SAINT JOSEPH'S PREPARATORY SCHOOL
PHYSICS .....T P FITZPATRICK
Rotation Homework Problems

1. A bicycle with wheels of 75.0 cm **diameter** is traveling at a speed of 12.0 m/s. What is the angular velocity of the bicycle wheels?
2. A bicycle with wheels of 75.0 cm **diameter** is traveling at a speed of 12.0 m/s. The bicycle decelerates uniformly and comes to rest 3.00 s after the brakes are applied. Find the angular acceleration of the wheels, the angle through which the wheels turn in the 3.00 s and the distance the bicycle travels after the brakes were applied.
3. A motorcycle whose wheels have a diameter of 60.0 cm approaches an intersection at a speed of 72.0 km/hr. When the motorcycle is 50.0 m from the intersection, the traffic light turns red and the cyclist applies the brakes, decelerating uniformly. She comes to rest at the intersection. Find the angular velocity of the wheels before the brakes are applied; the angular acceleration of the wheels and the angle through which each wheel turns during the time the cycle decelerates.
4. Change the following to radians: 30°, 45°, 153°, 1.7 revolutions, and 2.0 revolutions.
5. Find the angular velocity in radians per second of a 33.3 rpm record.
6. A router operates at 18,000 rpm. Through what angle does the shaft turn in 5.75 ms?
7. A helicopter blade rotates at 80.0 rpm. What is the value of ω in radians per second? If the diameter of the blade is 5.00 m, what is the tangential speed at the tip of the blade?
8. What is the speed of a point on the equator of the earth due to the rotation of the earth about its axis? What is the centripetal acceleration of an object on the equator?
9. What is the speed of the earth due to its annual motion about the sun?
10. What is the speed of a point on the surface of the earth at a latitude of 48° due to the daily rotation of the earth?
11. What is the tangential velocity of an LP phonograph record at its perimeter? The diameter of the record is 12.0 in and the angular velocity is 33.3 rpm.
12. The turntable of a record player reaches its rated speed of 33.3 rpm in 1.80 s, starting from rest. What is the average angular acceleration during this time, expressed in radian measure?
13. A grinding wheel has a diameter of 10.0 cm and rotates at 1800 rpm. What is the value of ω in radians per second? What is the speed of a point on its circumference?
14. When a piece of steel is placed against the grinding wheel of (the Previous Problem), the frictional force between the steel and the wheel's circumference is 6.25 N. What must then be the power supplied by the motor that drives the wheel so that it will continue to run at 1800 rpm?
15. A drum of 1.20 m diameter that is turning at 25.0 rpm is decelerating at constant rate to 10.0 rpm. If during this time, rope is winding up on the drum, and the drum takes $_{up}$120 m of rose. what was the value of a?

16. A car accelerates uniformly from 60.0 km/hr to 75.0 km/hr. During the time that this acceleration take place, the 55.0-cm-diameter wheels of the car make a total of 120 revolutions. Find the angular acceleration of the wheels; the time required for the change in speed the distance traveled by the car during this time. .

17. The sprocket at the rear wheel of a three speed bicycle has a radius of 4.00 cm. The diameter of the wheel is 58.0 cm. What should be the sprocket radii at the pedal so that the bicycle will travel at 22.0 km/hr when the rides pedals at 1.40 Hz (revolutions per second), 1.00 Hz, or 0.75 Hz?

18. The propeller of a single engine plane rotates 600 rpm while the plane is cruising at 240 km/hr. What is the speed of a point at the tip of the 1.80 m diameter. propeller as seen by the pilot; a person on the ground?

19. A 0.30-kg mass is attached to a string of length 20.0 cm whose other end is fixed at the center of a friction free horizontal table. If the tension in the string is 3.00 N. what is the angular velocity of the mass and string?

20. A particle 10.0 cm from the center of a centrifuge experiences an acceleration of 50,000 g. What is the angular velocity of the centrifuge in revolutions per minute?

21. Mike whirls a 0.20-kg stone at the end of a 30.0cm-long string in a horizontal plane above his head, 2.05 m off the ground. At a certain instant the string breaks and the stone lands on the ground 18.5 m from the boy. Find the angular velocity of the stone just before the string broke; the tension in the string just before it broke.

22. Mike's friend Joan bets that using a stone of the same mass and a string of the same strength, and again rotating the stone in a horizontal plane at the same height, she can make it travel farther (see the Previous Problem). She wins the bet, her stone striking the ground 24.0 m away. What did she do, and what was the angular velocity of her stone just before the string broke?