

## Section Summary

### 6.1 Angle of Rotation and Angular Velocity

- Circular motion is motion in a circular path.
- The angle of rotation  $\Delta\theta$  is defined as the ratio of the arc length to the radius of curvature.
- The arc length  $\Delta s$  is the distance traveled along a circular path and  $r$  is the radius of curvature of the circular path.
- The angle of rotation  $\Delta\theta$  is measured in units of radians (rad), where  $2\pi\text{ rad} = 360^\circ = 1\text{ revolution}$ .
- Angular velocity is the rate of change of an angle, where a rotation  $\Delta\theta$  occurs in a time  $\Delta t$ .
- The units of angular velocity are radians per second (rad/s).
- Tangential speed  $v$  and angular speed  $\omega$  are related by  $v = r\omega$ , and tangential velocity has units of m/s.
- The direction of angular velocity is along the axis of rotation, toward (away) from you for clockwise (counterclockwise) motion.

### 6.2 Uniform Circular Motion

- Centripetal acceleration  $\mathbf{a}_c$  is the acceleration experienced while in uniform circular motion.
- Centripetal acceleration force is a *center-seeking* force that always points toward the center of rotation, perpendicular to the linear velocity, in the same direction as the net force, and in the direction opposite that of the radius vector.
- The standard unit for centripetal acceleration is  $\text{m/s}^2$ .
- Centripetal force  $\mathbf{F}_c$  is any net force causing uniform circular motion.

### 6.3 Rotational Motion

- Kinematics is the description of motion.
- The kinematics of rotational motion describes the relationships between rotation angle, angular velocity, angular acceleration, and time.
- Torque is the effectiveness of a force to change the rotational speed of an object. Torque is the rotational analog of force.
- The lever arm is the distance between the point of rotation (pivot point) and the location where force is applied.
- Torque is maximized by applying force perpendicular to the lever arm and at a point as far as possible from the pivot point or fulcrum. If torque is zero, angular acceleration is zero.