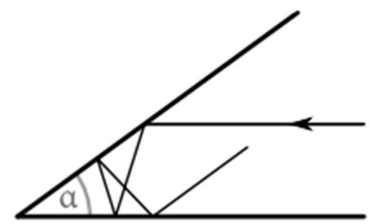
METÓDY RIEŠENIA FYZIKÁLNYCH ÚLOH 1 leto25 – Príklady 6

Cvičenie 7. 5. 2026

Príklad 1

17 Enka vzala dve zrkadielka a postavila ich tak, aby zvierali uhol α. Potom medzi ne zasvietila laserom tak, že lúč bol rovnobežný s jedným zo zrkadiel. Všimla si, že naspäť sa lúč spomedzi zrkadiel vracia presne pozdĺž druhého zrkadla.

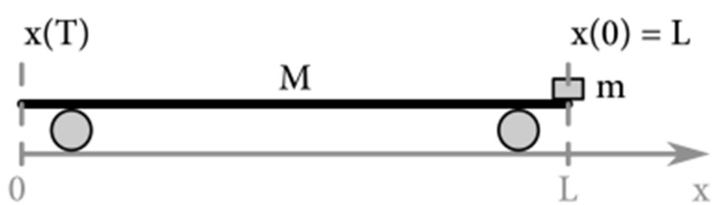
Aké všetky uhly mohli zrkadlá zvierať?



Príklad 2

Ak viete, že v nasledujúcich úlohách je práve jeden z ponúkaných výsledkov správny, nájdite ho bez toho, aby ste úlohu počítali.

Na skateboarde hmotnosti M a dĺžky L sa na prednom konci nachádza kameň hmotnosti m. Medzi kameňom a skateboardom však pôsobí trenie s koeficientom μ. Keď postrčíme skateboard nohou, udelíme mu rýchlosť v v pozdĺžnom smere. Aká je najväčšia možná rýchlosť postrčenia, aby sa kameň nezošmykol zo zadnej strany skateboardu?



Two columns:

1. $v = \sqrt{2\mu g L(\frac{m+M}{M})}$
2. $v = \sqrt{\mu g L(\frac{M}{M+m})}$
3. $v = \sqrt{gL}(\frac{2m+M}{M\mu})$
4. $v = \sqrt{\frac{2gL}{\mu}(\frac{m+M}{M})}$
5. $v = (\frac{m+M}{M})\sqrt{gL(1+\frac{m\mu}{M})}$
6. $v = \sqrt{\frac{\mu g}{L}(\frac{m+M}{3M})}$

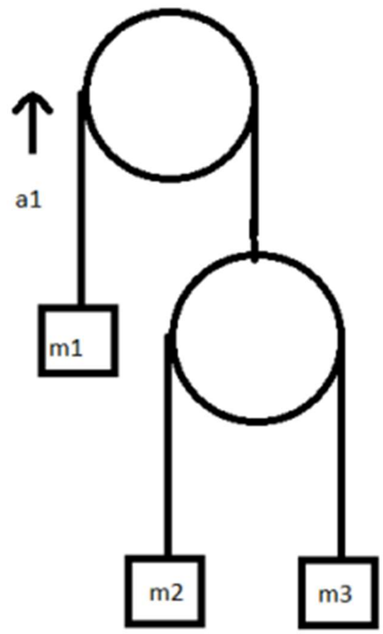
Dve gule s hmotnosťami m a M sa zrazia čelne rýchlosťami veľkosti v a V. Aké budú rýchlosti gúľ po zrážke?

a) $V' = \frac{2m}{m-M} v - \frac{m+M}{m-M} V$, $v' = \frac{2M}{M-m} V - \frac{M+m}{M-m} v$

b) $V' = \frac{2m}{m+M} v + \frac{m-M}{m+M} V$, $v' = \frac{2M}{M-m} V + \frac{M+m}{M-m} v$

c) $V' = \frac{2m}{m+M} v - \frac{m-M}{m+M} V$, $v' = \frac{2M}{M+m} V - \frac{M-m}{M+m} v$

d) $V' = \frac{m-M}{m+M} v - \frac{2m}{m+M} V$, $v' = \frac{M-m}{M+m} V - \frac{2M}{M+m} v$



a) $a_1 = \frac{4m_2m_3 - m_1(m_2+1)}{4m_2m_3 + m_1(m_2+1)}g$

b) $a_1 = \frac{m_1(m_2+m_3)}{4m_2m_3 + m_1(m_2+m_3)}g$

c) $a_1 = \frac{4m_2m_3 - m_1(m_2+m_3)}{4m_2m_3 + m_1(m_2+m_3)}g$

d) $a_1 = \frac{4m_2m_3 + m_1(m_2+m_3)}{4m_2m_3 - m_1(m_2+m_3)}g$

e) $a_1 = \frac{4m_2m_3}{4m_2m_3 + m_1(m_2+m_3)}g$

Príklad 3

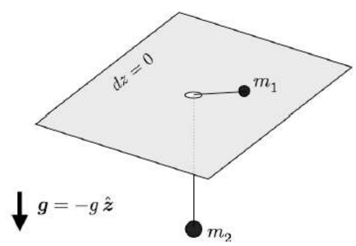
PROBLEM: An inextensible massless string of length ℓ passes through a hole in a horizontal table. A point mass m_1 on one end of the string moves frictionlessly along the table (*i.e.* with two degrees of freedom), and another point mass m_2 dangles vertically from the other end. (See the sketch below.)

(a) Write the Lagrangian for this system.

(b) Under what conditions will the hanging mass remain stationary?

(c) Starting from the situation in part (b), the hanging mass is pulled down slightly and then released. State clearly what is conserved during this process.

(d) Compute the subsequent motion of the hanging mass.



Príklad 4

You are driving at a constant speed of $v = 30\ m/s$, always in the NW direction. You are driving on a horizontal sheet of ice on the Arctic Ocean, with coefficient of friction $\mu = 0.1$. At what distance R from the N pole do you start to skid? Take $g = 9.8\ m/s^2$.

Príklad 5

The stem of the conical funnel, see figure, is initially closed. The funnel is filled with an incompressible liquid (mass density ρ) up to the level h. At $t = 0$, the funnel is opened and the liquid begins to flow out.

(a) Find the flux, J, through the stem as a function of h.

(b) Find the velocity of the upper surface of the liquid $\mathrm{d}h/\mathrm{d}t$ as the function of the flux.

(c) Write down a differential equation whose solution would yield $h(t)$.

(d) Solve the differential equation to obtain an explicit form of $h(t)$.