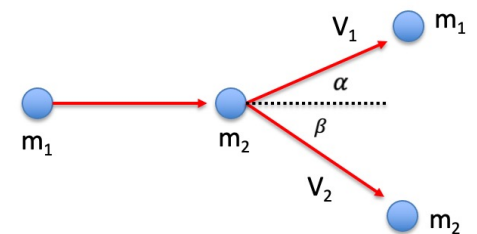
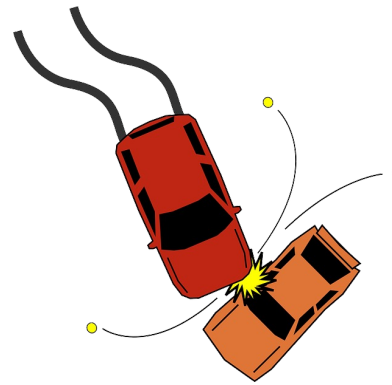
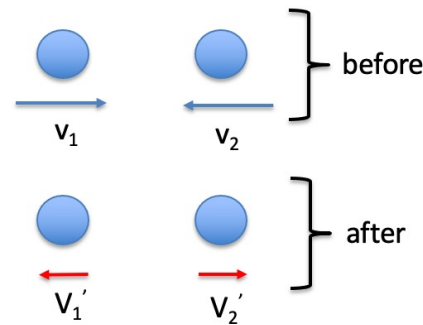


Conservation of Momentum

- Conservation in 1D
- Law of Conservation of Momentum
- Collision types
- Collision calculations
- Conservation in 2D



Preview File

Please enjoy this preview of your Student Version of the presentation. Please note within this sample file:

- Some slides appear blank because they have been removed
- Student versions have portions of the text removed which is given in the teacher version and appear as _____ which the students are to fill in
- Other slides may have on them, this represents writing that has been removed on this sample

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Conservation of Momentum

The total momentum in any closed system will remain constant.



Momentum

Before	After
Car mass = 1000 kg, Truck = 3000 kg	Car mass = 1000 kg, Truck = 3000 kg
Car velocity = 20.0 m/s Truck velocity = -20.0 m/s	Car velocity = -40.0 m/s Truck velocity = 0.0 m/s
Car momentum = 20,000 kg m/s Truck momentum = -60,000 kg m/s	Car momentum = -40,000 kg m/s Truck momentum = 0 kg m/s



Law of Conservation of Momentum

When two or more objects collide, the collision does not change the total momentum of the two objects. Whatever momentum is lost by one object in the collision is gained by the other.

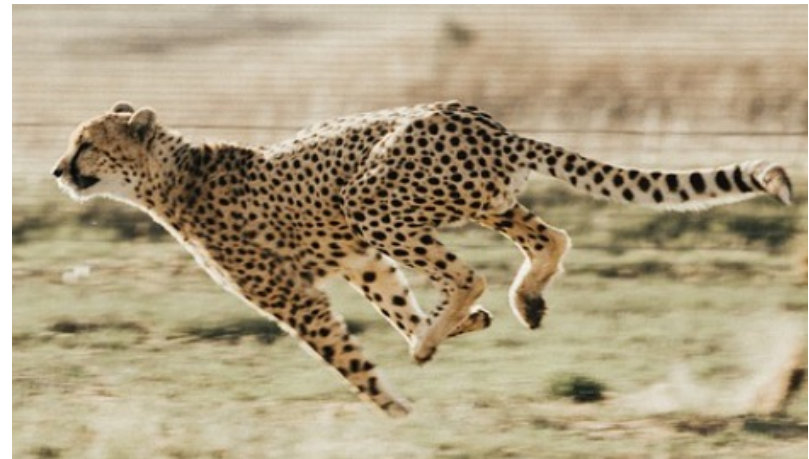
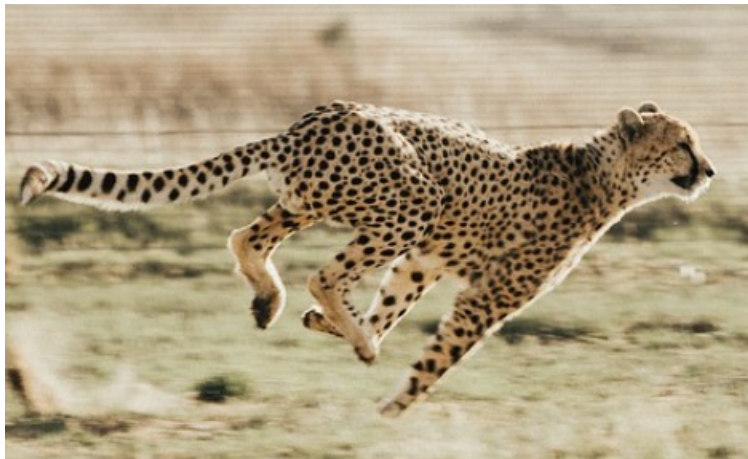


Newton's Cradle

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Recall

Momentum is a vector quantity – so direction **IS** important!



