Teszt

(1) $60\ \frac{km}{h}$, $80\ \frac{km}{h}$, s

	1	2
út	$\frac{1}{2}s$	$\frac{1}{2}s$
idő	$\frac{\frac{s}{2}}{80\frac{km}{h}}$	$\frac{\frac{s}{2}}{60\frac{km}{h}}$

$v_{átl} = \frac{s_ö}{t_ö} = \frac{s}{\frac{s}{160\frac{km}{h}} + \frac{s}{120\frac{km}{h}}} = \frac{1}{\frac{3}{480\frac{km}{h}} + \frac{4}{480\frac{km}{h}}} = \frac{480}{7}\frac{km}{h} < 70\frac{km}{h}$ (C)

(2) $\underline{v}_{rel} = \underline{v}_{tárgy} - \underline{v}_{megfigyelő}$

$\underline{v}_{rel} = \underline{v}_2 - \underline{v}_1 = 5\frac{m}{s}$, $5\frac{m}{s} = \underline{v}_1$, $\underline{v}_2 = 5\frac{m}{s}$, φ → egyenlő oldalú háromszög → $\varphi = 60°$ (B)

(3) m, v_1 → ← M, v_2 || $m+M$, u

$mv_1 - Mv_2 = (m+M)u \rightarrow u = \frac{mv_1 - Mv_2}{m+M}$

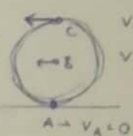
m, v_1 → M, v_2 → || $m+M$ → u

$mv_1 + Mv_2 = (m+M)u \rightarrow u = \frac{mv_1 + Mv_2}{m+M}$ ✓ (B)

m, v_1 → ; M, v_2 ↑ || u ↗ $m+M$

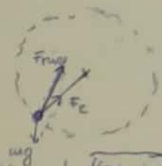
$\sqrt{(mv_1)^2 + (Mv_2)^2} = (m+M)u \rightarrow u = \frac{\sqrt{(mv_1)^2 + (Mv_2)^2}}{m+M}$

(4) (C)

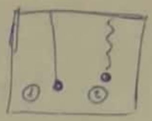
(5) 

$v_C > 5\frac{m}{s}$ (D)

$v_B = 5\frac{m}{s}$ → ø körmozgás

(6) egyenletes → dinamikai feltétel 

(C)

(7) 

① $\omega = \sqrt{g/l}$ || $\omega' = \sqrt{(g+a)/l}$

② $\omega = \sqrt{D/m}$ || $\omega' = \sqrt{g/l}$ (B)

(8) $T = \frac{2\pi}{\omega} = \frac{2\pi}{\sqrt{D/m}}$; $T = \frac{2\pi}{\sqrt{D/m}}$ (B)

egyensúly • $\Delta l = 0$ -ban • $\Delta l = \frac{mg}{D}$ -ben

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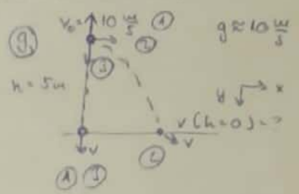
(9) 

$g \approx 10\frac{m}{s}$

①–③ $h = \frac{g}{2}t^2 + v_0 t \Rightarrow t = \frac{-v_0 \pm \sqrt{v_0^2 + 4\frac{g}{2}h}}{g} = \frac{-10 \oplus \sqrt{100+100}}{10} = \sqrt{2} - 1\ s$

$v = v_0 + gt = 10\frac{m}{s} + 10\frac{m}{s}\cdot(\sqrt{2} - 1\ s) = 10\sqrt{2}\ \frac{m}{s} = \sqrt{200}\ \frac{m}{s}$ → $v_1 = v_2 = v_3$ (A)

② független mozgások $v_x = 10\frac{m}{s}$, $v_y = \frac{2h}{t} = 10\frac{m}{s} \Rightarrow v = \sqrt{(10\frac{m}{s})^2 + (10\frac{m}{s})^2} = \sqrt{200}\ \frac{m}{s}$

