

LAB 20: MOMENT OF INERTIA

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QUESTION

Which type of soup can wins a race down a ramp, a can filled with a thin liquid or one filled with a creamy sauce?

SAFETY

Standard safety precautions apply.

MATERIALS

2 cans of soup (one liquid, e.g., chicken broth, and one creamy, e.g., cream of mushroom), a wooden plank to use as a ramp, a smooth floor

PROCEDURE

Up to now, you have dealt mostly with objects traveling in a straight line and ignored rolling or spinning. An object moving in a straight line or at rest is said to have inertia. The more inertia an object has, the more difficult it is to get it started moving or to stop it once it is moving. When an object is rolling, it has a similar “moment of inertia,” which is how difficult it is to get the object rolling or to stop it from rolling.

In this lab, you will be racing canned foods down a ramp and across the floor to determine which one has the highest moment of inertia and which one has the lowest. You must recall that an object with a large moment of inertia will be difficult to get started, but once it’s rolling, it will be difficult to stop its motion.

Part 1

1. Set up a ramp at least 1 m long with a piece of wood or stiff cardboard. Put it at an angle low enough that a can of soup will not slide down the ramp

Section 1

but will roll. Make sure that there is a lot of room for objects to roll at the end of the ramp (e.g., across the kitchen or garage floor).

2. Find your two different types of canned food: one that is liquid, like chicken broth, and one that is thick, like gravy. Race the “thin” and “thick” cans down the ramp three times and circle the winner from each race:

thin/thick

thin/thick

thin/thick

(*Note:* If it is too difficult to race them side by side, you can race them individually and time them with a stopwatch.)

Part 2

In this part, you will be timing how long it takes a can to get from the bottom of the ramp to a certain mark on the floor. The mark should be at least 3 m from the base of the ramp.

With the same ramp as in Part 1, roll each can individually and measure how long it takes for them to travel several meters from the bottom of the ramp. Repeat several times and average the results. Create a data chart from the skeleton chart below and record your data.

thick _____ **seconds**

thin _____ **seconds**

thick _____ **seconds**

thin _____ **seconds**

thick _____ **seconds**

thin _____ **seconds**

average:

thick _____ **seconds**

thin _____ **seconds**

Post-Lab Questions, Part 1

1. Which of the cans won the most races? Does that mean that it has the highest or lowest moment of inertia?
2. Which can had the highest moment of inertia? Which one had the lowest moment of inertia?
3. According to your results, if you were to race the cans across the floor after leaving the ramp, which one would win?

Post-Lab Questions, Part 2

1. Which can had the highest average speed?
2. How did this pattern compare to the pattern from Part 1?
3. Explain in terms of moment of inertia why the patterns came out this way in Parts 1 and 2.