# 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=20cm). 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 cm is rotating around its symmetry axis with angular frequency ω = 60 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?
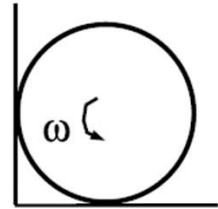
4.) A capacitor (C = 1 F), a coil (L = 0.3 H) and a resistor (R = 1000 Ω) are connected as shown in the figure. The circuit is connected to an alternating voltage source with an amplitude of 0.58 V and a circular frequency of 1732 Hz. What is the amplitude and phase shift of the current relative to the driving voltage? What is the average dissipated power in the resistor?
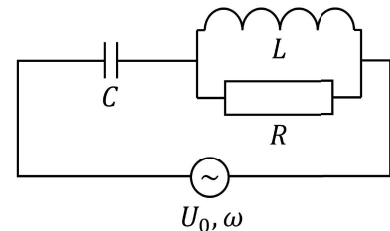
5.) We make a wire from copper with specific resistivity of ξ = 1.68×10^{-2} $\Omega mm^2/m$ in the shape of a cut filled ball (see sketch).
   a) Write the cross sectional area in relation to the position along the sphere S(x).
   b) What is the total resistance of the sphere?
   c) What is the electrical current flowing through the sphere, if we apply a voltage of 5 V? The other wires on the sketch have negligible resistance.