$h = \frac{g}{2}t^2 \rightarrow t = \sqrt{\frac{2h}{g}} = 1s$

(10) $a_{cpF} = 6 \cdot 10^{-3}\ \frac{m}{s^2}$

$R_y = 5R_F$

Kepler I ellipszispálya, gyújtópontban Nap

Kepler II vezérsugár azonos idők alatt azonos területek

Kepler III adott égitest körül $\frac{a_1^3}{T_1^2} = \frac{a_2^3}{T_2^2}$ → R $\Rightarrow T_y = \sqrt{\frac{R_y^3}{R_F^3}T_F^2} = \sqrt{5^3}\ T_F = 5^{3/2}\ T_F$

$a_{cp} = \frac{v^2}{R} = \omega^2 R = \left(\frac{2\pi}{T}\right)^2 R = \frac{4\pi^2}{T^2}R \Rightarrow a_{cpy} = \frac{4\pi^2}{T_y^2}R_y = \frac{4\pi^2}{5^3 T_F^2}5R_F = \frac{5}{5^3}\left(\frac{4\pi^2}{T_F^2}R_F\right) = \frac{1}{25}a_{cpF} = 0{,}24 \cdot 10^{-2}\ \frac{m}{s^2}$ (D)

Scanned with CamScanner

Számoljuk

$m = 2\,dkg = 0{,}02\,kg$; $g = 10\,\frac{m}{s^2}$ $\quad h = v_0 \cdot t$, $v_0 = \frac{v_0}{2}$, $t = \frac{v_0}{g}$

① a) $t = 0{,}3\,s$ (1 rémület) ; $h = \frac{v_0^2}{2g} = \frac{(3\,\frac{m}{s})^2}{2 \cdot 10\,\frac{m}{s^2}} = 0{,}45\,m$

b) $a = \frac{\Delta v}{\Delta t} = \frac{5{,}75\,\frac{m}{s}}{0{,}05\,s} = 115\,\frac{m}{s^2}$ $\quad$  $\quad ma = F - mg \rightarrow F = m(a+g) = 0{,}2\,kg\,(115\,\frac{m}{s^2} + 10\,\frac{m}{s^2}) = 2{,}5\,N$

c) $k = \frac{v_u}{v_e} = \frac{2{,}45\,\frac{m}{s}}{3\,\frac{m}{s}} = 0{,}817$; $k = \frac{h_u}{h_e} \rightarrow \frac{h_u}{h_e} = \frac{v_u^2}{v_e^2} = k^2 = 0{,}64$

$\Rightarrow h_u = 0{,}64^n \cdot h_0 = 0{,}5\,h_0 \Rightarrow n = \log_{0{,}64} 0{,}5 = \frac{\lg 0{,}5}{\lg 0{,}64} = 3{,}38 \Rightarrow$ 4 pattanás után csökken a felére

$= \frac{4100}{60} \approx \frac{1}{s} \approx 120\,\frac{1}{s}$

②  a) $f_0 = 4100\,RPM$, $d = 30\,\frac{nm}{bit}$, $D = 3{,}5'' = 3{,}5 \cdot 2{,}54\,cm = 8{,}89\,cm \Rightarrow R_1 = D_{/2} = 4{,}45\,cm = 4{,}45 \cdot 10^{-2}\,m$

$\eta = \frac{v_{kül}}{d}$ $\quad v_{külső} = \omega_1 \cdot R_1 = 2\pi f \cdot R_1 = 2\pi \cdot 4{,}45\,cm \cdot 120\,\frac{1}{s} = 33{,}6\,\frac{m}{s} \Rightarrow \eta_1 = \frac{33{,}6\,\frac{m}{s}}{3 \cdot 10^{-6}\,\frac{m}{bit}} = 11{,}2 \cdot 10^6\,\frac{bit}{s} = 1{,}12\,\frac{Gbit}{s}$

