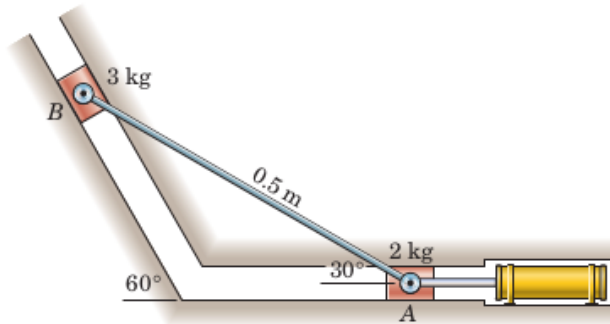
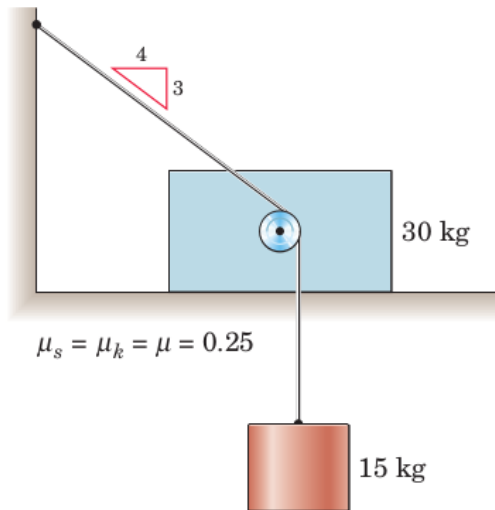


DYNAMICS (ME232)
Tutorial-3: Kinetics of particles

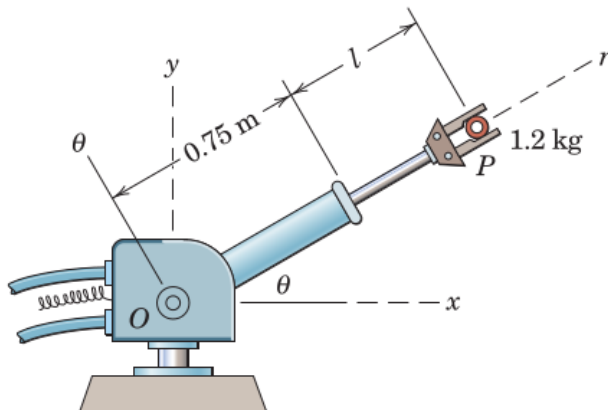
1. The slider A and B are connected by a light rigid bar and move with negligible friction in the slots, both of which lie in a horizontal plane. For the position shown, the hydraulic cylinder imparts a velocity and acceleration to slider A of 0.4 m/s and 2 m/s^2 , respectively, both to the right. Determine the acceleration of slider B and the force in the bar at this instant.



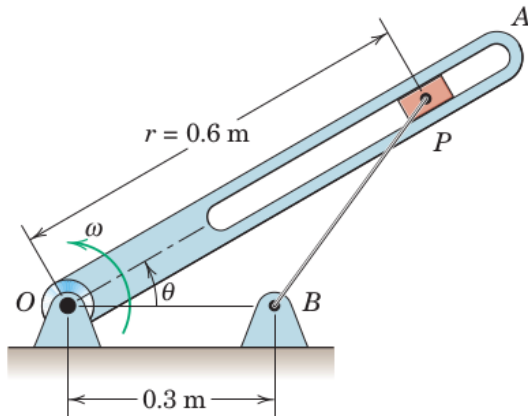
2. The system is released from rest in the position shown. Calculate the tension T in the cord and the acceleration a of the 30-kg block. The small pulley attached to the block has negligible mass and friction.