Check Your Understanding

A vacationer of mass 75 kg is standing on a stationary raft of mass 55 kg. The vacationer then walks toward one end of the raft at a speed of 2.3 m/s relative to the water. What are the magnitude and direction of the resulting velocity of the raft relative to the water? Neglect fluid friction between the raft and the water.

Check Your Understanding

During a football game, a fullback of mass 108 kg, running at a speed of 9.1 m/s [$\rightarrow$], is

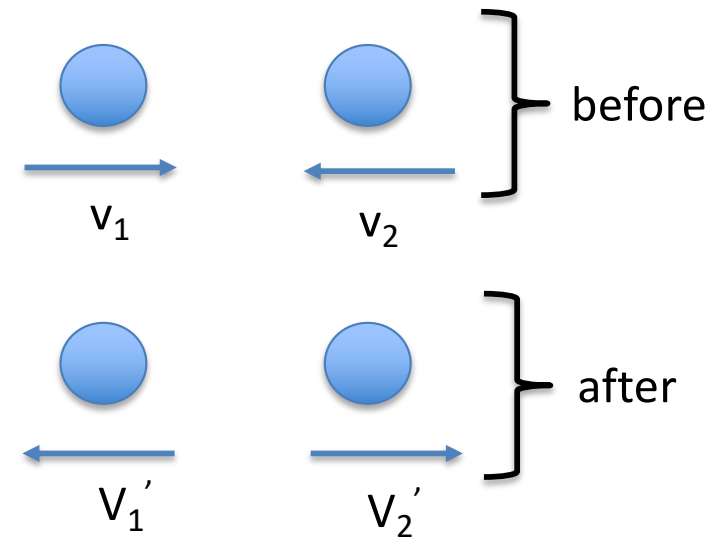
**Explain this scene using
conservation of momentum.**



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Types of Collisions - Elastic

- _____

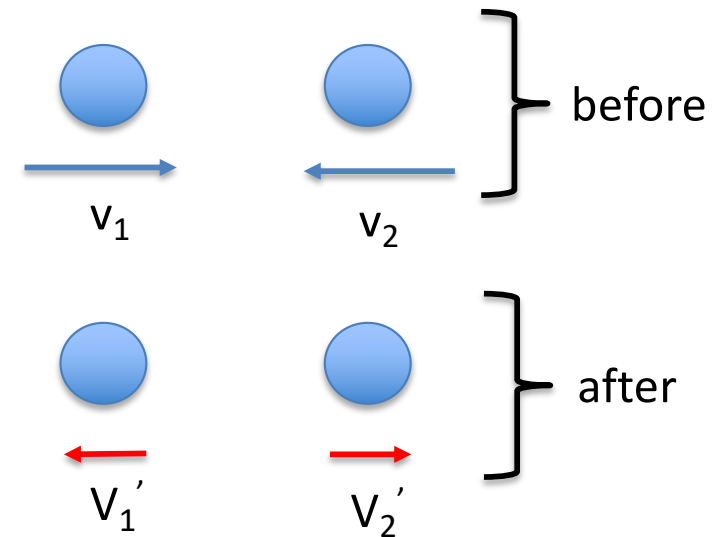


- Momentum is conserved
- This is shown by the velocity vectors pre-collision (v_1 and v_2) being equal to the vectors post-collision (v_1' and v_2')

