

# AP PHYSICS

## ROTATIONAL AND CIRCULAR MOTION

### ANGULAR KINEMATICS PROBLEMS

1. A potter's wheel moves from rest to an angular speed of 0.20 rev/s in 30.0 s. Assuming constant angular acceleration, what is its angular acceleration in rad/s?
2. A drill starts from rest. After 3.20 s of constant angular acceleration, the drill turns at a rate of 2628 rad/s.
  - a. Find the drill's angular acceleration.
  - b. Determine the angle through which the drill rotates during this period.
3. The tub within a washer goes into its spin cycle, starting from rest and reaching an angular speed of  $11\pi$  rad/s in 8.0 s. At this point, the lid is opened, and a safety switch turns off the washer. The tub slows to rest in 12.0 s. Through how many revolutions does the tub turn? Assume constant angular acceleration while the machine is starting and stopping.
4. A coin with a diameter of 2.40 cm is dropped onto a horizontal surface. The coin starts out with an initial angular speed of 18.0 rad/s and rolls in a straight line without slipping. If the rotation slows with an angular acceleration of magnitude  $1.90 \text{ rad/s}^2$ , how far does the coin roll before coming to rest?

### CENTRIPETAL FORCE, ACCELERATION, INVERSE SQUARE LAW

5. A lapidary plate at rest is turned on to cut a gemstone. The plate rotates until it reaches an angular speed of 12.0 rad/s in 4.0 s. What is the centripetal acceleration of a point 0.10 m from the center of the plate?
6. A 80.0 kg passenger is seated 12 m from the center of the loop of a roller coaster. What centripetal force does the passenger experience when the roller coaster reaches an angular speed of 3.14 rad/s?
7. What is the gravitational force between two trucks, each with a mass of  $2.0 \times 10^4$  kg, that are 2.0 m apart?  $G = 6.673 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$
8. A 61 kg student sits at a desk near 70.0 kg student. If the magnitude of the gravitational force between the two students is  $1.8 \times 10^{-7}$  N, how far apart are they?
9. The gravitational force between two masses is 36 N. What is the gravitational force if the distance between them is tripled?  $G = 6.673 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$
10. Is there an outward force in circular motion? Explain why you are thrown to the outside of a curve while turning in a car.