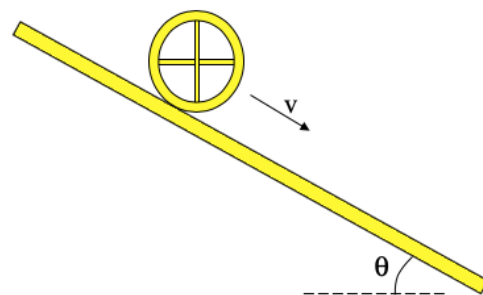


Problem 16-1: A round, spoked wheel of mass M rolls without slipping down a ramp of angle θ .



a.) As the wheel rolls down the incline, its angular velocity increases. What force(s) cause the wheel's angular velocity to change, with respect to its center of mass? Briefly explain your reasoning.

b.) A block of ice of mass M is released from rest just as the wheel is released, also from rest. Both start from the same height. The block slides down the ramp with negligible friction.

i.) Which object, if either, reaches the bottom of the ramp with the greatest speed?

 x block wheel neither (both reach with the same speed)

Briefly explain your answer in terms of forces acting on the system.

ii.) Briefly explain your answer in terms of energy.

Problem 16-2: A toy ball is advertised as being able to “bounce perfectly elastically” off hard surfaces. A student decides to test that claim. The hypothesis is that at low velocity, the bounces are close to elastic but that at high velocity, the bounces are not. Additionally, it is supposed that the system deviates more and more from being elastic as the velocity gets larger and larger.

a.) Design an experiment to test the hypothesis about collisions of the ball with a hard surface. Assume you have the equipment that would normally be found in a school physics lab.

i.) What quantities would be measured?

- ii.) What equipment would be used for the measurements, and how would that equipment be used?

- iii.) Describe the procedure used to test the hypothesis. Give enough details so that another students could replicate the experiment.

- b.) Describe how you might use a graph to draw your conclusions about your hypothesis.

- c.) A student tries the experiment and concludes something went wrong because the collisions appear to be nearly elastic for low velocities, but appears to violate a basic physics principle at higher velocities.
 - i.) What would the graph alluded to in *Part b* look like for this situation? That is, what anomaly would you notice in the graph that would make you think a physics principle has been violated. Explain how this makes sense?

 - ii.) What physical principle might be violated? (There may be more than one; just pick one). Explain how it was violated (you don't need to explain how this happened).