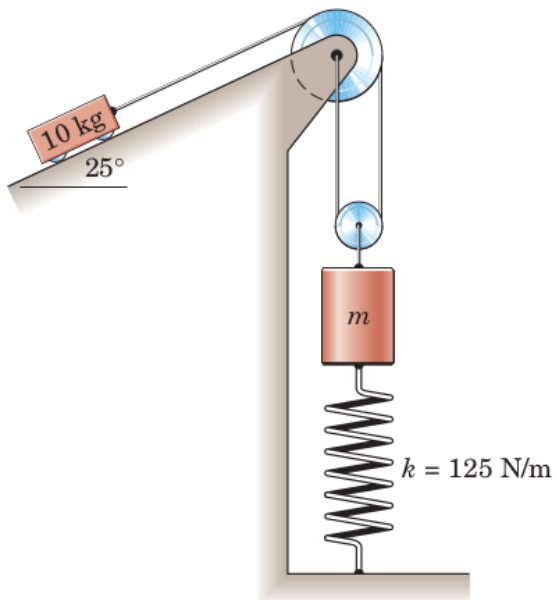
3. The robot arm is elevating and extending simultaneously. At a given instant, $\theta = 30^\circ$, $\dot{\theta} = 40\text{ deg/s}$ and $\ddot{\theta} = 120\text{ deg/s}^2$, $l = 0.5\text{ m}$, $\dot{l} = 0.4\text{ m/s}$ and $\ddot{l} = -0.3\text{ m/s}^2$. Compute the radial and transverse forces F_r and F_θ that the arm must exert on the gripped part P , which has a mass of 1.2 kg . Compare with the case of static equilibrium in the same position.



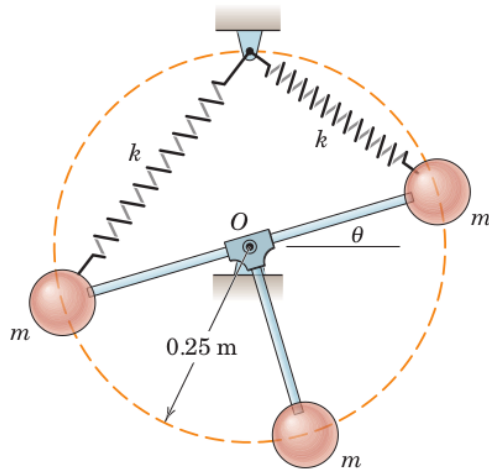
4. The slotted arm OA rotates about a horizontal axis through point O . The 0.2 kg slider P moves with negligible friction in the slot and is controlled by the inextensible cable BP . For the instant under consideration, $\theta = 30^\circ$, $\omega = \dot{\theta} = 4\text{ rad/s}$, $\ddot{\theta} = 0$, and $r = 0.6\text{ m}$. Determine the corresponding values of the tension in cable BP and the force reaction R perpendicular to the slot. Which side of the slot contacts the slider?



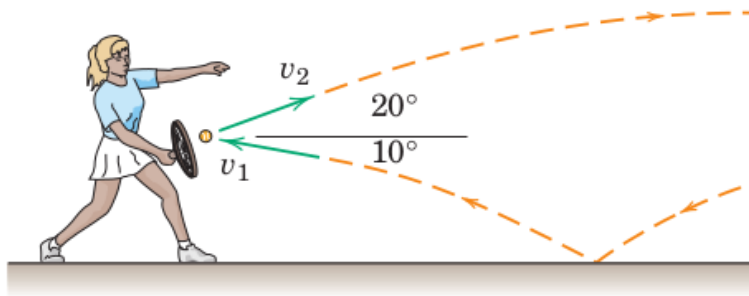
5. The system is released from rest with no slack in the cable and with the spring stretched 200 mm . Determine the distance s traveled by the 10 kg cart before it comes to rest (a) if m approaches zero and (b) if $m = 2\text{ kg}$. Assume no mechanical interference.



6. The two springs, each of stiffness $k = 1.2\text{ kN/m}$ are of equal length and undeformed when $\theta = 0$. The mass m of each sphere is 3 kg . Treat the sphere as particles and neglect the masses of the light rods and springs.



7. A tennis player strikes the tennis ball with her racket while the ball is still rising. The ball speed before impact with the racket is $v_1 = 15\text{ m/s}$ and after impact its speed is $v_2 = 22\text{ m/s}$, with directions as shown in the figure. If the 60-g ball is in contact with the racket for 0.05 seconds, determine the magnitude of the average force \mathbf{R} exerted by the racket on the ball. Find the angle β made by \mathbf{R} with the horizontal. Comment on the treatment of the ball weight during impact.



8. A particle is launched with a horizontal velocity $v_0 = 0.55\text{ m/s}$ from the 30° position shown and then slides without friction along the funnel-like surface. Determine the angle θ which its velocity vector makes with the horizontal as the particle passes level $O - O$. The value of r is 0.9 m .

