Conservation of Momentum and Kinetic Energy in Collisions

TOPICS AND FILES

Mechanics Topic

Collisions and explosions; momentum and KE

Capstone File

33 Momentum.cap

EQUIPMENT LIST

Qty	Items	Part Numbers
1	PASCO Interface (for two sensors)	
2	Rotary Motion Sensor	CI-6538
2	Dynamics Track Mount	CI-6692
2	RMS/IDS Adapter	ME-6569
2	Dynamics Cart	ME-9430
1	1.2 m Dynamics Track	ME-9435A
1	Balance	SE-8723
5 m	Thread	

INTRODUCTION

The purpose of this activity is the measure momentum and kinetic energy in elastic and inelastic collisions. Use the rotary motion sensors to measure the motion of carts in the collisions. Use *Capstone* to record and display the motion and the amount of momentum and kinetic energy in various collisions. Compare the momentum and kinetic energy in elastic and inelastic collisions.

BACKGROUND

The momentum of a cart depends on its mass and velocity.

$$\text{Momentum} = \vec{p} = m\vec{v} \tag{1}$$

The direction of the momentum is the same as the direction of the velocity. During a collision, the total momentum of the system of both carts is conserved because the net force on the system is zero. If the momentum of one cart decreases, the momentum of the other cart increases by the same amount. This is true regardless of the type of collision, and even in cases where kinetic energy is not conserved. The principle of conservation of momentum is stated as follow.

$$\vec{p}_{\text{Total Before Collision}} = \vec{p}_{\text{Total After Collision}} \tag{2}$$

The kinetic energy of a cart also depends on its mass and velocity but kinetic energy is a scalar.

$$\mathrm{KE} = \frac{1}{2}mv^2 \tag{3}$$

The total kinetic energy of the system of two carts is found by adding the kinetic energies of the individual carts.

