

Megoldások

1.feladat

$$T \perp \Delta x \Rightarrow L = 0$$

2.Feladat

$$\Delta x = 1,2km; \quad \Delta t = 1/30h \Rightarrow v = 36km/h$$

3.Feladat

kis rugók:

$$k_1 = 15k$$

parhuzamosan kapcsolt rugók

$$k_f = 15k_1 = 225k$$

4.Feladat

$$F_f = F_s + mg \sin(\alpha)$$

$$F_s = mg \sin(\alpha) + F_l$$

$$\Rightarrow m = \frac{F_f - F_l}{2mg \sin(\alpha)} = 10kg$$

5.Feladat Osszenergiaváltozás:

$$\frac{mv_0^2}{2} + mg\Delta h = \mu mg \cos(\alpha)\Delta x$$

$$\frac{m9v_0^2}{2} = \mu mg \cos(\alpha)\Delta x + mg\Delta h$$

$$\delta h = \Delta x \sin(\alpha)$$

$$\Rightarrow \mu = \frac{5 \tan(\alpha)}{4} = 0,72$$

6. Feladat

$$v_1(\Delta t) = v_1(0) - g\Delta t = 5m/s$$

$$v_r = v_1(\Delta) - v_2 > 0 \Rightarrow v_2 < v_1(\Delta t) = 5m/s$$

7. Feladat

$$mg = 2T \Rightarrow T = 1N$$

$$\Delta x_1 = \frac{T}{k_1}; \quad \Delta x_2 = \frac{T}{k_2}$$

$$\delta x = \frac{\Delta x_1 + \Delta x_2}{2} = 6, (6)cm$$

8. Feladat

$$F_s = \mu mg \cos(\alpha)$$

Energiamegmaradás

$$\frac{mv_0^2}{2} = \mu mg \cos(\alpha) \Delta x + mg \Delta x \sin(\alpha)$$

$$\Delta x = \frac{v_0^2}{2(mg \sin(\alpha) + \mu g \cos(\alpha))} = 8,28m$$

9. Feladat

$$T = \frac{\Delta t}{n} = 3s$$

$$\omega = \frac{2\pi}{3}; v_r = \omega l \Rightarrow v_r = \frac{\pi}{3}$$

$$v_{max} = v_1 + v_r = \frac{30 + \pi}{3}$$

10. Feladat

$$a_{konyv} \geq \mu_1 g = 2m/s^2$$

$$a_{doboz} = \mu_2 g = 1m/s^2$$

11. Feladat

$$h = \frac{gt^2}{2} \Rightarrow t = 0.4s$$

$$v_{0x}t = \Delta x \Rightarrow v_{0x} = \frac{\Delta x}{t} = 5m/s \Rightarrow$$

Az asztal szeléről indítottuk a testet

12. Feladat

$$\frac{mv_0^2}{2} = mgh_{max}$$

$$\frac{mv_0^2}{2} = \frac{mv_1^2}{2} + 0,84mgh_{max} \Rightarrow$$

$$v_1 = 0,4v_0$$

13. Feladat

$$m_0(g + a) = mg$$

$$m_0(g - a) = mg/2$$

$$m_0(g + 2a) = m_1g \Rightarrow$$

$$m_1 = \frac{5}{4}m$$

14. Feladat

$$\begin{aligned}a &= 4m/s; F = 8N \\L &= F\Delta y = -Fy_{max} \\y_{max} &= 9/2m \Rightarrow L = -36J\end{aligned}$$

15. Feladat

$$\begin{aligned}m_2a &= m_2g - T \\m_1a &= T - m_1g \\a &= \frac{m_2 - m_1}{m_2 + m_1}g = 4m/s^2 \\ \Delta y &= 2m \\t &= \sqrt{\frac{2\Delta x}{a}} = \sqrt{\frac{h}{a}} = 1s\end{aligned}$$

16. Feladat Mozgas kezdete

$$F_{min} \cos(\alpha) = \mu mg \Rightarrow F_{min} = 3N \Rightarrow t_{start} = \frac{F_{min}}{0,2} = 15s$$

Test elvalik az asztaltól

$$\begin{aligned}F_{max} \sin \alpha &= mg \Rightarrow F_{max} = 6N \rightarrow t_{end} = 30s \\ \Delta t &= 15s\end{aligned}$$

