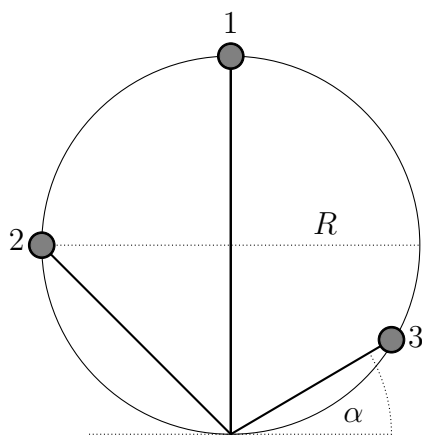


37. Ordnungsaufgabe – Kistenziehen

F_i ... Kraft, mit der das Seil $i = \{A, B, C, D, E, F\}$ gespannt ist

$$\underline{\underline{F_D > (F_E, F_B) > (F_A, F_C, F_F)}}$$

40. Welche Perle ist schneller?



a)

$$r_1(t) = 2R - \frac{g}{2}t^2$$

$$r_1(t) = 0 \Rightarrow t_1 = 2\sqrt{\frac{R}{g}}$$

$$r_2(t) = \sqrt{2}R - \frac{g}{2\sqrt{2}}t^2$$

$$r_2(t) = 0 \Rightarrow t_2 = 2\sqrt{\frac{R}{g}}$$

$$\Rightarrow \underline{\underline{t_1 = t_2}}$$

b)

$$r_3(t, \alpha) = 2R \sin(\alpha) - \frac{g \sin(\alpha)}{2} t^2$$

$$r_3(t, \alpha) = 0 \Rightarrow \underline{\underline{t_3(\alpha) = \sqrt{\frac{4R \sin(\alpha)}{g \sin(\alpha)}} = 2\sqrt{\frac{R}{g}}}}$$

Die Zeit, die die Perle braucht, um am Ziel anzukommen, hängt nicht vom Winkel α ab

50. Kiste auf schiefer Ebene

a) $F_G = mg; \quad g = 9.81 \text{ m/s}^2$

$$\underline{\underline{\vec{F}_Z(m, \theta) = 9.81m \sin(\theta) \begin{pmatrix} \cos(\theta) \\ \sin(\theta) \end{pmatrix}}}$$

$$\underline{\underline{\vec{F}_N(m, \theta) = 9.81m \cos(\theta) \begin{pmatrix} \sin(\theta) \\ \cos(\theta) \end{pmatrix}}}$$

b) $g = 9.81 \text{ m/s}^2; \quad m = 5 \text{ kg}; \quad \theta = 60^\circ$

$$F_Z = 9.81 \text{ m/s}^2 * 5 \text{ kg} * \sin(60) = \underline{\underline{42 \text{ N}}}$$

$$F_N = 9.81 \text{ m/s}^2 * 5 \text{ kg} * \cos(60) = \underline{\underline{25 \text{ N}}}$$

c) $f_H = 0.5; \quad f_G = 0.3$

$$F_H = f_H * F_N = \frac{gm \cos(\theta)}{2}$$

$$F_{\parallel} = mg \sin(\theta)$$

$$F_c = 20 \text{ N}$$

$$F_{\parallel} = F_c + F_H$$

$$mg \sin(\theta_c) = 20 + \frac{gm \cos(\theta_c)}{2}$$

$$(mg \sin(\theta_c))^2 = (20 + \frac{gm \cos(\theta_c)}{2})^2$$

$$0 = m^2 g^2 \sin^2(\theta_c) - 400 - 20mg \cos(\theta_c) - \frac{m^2 g^2 \cos^2(\theta_c)}{4}$$

$$0 = m^2 g^2 - 400 - 20mg \cos(\theta_c) - \frac{m^2 g^2 \cos^2(\theta_c)}{4} - \frac{4m^2 g^2 \cos^2(\theta_c)}{4}$$

$$0 = -\frac{5m^2 g^2 \cos^2(\theta_c)}{4} - 20mg \cos(\theta_c) + m^2 g^2 - 400$$

$$0 = \cos^2(\theta_c) + \frac{80}{5mg} \cos(\theta_c) - \frac{4}{5} + \frac{1600}{5m^2 g^2}$$

$$\cos(\theta_c) = -\frac{80}{10mg} \pm \sqrt{\left(\frac{80}{10mg}\right)^2 - \left(-\frac{4}{5} + \frac{1600}{5m^2 g^2}\right)}$$

$$\cos(\theta_c) = -0.163... \pm 0.832...$$

$$\cos(\theta_c) = 0.669...$$

$$\theta_c = \underline{\underline{47.95^\circ}}$$

d)

$$F = F_{\parallel} - f_G * F_N$$

$$ma = mg \sin(\theta_c) - \frac{3mg \cos(\theta_c)}{10}$$

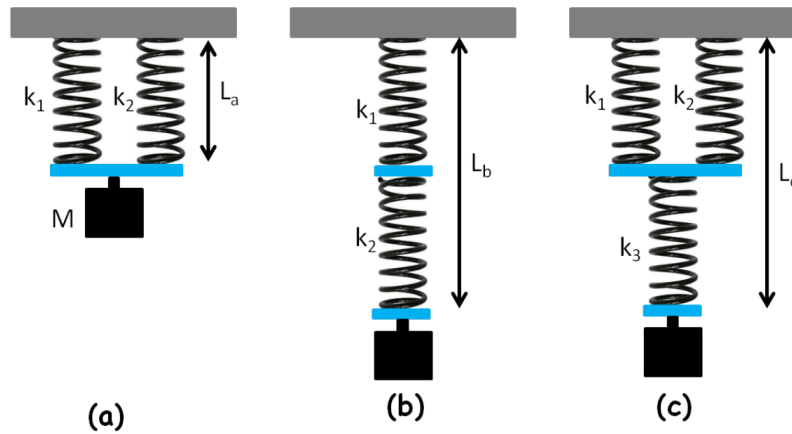
$$a = \frac{g(10 \sin(\theta_c) - 3 \cos(\theta_c))}{10} = 5.31 \text{ m/s}^2$$

$$r(t) = \frac{a}{2} t^2$$

$$1.3 \text{ m} = \frac{5.31 \text{ m/s}^2}{2} t^2$$

$$t = \sqrt{\frac{2.6 \text{ m}}{5.31 \text{ m/s}^2}} = \underline{\underline{0.7 \text{ s}}}$$

52. Gekoppelte Federn



$$F = -k * x = Mg; \quad g = 9.81 \text{ m/s}^2; \quad L_{a,b,c} = L_0 + x_{a,b,c}$$

a)

$$k = \underline{\underline{k_1 + k_2}}$$

$$L_a = L_0 + \frac{F}{-k}$$

$$L_a = \underline{\underline{L_0 + Mg \left(\frac{1}{k_1 + k_2} \right)}}$$

b)

$$k = \underline{\underline{\frac{k_1 k_2}{k_1 + k_2}}}$$

$$L_b = 2L_0 + \frac{F}{-k}$$

$$L_b = \underline{\underline{2L_0 + Mg \left(\frac{k_1 + k_2}{k_1 k_2} \right)}}$$

c)

$$k = \underline{\underline{\frac{k_3(k_1 + k_2)}{k_1 + k_2 + k_3}}}$$

$$L_c = 2L_0 + \frac{F}{-k}$$

$$L_c = \underline{\underline{2L_0 + Mg \left(\frac{k_1 + k_2 + k_3}{k_3(k_1 + k_2)} \right)}}$$