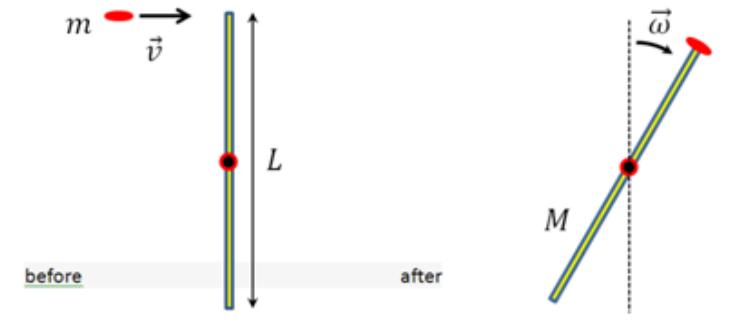


Answer on Question #73658, Physics / Mechanics | Relativity

Question. A small projectile of mass m moves with speed v to the right. The projectile strikes and sticks to the end of a stationary bar of mass M , length L , pivoted about a frictionless axle through its centre. Derive an expression for the angular velocity of the system immediately after the collision.

Solution.



Using the law of the conservation of angular momentum we get

$$\frac{mvL}{2} = I\omega,$$

where I – moment of inertia of the system after interaction.

$$I = \frac{mL^2}{4} + \frac{ML^2}{12}.$$

Hence

$$\omega = \frac{mvL}{2I} = \frac{mvL}{2\left(\frac{mL^2}{4} + \frac{ML^2}{12}\right)} = \frac{mv}{\frac{mL}{2} + \frac{ML}{6}} = \frac{6mv}{3mL + ML} = \frac{6mv}{(3m + M)L}$$

Answer. $\omega = \frac{6mv}{(3m + M)L}$.

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