

32005 Adding Momenta

Purpose:

Analyzing vector behavior into components at right angles to each other is common in several areas of Physics. This device enables the synthesis of such components over a suitable range of possibilities for the momentum imparted to a croquet ball by two mounted hammers. The trajectory of the ball is seen to depend on the components involved in the mutual collision.

Required Accessories:

Laboratory stand, sheets of paper



Assembly:

A suitable laboratory stand is placed on a clean horizontal surface and the right angle clamp is attached to it. Next, the mounting bracket is attached at its midpoint with the two arms leading away horizontally. Then, the hammers are mounted, one on each arm of the bracket and the clamp adjusted for height above the horizontal surface. The hammers should be free to swing without hitting any part of the stand, but should be low enough to make proper contact with the cue ball.

Demonstration:

A reinforcing ring is removed from the roll supplied and placed near one corner of a piece of paper. The essential idea governing the placement of all parts is that the ring will keep the ball from rolling away while positioning it so that the two hammers will just touch the ball as they quietly hang from the bracket that serves as their pivot. By drawing back and releasing the two hammers, the momentum of each is transferred to the ball which rolls off with the sum of the two components. The timing of the hammers must be such that the second hammer does not miss the ball, unless that is the point being demonstrated. A very small difference in the arrival time of the hammers will make a big difference in the observed trajectory of the ball. The possible trajectories are spread over a full 90° span between the pathways of the ball for each hammer swung individually. The hammer faces are made quite large since the ball may already be moving when struck by the second hammer. The total momentum of each hammer is not transferred to the ball, since the hammer does recoil. A very massive ball would make this point even more obvious.

Time Allocation:

To prepare this product for an experimental trial should take less than five minutes. Actual experiments will vary with needs of students and the method of instruction, but are easily concluded within one class period.