

Physics 100
Rotational Motion Exercises

1. As we discussed in class, the speedometer in a car translates the rotational speed of the tires into the linear speed of the car. The speed shown on the speedometer is calibrated for the stock tires for the model of car. How will the speed of the car compare to the speed shown on the speedometer if larger tires are installed on the car? Explain.
2. The gears on a single speed bicycle are designed such that the front gear (the one connected to the pedals) is larger than the rear gear (the one connected to the wheel). Which gear rotates faster when someone pedals the bike?
3. An object on a string is spun in a circular path. Does the centripetal acceleration increase, decrease, or stay the same if the radius of the circle is reduced?
4. What provides the centripetal acceleration for a car rounding a corner?
5. How did Isaac Newton use centripetal force to verify his law of gravity? A simple outline of the process will be sufficient.
6. Will increasing the length of a screwdriver reduce the force necessary to apply to the screwdriver to apply a given torque to a screw? In other words, will it make it easier to turn the screw?
7. Will increasing the diameter of the handle of a screwdriver reduce the force necessary to apply to the screwdriver to apply a given torque to a screw? In other words, will it make it easier to turn the screw?
8. The sprockets on a bicycle are torque converters. They convert the torque applied to the pedals into torque on the wheel. In the process, the sprockets either amplify the applied torque or reduce the torque depending on the ratio of the size of the sprockets. Is the torque amplified or reduced when the front sprocket is larger than the rear sprocket?
9. A bicycle is easier to balance on when it is rolling than when it is stationary. What physical principle is most responsible for this fact?
10. A ballerina will pull her arms in to do a pirouette and then extend them to when she stops rotating. Why does she do this? Ignore possible aesthetic reasons.
11. The solar system was formed by gravitational collapse of a large mass of dust. As the mass from the outer regions was pulled toward the center did the orbital speed of the mass increase, decrease, or stay the same? Why?
12. Why do rolling objects slow down? Be as specific as you can.