A rigid rod of length \( d \) and mass \( m \) is lying on a horizontal frictionless table and pivoted at the point \( P \) on the one end (shown in the figure). A point-like object of the same mass \( m \) is moving to the right (see figure) with speed \( v_0 \). It collides elastically with the rod at the midpoint of the rod and rebounds backwards with speed \( v_f \). The moment of inertia of a rod about the center of mass is \( I = \frac{1}{12} md^2 \). After the collision, the rod rotates clockwise about its pivot point \( P \) with angular speed \( \omega_f \). Find the angular speed \( \omega_f \). Express your answer in terms of \( d \), \( m \), \( v_0 \), and \( v_f \) as needed.