Angular velocity

Angular velocity is defined in a manner similar to that for linear velocity. The average angular velocity of a rotating rigid object is the ratio of the angular displacement, $\Delta\theta$, to the corresponding time interval, Δt. Thus, angular velocity describes how quickly the rotation occurs. Angular velocity is abbreviated as ω_{avg} (ω is the Greek letter omega).

ANGULAR VELOCITY

$$\omega_{avg} = \frac{\Delta\theta}{\Delta t}$$

$$\textbf{average angular velocity} = \frac{\textbf{angular displacement}}{\textbf{time interval}}$$

Angular velocity is given in units of radians per second (rad/s). Sometimes, angular velocities are given in revolutions per unit time. Recall that 1 rev $= 2\pi$ rad. The magnitude of angular velocity is called *angular speed.*

Angular acceleration

Figure 4 shows a bicycle turned upside down so that a repairperson can work on the rear wheel. The bicycle pedals are turned so that at time t_1 the wheel has angular velocity ω_1, as shown in **Figure 4(a).** At a later time, t_2, it has angular velocity ω_2, as shown in **Figure 4(b).** Because the angular velocity is changing, there is an **angular acceleration.** The average angular acceleration, α_{avg} (α is the Greek letter *alpha*), of an object is given by the relationship shown below. Angular acceleration has the units radians per second per second (rad/s^2).

ANGULAR ACCELERATION

$$\alpha_{avg} = \frac{\omega_2 - \omega_1}{t_2 - t_1} = \frac{\Delta\omega}{\Delta t}$$

$$\textbf{average angular acceleration} = \frac{\textbf{change in angular velocity}}{\textbf{time interval}}$$

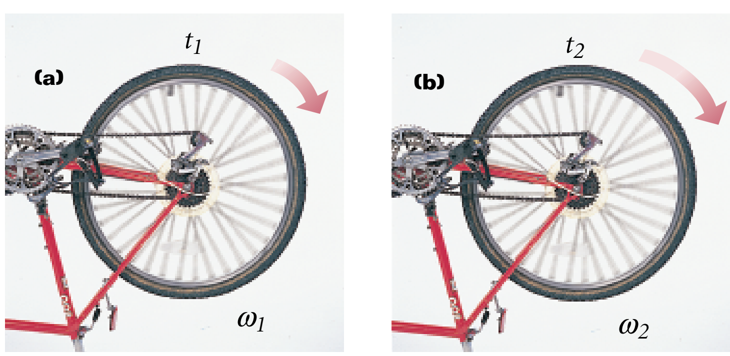

Figure 4
An accelerating bicycle wheel rotates with **(a)** an angular velocity ω_1 at time t_1 and **(b)** an angular velocity ω_2 at time t_2. Thus, the wheel has an angular acceleration.