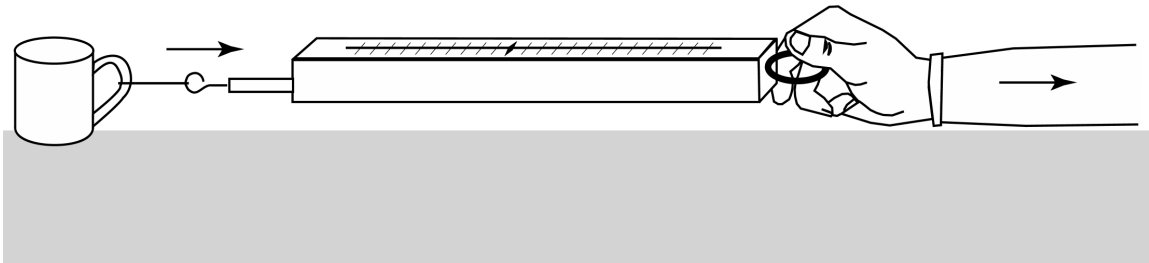


SLIDING AND STUTTERING

Instructions for Students

You will measure friction using a simple device called a spring scale. Take a few minutes to examine it and see if you can figure out how it works. Then attach a piece of string about 20-30 cm long to the hook at the bottom of the scale, and tie the other end of the string to the middle of your cup's handle. Add pennies, nails, or pebbles to your cup until it is about one-third full.

Working on a clean table or counter top, hold the scale next to your cup. The scale should be a few inches above the table top, not resting on it. Keeping the scale flat (parallel to the table), pull on the top end of the scale until the string goes taut and you begin to pull gently on the cup (see the diagram below). Try to keep both the string and the scale parallel to the table as you pull. At the point where you just begin to move the cup, you should notice that the marker on the scale has moved away from the zero point and down onto the gauge of the scale. Watch carefully to see what the marker does. You might find that it is hard to pull evenly enough so the marker stays in one place on the scale once you get the cup moving. Take turns in your group so that everyone can practice both pulling and reading the scale. Try to pull the cup so that it slides at a steady speed across the table, and does not “stutter” (stop and start several times.)



You probably noticed that the marker also jumps around, or “stutters”, when the cup does. Once you get good at setting the cup in motion smoothly and keeping it moving at a steady pace, however, you will probably see that the gauge marker still does something unexpected. You may see it go pretty far down the scale before the cup starts to move -- for example, to 135 g. But then, just as the cup starts to move smoothly, the marker will move up some -- perhaps to a gauge reading of 95 g. What do you think is happening? Which gauge reading is the correct one?

It turns out they are *both* correct, and as you do your experiments you can think about and discuss with your group why that is so. In the meantime, however, you will need to record both gauge readings in your data table: (I) the higher one that occurred just before the cup moved, and (II) the lower one corresponding to the steady sliding of the cup. Do three trials, and then find the averages of each set of measurements.

Then repeat this procedure after you have attached a different material to the bottom of the cup. When you record your data in the table provided, be sure to note what the bottom surface of the cup was that you tested. Do this for as many different surfaces as you have time for. Then, if you still have more time to experiment, you can try sliding your cup, either plain or with a modified bottom, on a different surface, such as a concrete or linoleum floor.