611-1700 (40-120) Collision in One Dimension

Warranty and Parts:

We replace all defective parts free of charge. Additional parts may be ordered toll-free at **1-800-875-3214.** We accept Mastercard, Visa, School P.O's. All products are warranted to be free from defect for 90 days**.** This warranty does not apply to accident, misuse, or normal wear and tear.

Introduction:

This device performs the same function as Newton's Cradle - propel one or more balls toward one or more grouped further down the track. Watch how far and how many balls move.

It consists of an aluminum channel track, 27 " in length, with plastic molded end supports, five (5)3/4" diameter steel balls and instructions.

Operation:

An elastic collision is one which involves the full conservation of both momentum and energy. Objects involved in elastic collisions behave in a restricted manner. For a given set of precollision conditions, there is one, and only one, set of results. This can be demonstrated by using balls of uniform mass. Balls are employed because they have low friction in their movement. Hard materials despite appearance are usually more elastic than soft ones.

Momentum is always conserved. The product of mass times velocity after a collision is the same as before. If the colliding masses are equal in mass, the mathematical treatment is simpler.

Place several balls in the collision ball apparatus. For example, use **four balls** of equal mass placed **near the middle of the track** and in close contact. If the group of balls is struck by a fifth one, also of equal mass, moving at a velocity **V**, the momentum of this ball (**mV**) would be imparted to the four it had struck. You could expect any of the following conditions to satisfy conservation of momentum:

A One ball departs at velocity V
B 2 balls depart at velocity 1/2 V
C 3 balls depart at velocity 1/3 V
D 4 balls depart at velocity 1/4 V

If you expect the conservation of energy to be 1/2 mV^2, the mV^2 of the departing balls must equal the mV^2 of the original moving ball. For the four conditions above, the energies of the departing balls would be:

A $= 1/2\ mV^2$
B $= 2 \times 1/2\ m \times (1/2V)^2$ **or** $1/4\ mV^2$
C $= 3 \times 1/2m \times (1/3V)^2$ **or** $1/6\ mV^2$
D $= 1/8\ mV^2$

You can see that only Condition **A** meets the requirement of conserving both momentum and energy. Therefore, when one moving ball strikes, only one ball departs and at the same velocity as the striking ball. (See if any other possible combinations would conserve both momentum and energy.)

For the sake of simplicity the collision of balls of different masses has been omitted. If balls of different masses where included, you would have to consider the velocity of rebound of the striking mass.

Related Products:

We make many low-cost science labs that may be ordered from most science education dealers. If unavailable from your dealer, please contact **Science First.**

611-0100 Force Mechanism Trough - For studying acceleration and the effect of gravity of a moving body. With new to industry experiment. Contains 43" long track, trigger mechanism, 5 steel balls, irregular wood block.

611-1140 Inertia Apparatus - Ball rests on card. When you pull back the spring, the card shoots forward, but the ball returns to its perch.

611-1220 Variable Inertia - two plastic discs with 8 steel balls. Load balls in your choice of compartments inside disc, roll down an incline. Which is faster, the one with the balls in the center or at the rim?

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