17. Feladat

$$\begin{aligned}\sin(\alpha) &= 3/5; \cos(\alpha) = 4/5 \\T \cos(\alpha) &= mg \\F_{cp} &= T \sin(\alpha) = m\left(\frac{2\pi}{T}\right)^2 R \\T &= 2\pi \sqrt{\frac{\cos(\alpha)R}{\sin(\alpha)g}} = 2\pi \sqrt{\frac{6}{5}}s\end{aligned}$$

18. Feladat

$$\begin{aligned}k_{eq} &= 2k = 200N/m \\ \frac{k_{eq}\Delta x^2}{2} &= mgh_{max} \Rightarrow \Delta x = 5cm\end{aligned}$$

19. Feladat Energiaváltozás:

$$L = mgh - \frac{mv_f^2}{2}$$

$$L = \Delta x F_s = \Delta x \mu m g \cos(\alpha)$$

$$\Rightarrow \Delta x = \frac{gh - \frac{v_f^2}{2}}{\mu g \cos(\alpha)} = 7,99m$$

$$\frac{\Delta x}{S} = \frac{7,99}{15} = 52,26\%$$

20. Feladat I

$$N_2 = m_2 g \cos(\alpha)$$

$$m_2 a = m_2 g \sin(\alpha) + N_0 - \mu_2 N_2 \Rightarrow$$

$$m_2 a - m_2 g \sin(\alpha) + N_0 - \mu_2 m_2 g \cos(\alpha)$$

$$m_1 a = m_1 g \sin(\alpha) - N_0 \Rightarrow$$

$$a(m_1 + m_2) = (m_1 + m_2) g \sin(\alpha) - \mu m_2 g \cos(\alpha) \Rightarrow$$

$$a = g \sin(\alpha) - \frac{m_2}{m_1 + m_2} \mu_2 g \cos(\alpha) = 3,96m/s^2$$

20. Feladat II

$$m_1 a = m_1 g \sin(\alpha) - N_0 \Rightarrow$$

$$N_0 = m_1 (g \sin(\alpha) - a) = k \Delta x \Rightarrow$$

$$\Delta x = 12cm$$

20. Feladat III.

$$a_1 = g \sin(\alpha) = 5m/s^2$$

$$t_1 = \sqrt{\frac{2S}{a_1}} = 0,447s$$

$$a_2 = g \sin(\alpha) - \mu_2 g \cos(\alpha) = 3,26m/s^2$$

$$t_2 = \sqrt{\frac{2S}{a_2}} = 0,553s$$

$$\Delta t = t_2 - t_1 = 0,106s$$

21. Feladat I.

$$v_r = v_2 - v_1 = 30km/h; L = L_1 + L_2 = 500m$$

$$\Delta t = \frac{L}{v_r} = \frac{1}{60}h = 1 perc = 60s$$

21. Feladat II.

$S = 5m$ - Doboz-utas távolság

Δx - doboz-utas távolság haladási irányra eső vetülete

$\Delta y = 4m$ - doboz-utas távolság haladási irányra eső vetülete

$$\Delta x = \sqrt{S^2 - \Delta y^2} = 3m$$

$$\Delta x = v_r \Delta t_1$$

$$\Delta y = v_l \Delta t_1$$

$$\Rightarrow \frac{\Delta x}{\Delta y} = \frac{v_r}{v_l} \Rightarrow v_l = v_r \frac{\Delta y}{\Delta x} = 40 km/h$$

21. Feladat III

v_a - lövedék ütközés előtti sebessége a földhöz képest

v_b - lada ütközés előtti sebessége a földhöz képest

$$v_{ax} = v_2 = 90 km/h; v_{ay} = 40 km/h$$

$$v_{bx} = v_1 = 60 km/h; v_{by} = 0 km/h$$

Rugalmatlan ütközés, impulzusmegmaradás:

$$(m_1 + m_2)v_x = m_1 v_{bx} + m_2 v_{ax} \Rightarrow v_x = \frac{m_1 v_{bx} + m_2 v_{ax}}{m_1 + m_2} = 62, (72) km/h$$

$$(m_1 + m_2)v_y = m_2 v_{ay} \Rightarrow v_y = \frac{m_2 v_{ay}}{m_1 + m_2} = 5, (45) km/h$$