$$E_K' = E_K$$
$$\vec{p}' = \vec{p}$$

Types of Collisions – Inelastic

- _____

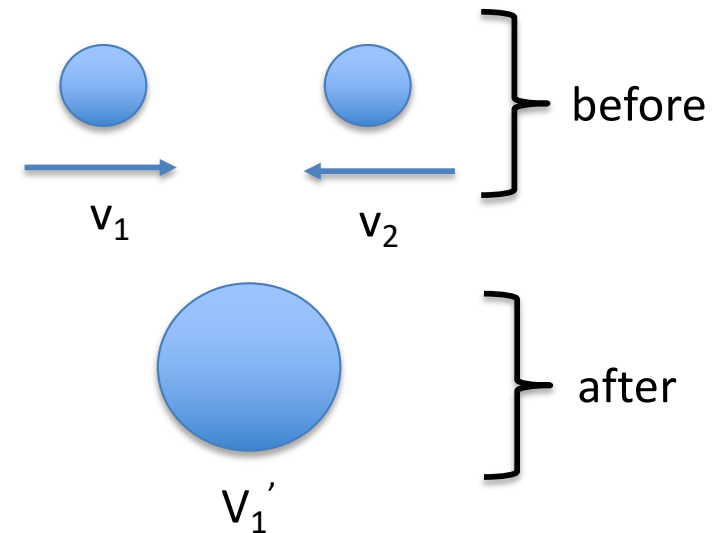


- Energy is lost to heat and sound during the collision
- Most real-life collisions are Inelastic
- This is shown by the velocity vectors pre-collision (v_1 and v_2) **NOT** being equal to the vectors post-collision (v_1' and v_2')

$$E_K' \neq E_K$$
$$\vec{p}' = \vec{p}$$

Completely Inelastic

- _____
- Energy is lost to heat and sound during the collision
- Since the objects stick together, they have the same final velocity

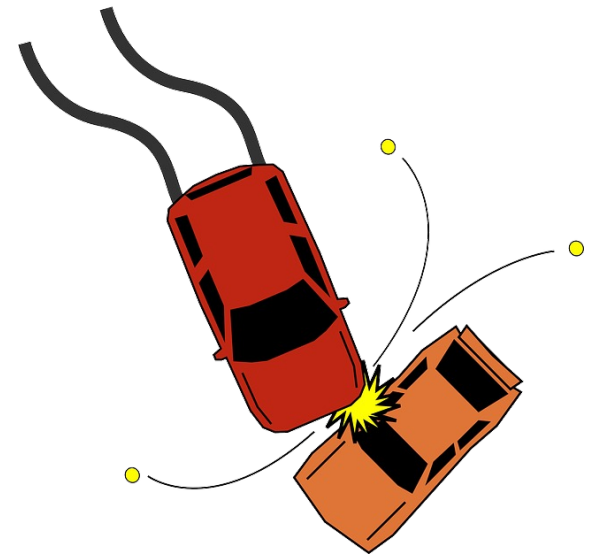
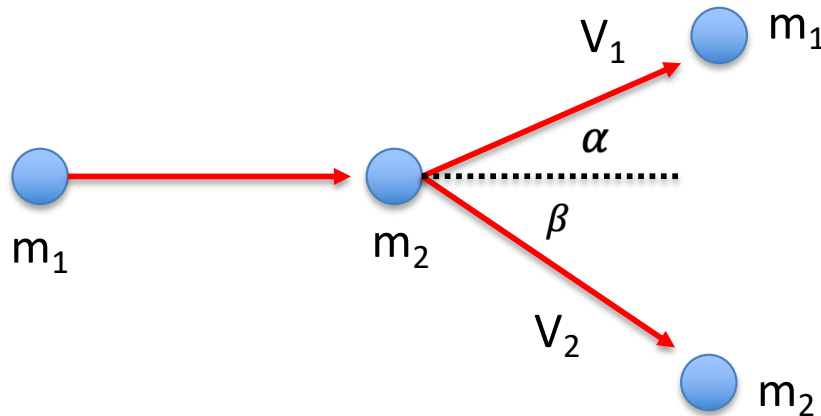


$$E_K' < E_K$$
$$\vec{p}' = \vec{p}$$

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Conservation of Momentum in 2D

- 2 Dimensional Collisions – a collision where an object collides at an angle to a second object causing the first object to travel at a different angle to the direction it was originally travelling
- _____



Check your Understanding

Two balls of equal mass “ m ” undergo a collision. Ball two was initially stationary. After the collision, the velocities of the balls make angles of 31.1° below the horizontal (Ball 1) and 48.9° above the horizontal (Ball 2) relative to the original direction of motion of the moving ball.

- a) Draw a diagram showing the initial and final situations.
- b) If the initial speed of the moving ball is 2.25 m/s , what are the speeds of the balls after the collision?
- c) Is this collision elastic?

Check Your Understanding

A nucleus, initially at rest, decays radioactively, leaving a residual nucleus. In the process, it emits two particles: an electron with momentum

- a) In what direction does the residual nucleus move? Hint: opposite the combined vector momentums of the other two particles.
- b) What is the magnitude of its momentum?
- c) If the mass of the residual nucleus is 3.6×10^{-25} kg, what is its resulting velocity?