

# Inertia Demos

Bottle & Pencil and Breaking Broomstick

CSAAPT Spring 2024, Al Tobias, University of Virginia

# Bottle and Pencil

Right-handed person removes hoop with a quick motion in the left direction contacting the hoop with their finger at "B" making the wood stretch horizontally.

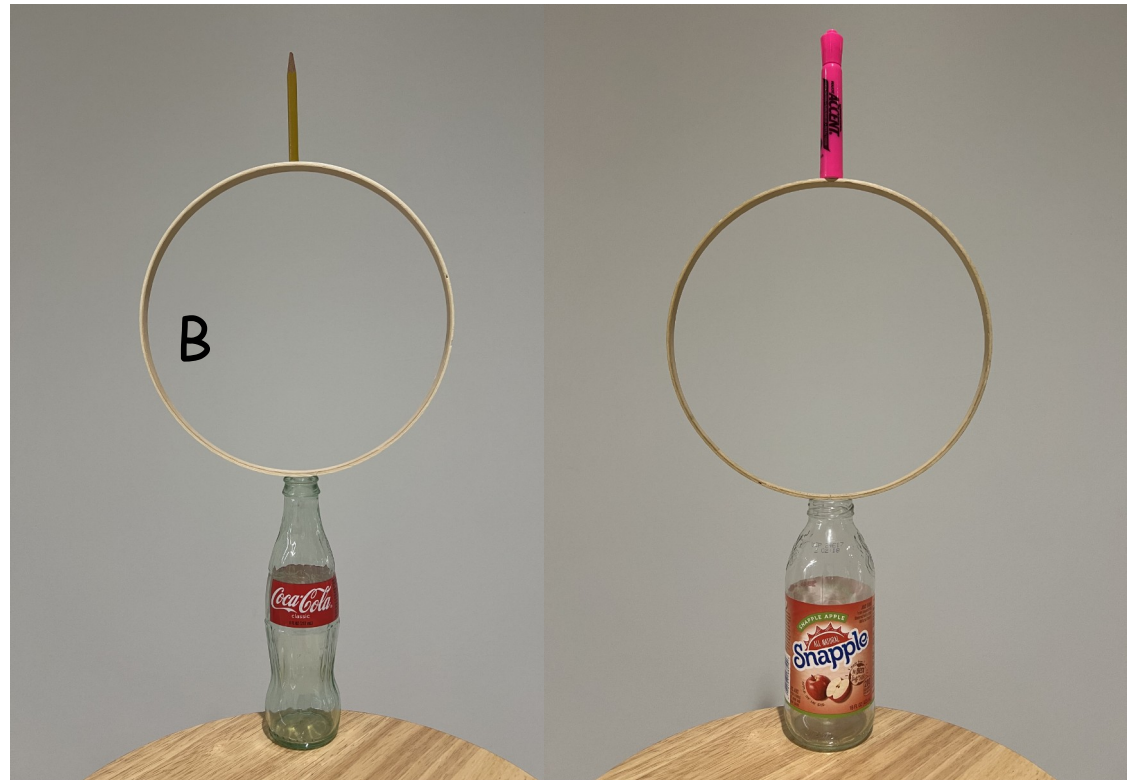
Dick & Rae note to keep an object almost stationary:

$$\Delta p = m \Delta v = F \Delta t$$

make  $\Delta t \approx 0$  to get  $\Delta v \approx 0$

Ref: Dick & Rae Physics Demo Notebook, M-230 (1993)

Ref: The Physics Teacher 32, 80 (1994)



# Breaking Broomstick

The following quote and illustration appeared in "Experiment to demonstrate Inertia" (1881):

*"A needle is fixed at each end of the broomstick, and these needles are made to rest on two glasses, placed on chairs; the needles alone must be in contact with the glasses. If the broomstick is then struck violently with another stout stick, the former will be broken, but the glasses will remain intact. The experiment answers all the better the more energetic the action."*

Ref: The Physics Teacher 31, 230 (1993)

Ref: Halliday & Resnick, *Physics* 3rd Ed. (1988) p. 97.





