Through what angle in degrees does a 45 rpm record turn in 1.5 s?

7 inch format

$\Theta = \omega.t$

$\omega = 45$ rpm $= (45.\ 2\pi)/60$ sec $= 4.7$ rad/s

$\Theta = (4.7$ rad/s$).(1.5$ s$) = 7.06$ rad

24,500 rev in 1 day; $\omega = ?$; $\omega = \frac{\Delta\theta}{\Delta t}$

32. **ORGANIZE AND PLAN** The angular velocity is from Equation 8.3: $\omega = \Delta\theta/\Delta t$. We'll solve for this in both revolutions per minute and radians per second.

Known: $\Delta\theta = 24{,}500$ rev, $\Delta t = 1$ day.

SOLVE The angular displacement in radians is:

$$\Delta\theta = 24{,}500 \text{ rev}\left[\frac{2\pi \text{ rad}}{1 \text{ rev}}\right] = 1.54\times10^5 \text{ rad}$$

Solving Equation 8.3:

$$\omega = \frac{24{,}500 \text{ rev}}{1 \text{ day}}\left[\frac{1 \text{ day}}{24\cdot60 \text{ min}}\right] = 17.0 \text{ rpm}$$

$$= \frac{1.54\times10^5 \text{ rad}}{1 \text{ day}}\left[\frac{1 \text{ day}}{24\cdot60\cdot60 \text{ s}}\right] = 1.78 \text{ rad/s}$$

REFLECT A rotation rate of 17 rpm may not sound all that fast, but hydroelectric turbines are typically a few meters in radius, so it would not be safe for them to turn as fast as a CD, for example.

5. If a wheel is turning at 3.0 rad/s, the time it takes to complete one revolution is about:

1) 0.33 s
2) 0.67 s
3) 1.0 s
4) 2.1 s

Answer $\omega = \frac{\theta}{t} = \frac{2\pi}{t} = 3\ \frac{rad}{s}$; $\theta = 2\pi = \omega \cdot t$

$T = t = \frac{2\pi}{\omega} = \frac{2 * 3.14\ [rad]}{3.0\ [rad/s]} = 2.1\ s$

$\omega = 43.8 \frac{\text{rad}}{\text{s}}$ | after 2.45 s $\omega = 0$ | $\alpha = ?$

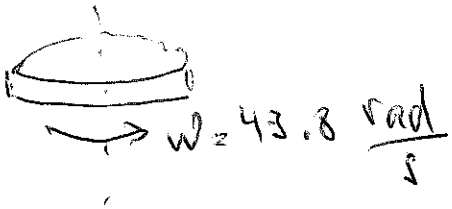
34. **ORGANIZE AND PLAN** The disk goes from 43.8 rad/s to 0 rad/s in 2.45 s. We can use Equation 8.6 to find the average angular acceleration: $\bar{\alpha} = \Delta\omega / \Delta t$.

Known: $\Delta\omega = 0 \text{ rad/s} - 43.8 \text{ rad/s} = -43.8 \text{ rad/s}$; $\Delta t = 2.45 \text{ s}$.

SOLVE Plugging the values into Equation 8.6:

$$\frac{\omega_f - \omega_i}{\Delta t} = \bar{\alpha} = \frac{\Delta\omega}{\Delta t} = \frac{(-43.8 \text{ rad/s})}{2.45 \text{ s}} = -17.9 \text{ rad/s}^2$$

REFLECT The acceleration is negative, as it should be, since the disk decelerates when the power is turned off due to friction.



27. A child, riding on a large merry-go-round, travels a distance of 3000 m in a circle of diameter 40 m. The total angle in radians through which she revolves is:

1) 50
2) 75
3) 150
4) 314

Ans: 3

$r = \frac{d}{2} = \frac{40}{2} = 20\,m$

$\frac{3000\,m}{2\pi r} = 23.8\,rev$

$23.8\,rev * (2\pi) = 150\,rad$