Chapter 8 Objectives

1. Be able to describe the rotation of an object with respect to a specified axis in terms of angular position, θ, angular velocity, ω, and angular acceleration, α.
2. Be able to relate angular quantities $\Delta\theta$, ω, and α to the tangential quantities l (*i.e.* arc length), $v_{tangential}$, and $a_{tangential}$, respectively.
3. Be able to distinguish between $a_{centripetal}$ and $a_{tangential}$ for rotating and revolving objects.
4. Be able to use basic kinematic relationships for rotational motion to calculate unknown quantities. These relationships are:
   - $\overline{\omega} = \dfrac{\Delta\theta}{\Delta t}$
   - $\overline{\alpha} = \dfrac{\Delta\omega}{\Delta t}$
   - $\Delta\theta = \omega_0\Delta t + \dfrac{1}{2}\alpha\Delta t^2$
   - $\omega_f^2 = 2\alpha\Delta\theta + \omega_0^2$
5. Be able to state the condition under which
   - $\Delta\theta = \omega_0\Delta t + \frac{1}{2}\alpha\Delta t^2$
   - $\omega_f^2 = 2\alpha\Delta\theta + \omega_0^2$

   are valid and to recognize this condition in problems and in nature.
6. Be able to define torque mathematically and to determine if a torque is positive or negative according to our convention.
7. Be able to describe what is meant by "torque arm" or its synonym "lever arm."
8. Be able to draw and label "free-body diagrams" for extended objects subject to forces.
9. Be able to calculate individual torques and the net torque on an object.
10. Be able to describe what is meant by "moment of inertia" in qualitative terms and to distinguish it from "mass," which is ordinary inertia.
11. Be able to use the Table of Moments of Inertia to determine the moments of inertia for objects under consideration.
12. Be able to use the rotational analogue of Newton's 2$^{\text{nd}}$ Law to relate α, I, and τ_{net}.
13. Be able to calculate the total kinetic energy for an object that is rolling without slipping given its speed, mass, and a Moment of Inertia table.
14. Be able to construct an argument to predict which of two objects will win a race down a ramp in terms of α, kinetic energy, and/or I.
15. Be able to state how the moment of inertia of objects depends on the distance of mass from the axis of rotation.

16. Be able to determine the magnitude and the direction assigned to the angular momentum of an object given its ω and a Moment of Inertia table.

17. Be able to state the condition under which the angular momentum of a system remains constant.

18. Be able to use the Conservation of Angular Momentum to explain the change in ω and $\frac{1}{2}I\omega^2$ for rotating objects that undergo changes in the distribution of their mass.