# Breaking Broomstick



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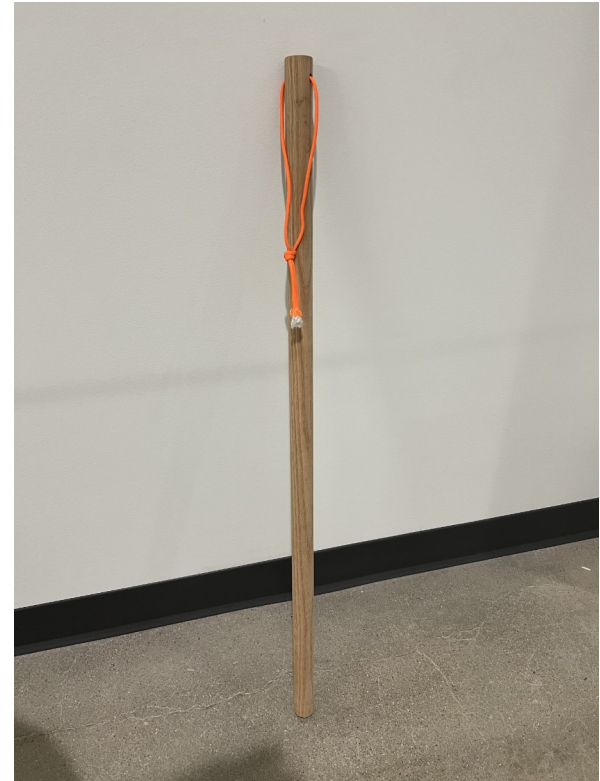
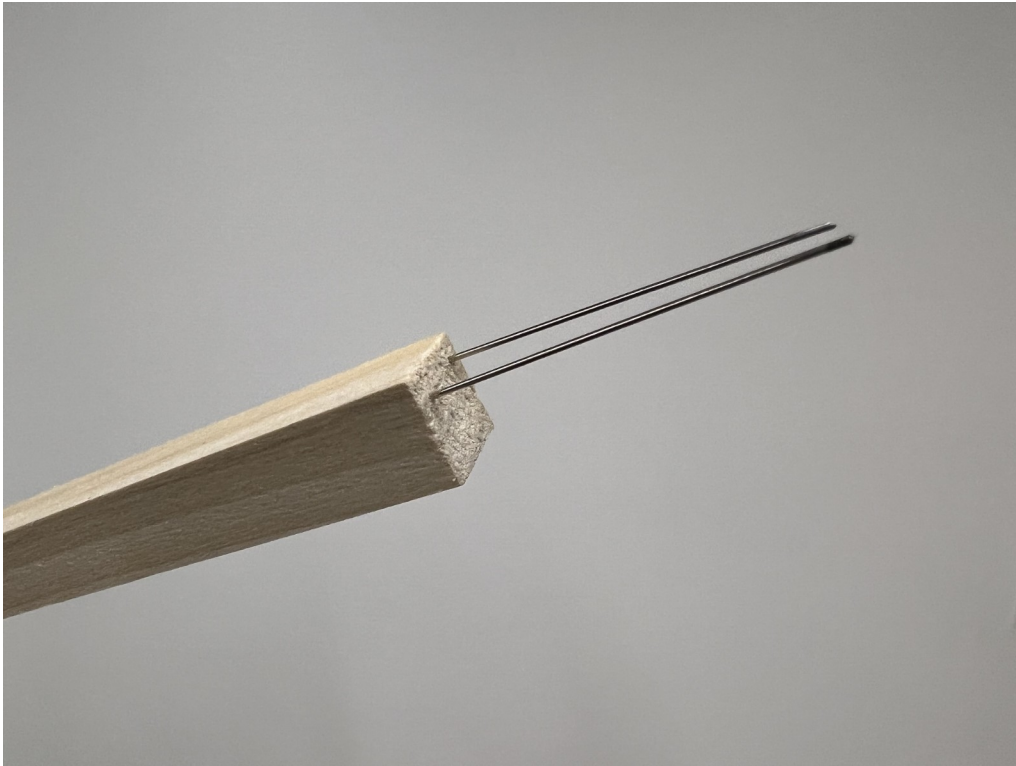
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# Breaking Broomstick

One can do demonstration by resting stick directly on the wine glasses or indirectly via dressing pins. The pins provide fail-safe to prevent glasses from breaking in case something goes wrong.

Note the pins extend the end of the stick beyond reaching any part of wine glass or stand it's sitting on in case stick goes straight down. I use a double pin with rectangular cross section sticks.

Glasses that have their lips curve back in toward the center are better in case any forces created will less likely tip the glass over.

Most of my senior colleagues have done this demo using actual broomsticks which is more difficult. For better success one can use pine lumber or poplar dowel sticks, round or square.

Ref: *The Physics Teacher*, 31, 230 (1993)