

1. A tree trunk lies horizontally on the ground. Its diameter is 20 cm. What is the minimal velocity with which a grasshopper should spring away from the ground in order to leap over the tree trunk? (Air resistance should be neglected!)

2. A closed, cylindrical vessel of height 3 dm contains air at temperature 300 K and pressure 10^5 Pa. By cooling, and heating from outside, respectively, we lower the temperature of the base to 270 K and raise the temperature of the top to 300 K and then we keep them at these temperatures. (The thermal conductivity of the sidewall of the vessel is zero.)

- a) Does the pressure of the gas change in comparison to the original state?
- b) Estimate the shift of the center of mass of the enclosed gas!

3. A plastic ball of diameter 1 cm is hanging from an insulating thread. The ball carries an electric charge of 10^{-8} C, distributed uniformly on its surface. We bring the ball above a broad, big vessel with salty water in it such that the lowest part of the ball be at a height of 1 cm above water level. The surface of the water beneath the ball will rise a little. How big is that rise? (The role of the surface tension can be neglected, the density of the salty water may be taken 1000 kg/m^3 .)