**METÓDY RIEŠENIA FYZIKÁLNYCH ÚLOH 1 leto24 – Príklady 3**

Cvičenie 7. 3. 2024

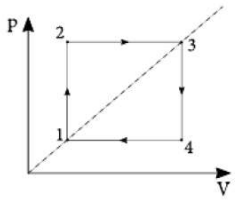
**Príklad 1**

Štyri rovnaké planéty s hmotnosťou $m$ rozmiestnené do štvorca obiehajú okolo spoločného ťažiska po kružnici s polomerom $R$. Aká je perióda ich obehu?

**Príklad 2**

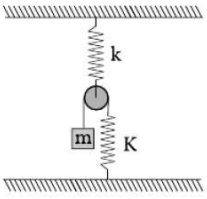
V nasledujúcom je vždy práve jedno riešenie úlohy správne. Nájdite ktoré to je bez toho, aby ste úlohu počítali.

Akú prácu vykoná $n$ molov plynu pri nasledujúcom deji? Teploty v ľavom dolnom a prvom hornom rohu štvorca sú $T_1$ a $T_3$.




1. $W = nR\frac{T_3^2 T_1}{(T_3-T_1)^2}$
2. $W = nR\left(\sqrt{T_3}-\sqrt{T_1}\right)^2$
3. $W = nR\left(\sqrt{T_3}+\sqrt{T_1}\right)^2$
4. $W = nR\left(\sqrt{T_3}-\sqrt{T_1}\right)^2$
5. $W = nR\left(\frac{T_3-T_1}{\sqrt{T_1}}\right)^2$
6. $W = nR\sqrt{T_3 T_1}$

Aká je perióda kmitov tejto hračky?




1. $T = 2\pi\sqrt{m\frac{4K+k}{kK}}$
2. $T = 2\pi\sqrt{m\frac{K+4k}{kK}}$
3. $T = 2\pi\sqrt{m\frac{K-k}{kK}}$
4. $T = 2\pi\sqrt{m\frac{4K+k}{k^2}}$
5. $T = 2\pi\sqrt{m\frac{4K+k}{K^2}}$
6. $T = 2\pi\sqrt{m\frac{1}{k+K}}$

Ponorka používa na meranie hĺbky vodorovného dna ultrazvuk, čiže vysiela signál všetkými smermi. Následne zaznamenáva, kedy sa jej vráti signál odrazený odo dna. Uvažujte ponorku pohybujúcu sa vodorovne rýchlosťou $v$. Ako vysoko je ponorka odo dna, ak sa signál vrátil po čase $T$? Rýchlosť zvuku vo vode je $c$.

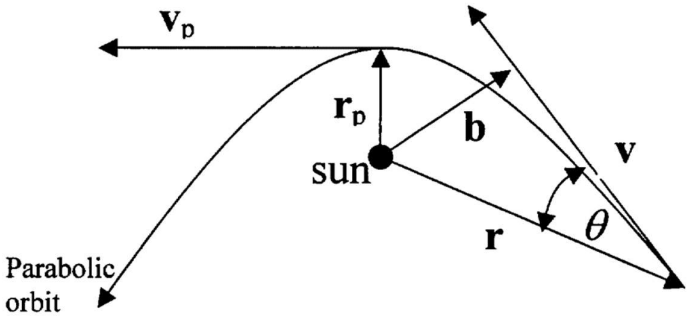
1. $h = \frac{vT}{2}\sqrt{1-\frac{v^2}{c^2}}$
2. $h = \frac{cT}{2}\sqrt{1-\frac{v^2}{c^2}}$
3. $h = \frac{cT}{2}\frac{1}{1+\frac{v^2}{c^2}}$
4. $h = \frac{cT}{2}\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}$
5. $h = \frac{vT}{2}\frac{1}{\sqrt{1-\frac{c^2}{v^2}}}$
6. $h = \frac{vT}{2}$

**Príklad 3**

Two parallel plates plates are maintained at temperatures $T_L$ and $T_R$ respectively and have emissivities $\epsilon_L$ and $\epsilon_R$ respectively. Given the Stephan-Boltzmann constant $\sigma$, express the net energy transfer rate per area from the left plate ($L$) to the right plate ($R$). *Hint:* this problem can be solved by using an infinite series, or by finding the energy transfer rate per area to the right and left, $I_R$ and $I_L$, respectively.

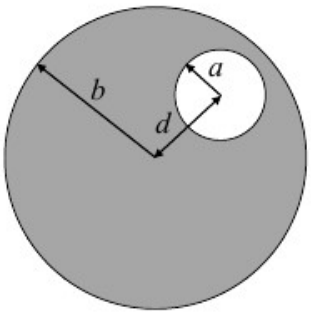
**Príklad 4**

[Classical Mechanics] A comet, barely unbound by the sun (its total energy vanishes), executes a parabolic orbit about it. At a certain time the comet is known to have a speed $v$ and impact parameter $b$ with respect to the sun. You may neglect the comet's mass $m$ with respect to the sun's mass $M$. Find the perigee (distance of closest approach to the sun) of the comet.




**Príklad 5**

PROBLEM: A cylindrical hole of radius $a$ is drilled in a solid cylinder of radius $b$. The two cylinder axes are parallel and are at a distance $d$ apart. A constant current $I$ flows in this structure, with uniform current density. Find the magnetic field at the center of the hole.




**Príklad 6**

A stick of length $L$ is placed vertically by the wall. At its lower end sits a bug. The end B of the stick starts moving to the right with speed $v$, and at the same moment the bug starts crawling along the stick with speed $u$ relative to the stick. What is the maximal height above the floor that the bug reaches while it crawls along the stick? End A of the stick does not lose contact with the wall.