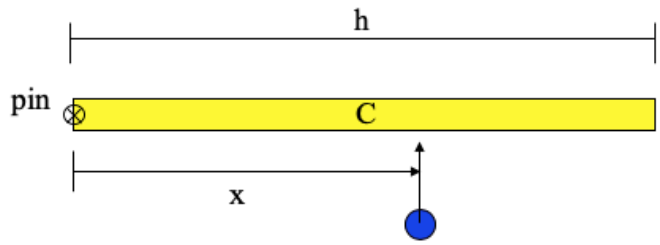
Problem 17-3: A rod of mass m, length h and rotational inertia I sits on a frictionless table. It can pivot about a frictionless pin at one end. Point D identifing the center (midpoint) of the rod. Assume the rod starts out at rest. A disk of mass m_d slides toward the rod with velocity v_o perpendicular to the rod, sticking to the rod a distance x units from the pivot. The student wants the rod-disk system to end up with as much angular velocity as possible.



a.) If the rod is much more massive than the disk, should the disk strike the rod *to the left of D, directly at the center (at D)* or *to the right of D*? Briefly explain your reasoning without manipulating equations.

b.) A student finds the following equation for the post-collision angular velocity of the rod to be $\omega = \frac{m_d x v_o}{I}$. Ignoring whether this equation is correct, does it agree with your conclusion in Part a? In other words, does this equation have the expected dependence as reasoned in Part a? Briefly explain your reasoning without deriving an equation for ω.

c.) Another students derives the post-collision angular velocity as $\omega = \frac{I x v_o}{m_d h^4}$. This is incorrect. Without doing the derivation, how can you tell that this is not plausible? That is, how can you tell it doesn't make sense? Briefly explain.

For Parts d and e, do NOT assume that the rod is much more massive than the disk.

d.) Immediately before the collision, the disk's rotational inertia about the pivot will be $I_{init,d} = m_d x^2$ and its angular momentum will be $m_d v_o x$. Explain how you would determine the rod's angular momentum after the collision.

e.) Reconsider the collision alluded to in Part d, but this time assume the disk doesn't stick to the rod but, instead, bounces back away from the rod. Is the post-collision angular speed of the rod *greater than*, the *same* as or *less than* the angular speed of the rod in the situation outlined in Part d? Briefly explain your reasoning without the use of equations.