177. Stabpendel mit Kugeln

$$L = 0.3 \text{ m}; \qquad r_1 = 0.02 \text{ m}; \qquad r_2 = 0.03 \text{ m}$$
$$m_0 = 0.1 \text{ kg}; \qquad m_1 = 0.1 \text{ kg}; \qquad m_2 = 0.3 \text{ kg}$$

a) $I_{ges} = I_{Stab} + I_{Kugel_1} + I_{Kugel_2}$

$$I_{Stab} = \tfrac{1}{12} m_0 L^2 = 2.3 * 10^{-3} \text{ kg m}^2$$
$$I_{Kugel_1} = \tfrac{2}{5} m_1 r_1^2 + m_1 (\tfrac{L}{2} + r_1)^2 = 2.9 * 10^{-3} \text{ kg m}^2$$
$$I_{Kugel_2} = \tfrac{2}{5} m_2 r_2^2 + m_2 (\tfrac{L}{2} + r_2)^2 = 9.8 * 10^{-3} \text{ kg m}^2$$

$$\Rightarrow I_{ges} = \underline{\underline{1.5 * 10^{-2} \text{ kg m}^2}}$$

b)

$$x_{Stab_{sp}} = 0 \text{ m}$$
$$x_{Kugeln_{sp}} = \frac{m_1 \left(-\frac{2r_1 + L}{2}\right) + m_2 \left(\frac{2r_2 + L}{2}\right)}{m_1 + m_2} = 0.0925 \text{ m}$$

$$x_{sp} = \frac{x_{Stab_{sp}} * m_0 + x_{Kugeln_{sp}} * (m_1 + m_2)}{m_0 + m_1 + m_2} = \underline{\underline{0.074}} \text{ m}$$

c) $T = 2\pi \sqrt{\frac{I}{Mgl}}$

$$T = 2\pi \sqrt{\frac{I}{(m_0 + m_1 + m_2)\, g \left(\frac{2r_2 + L}{2}\right)}}$$
$$= \underline{\underline{0.69 \text{ s}}}$$