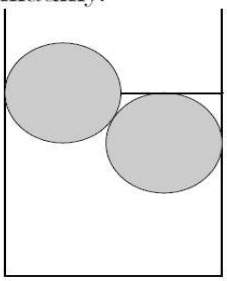
**METÓDY RIEŠENIA FYZIKÁLNYCH ÚLOH zima21 – Príklady 1**

Cvičenie 21.9.2021

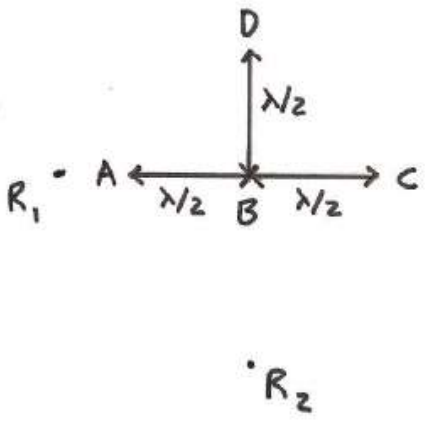
Príklad 1

15. Akou silou pôsobia na steny úzkej nádoby dve brvná (obr.)? Hmotnosť každého dreva je 100 kg. Jedno brvno je do polovice ponorené vo vode, vrchná časť druhého sa dotýka vodnej hladiny.



Príklad 2

2. Four identical coherent monochromatic wave sources $A$, $B$, $C$, $D$ as shown below produce waves of the same wavelength $\lambda$. Two receivers $R_1$ and $R_2$ are at great (but equal) distances from $B$.
   (a) What is the approximate relative signal size picked up by the two receivers?
   (b) What is the approximate relative signal size picked up by the two receivers if source $B$ is turned off?
   (c) What is the approximate relative signal size picked up by the two receivers if source $D$ is turned off?
   (d) Which receiver can tell which source, $B$ or $D$, has been turned off? Explain.

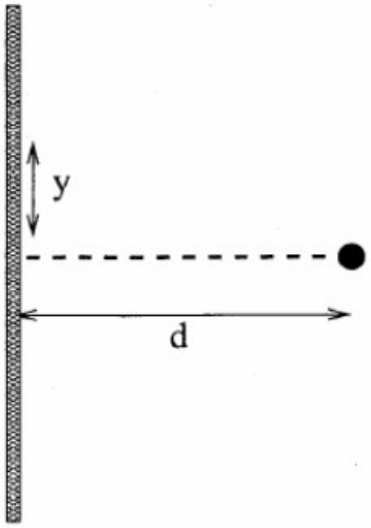


Príklad 3

A very long wire of radius $a$ is suspended a distance $d$ above an infinite conducting plane. In the case that $d >> a$, find approximate expressions for

a. The capacitance per unit length of the wire, conducting plane system.

b. The surface charge density on the conducting plane as a function of $y$, the distance along the plane lateral to the wire.




Príklad 4

A Newtonian test particle orbits in a central potential $V(r)$, i.e. the acceleration of the particle is $-\vec{\nabla}V$.

a) Determine the period of a circular orbit of radius $r$, in terms of $V(r)$ and its derivatives.

b) Suppose that the orbit is slightly noncircular, with $r(t) = r_0 + \epsilon(t)$ where $r_0$ is constant. Find the **general solution** for $\epsilon(t)$ in the limit $\epsilon^2 \ll r_0^2$; your answer should depend on the energy per unit mass $E$ and on $V(r_0)$ and its derivatives. Determine the period of radial oscillation in terms of $V(r_0)$ and its derivatives.

c) Show that there are no stable circular orbits for the Yukawa potential

$$V(r) = -\frac{GM}{r}e^{-kr} \ , \tag{1}$$

if $r > (2k)^{-1}(1 + \sqrt{5})$.

d) Show that it is possible to have bound orbits with positive energy for the Yukawa potential (with $V = 0$ at infinity).