

1) **Physical Pendulum:** A physical pendulum is a pendulum that has an extended body allowed to pivot around a single point or line. Consider a metal bar of mass M with dimensions $w \times w \times L$ where $L \gg w$. It is allowed to pivot around a line that is centered at a distance $L/3$ from an end along the long dimension. What is the frequency of small oscillations?

2) **Moments of Inertia:** Calculate the moments of inertia for an ellipsoid of mass M and semi-axes $a > b > c$.

3) **Billiard Ball:** At what height should a billiard ball be struck (with a force parallel to the table) such that it rotates without slipping?

4) **Oscillating Disk:** A disk of radius R rolls without slipping inside the parabola $y = x^2/2R$. Find the oscillation period for small-amplitude oscillations.