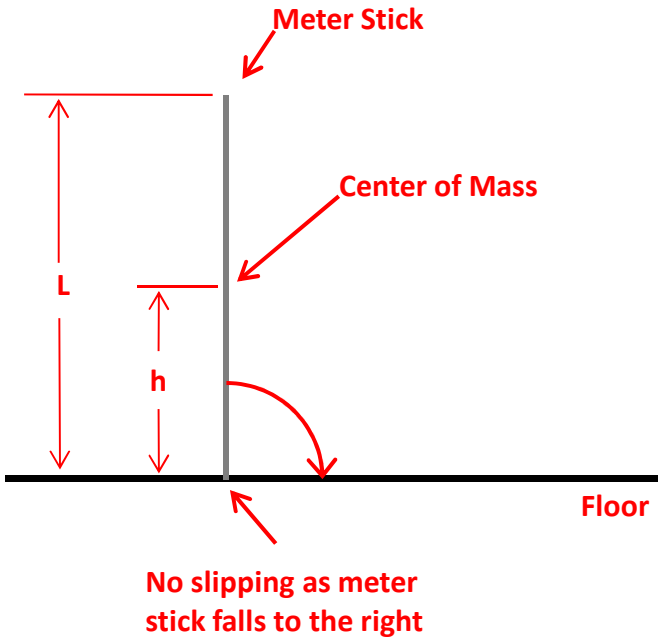
Derivation of Falling Meter Stick Equation



- To provide a more general solution, we assume that the length of the stick is L.
- The center-of-mass is, therefore, at a height h=L/2 above the floor.
- Initially, the stick is at rest vertically with a gravitation potential energy mgh, where m is the mass of the stick and g is the acceleration of gravity.
- Just before hitting the floor after being released, the gravitational potential energy is zero, and the rotational kinetic energy is $\frac{1}{2}I\omega^2$, where I is the moment of inertia of the stick and ω is the angular velocity ***in radians/s*** at that instant. (π radians = 180°).
- The moment of inertia I of a thin rod about an axis through one end perpendicular to the length is $mL^2/3$.
- Neglecting any loss of energy due to air resistance or other frictional sources, conservation of energy tells us that $mgh = \frac{1}{2}I\omega^2$.
- A moderate amount of algebraic manipulation allows us to conclude that

$$\omega = \sqrt{\frac{3g}{L}}$$

- *The angular velocity just before hitting the table is independent of the mass and inversely proportional to the square root of the length of the stick.*