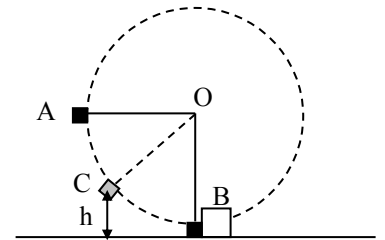




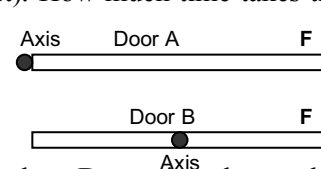
- Two bodies, masses 500 and 1000 kg, move at the same speed, 180 km/h. Determine their respective velocities after a frontal, inelastic collision **Ans:** 60 km/h
- An artillery shell is fired forming an angle of 45° , initial speed 30 m/s. It explodes into two equal-mass fragments in the highest point of its trajectory. The first fragment continues in the direction of motion at velocity of 45 m/s. Determine what is the distance from firing point reached by the second fragment.
Ans: 40,35 m from firing point
- A body of mass m is on a horizontal plane at rest. Another body collides elastically with it at velocity V and it deviates an angle α . Calculate the velocities of both bodies after collision. **Ans:** $|\vec{v}_1| = V \cdot \cos\alpha$ with angle α ; $|\vec{v}_2| = V \cdot \sin\alpha$ with angle $-(90^\circ - \alpha)$

- The simple pendulum of the figure has a mass $m_1 = 20$ kg, and it is tied to a rope of length 1,5 m. We leave this mass to fall down from position A. When it reaches position B, it collides elastically with other mass $m_2 = 25$ kg, initially at rest, no friction. Because of the collision, m_1 bounces back and reaches point C, at height h . Determine: a) Velocity of m_1 at point B before collision, and the tension of the rope at that precise instant. b) Velocities of m_1 and m_2 after collision. c) Kinetic energy E_k lost by m_1 during collision. d) Height h .



Ans: a) $v = 5,42$ m/s; $T = 588$ N; b) $v_1 = -0,60$ m/s; $v_2 = 4,82$ m/s; c) $\Delta E_k = -290,2$ J; $h = 18,5$ mm.

- Consider a pulley with mass 10 kg and radius 10 cm. Two masses, $m_1 = 13$ kg and $m_2 = 7$ kg, hang from an inextensible and weightless rope. Both masses at rest. Let $g = 10$ m/s² and the Moment of Inertia of the pulley $\frac{1}{2} MR^2$. Determine: a) Linear acceleration of the bodies and angular acceleration of the pulley; b) Kinetic energy of each body and the pulley after 2 secs. **Ans.:** a) $2,4$ m/s², 24 rad/s²; b) $149,76$ J, $80,64$ J, $9,22$ J
- The figure shows two identical doors seen from above. The same force F acts on the doors. The door A rotates around an axis located in its leftmost edge. The door B rotates around an axis located in its middle point. The door A rotates a given angle after 3 secs (initially at rest). How much time takes the door B to rotate the same angle? $I_A = (1/3)MI^2$, $I_B = (1/12)MI^2$. **Ans.:** 2,12 s



- A cylinder ($I = 1/2 \cdot m \cdot R^2$) rolls over a horizontal surface at speed v . Determine the work needed for stopping it **Ans.:** $3/4mv^2$.
- A solid sphere radius R and a solid cube are on top of a ramp, height H . The sphere rolls without slipping, the cube slides with no friction. The moment of inertia of the sphere is $I = 2/5 \cdot M \cdot R^2$.
a) Calculate the velocities of the bodies when reaching the zero-level height. b) Determine which body arrives the first to the base of the ramp.
Ans: $v_{\text{sphere}} = \sqrt{10gH/7}$; $v_{\text{cube}} = \sqrt{2gH}$ b) The cube arrives the first.
- A person (mass 91kg) jumps into a moving boat (mass 510 kg) with another person already on board (mass 75 kg) Initial speed of the boat is 11 m/s. What is the speed of the boat after the jump? **Ans:** 9.52 m/s

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