$1\,Gbit = 10^9\,bit$

külső adatsávszélesség ($\frac{bit}{s}$)

b) $R_2 = 2\,cm$ $\Rightarrow \eta_2 = \frac{v_{kül}}{d} = \frac{R_2 \omega}{d} = \frac{3\,cm \cdot 120\,\frac{1}{s} \cdot 2\pi}{3 \cdot 10^{-6}\,\frac{m}{bit}} = 4{,}5 \cdot 10^8\,\frac{bit}{s} = 0{,}45\,\frac{Gbit}{s}$

c) $1\,cm = R_{1\,min} < R_1 < R_{1\,max} = 4{,}5\,cm$; $1\,byte = 8\,bit$

1 bit helye $A_\square = d^2 = 9 \cdot 10^{-12}\,m^2$; lemez területe (2 sugár körök) $= A_0 = R_{max}^2 \pi - R_{min}^2 \pi = [(4{,}5\,cm)^2 - (1\,cm)^2]\,\pi = 63\,cm^2 = 5{,}3 \cdot 10^{-5}\,m^2$

bele hány egy lemezen: $N = \frac{A_0}{A_\square} = 0{,}588 \cdot 10^{10}$; Gbyte-ok száma $\Rightarrow \frac{N}{8 \cdot 10^9} = 0{,}0211 \cdot 10^2 = 211\,Gbyte$

③  $g = 10\,\frac{m}{s^2}$

$\Delta l = 5\,cm = 0{,}05\,m$

$A = 2\,cm = 0{,}02\,m$

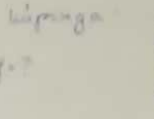
a) $T = ?$ $\quad T = \frac{2\pi}{\omega} = \frac{2\pi}{\sqrt{D/m}} = \frac{2\pi}{\sqrt{200\,\frac{1}{s^2}}} = 0{,}44\,s$

egyensúly: $mg = D\Delta l \rightarrow \frac{D}{m} = \frac{g}{\Delta l} = \frac{10\,\frac{m}{s^2}}{0{,}05\,m} = 200\,\frac{1}{s^2} = \omega^2$

b) $v_{max} = ?$ $\quad v(t) = A\omega \cos(\omega t + \varphi) \Rightarrow v_{max} = A\omega = 0{,}02\,m \cdot \sqrt{200\,\frac{1}{s^2}} = 0{,}42\,\frac{m}{s}$

a) $a_{max} = ?$ $\quad a(t) = -A\omega^2 \sin(\omega t + \varphi) \Rightarrow a_{max} = A\omega^2 = 0{,}02\,m \cdot 200\,\frac{1}{s^2} = 6\,\frac{m}{s^2}$

$(v(t) = A\sin(\omega t + \varphi))$

④ Lejtőn:  $\quad f = ?$ $\quad g = 9{,}8\,\frac{m}{s^2}$

$mg = K \cdot \cos\alpha \rightarrow K = \frac{mg}{\cos\alpha}$ ← Newton II

$m\omega^2 R = K \sin\alpha \rightarrow m\omega^2 R = \frac{mg}{\cos\alpha} \sin\alpha \rightarrow \omega = \sqrt{\frac{g \tg\alpha}{R}} = \sqrt{\frac{9{,}8\,\frac{m}{s^2} \cdot \tg 60°}{1/4\,m}} = 5{,}824\,\frac{1}{s}$

$R = l \sin\alpha = 1\,m \cdot \frac{\sqrt{3}}{2} = 60° = \frac{\sqrt{3}}{4}\,m$

$f = \frac{\omega}{2\pi} = \frac{1}{2\pi}\sqrt{\frac{g \cdot \sin\alpha/\cos\alpha}{\Delta l \cdot \sin\alpha}} = \frac{1}{2\pi}\sqrt{\frac{g}{l \cos\alpha}} = 0{,}405\,\frac{1}{s}$