

Angular Kinematics

Solve the following problems

1. (Walker, p. 279, # 1) To throw a curve ball, a pitcher gives the ball an initial angular speed of 36.0 rad/s . When the catcher gloves the ball 0.595 s later, its angular speed has decreased due to air resistance to 35.2 rad/s . What is the ball's angular acceleration? How many revolutions does the ball make before being caught?
2. (Walker, p. 301, # 13) On a certain game show, contestants spin a wheel when it is their turn. One contestant gives the wheel an initial angular speed of 3.40 rad/s . It then rotates through one-and-one-quarter revolutions and comes to rest. What is the angular acceleration of the wheel? How long does it take for the wheel to come to rest? Through what angle has the wheel turned when its angular speed is 2.45 rad/s ?
3. (Walker, p. 301, # 14) The angular speed of a propeller on a boat increases with constant acceleration from 12 rad/s to 26 rad/s in 2.5 seconds. What is the acceleration of the propeller?
4. Walker, p. 301, # 15) The angular speed of a propeller on a boat increases with constant acceleration from 11 rad/s to 28 rad/s in 2.4 seconds. Through what angle did the propeller turn during this time?
5. (Walker, p. 301, # 16) After fixing a flat tire on a bicycle you give the wheel a spin. **(a)** If its initial angular speed was 6.35 rad/s and it rotated 14.2 revolutions before coming to rest, what was its average angular acceleration? **(b)** How long did the wheel rotate?

6. (Walker, p. 301, # 17) A ceiling fan is rotating at 0.96 rev/s . When turned off it slows uniformly to a stop in 2.4 min . **(a)** How many revolutions does it make in this time? **(b)** Using the result from part (a), find the number of revolutions the fan must make for its speed to decrease from 0.96 rev/s to 0.48 rev/s .
7. (Walker, p. 301, # 18) A discus thrower starts from rest and begins to rotate with a constant angular acceleration of 2.2 rad/s^2 . **(a)** How many revolutions does it take for the discus thrower's angular speed to reach 6.3 rad/s ? **(b)** How long does this take?
8. (Walker, p. 301, # 19) At 3:00 the hour hand and the minute hand of a clock point in directions that are 90.0° apart. What is the first time after 3:00 that the angle between the two hands has decreased to 45.0° ?
9. (Walker, p. 301, # 20) A centrifuge is a common laboratory instrument that separates components of differing densities in solution. This is accomplished by spinning a sample around in a circle with a large angular speed. Suppose that after a centrifuge in a medical laboratory is turned off it continues to rotate with a constant angular deceleration for 10.2 s before coming to rest. **(a)** If its initial angular speed was 3850 rpm , what is the magnitude of its angular deceleration? **(b)** How many revolutions did the centrifuge complete after being turned off?
10. (Walker, p. 301, # 21) The Earth's rate of rotation is constantly decreasing, causing the day to increase in duration. In the year 2000 the Earth takes about 0.548 s longer to complete 365 revolutions than it did in the year 1900. What is the average angular acceleration of the Earth?

