0\ \mu\text{g}$ in nabojem $e = -1800\ e_0$ postavimo na sredino ploščatega kondenzatorja. Kondenzator priključimo na napetost U_1 , tako da kroglica lebdi pri miru. Izračunaj U_1 . Nato napetost na kondenzatorju v trenutku povečamo na $U_2 = 102\text{ kV}$, tako da se začne kroglica pospešeno gibati navpično navzgor. Izračunaj pospešek in hitrost kroglice v trenutku ko trči v zgornjo ploščo kondenzatorja. Razmik med ploščama je 0.5 mm .



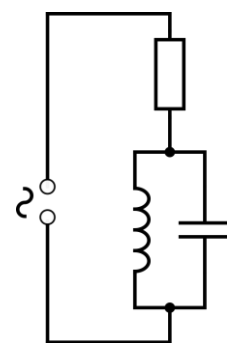
3.) Na mizi ležita dva vzporedna vodnika. Po prvem teče tok $I_1 = 1\text{ A}$, po drugem pa tok $I_2 = 2\text{ A}$ v isto smer. Razmik med vodnikoma je $d = 1\text{ cm}$. Na katero razdaljo x od prvega vodnika moramo postaviti tretji vodnik, po katerem teče tok $I_3 = 3\text{ A}$ v nasprotno smer, da je sila nanj enaka 0? Nato tretji vodnik postavimo simetrično med prva dva vodnika ($x = 0.5\text{ cm}$) in vključimo zunanje magnetno polje, ki kaže pravokotno na mizo. Določi smer in velikost B , da je sila na tretji vodnik enaka nič.



4.) Žica v obliki pravokotne zanke s stranicama $a = 50\text{ cm}$ in $b = 100\text{ cm}$ ima specifično upornost $\zeta = 0.035\ \Omega\text{ mm}^2/\text{m}$ in presek 1 mm^2 . Na začetku je zanka postavljena v ravnini, ki je pravokotna na zunanje magnetno polje $B = 0.5\text{ T}$. Zanko vrtimo s konstantno kotno hitrostjo $\omega = 2/\text{s}$ okoli krajše stranice (a). Kolikšen je magnetni pretok skozi zanko, ko se zanka zavrti za kot 30 stopinj od začetne lege? Izračunaj, kolikšen tok takrat teče po zanki.

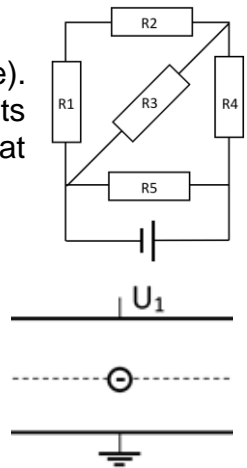


5.) Električni nihajni krog priključimo preko upora (glej skico) na izmenično napetost z amplitudo $U_0 = 1\text{ V}$. Krožna frekvenca nihajnega kroga je $\omega_0 = 1/\sqrt{LC} = 1\text{ kHz}$, $\tau = RC = 1\text{ ms}$, $R = 1\ \Omega$. Kolikšna je absolutna vrednost impedance vezja z_0 pri frekvenci gonilne napetosti $\omega = 2\text{ kHz}$? Kolikšna je tedaj amplituda napetosti na kondenzatorju U_C ? Pri kateri frekvenci ω je napetost U_C največja in pri kateri frekvenci je najmanjša?

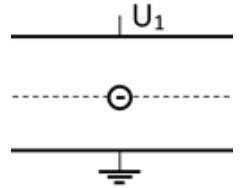


2. midterm exam in physics - 12. 1. 2022

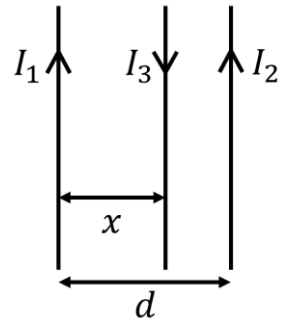
1.) A circuit is connected to a Li-ion battery with a voltage of 3.8 V (see image). Calculate the equivalent resistance of the entire circuit. Calculate the currents flowing through resistor $R5$ and resistor $R4$. Calculate the power consumed at resistor $R4$. ($R1 = R2 = R3 = R4 = R5 = 1\ \Omega$)



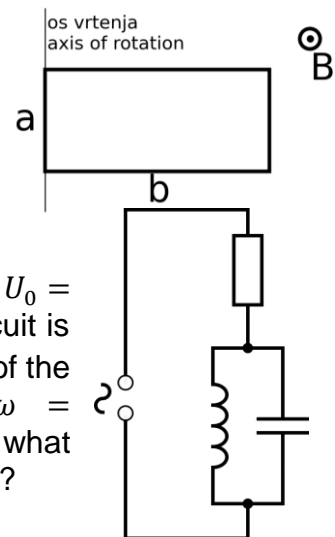
2.) A ball with mass of $3.0\ \mu\text{g}$ and charge of $e = -1800\ e_0$ is placed in the middle of a flat capacitor. A voltage U_1 is applied to the capacitor so that the ball levitates. Calculate U_1 . Then the voltage is increased to $U_2 = 102\text{ kV}$ so that the ball accelerates upwards. Calculate the acceleration and the velocity of the ball as it collides with the top plate of the capacitor. The distance between the plates is 0.5 mm .



3.) There are two parallel wires on the table. The first conductor carries a current $I_1 = 1\text{ A}$ and the second conductor carries a current $I_2 = 2\text{ A}$ in the same direction. The distance between the conductors is $d = 1\text{ cm}$. At what distance x from the first conductor must we place the third conductor, carrying current $I_3 = 3\text{ A}$ in the opposite direction, so that the force on it is 0? Then we place the third conductor symmetrically between the first two conductors ($x = 0.5\text{ cm}$) and apply an external magnetic field pointing perpendicular to the table. Determine the direction and magnitude of B so that the force on the third conductor is zero.



4.) A wire in the form of a rectangular loop with sides $a = 50\text{ cm}$ and $b = 100\text{ cm}$ has a specific resistance $\zeta = 0.035\ \Omega\text{mm}^2/\text{m}$ and a cross-section of 1 mm^2 . The loop is initially placed in a plane perpendicular to the external magnetic field $B = 0.5\text{ T}$. The loop is rotated at a constant angular velocity $\omega = 2/\text{s}$ around the short side (a). What is the magnetic flux through the loop when the loop is rotated 30 degrees from its initial position? Calculate the current flowing through the loop in that position.



5.) We connect an electric oscillating circuit to an AC voltage of an amplitude $U_0 = 1\text{ V}$ using a resistor (see figure). The circular frequency of the oscillating circuit is $\omega_0 = 1/\sqrt{LC} = 1\text{ kHz}$, $\tau = RC = 1\text{ ms}$, $R = 1\ \Omega$. Calculate the absolute value of the impedance z_0 of the circuit if the frequency of the AC driving voltage is $\omega = 2\text{ kHz}$. Calculate the amplitude of the voltage on the capacitor U_C ? At what frequency is the amplitude the highest and at what frequency is it the lowest?