

Chapter 7 Problem Set

Advanced Physics I

1. Explain why a car going around a curve with the speedometer reading constantly at 35mph has acceleration. What direction is the acceleration? What direction is the force? What is applying the force? Is this force centripetal?
2. Explain why you feel your body getting thrown back into the seat of a tilt-o-whirl ride as it spins very fast. Why is centrifugal force considered imaginary?
3. What is the linear velocity(v) and acceleration(a) and angular velocity(ω) of your car tire with a radius of .50m going 10.0m/s forward and north? ...backward and south?
4. Draw a two force diagrams of car going around a curve at a constant speed, one looking down from above and one from behind the car.
5. Calculate what a Newton scale would read if you were standing on it at the North Pole and then at the equator.

6. The tires on a small hybrid car have a diameter of 2.0ft and are warranted for 6.00×10^4 miles. Determine the angle in radians through which one of these tires would rotate and number of revolutions during this period.

7. An LP record (old CD) rotates at a constant 33rpm's. What is the angular speed in rad/s ? What angle in radians does it rotate through if the record plays for 20.0min? Compare the angle the needle travels to the distance in meters at the rim of the record ($r=.14\text{m}$) to close to the center ($r=.070\text{m}$).

8. Mr. K. has to go to the dentist. One of his wooden teeth has a termite and needs drilled and filled with some wood putty. The drill starts from rest and after 3.20 seconds of constant angular acceleration it is turning 2.51×10^4 rev/min. Find the angular acceleration and the angle the drill turns through during this period.

9. Dr. H. is on a bike trip. His front wheel rotates 37.0 times in 3.00s. Its angular velocity at the end of the 3.00s is 98.0rad/s. What is ω_0 ? What is the angular acceleration? What is the tangential velocity at the end of the 3.00s if his tire has a 16.0in diameter?

10. It has been proposed that artificial gravity could be made by rotating a cylindrical space ship with a diameter of 5.0mi and 10.0mi long. The curved floor would provide the centripetal force. What angular speed would be needed to equal Earth's gravity?

11. When you exit the toll road to get to IMSA the lane must be banked in such a way that the necessary force causing the centripetal acceleration will be supplied by the component of the normal force toward the center of the circular path. Show that for a given speed of v and a radius of r , the curve must be banked at the angle θ such that $\tan\theta = v^2/rg$. Find the angle at which the curve should be banked if the radius is 50.0m and the car speed is 13.4m/s.
12. Mr. L's secret identity is spiderman. He formulates his spider web formula in the organic chemistry lab. His new batch has a tensile strength of 1000n. Spiderman has to rescue the IMSA mascot being held hostage by the fitness center. He is standing on the railing by the batting cage. He shoots 10.0m of his web to one of the basketball backboard supports (that is at the same level as him and the mascot) and swings out over the gym which has been filled with person-eating tigers. If Spiderman's mass is 85kg, can he make it?
13. What is the maximum speed a roller coaster car can go over a 15.0m radius hill, without leaving the track?

