

3. izpit iz fizike - 24. 8. 2022

10:15-11:45, oddaja do 12:05. Podaljšan čas pisanja do 12:30, oddaja 12:50

English version below.

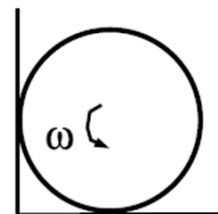
1.) SpaceX-ov satelit "Starlink" z maso 300 kg kroži okoli zemlje na razdalji 550 km od površja.

- Izračunaj gravitacijsko silo, s katero zemlja privlači satelit.
- Izračunaj radialni pospešek satelita
- Izračunaj obodno hitrost satelita.
- Izračunaj potreben čas, da satelit opravi en obhod okoli zemlje.

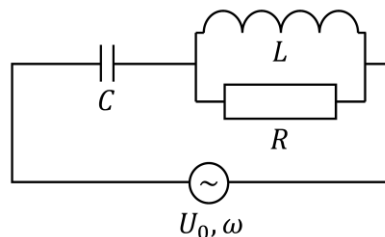
Masa zemlje: 6×10^{24} kg, polmer zemlje: 6400 km.

2.) Med dvema ravnima vzporednima vodnikoma je razdalja 40 cm. Po levem vodniku teče tok 0.1 A, po desnem pa 0.2 A v nasprotni smeri. Izračunaj gostoto magnetnega polja na sredini med vodnikoma ($r=20$ cm). Na isto razdaljo od vodnikov nato postavimo majhno tuljavico (polmer 5 cm, številom obojev 60, tok 0.1 A) tako, da je njen magnetni moment poravnan z magnetnim poljem. Izračunaj spremembo magnetne energije, če tuljavico zasukamo za 90° tako, da magnetni moment kaže v isto smer toka levega vodnika.

3.) Valj s polmerom $r = 10$ cm se vrti okrog simetrijske osi s krožno frekvenco $\omega = 60$ Hz. Postavimo ga v kot. Koeficient trenja med stenami kota in valjem je $k_t = 0,1$. Kolikokrat se valj za tem, ko ga postavimo v kot, še zavrti?

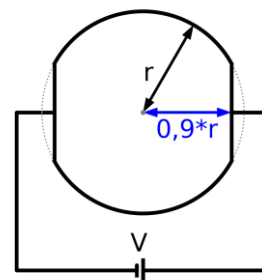


4.) Kondenzator ($C = 1 \mu\text{F}$), tuljavo ($L = 0,3$ H) in upornik ($R = 1000 \Omega$) vežemo, kot je prikazano na sliki. Vezje priključimo na vir izmenične napetosti, z amplitudo 0,58 V in krožno frekvenco 1732 Hz. Kakšna je amplituda in fazni zamik toka, glede na gonilno napetost? Kolikšna povprečna moč se troši na uporniku?



5.) Iz bakra s specifično upornostjo $\xi = 1,68 \times 10^{-2} \Omega\text{mm}^2/\text{m}$ naredimo žico v obliki presekanе polne krogle s polmerom $r = 1$ cm (glej skico).

- Zapiši funkcijsko odvisnost preseka od lege vzdolž krogle $S(x)$.
- Kolikšen je celoten upor krogle?
- Kolikšen tok teče čez kroglo, če nanjo priključimo napetost 5V? Ostale žice v narisanim vezju imajo zanemarljiv upor.



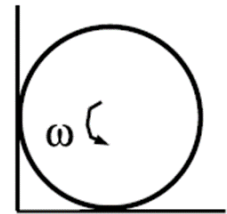
2. exam in physics - 24. 8. 2022

1.) SpaceX's satellite "Starlink" with a mass of 300 kg is orbiting around the earth at a height above the surface of 550 km.

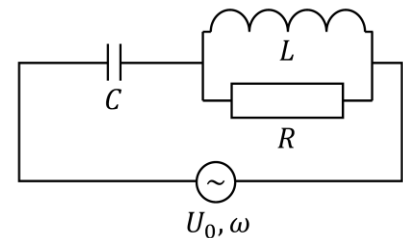
- a) Calculate the gravitational force between the Earth and the satellite.
- b) Calculate radial acceleration of the satellite.
- c) Calculate satellite's tangential velocity.
- d) Calculate time in which satellite makes one revolution.

2.) Two straight parallel conductors are placed at a distance of 40 cm. A current of 0.1 A flows through the left conductor, and 0.2 A flows through the right conductor in the opposite direction. Calculate the density of the magnetic field in the middle between the two conductors ($r=20\text{cm}$). At the same distance from the conductors, we then place a small coil (radius 5 cm, number of turns 60, current 0.1 A) so that its magnetic moment is aligned with the magnetic field. Calculate the change in magnetic energy if the coil is rotated 90° so that the magnetic moment points in the same direction as the current in the left conductor.

3.) A cylinder with radius $r = 10\text{ cm}$ is rotating around its symmetry axis with angular frequency $\omega = 60\text{ Hz}$. The cylinder is in a corner, touching the floor and the wall. The coefficient of friction between wall and cylinder as well as between floor and cylinder is $k_t = 0,1$. How many revolutions does it make, before coming to a stop?



4.) A capacitor ($C = 1\text{ F}$), a coil ($L = 0.3\text{ H}$) and a resistor ($R = 1000\ \Omega$) are connected as shown in the figure. The circuit is connected to an alternating voltage source with an amplitude of 0.58 V and a circular frequency of 1732 Hz . What is the amplitude and phase shift of the current relative to the driving voltage? What is the average dissipated power in the resistor?



5.) We make a wire from copper with specific resistivity of $\xi = 1.68 \times 10^{-2}\ \Omega\text{mm}^2/\text{m}$ in the shape of a cut filled ball (see sketch).

- a) Write the cross sectional area in relation to the position along the sphere $S(x)$.
- b) What is the total resistance of the sphere?
- c) What is the electrical current flowing through the sphere, if we apply a voltage of 5 V ? The other wires on the sketch have negligible resistance.

