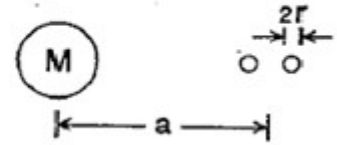


## METÓDY RIEŠENIA FYZIKÁLNYCH ÚLOH 3 leto20 – Príklady 4

Cvičenie 28.4.2020

### Príklad 1

Two small spherical objects, each of radius  $r$  and uniform density  $\rho$  are a distance  $a$  from a large mass  $M$ . Note that  $r/a \ll 1$ . Find the critical density  $\rho_c$  above which the two small objects will not be pulled apart by  $M$ .



### Príklad 2

7. Two equal containers, each of volume  $V$ , contain ideal gases at temperature  $T$ , pressure  $p$ . In container 1, the gas consists of  $N_1$  molecules of gas  $\alpha$  and  $M_1$  of gas  $\beta$  in container 2,  $N_2$  and  $M_2$  respectively - note that  $N_1 + M_1 = N_2 + M_2$ . Derive an expression for the entropy of mixing, i.e. the entropy gain obtained by allowing the containers to freely mix. Evaluate the two limiting cases (1)  $N_1 = N_2$  and (2)  $N_1 = M_2$ .

### Príklad 3

**PROBLEM:** A long, straight cylindrical wire, of radius  $a$  carries a uniformly distributed current  $I$ . It emits an electron from  $r = a$ , with initial, relativistic velocity  $v_0$  parallel to its axis. Find the maximum distance  $r_{max}$  from the axis of the wire which the electrons can reach, treating everything relativistically.

### Príklad 4

**PROBLEM:** A mathematical function has the integral representation

$$F_\nu(x) = \frac{1}{2} \left(\frac{x}{2}\right)^\nu \int_0^\infty \exp\left(-t - \frac{x^2}{4t}\right) t^{-\nu-1} dt,$$

where  $\nu$  and  $x$  may be regarded as real, positive numbers.

With  $\nu$  fixed, determine the *asymptotic* behavior of this function for  $x \gg 1$ .