METÓDY RIEŠENIA FYZIKÁLNYCH ÚLOH zima23 – Príklady 5

Cvičenie 23.11.2023

Príklad 1

4. Two masses, two pulleys and a rope

A block of mass m_1 is attached to a massless ideal rope. The rope goes around a massless pulley and then goes around a second massless pulley that is attached to a block of mass m_2 which is free to slide on a frictionless table. The other end of the rope is anchored to a wall. What is the acceleration of m_1 when the system is released?
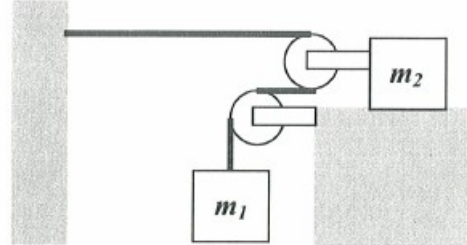
Two small spherical objects, each of radius r and uniform density ρ are a distance a from a large mass M. Note that $r/a \ll 1$. Find the critical density ρ_c above which the two small objects will not be pulled apart by M.
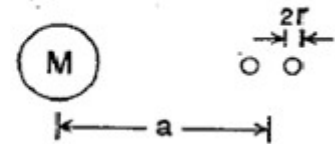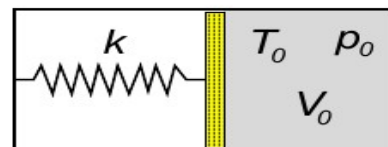
Príklad 2

3. Current carrying wire

An electron of mass m moves at velocity v parallel to a wire carrying current I. The electron is a distance r away from the wire. This is the frame F.
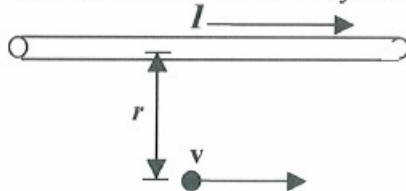
a. Find the force on the electron due to the current in the wire.
b. Find a frame F' in which there is no magnetic force on the electron. Find all forces on the electron in F'.

Príklad 3

Find the heat capacity of the system consisting of a container that has two compartments separated by a piston. To the right of the piston is a gas of monoatomic molecules (gas parameters p_0, T_0, V_0), and to the left is vacuum. The piston is held by a spring. If the gas is removed, the piston touches the right wall and the spring is relaxed.

Heat capacities of the materials composing spring, piston and container walls can be neglected.

Príklad 4

Two masses m separated by a distance l are given initial velocities v_0 as shown in the diagram. The masses interact only through universal gravitation.
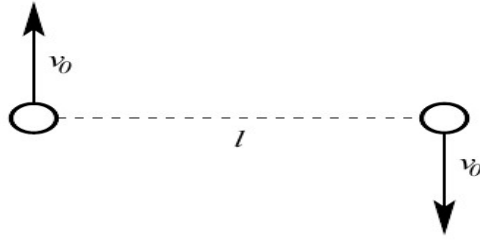
    a. Under what conditions will the masses eventually collide?

    b. Under what conditions will the masses follow circular orbits of diameter l?

    c. Under what conditions will the masses follow closed orbits?

    d. What is the minimum distance achieved between the masses along their path?