Physics 201 Lab 6
Rolling Things

Feb 25, 2013

Equipment

- Meter sticks
- Vernier calipers
- Stopwatches
- Small white balls
- Small disks
- Small rings
- Stacking blocks
- Raquetballs

Conservation of Energy

In order to observe rolling motion we need an inclined surface. Raise one end of your table by putting three stacking blocks under each leg at that end. Now measure the time it takes for the solid ball to roll the entire length of the table, starting from rest. This timing can be tricky, but a good method will yield surprisingly accurate results. Make sure that the ball rolls nearly straight down the table, and that no bumping or slipping occurs. Most importantly, average many different trials with various people operating the stopwatch.

We are interested in the translational speed of the ball at the bottom of the table. Using the fact that it experienced constant linear acceleration as it rolled, and taking into consideration the length of your table, calculate its speed at the bottom. (Hint: think back a few chapters.)

Now we will verify that mechanical energy was conserved. The two points at which we will consider the energy of the ball are the top of the table and the bottom.

At the top: What is its gravitational potential energy?

- What is its translational kinetic energy?
- What is its rotational kinetic energy?
- What is the sum of the mechanical energy at the top?

At the bottom: What is its gravitational potential energy?

- What is its translational kinetic energy?
- What is its rotational kinetic energy?
- What is the sum of the mechanical energy at the bottom?

Your results should reflect that fact that mechanical energy was conserved (within the range of uncertainty).

Rotational Inertia

Obtain one of each of the following four different objects: solid sphere, hollow sphere, solid cylinder, and hollow cylinder. Recall that in a race, the order these objects finish is determined by their shape, and not by their mass or radius. Look at the table in your textbook of the moments of inertia for the various shapes. Rank the objects from smallest to largest rotational inertia.

Now roll all four objects down the table, releasing them simultaneously. (Hint: race two at a time if you are having trouble racing all four at the same time.)

How does the order in your rotational inertia list compare to the finishing order that you obtained in your experiment? Discuss the results you obtained in terms of the relationship between rotational inertia and rotational acceleration.