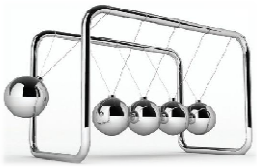
SPH4U UNIVERSITY PHYSICS

ENERGY & MOMENTUM

- Analyzing Collisions (P.233-234)

Analyzing Collisions

*Momentum is conserved in both the collisions shown below, but the two cases are quite different. When the metal spheres in the Newton's cradle collide, kinetic energy is conserved. However, when the cars crash, kinetic energy is **not** conserved.*



Analyzing Collisions

*This feature divides all collisions into two classes. Collisions in which kinetic energy is conserved are said to be **elastic**. However, when kinetic energy is not conserved, the collisions are said to be **inelastic**.*

Analyzing Collisions

ELASTIC COLLISION

- collision in which momentum and kinetic energy are both conserved

INELASTIC COLLISION

- collision in which momentum is conserved, but kinetic energy is not

NOTE!

You can determine whether a collision is elastic or inelastic by calculating both the kinetic energy before and after the collision. Since momentum is always conserved ($\Delta p=0$), if the total kinetic energy before and after a collision are the same, the collision is elastic. If not, the collision is inelastic.

Elastic or Inelastic?

PRACTICE

1. A 0.50 kg object (A) is moving at 5.0 m/s[E] when it collides, head-on, with a stationary 1.0 kg object (B). If the 0.50 kg rebounds directly backward at 1.2 m/s, was the collision elastic? (Hint: you will first need the find the velocity of the 1.0 kg object after the collision.)

   since $\Delta p = 0$, $v_{Bf} = 3.1$ m/s[E]
   $E_{kTi} = 6.25$ J & $E_{kTf} = 5.165$ J
   since $E_{kTi} \neq E_{kTf}$ the collision is inelastic

Elastic or Inelastic?

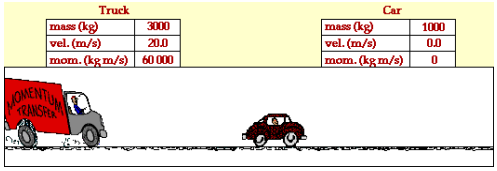
PRACTICE

2. Car A, with a mass of 1800 kg, was travelling north at 46 km/h and car B, with a mass of 2500 kg, was travelling east at 38 km/h when they collided at an intersection. The cars stuck together after the collision.
   (a) Would the cars be located more to the north or east?
   (b) Was the collision elastic or inelastic?

   (a) more to east since the 2500 kg car had more momentum
   (b) inelastic – they stuck together

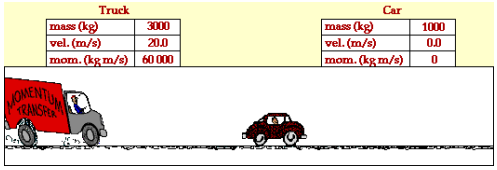
Perfectly Elastic & Inelastic Collisions – DYK?

*A **perfectly elastic collision** is an idealized situation where friction and other external forces are negligible, and therefore momentum and kinetic energy are perfectly conserved.*



Perfectly Elastic & Inelastic Collisions – DYK?

*On the other hand, a **perfectly inelastic collision** is one in which the two objects in a collision stick together after the collision so that the objects have the same final velocity.*



Perfectly Elastic & Inelastic Collisions – DYK?

Perfectly elastic and perfectly inelastic collisions occur in isolated systems in which the effects of friction and other external forces are negligible. Perfectly elastic and perfectly inelastic collisions are extremely rare and represent idealized cases. Most real collisions fall somewhere between these two extreme situations. However, it is useful to consider perfectly elastic and perfectly inelastic collisions as ideal examples of Newton's laws.

✔ Check Your Learning

WIKI (ENERGY & MOMENTUM)

✎.... 4U2 - ASG#1 (Collisions)