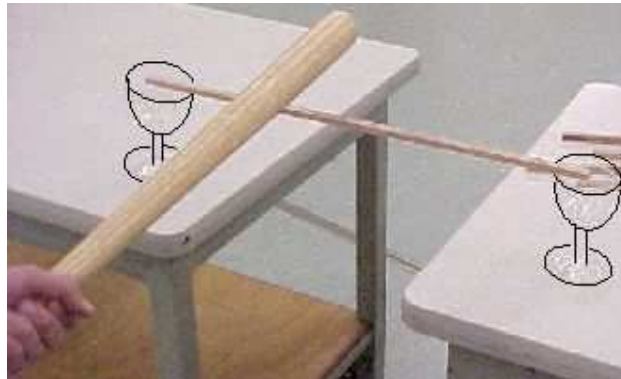


Not breaking a wine glass

Aim: A demonstration of Newton's first law.

Subjects: 1F20 (Inertia of Rest)

Diagram:



Equipment:

- 2 wine glasses
- 3 wooden sticks (we use meranti multi-ply, $12 \times 9 \text{ mm}$.)
 - $l_1 = 100 \text{ cm}$
 - $l_2 = 50 \text{ cm}$
 - $l_3 = 25 \text{ cm}$
- a heavy club (we use a baseball bat).

Presentation: Place a wine glass on the edge of each of two tables. Take a stick and show the audience that it takes quite some force to break it. Let the ends of stick l_1 with its broad side up rest on the two glasses. Now hit the middle of the thin stick with the heavy club, giving it enough speed.

The stick will break, leaving the wine glasses unmoved.

Repeat this performance with l_2 and then l_3 . The shorter the stick the more surprising the experiment

Explanation: When the club comes down it touches the horizontal stick and acts on it with a force F . The effect ($m\Delta v$) of this force depends on the impulse $F\Delta t$. The impulse is smallest when the club hits quickly, causing the least disturbance of the stick (Δt is small). For this reason the club should be given a high speed.

As soon as the horizontal stick is broken into two halves, these halves not only drop but also rotate around their center of mass -The centers of mass stay where they were just before hitting (inertia of rest). Due to this rotation a stick-half moves away from the wineglass in an upward direction, provided the club has given it enough speed of rotation.

When the horizontal stick between the wine glasses is chosen shorter, the effect (Δv) is small only when the contact-time between club and stick is still shorter than it was before, because the mass of the stick is smaller now. So, in this case, the club should have an even higher speed

Remarks: This demonstration is a variation of the demonstration in which a penny is shot out from under a stack of pennies. The stick on the wine glasses is a horizontal version of the vertical stack of pennies.