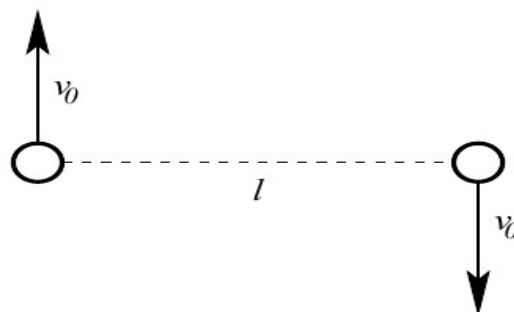


Cvičenie 13.12.2022

Príklad 1

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.



- Under what conditions will the masses eventually collide?
- Under what conditions will the masses follow circular orbits of diameter l ?
- Under what conditions will the masses follow closed orbits?
- What is the minimum distance achieved between the masses along their path?

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 2

A spherical black body of radius r at absolute temperature T is surrounded by a thin spherical and concentric shell of radius R , black on both sides. Show that the factor by which this radiation shield reduces the rate of cooling of the body (consider space between spheres evacuated, with no thermal conduction losses) is given by the following expression: $aR^2/(R^2 + br^2)$, and find the numerical coefficients a and b .

Príklad 3

Consider a simplified model of lunar tides in which the ocean is assumed to be of a constant depth, there is no land, the Earth does not rotate, and the water achieves the equilibrium in the gravitational field instantaneously. Calculate the difference in the heights of the high and the low tides using the following input parameters: the mass of the Moon is $\mu = 0.012$ of Earth's mass, the radius of the Earth is $R_0 = 6400$ km, the distance between the Earth and the Moon is $R = 380,000$ km.